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«ХАЛЫҚ» ЖҚ

Х А Б А Р Л А Р Ы

ИЗВЕСТИЯ

РОО «НАЦИОНАЛЬНОЙ
АКАДЕМИИ НАУК РЕСПУБЛИКИ
КАЗАХСТАН»
ЧФ «Халық»

N E W S

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NAS RK is pleased to announce that News of NAS RK. Series of geology and technical sciences scientific journal has been accepted for indexing in the Emerging Sources Citation Index, a new edition of Web of Science. Content in this index is under consideration by Clarivate Analytics to be accepted in the Science Citation Index Expanded, the Social Sciences Citation Index, and the Arts & Humanities Citation Index. The quality and depth of content Web of Science offers to researchers, authors, publishers, and institutions sets it apart from other research databases. The inclusion of News of NAS RK. Series of geology and technical sciences in the Emerging Sources Citation Index demonstrates our dedication to providing the most relevant and influential content of geology and engineering sciences to our community.

Қазақстан Республикасы Ұлттық ғылым академиясы «ҚР ҰҒА Хабарлары. Геология және техникалық ғылымдар сериясы» ғылыми журналының Web of Science-тің жаңаланған нұсқасы Emerging Sources Citation Index-те индекстелуге қабылданғанын хабарлайды. Бұл индекстелу барысында Clarivate Analytics компаниясы журналды одан әрі the Science Citation Index Expanded, the Social Sciences Citation Index және the Arts & Humanities Citation Index-ке қабылдау мәселесін қарастыруда. Web of Science зерттеушілер, авторлар, баспашылар мен мекемелерге контент тереңдігі мен сапасын ұсынады. ҚР ҰҒА Хабарлары. Геология және техникалық ғылымдар сериясы Emerging Sources Citation Index-ке енуі біздің қоғамдастық үшін ең өзекті және беделді геология және техникалық ғылымдар бойынша контентке адалдығымызды білдіреді.

НАНПК сообщает, что научный журнал «Известия НАНПК. Серия геологии и технических наук» был принят для индексирования в Emerging Sources Citation Index, обновленной версии Web of Science. Содержание в этом индексировании находится в стадии рассмотрения компанией Clarivate Analytics для дальнейшего принятия журнала в the Science Citation Index Expanded, the Social Sciences Citation Index и the Arts & Humanities Citation Index. Web of Science предлагает качество и глубину контента для исследователей, авторов, издателей и учреждений. Включение Известия НАНПК. Серия геологии и технических наук в Emerging Sources Citation Index демонстрирует нашу приверженность к наиболее актуальному и влиятельному контенту по геологии и техническим наукам для нашего сообщества.



ЧФ «ХАЛЫҚ»

В 2016 году для развития и улучшения качества жизни казахстанцев был создан частный Благотворительный фонд «Халык». За годы своей деятельности на реализацию благотворительных проектов в областях образования и науки, социальной защиты, культуры, здравоохранения и спорта, Фонд выделил более 45 миллиардов тенге.

Особое внимание Благотворительный фонд «Халык» уделяет образовательным программам, считая это направление одним из ключевых в своей деятельности. Оказывая поддержку отечественному образованию, Фонд вносит свой посильный вклад в развитие качественного образования в Казахстане. Тем самым способствуя росту числа людей, способных менять жизнь в стране к лучшему – профессионалов в различных сферах, потенциальных лидеров и «великих умов». Одной из значимых инициатив фонда «Халык» в образовательной сфере стал проект *Ozgeris powered by Halyk Fund* – первый в стране бизнес-инкубатор для учащихся 9-11 классов, который помогает развивать необходимые в современном мире предпринимательские навыки. Так, на содействие малому бизнесу школьников было выделено более 200 грантов. Для поддержки талантливых и мотивированных детей Фонд неоднократно выделял гранты на обучение в Международной школе «Мирас» и в Astana IT University, а также помог казахстанским школьникам принять участие в престижном конкурсе «USTEM Robotics» в США. Авторские работы в рамках проекта «Тәлімгер», которому Фонд оказал поддержку, легли в основу учебной программы, учебников и учебно-методических книг по предмету «Основы предпринимательства и бизнеса», преподаваемого в 10-11 классах казахстанских школ и колледжей.

