

Article

Hay And Seed Productivity Of Atriplex Canescens And Atriplex Undulata Species

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Abstract: The article presents data on the yield indicators of hay and seeds of many-year-old *Atriplex canescens* and *Atriplex undulata* plant species in the conditions of Karnabchul, and these indicators indicate their good adaptation to new living conditions.

Keywords: desert, pasture, phytomelioration, potential, real seed productivity, yield, ecology, local, adaptation.

Introduction

For desert and semi-desert pastures, their radical improvement is of great importance, as a result of which the yield increases 4-9 times, the yield of feed mass consumed by Karakul sheep in sown pastures is 14-20 c/ha in different years, with a yield of 3 c/ha in natural pastures [1]. The identified promising species of phytomeliorants belong to the local flora, however, the results of introduction work carried out in recent years indicate that some plant species imported from foreign countries can also be promising for the radical improvement of low-yielding pastures. Below we present some results of the introduction of perennial species of the genus *Atriplex* in the conditions of the Karnabchul pollen-efemeral desert [2].

However, the productivity and adaptive potential of introduced perennial *Atriplex* species under the specific soil and climatic conditions of Karnabchul require further evaluation, particularly in comparison with local desert phytomeliorants. Assessing hay yield, seed productivity, and reproductive performance is important for determining their suitability for improving the productivity and sustainability of desert pastures [3].

The aim of this study is to evaluate the hay and seed productivity and adaptive potential of *Atriplex canescens* and *Atriplex undulata* under the soil and climatic conditions of Karnabchul and to compare their productivity characteristics with those of promising local desert forage plants [4].

Materials And Methods

The research material was the perennial species of the genus *Atriplex*: *A. canescens* and *A. undulata*. The seeds of these species were obtained from ICBA. Introductory work with these types was carried out according to the described methodology.

Field observations were conducted under the soil and climatic conditions of the Karnabchul desert. The productivity of *Atriplex canescens* and *Atriplex undulata* was evaluated over several growing seasons and compared with promising local desert forage plants. The main parameters assessed included dry-mass yield, seed yield, potential seed productivity, real seed productivity, and the seed productivity coefficient (SPC).

To assess reproductive performance, 20 plants of each *Atriplex* species were examined, and the number of flower buds and developed seeds on generative shoots was determined. The seed productivity coefficient was calculated from the relationship between the number of formed seeds and the potential number of flower buds. The obtained productivity indicators were comparatively analyzed to evaluate the adaptation of the introduced species to Karnabchul conditions. The results were expressed using descriptive statistical indicators, and differences were evaluated at a significance level of $P < 0.05$.

Results And Discussion

When comparing the hay and seed yield of perennial *Chenopodiaceae* species with promising varieties of local desert forage plants, a significant advantage of these species over local ones was revealed (Table 1). As can be seen from the table data, perennial *Chenopodiaceae* species are well adapted to growing in the soil and climatic conditions of the Karnabchul steppe, and their yield indicators from the second year of life were 15-25 c/ha, while in local phytomeliorants this indicator was 12-18 c/ha [5].

Table 1

Hay and seed yield of promising desert forage plants, c/ha (2023-2025).

Types and varieties	Dry mass yield, c/ha			Seed yield, kg/ha		
	2- years (2023 y)	3- years (2024 y)	4- years (2025 y)	2- years (2023 y)	3- years (2024 y)	4- years (2025 y)
<i>Atriplex canescens</i>	17,6±2,3	23,4±4,2	23,3±3,9	216,7±7,1	326,6±12,1	332,3±9,6
<i>Atriplex undulata</i>	15,8±2,1	24,3±3,2	25,8±3,0	250,0±6,6	356,0±11,6	328,0±8,5
<i>Kochia prostrata</i>	13,2±1,9	15,2±3,6	14,8±2,6	111,6±21,3	154,6±31,6	172,3±21,6
<i>Halothamnus subaphylla</i> ,	14,6±1,7	16,2±3,4	18,4±2,9	196,4±14,6	212,4±21,6	316,4±31,6
<i>Ceratoides ewersmanniana</i> ,	12,6±1,9	13,3±2,8	15,2±1,7	96,4±21,3	116,4±23,4	119,6±26,3
Worm wood-ephemeral pasture	3,6±0,8	3,9±0,6	4,2±0,4	-	-	-

From the table data, it is evident that the yield of seeds of perennial saltbush species significantly exceeds the yield of seeds of local phytomeliorants, that is, the yield of seeds of saltbush species per hectare in different years also significantly exceeds the yield of seeds of perennial saltbush species compared to local phytomeliorants, that is, the yield of seeds of saltbush species per hectare in different years was 216-356 kg, while in local phytomeliorants this indicator was 96-316 kg. Individual assessment of yield indicators also indicates the prospects of perennial species. Plants in populations can be divided into large, medium, and small groups. This property is characteristic of all tested species [6]. Potential and real seed productivity of plants. For example, if 18.4-24.1% of pollinated flowers of leguminous plants formed seeds at 900-1000 in the morning, when the air temperature was relatively low and relative humidity was high, then a sharp increase in the indicator of seed formation from pollinated flowers was observed at 1300-1500 in the morning, when the air temperature increased [7]. In peas (*Vicia pachycarpa*) growing on plains, i.e., in places with relatively high soil moisture, the indicator of seed formation was 17.5-19.3%, while in plants growing on hills, i.e., in places with relatively low soil moisture, this indicator decreased to 11.8-15.5%. Consequently, soil moisture also plays a significant role in seed formation [8]. The degree of soil salinity also has a great influence on seed formation indicators. The indicators of seed formation in plants growing on non-saline soils were 1.5-6.0 times higher than in plants growing on moderately and heavily saline soils [9].