Помимо помощи школьникам, учащимся колледжей и студентам Фонд считает важным внести свой вклад в повышение квалификации педагогов, совершенствование их знаний и навыков, поскольку именно они являются проводниками знаний будущих поколений казахстанцев. При поддержке Фонда «Халык» в южной столице был организован ежегодный городской конкурс педагогов «Almaty Digital Ustaz».

Важной инициативой стал реализуемый проект по обучению основам финансовой грамотности преподавателей из восьми областей Казахстана, что должно оказать существенное влияние на воспитание финансовой грамотности и предпринимательского мышления у нового поколения граждан страны.

Необходимую помощь Фонд «Халык» оказывает и тем, кто особенно остро в ней нуждается. В рамках социальной защиты населения активно проводится

работа по поддержке детей, оставшихся без родителей, детей и взрослых из социально уязвимых слоев населения, людей с ограниченными возможностями, а также обеспечению нуждающихся социальным жильем, строительству социально важных объектов, таких как детские сады, детские площадки и физкультурно-оздоровительные комплексы.

В копилку добрых дел Фонда «Халык» можно добавить оказание помощи детскому спорту, куда относится поддержка в развитии детского футбола и карате в нашей стране. Жизненно важную помощь Благотворительный фонд «Халык» оказал нашим соотечественникам во время недавней пандемии COVID-19. Тогда, в разгар тяжелой борьбы с коронавирусной инфекцией Фонд выделил свыше 11 миллиардов тенге на приобретение необходимого медицинского оборудования и дорогостоящих медицинских препаратов, автомобилей скорой медицинской помощи и средств защиты, адресную материальную помощь социально уязвимым слоям населения и денежные выплаты медицинским работникам.

В 2023 году наряду с другими проектами, нацеленными на повышение благосостояния казахстанских граждан Фонд решил уделить особое внимание науке, поскольку она является частью общественной культуры, а уровень ее развития определяет уровень развития государства.

Поддержка Фондом выпуска журналов Национальной Академии наук Республики Казахстан, которые входят в международные фонды Scopus и Wos и в которых публикуются статьи отечественных ученых, докторантов и магистрантов, а также научных сотрудников высших учебных заведений и научно-исследовательских институтов нашей страны является не менее значимым вкладом Фонда в развитие казахстанского общества.

**С уважением,
Благотворительный Фонд «Халык»!**

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STUDYING DWARFISM IN *KOCHIA PROSTRATA* GROWTH ON SALINE LANDS OF THE NORTHERN CASPIAN DESERT

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Abstract. Desertification is a global threat to humankind that affects the livelihoods of millions (and possibly billions) of people residing in arid and adjacent areas. Due to the sharp retreat of the Caspian Sea by fifty kilometers from its former shore, the bare and unvegetated loose lands, previously occupied by the sea, turn into a source of dust storms, carrying with them toxic salts harmful to all living creatures of the Caspian adjacent areas. The increasing frequency of dangerous natural phenomena such as dust storms, contrasting halomorphic manifestations, and increasing areas of degraded desert soils dictate the need for research on combating progressive soil salinization. Phytomelioration as well as selection of salt- and drought-resistant plants from natural pastures of the Caspian Sea and study of their adaptive properties to salinity and soil drought are applied as the core reclamation methods of saline soils in rainfed conditions, as they have a joint negative effect on plants due to the fact that they occur together everywhere in the soils of this zone. This paper reveals the causes of abnormal dwarf growth and development in first-year *Kochia prostrata* and studies the effect of dwarfism

on the growth and development of its subsequent years, particularly on its productivity and seed quality. As a result of the research, dwarfism of first-year *Kochia prostrata* plants is stated to be caused by sowing incomplete seeds. The formation of incomplete seeds is caused by the mowing of the first-year plants or their stratification by animals.

Keywords: degradation, secondary salinization, arid cultures, salt tolerance of plants, *Kochia prostrata*, dwarfism, bioremediation

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СОЛТҮСТІК КАСПИЙ ШӨЛЕДІНІҢ ТҮЗДАНҒАН ЖЕРЛЕРІНДЕГІ ИЗЕННІҢ ӨСУІНІҢ ЕРГЕЖЕЙЛІЛІГІН ЗЕРТТЕУ

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Аннотация. Шөлейттену-адамзатқа жаһандық қауіп, ол құрғақ және оған жақын аудандарда тұратын миллиондаған (мүмкін миллиардтаған) адамдардың өмір сүруіне зиянды әсер етеді. Каспий теңізінің бұрынғы жағалаудан елу шақырымға күрт шегінуіне байланысты, бұрын теңіз астында орналасқан жалаңаш, өсімдік жамылғысы жоқ борпылдақ жерлер шаңды дауылдың пайда болу көзі болып табылады, өзімен бірге Каспий маңы мен оған іргелес аудандардың барлық тіршілігіне зиянды улы тұздар алып жүреді. Шаңды дауылдар болып табылатын қауіпті табиғи құбылыстардың көбеюі, холоморфты көріністердің қарама-қайшылығы және деградацияланған шөлейт топырақтардың ұлғаюы топырақтың үдемелі тұздануына қарсы зерттеулер жүргізу қажеттілігін талап етеді. Тәлімі жағдайда тұзды топырақты мелиорациялаудың негізгі әдісі-фитомелиорация, Каспийдің табиғи жайылымдарынан тұз-тұзды және құрғақшылыққа төзімді өсімдіктерді тандау және олардың тұздануға және топырақтың құрғақшылығына

бейімделу қасиеттерін зерттеу, өйткені олар өсімдіктерге бірлескен теріс әсер етеді, өйткені олар осы аймақтың топырақтарында барлық жерде кездеседі. бірге. Бұл жұмыс өмірдің бірінші жылындағы изеннің қалыптан тыс ергежейлі өсуі мен дамуының себептерін ашады, ергежейлі өсудің өмірінің кейінгі жылдарының өсуіне және дамуына, атап айтқанда, тұқымның өнімділігі мен сапасына әсерін зерттейді. Ғылыми зерттеулердің нәтижесінде өмірдің бірінші жылындағы изен өсімдіктерінің өсуінің ергежейлілігі ақаулы тұқымдармен себілген кезде пайда болатындығы анықталды. Төмен тұқымдардың пайда болуы өмірдің бірінші жылындағы өсімдіктерді шабумен немесе оларды жануарлармен жоюмен байланысты.

Түйін сөздер: деградация, қайталама тұздану, аридті дақылдар, өсімдіктердің тұзға төзімділігі, жатаған изен, ергежейлі, биомелиорант

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ИЗУЧЕНИЕ КАРЛИКОВОСТИ РОСТА ПРУТНЯКА НА ЗАСОЛЕННЫХ ЗЕМЛЯХ СЕВЕРНОЙ ПУСТЫНИ ПРИКАСПИЯ

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Аннотация. Опустынивание — это глобальная угроза человечеству, губительно сказывается на средствах к существованию миллионов (а возможно миллиардов) людей, проживающих в аридных и прилегающих к ним районах. В связи с резким отступлением Каспийского моря на полсотни километров от прежнего берега, оголенные, без растительности рыхлые земли, занятые ранее под морем, служат источником возникновения пыльной бури, несущие с собой токсические соли, вредные всему живому Прикаспия и прилегающих к ним районов. Учащение опасных природных явлений, какими являются пыльные бури, контрастность

галоморфных проявлений и увеличение площадей деградированных опустыненных почв диктует на необходимость проведения исследований по борьбе с прогрессирующим засолением почв. Основным методом мелиорации засоленных почв в богарных условиях служит фитомелиорация, подбор соле-солонце и засухоустойчивых растений из естественных пастбищ Прикаспия и изучение их адаптивных свойств к засолению, солонцеватости и почвенной засухе, поскольку они оказывают на растения совместное отрицательное влияние, из-за того, что встречаются в почвах данной зоны повсеместно вместе. В данной работе раскрываются причины аномального карликового роста и развития прутняка первого года жизни, изучается влияние карликового роста на рост и развитие последующих годов его жизни, в частности, на продуктивность и качество семян. В результате научных исследований установлено, что карликовость роста растений прутняка первого года жизни вызывается при посеве неполноценными семенами. Образование неполноценных семян обусловлено со скашиванием растений первого года жизни или же стравливания их животными.