Consequently, environmental factors have a very strong influence on the reproduction process of plants, and it is possible to assess the adaptive potential of plants through seed production indicators [10]. Especially this is an important feature that needs to be studied in plant introduction, which can be the basis for the correct conclusion about whether plants have been able to adapt to the new growing conditions. Because the formation of seeds by introducers in new conditions indicates their ability to adapt to these conditions. The genus *Atriplex* L. belongs to the *Chenopodiaceae* family. It is known that the distribution range of species belonging to this family is very wide and adapted to growing in various soil and climatic conditions [11]. Moreover, the flowering periods of species belonging to this family are very long (May-September), and during this period, ecological conditions also vary. It has been established that *izen* (*Kochia prostrata* (L.) Schrad) only 25% of the flower buds formed in the plant turn into seeds [12]. When studying the potential and real seed productivity of the species *Atriplex canescens* and *Atriplex undulata* in the soil and climatic conditions of Karnabchul, we determined the number of flower buds and seeds formed on 20 plants of each species by identifying 1 generative shoot. This is due to the fact that many generative shoots are formed on each bush of these species, and certain difficulties arise in determining the number of flower buds [13]. The obtained data show that in the species *Atriplex canescens*, up to 95-206 flower buds are formed on each generative shoot. The number of seeds formed on each shoot was 22-58, or the seed productivity coefficient was 25.9% [14]. In the *Atriplex undulata* species, 135-291 flower buds were formed on each generative shoot, and the number of seeds formed on each shoot was 29-96, or the seed productivity coefficient was 24.6%, that is, this indicator is almost the same in both species (Table 2). The obtained data indicate that the real seed productivity (RUM) of *Atriplex canescens* and *Atriplex undulata* species is not lower than the indicators of local phytomeliorants (*izen*), which indicates that these species have been able to adapt well to growing in new soil and climatic conditions. Studies have shown that its real seed yield ranges from 12.7% to 24.6%, i.e., full seeds ripen in 12.7-24.6% of the [15].

Table 2

Plant species	Indicators		Seed Productivity Coefficient (SPC)
	Number of flower buds formed, pcs. (PUM)	Number of seeds formed (RUM)	
<i>Atriplex canescens</i>	95-206	22-58	25,9 ± 0,81
<i>Atriplex undulata</i>	135-191	29-96	24,2 ± 0,85
<i>Kochia prostrata</i> *	852-1080	196-278	25,0 ± 0,92

The real seed yield of the *izen* plant was 4-25%. In terms of this indicator, it was found that *Atriplex canescens* and *A. undulata* are not inferior to the local species, and we can conclude that their cultivation in the soil and climatic conditions of Karnabchul has a scientific basis. Thus, a comparative study of the economic characteristics of the plant *Atriplex undulata* with the *izen* plant, which is considered a promising local phytomeliorant in the soil and climatic conditions of the Karnabchul steppe, showed that these species have high yield potential.

Therefore, the development of the agrotechnical basis for their cultivation in the wormwood-ephemeral soil and climatic conditions of Karnabchul allows for a significant increase in the productivity of natural pastures, extending the pasture use period, and strengthening the fodder

Table 3

Individual seed yield of desert forage plants, g/plant
(2022-2024, n=25)

Plant species	In year 1 (2022)			In year 2 (2023)			In year 3 (2024)		
	Seed fruitful, g/tup (variable thirst range)	M ± m	CV, %	Seed fruitful, g/tup (variable thirst range)	M ± m	CV, %	Seed fruitful, g/tup (variable thirst range)	M ± m	CV, %
Kochia prostrata	7-15	10,3 ± 0,50	29,9	32-72	51,4 ±20,4	198,4	54-180	79,4±6,38	40,1
Halothamnus sybaphylla	13-32	21,3 ± 1,16	27,2	51-105	72,0 ±3,43	23,7	117-756	258,2±9,7	18,8
Atriplex canescens	5,9-19	12,9 ± 0,76	29,4	52-121	71,0 ±3,48	24,5	106-314	178,3±2,06	5,7

The obtained results demonstrate that *Atriplex canescens* and *Atriplex undulata* have high productive and reproductive potential under Karnabchul conditions. Their dry-mass and seed yields were generally higher than those of the local phytomeliorants included in the comparison. The seed productivity coefficients of the introduced *Atriplex* species were also comparable with that of *Kochia prostrata*, indicating successful reproductive adaptation to the new environment.

These findings suggest that both *Atriplex* species can be considered promising forage plants for the phytomelioration of low-productivity desert pastures. Their stable seed formation and increasing biomass productivity provide an important biological basis for their further cultivation and use in pasture improvement under arid conditions.

Conclusion

The seed productivity coefficient (SPC) of *Atriplex canescens* and *Atriplex undulata* plants in the Karnabchul conditions is 24.2-25.9%, which indicates their good adaptation to the new living conditions. Because it was found that this indicator is also about 25% in the ize plant, which is a local phytomeliorant. The increase in the absolute mass of seeds (absolute mass of the original seeds of *Atriplex canescens* 6.7 g., *Atriplex undulata* 3.5 g., Karnabchul reproductions 7.4-7.7 g. in *Atriplex canescens* and 3.6-3.9 g. in *Atriplex undulata*) also indicates that these plant species are well adapted. Overall, the results confirm that *Atriplex canescens* and *Atriplex undulata* are promising introduced species for improving the productivity of desert pastures under Karnabchul conditions. Their relatively high hay and seed productivity, together with stable reproductive performance, demonstrates their successful adaptation to the local environment. Further research should focus on developing appropriate cultivation technologies and evaluating the long-term productivity and ecological stability of these species under different arid pasture conditions.

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