Ключевые слова: деградация, вторичное засоление, аридные культуры, солеустойчивость растений, прутняк простертый, карликовость, биомелиорант

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Introduction

Issues of combating the above-mentioned phenomena are determining factors that contribute to sustainable growth and development of arid crops. To preserve biodiversity, which serves as a filter for more than 10 % of all carbon emissions on the planet, Kazakhstan has planned to plant 2 billion seedlings of forest crops (Balyan, 1972).

However, as studies show, forest crops do not take root in the desert zone of Kazakhstan, which involve the entire territory of Atyrau region due to severe soil-reclamation and climatic conditions (Mukhambetov et al., 2021; Mukhambetov et al., 2020).

From the geological and soil-reclamation point of view, the Ural River delta is an exceptionally young territory, recently released from the Caspian Sea. The deposits of greenish-gray clayey Khazar strata are found everywhere with layers of fine-grained sands in some places. Khazar beds are formed by layered clays and fine-grained gray-brown sandy dark gray dense clays. The New Caspian strata are distributed almost throughout the described area intersected with marine alluvial and deltaic facies, which connect the floodplain terraces of the Ural River and are formed mainly by fine brownish gray sand with layers of brown clay and loam (Kabiev, 2022; Nikolaev, 1953; Zhaparkulova et al., 2021).

The given soil and climatic conditions cause dwarfism in forest crops growth, which is limited to a height of no more than 1.5–2.0 meters.

Such plants naturally cannot utilize carbon dioxide gases in the required volume, i.e. they cannot cope with the tasks assigned to them.

Semi-shrubby and semi-tree plant *Kochia prostrata* also behaves in culture, which

has abnormal growth in the first year of life (height not more than 5–6 cm) or field non-germination of seeds in culture once in five years of sowing.

Dwarfism of growth is a biologically predetermined property inherent along with woody, semi-tree and semi-shrubby plants, evidenced by numerous literature sources, and *Kochia prostrata* is a pronounced representative of them (Genkel, 1967).

In this regard L.Y. Kurochkina notes that *Kochia prostrata* sprouts appear in March, but in dry years by August their mass death is observed. By September, the surviving young plants can reach a height of 5–7 cm (Larin et al., 1975).

G.D. Gerasimenko cites that most of the seedlings die at a very young age, the remaining ones continue to grow and develop very slowly (Radchenko, 1966). During the year young plants give very little growth and reach only a few centimeters by 2–3 years of age. By the autumn of 1965, the sprouts of prostrate summer cypress reached 1–2 cm, a year later their height increased by 1 cm, and by the third year it was already 3.2 cm.

I.F. Momotov et al. emphasize that the pace of development of gypsum desert plants, both in natural conditions and in culture in dry years is so slow that literally miniature plants grow out of seedlings (Leontieva, 1969). Wormwood and keireuk in dry years grow 3–5 cm, but black saxaul reaches 15–20 cm.

Thus, it should be concluded that plant introduction cannot be successful in case of dwarfism, and it in turn determined the choice of research direction as selection and study of ecotypes of local fodder plants, persistently preserving the morphological structure of the above-ground part in an unchanged form, less susceptible to climatic and edaphic conditions of the environment.

It is obvious that to obtain a sufficient number of sprouts in crops, viable full-grown seeds are needed (Mukhambetov et al., 2023; Nasiyev, 2016; Nasiyev et al., 2015).

The study is aimed at identifying the causes of abnormally dwarfed growth and development of first-year *Kochia prostrata* and developing measures to prevent such undesirable growth and development of the plant.

The task of research is to study and substantiate the following aspects:

influence of stratification of first-year-growing *Kochia prostrata* on productivity and quality of its seeds in the second year of life;

influence of soil treatments on field germination and productivity of *Kochia prostrata* seeds;

dependence of seed quality on the timing of the plant stratification of the first and subsequent years of life;

measures to prevent abnormal growth and development of first-year plants.

Materials and methods

The main method of research is field, which provides for the establishment of experiments on degraded lands to obtain scientific data available to judge the effectiveness of a particular agro-approach.

The experiments were laid out in the specified terms on winter plowing with a depth of 20–22 cm. Before plowing, the fields intended for plowing were disked with BDT-7 heavy harrows.

The last operation with harrowing is repeated after plowing. Before and after sowing, the soil is rolled with a roller (KKSh-6). No other agrotechnical methods in the year of sowing are introduced, while subsequent years in the experiments experienced mowing of weeds.

The experiment was carried out in the winter of 2023 in an area of 10 m² with fourfold repetition (Figure 1).



Figure 1 – Trial establishment

In addition to field experiments, laboratory ones were established according to the generally accepted method of determining *Kochia prostrata* germination by seed germination in a thermostat. The place of field experiments is an experimental plot in Saraychik settlement in Makhambet district of the Atyrau region, and laboratory work was carried out at Kh. Dosmukhamedov Atyrau University. As field and laboratory germination of *Kochia prostrata*, along with dwarfism of growth, is the fundamental direction of research, in accordance with the methodology of research, it is analyzed depending on the prevailing soil and climatic conditions of a particular year, as well as on the mowing height of the plant. The influence of mowing height on the formation of seed quality is also studied.

Results

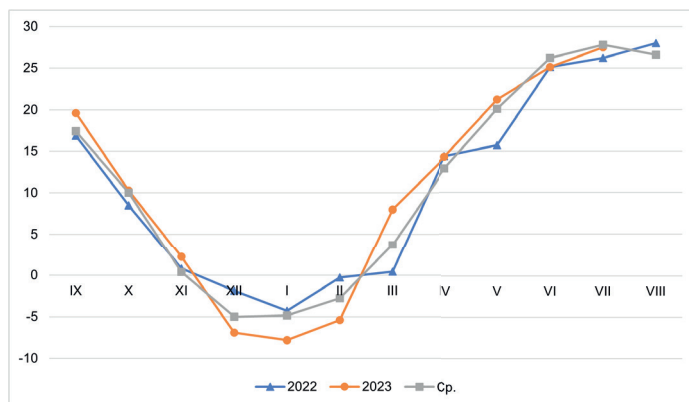


Figure 2 – Average monthly air temperature, °C (the 2022–2023 period)

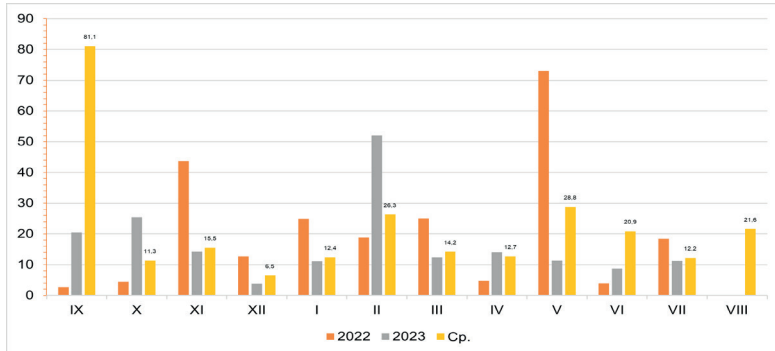


Figure 3 - Precipitation per month in mm (for the period 2022–2023)

Figures 2 and 3, representing the meteorological data of the last two years, display a considerable difference in terms of precipitation, as in 2021–2022, there was 208.95 mm of rain, which was 14.95 mm more than the average annual norm of 194 mm. According to this indicator, the year is classified as particularly moistened, while the 2022–2023 agricultural year was mediocre (208.75 mm vs. 194 mm). In the particularly moist agricultural year of 2021–2022, optimal seedlings were obtained in all experiments, and the growth and development of *Kochia prostrata* were quite favorable; however, from the middle of May to the first decade of 2022, the plant herbage from seed plots was completely subjected to meadow moth infestation.

The meadow moth completely destroyed the upper part of the plants, where the apical meristem usually concentrates. As a consequence, the plants could not recover for a long time; the former pace of growth and development was sharply disturbed, and only a month and a half after the infestation, the plants continued their further growth. However, the meadow moth infestation of the upper meristem had a drastic adverse effect both on the seed productivity of *Kochia prostrata* and seed quality. Seed plots yielded no more than 0.2 c/ha of stubby, incomplete seeds with low laboratory germination (no more than 3-4%). With seeds received in 2022, experiment 1 was planted in the sub-winter of 2023.

Table1. Studying the influence of soil tillage methods on seed productivity of *Kochia prostrata*. 2023-subwinter sowing. Experiment 1.

№	Variants	Number of plants, pcs/m ²	Plant height in cm	Seed productivity, c/ha	Laboratory germination
1	Control, natural vegetation	21.0	10.2	1.4	-
2	Direct sowing without tillage	4.0	6	0.10	1
3	20-22 cm-depth ploughing	5.0	7	0.13	1
4	Sowing in 10×10 cm steep groove	6.0	8	0.20	1

- productivity of ephemeral pastures

Table 1 (Figure 4) data show that when sowing with inferior seeds received in 2022 after the meadow moth infestation, the laboratory germination of seeds decreases to 1 %, i.e., below the standard level. Along with this, the plants of *Kochia prostrata* grow dwarf; their growth at the end of May barely reached a height of 5–6 cm, and at the end of the year the indicator was up to 8 cm. Naturally, such dwarf plants in the first year of life provided extremely low seed productivity, that is, from 0,1 to 0,2 c/ha of seeds, according to the variants of soil treatment.



Figure 4 – Dwarfism in *Kochia prostrata*

The growth and development of *Kochia prostrata* displayed certain regularity: 80–90 % of the plants of the first year of life, grown from incomplete seeds of the harvest of 2022 by the time of autumn coolness, started from the third decade of October, became so withered that the precipitation could not revive them. In all probability, they will completely drop out of the grass stand during the winter of 2023–2024.

The remaining 10–20 % of *Kochia* plants had quite decent photosynthetic activity, with an abundance of dark-colored leaves (36 %) at a height of 11–13 cm and a healthy appearance, so they surpassed the overwintering.

Withered plants gave single fruits, laboratory germination of which was 0 %, and healthy viable plants of *Kochia prostrata* produce quite high quality seeds, and their germination comprised 70.5 %. Experiment 2 studies the influence of the height of stratification of first-year plant on seed productivity in the following years of life.

Table 2 – Studying the influence of the height of stratification of first-year *Kochia prostrata* on second-year seed productivity. Experiment 2.

№	Variants	Plant number at the end of vegetation, pcs/m ²	Plant height, cm	Seed productivity, c/ha	<i>Kochia prostrata</i> seed germination, %
1	Control	21.4	9.6	0.02	4
2	<i>Kochia prostrata</i> is not used for grazing and haying	20.6	42.0	2.6	88

- According to the current recommendation adopted by the Ministry of Agriculture of the Republic of Kazakhstan, *Kochia prostrata* crops in late autumn should be stripped by animals or mowed, therefore this option is considered to be a control one.

In the experiment, two variants are studied: first-year *Kochia prostrata* with stratification and without. The experiment was planted in the subwinter of 2022 with full-grown seeds. Plants of the first year of life in 2022 were isolated by gauze bags, that is, were not subjected to the invasion of meadow moth, and the accounting of yield and biometric indicators were carried out in 2023, in the second year of life of the plant.

It is clearly seen by the data in Table 2 that almost the same number of plants in m² (21.4 and 20.6) differ greatly in height, as with stratification on the control plant, growth barely reaches 9.6 cm, while in the variant without stratification, plants of second-year *Kochia prostrata* are characterized by a fairly high growth of 42.0 cm.

As already mentioned, the high yield of *Kochia prostrata* seeds depends entirely on the height at which the plant finishes its development cycle in the first year of life. It is noted that the higher the growth of *Kochia prostrata*, the bigger the yield of seeds in the following years of life.

This situation is clearly confirmed by the growth indicators of *Kochia prostrata*, where the productivity of seeds of second-year plants without stratification (2.6 c/ha) is much higher than in the case of their stratification (0.02 c/ha). The lower the height of plants, the poorer their laboratory germination (4 %) compared to variants without stratification (88 %).

The regularities obtained in experiment 2 are repeated in experiment 3, where we study the influence of time and height of stratification of third-year *Kochia prostrata* on seed productivity (Table 3, Figure 5).

Table 3 – Study of the influence of time and height of third-year *Kochia prostrata* stratification on seed productivity and seed quality. Experiment 3.

№	Variants	Amount of plans, pcs/m ²	Plant height, cm	Seed productivity, c/ha	Laboratory germination of seeds (%)
1	Control by mowing at the end of June	5.4	32	0.6	26
2	<i>Kochia prostrata</i> is not grazed and mown	6.2	66	7.0	98

In experiment 3, the regularities established in the previous experiment are repeated: when mowing, plant growth is 2 times lower compared to unmowed plants (32 vs. 66); seed productivity is 11.7 times lower (0.6 vs. 7.0, respectively); and the most remarkable germination of seeds obtained from mowed plants is extremely low (26 %) compared to unmowed plants (98 %).

All these data convincingly demonstrate that mowing first- and second-year plants is in no way favorable for seed production. At the same time, mowing during the period of budding and flowering plants in their third year of life does not ensure the production of full-fledged, high-quality seeds. In other words, the seeds of *Kochia prostrata* should not be mowed to produce hay. The height of the unstratified and unmown plant in its

third year of life (60–70 cm) shown in Figure 5 can vary from 65 to 100 cm by year of life depending on the soil and weather conditions.



Figure 5 – The height of an ungrazed and unmown *Kochia prostrata* in the third year

The phenomenon of plant dwarfism has been thoroughly and systematically studied in plant physiology and biochemistry, but in crop production, in particular, in arid fodder production, we consider the issue for the first time worldwide.

As scholars noted in literary sources, growth dwarfism of woody plants, including the semi-timber plant of *Kochia prostrata*, is caused either by insufficient content of nutritional elements in a plant (5), by disturbances in the balance of growth stimulants and inhibitors in plants (3), or by the level of stratification stage (4) in seeds.

Long-term observations and studies we conducted for at least half a century have shown that in addition to the above factors, other ones that cause dwarfism of the plant are soil conditions, namely, excessively loose non-capillary porosity and clumpiness created by soil plowing. The mentioned factors contribute to rapid soil drying, leading to premature drying of seeds before the time of mass sprouting. As a result, in some places sprouts of plants are completely absent, and in other places established single plants grow dwarfishly, not more than 6–8 cm high, which represents the difference between plant crops in production conditions.

Dwarf plants will remain dwarf for a long time until they grow after abundant rainfall, but a favorable time for the exuberant growth of dwarf plants will be uncertain, so plants might remain dwarf throughout ontogenesis in the absence of excessive precipitation.

Evidently, such dwarf plants are not welcomed by peasant practitioners and farmers, and *Kochia prostrata* is not introduced into production.

Conclusion

Dwarfism, a characteristic feature of *Kochia prostrata*, is manifested when plowing on windward slopes. The moldboard plow is a tool that is not adapted for arid soils since plowing creates a clumpy structure and excessive non-capillary porosity, which is quickly blown away. Consequently, the plants lack moisture and grow dwarf.

Recommendations on stratification or haying in the first year of life are not valid as the plants of *Kochia prostrata* grow dwarf, unable to form full-conditioned seeds.

The plants remain dwarf for a long time (3–4 years) in ontogenesis, and their growth can be improved in favorable rainy terms, but the exact time for exuberant precipitation cannot be predicted.

One of the reasons *Kochia prostrata* was not introduced into production is its dwarfism, which makes the plant unsuitable for mowing and for grazing animals.

Dwarfism of growth is possible to prevent with the preservation of skeletal axes of first-year plants in the unchanged form, achieved by no grazing or haying in the first and second years of life.

REFERENCES

- Abdraimova K.T., Ibragimova E.K., Issayev G.I., Akhmetov N.A. (2023). Use of fabaceae plants as a phytomeliorant in salinated lands and study of the translocation coefficient/News of the National Academy of Sciences of the Republic of Kazakhstan, Series of Geology and Technical Sciences, 2023, — 6(462). — Pp. 8–19.
- Alexey Rau, Kadasheva Zhanar, Genadiy Rau, Anuarbekov Kanat, Rossitza Meranzova (2020). Geological structure of soils and rice yield in the Ili river basin/News of the National Academy of Sciences of the Republic of Kazakhstan, Series of Geology and Technical Sciences, 2020, —5. — Pp. 165–171.
- Balyan G.A. (1972). *Kochia prostrata* and its culture in Kyrgyzstan [Prutnyak prostertyj i ego kul'tura v Kirgizii], 1972, — P.2. (in Russ.).
- Genkel P.A. (1967). Physiology of agricultural plants [Fiziologiya sel'skohozyajstvennyh rastenij], 1967. — Pp. 351–352. (in Russ.).
- The dynamics of the Ural River Atyrau and the natural potential of geogroup [text]: dazhyn for obtaining a doctor of Philosophy (PhD) degree. — Diss: 6D060900-geography / E.S. Kabiev; scientific publications: M.N. Musabaeva, Emin Atasoy; L.N. Gumilyov Eurasian National University. — Nur-Sultan: 2022. — 156 p. — Pp. 132–142
- Zhaparkulova E.D., Amanbayeva B.Sh., Dzhaisambekova R.A., Mirdadayev M.S., Mosiej Józef (2021). Geological structure of soils and methods of water resources management of the Asa river / *News of the National Academy of Sciences of the Republic of Kazakhstan, Series of Geology and Technical Sciences*, 2020, — 4. — Pp. 131–138.
- Larin I.V., Beguchev P.P., Rabotnov T.A., Leontieva I.P. (1975). Meadow farming and pasture farming [Lugovodstvo i pastbishchnoe hozyajstvo], 1975. — Pp.26. — 394, — 395 (in Russ.).
- Leontieva I.P. (1969). Some issues of the use and agrotechnics of prutnyak in the zone of light chestnut soils of the Volgograd region. In the collection: Introduction to the culture of forage plants for the improvement of semi-desert and desert pastures, 1969. — Pp. 87
- Mukhambetov B., Abdinov R., Alzhanova R., Kadasheva Zh. (2020). Growth and development of *Kochia prostrata* (L.) Schrad in the extraordinary year in the north desert of Atyrau region in Kazakhstan/ IOP Conference Series: Earth and Environmental Science, 2020, — 548: 072037. — <http://dx.doi.org/10.1088/1755-1315/548/7/072037>.
- Mukhambetov B., Abdinov R., Kadasheva Zh., Alzhanova R., Doskaliyeva S., Kabiyeu Y. (2021). Soil cultivation efficiency in pasture management of the arid zone of Central Asia and Kazakhstan/ IOP Conference Series: — Earth and Environmental Science, 2021, —839: 022029, — <http://dx.doi.org/10.1088/1755-1315/839/2/022029>.

Mukhambetov B., Nasiyev B., Abdinov R., Kadasheva Z., Mamyrova L. (2023). Influence of soil and climatic conditions on the chemical composition and nutritional value of *Kochia prostrata* feed in the arid zone of Western Kazakhstan/Caspian Journal of Environmental Sciences, 2023, — 21(4). — Pp. 853–863.

Nasiyev B. (2016). The study of the processes, degradation factors and the selection of crops for the restoration of bioresources capacity of the grassland of semi-desert zones. Research Journal of Pharmaceutical, Biological and Chemical Sciences, 2016, — 7: 2637–2646.

Nasiyev B., Gabdulov M., Zhanatalapov N., Makanova G., Izbasova G. (2015). Of the phenology, abundance and harmfulness of locusts in the semi-desert zone and the organization of locust control measures. Biosciences Biotechnology Research Asia, 2015, — 12. — Pp.1759–1766. — <https://www.biotech-asia.org/vol12no2/study-of-the-phenology-abundance-and-harmfulness-of-locusts-in-the-semi-desert-zone-and-the-organization-of-locust-control-measures>.

Nikolaev N.I. (1953). Stratigraphy of Quaternary sediments of the Caspian Lowland and the Lower Volga region, 1953. — Pp. 246–256.

Radchenko S.I. (1966). Temperature gradients of the environment and plants [Temperaturnye gradienty sredi i rasteniya], 1966. — Pp. 204–206. (in Russ.).

Tauova N., Yessenamanova M.S., Kozhakhmet, K., Kushakov, A.R., Kaliyeva, A. (2022). Geological state of the stratigraphic complex of the Tengiz deposit/News of the National Academy of Sciences of the Republic of Kazakhstan, Series of Geology and Technical Sciences, 2022, — 5. — Pp. 249–265. — 10.32014/2518-170X.230.

Tumlert V.A., Kasymbekov Zh.K., Dzhaisambekova R.A., Tumlert E.V., Amanbayeva B.Sh. (2023). Influence of the hydrogeological mode of operation on the character of collating of the filter and the filter zone of seasonal wells/News of the National Academy of Sciences of the Republic of Kazakhstan, Series of Geology and Technical Sciences, 2023, —3(459). — Pp.295–304 — <https://doi.org/10.32014/2023.2518-170X.314>

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