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The productivity, chemical composition and nutritional value of pastures dominated by *Artemisia diffusa* and *Cousinia resinosa* in arid lands of southwestern Uzbekistan

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Abstract. *Bazarov B, Rajamuradov Z, Safin M, Rajabov A, Khayitov D, Kuziev M, Aminjonov S, Ismayilova M, Kudratov J, Khujabekov M, Khaydarov D. 2023. The productivity, chemical composition and nutritional value of pastures dominated by* Artemisia diffusa *and* Cousinia resinosa *in arid lands of southwestern Uzbekistan. Biodiversitas 24: 3916-3923.* In recent years, extensive degradation of pastures has been observed all over the world as a result of drastic changes in climate and the increase of anthropogenic factors. As a result, the biological diversity of plant communities in pastures decreases, and specific changes occur in dry mass productivity, nutritional value, and other indicators of plant biomass. Therefore, studies aimed at assessing the condition of the vegetation in pastures are important. This research is one of the first studies of this type aimed at determining the biomass yield of pastures dominated by *Artemisia diffusa* Krasch. ex Poljako and *Cousinia resinosa* Juz. at varying elevations in arid areas of the southwestern regions of Uzbekistan, analyzing the chemical composition and nutritional value contained in the plants and evaluating the yield and quality of milk of goats fed with such plants. The results showed that dry mass yield, chemical composition, amount of substance, and nutritional value of the biomass produced by the plants in the pastures were directly influenced by the type of plants that make up the pasture, the elevation of the pastures, and climate factors (i.e., season). Our analysis also showed that the resiproductivity, chemical composition, and nutritional parameters were the highest in the mountain pastures compared to those in the hill and desert pastures. Goats fed by grazing in the pastures produced a higher yield and quality of milk compared to goats fed with conventional rations. The findings of this study explain the diversity of the productivity, chemical composition, nutritional value, and potential of the biomass produced by plants in pastures with dominant species *A. diffusa* and *C. resinosa* in increasing goat milk production in arid regions.

Keywords: *Artemisia diffusa*, chemical composition, *Cousinia resinosa*, diversity, goat, milk, nutritional value, pasture

INTRODUCTION

Pastures are natural resources that provide the cheapest feed sources for livestock and can be used in all seasons of the year (Akhylbekova et al. 2022). In natural pastures, the complexity of environmental factors influences the botanical composition and the chemical, nutritional value, and total productivity of nutritious plants, which in turn affects livestock productivity (Rajamuradova et al. 2022). The diversity and composition of the plants, the chemical contents, and the nutritional value of the biomass they produce are some of the factors that directly affect the meat and milk productivity of livestock raised in pastures (Ferro et al. 2017; Adamchuk et al. 2023).

The biological diversity of pastures of the arid regions of the southwestern region of Uzbekistan is of interest to local and foreign researchers because it changes over the seasons and years, yet it is little studied. Valiyev et al. (2023), Jurakulov et al. (2023), Kudratov et al. (2023), Zokirova et al. (2022), and Narzullayev (2022; 2023) recorded important information about the composition, distribution, and importance of the flora and fauna of this area as a result of their extensive research. At the same time, the degradation of pastures in arid regions is intensifying, as observed all over the world in recent years (Rajabov et al. 2022).

The vegetation cover of the pastures in the arid regions of the southwestern region of Uzbekistan has a complex structure, which is due to the initial stagnation of the micro- and meso-relief landscape, soil denudation, salt accumulation, and the increase of moisture in soil profiles. Most of the species occurring in these regions belong to the Chenopodiaceae, Asteraceae, Poaceae, Fabaceae and Brassicaceae families, relatively low to the Polygonaceae, Plumbaginaceae, Zygophyllaceae, Cyperaceae families, and very few species belong to the Eleagnaceae, Plantagainaceae and Frankeniaceae families (Toderich et al. 2013). Researchers have recorded more than 600 species of plants in these regions including *Artemisia diffusa*, *Ceratoides ewersmanniana*, *Kochia prostrata* (Khaydarov

et al. 2020, Valiyev et al. 2023), *Cousinia resinosa* (Islamov et al. 2020), *Halocnemum strobilaceum* (Alikulov et al. 2023), *Halostachys belangeriana* (Alikulov et al. 2022). The pastures of the arid regions of the southwestern region of Uzbekistan are mainly composed of meadows dominated by *A. diffusa* and *C. resinosa*.

Artemisia diffusa Krasch. ex Poljakov is a perennial herb or shrub belonging to the Asteraceae family. This species has geographical distribution in Afghanistan, Iran, Kazakhstan, and Uzbekistan (https://powo.science.kew.org/taxon/urn:lsid:ipni.org:names:179413-1). It is 25-45 cm tall, with its stem covered with thick hairs. The leaf is divided into stringy pieces. The flowers are basket-shaped, small, yellow, and bisexual. It grows on deserts and sometimes on hills. It produces leaves from the second half of February, stops growing, and sheds its leaves in July and August. It blooms again in September, the seeds ripen in November, and the green leaves remain until frost. In pastures, it is the main food plant for livestock. One-year branches of this plant contain protein, fat, fiber, 43.1% nitrogen-free extractives, and 0.81-1.25% essential oil in the above-ground part. Cattle like to eat *A. diffusa* in winter and spring (Khaydarov et al. 2020).

Cousinia resinosa Juz. is a monocarpic, biennial herb belonging to the Asteraceae family. This species is originally distributed in Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, and Uzbekistan (https://powo.science.kew.org/taxon/urn:lsid:ipni.org:names:199260-1). It is up to 75 cm tall. It blooms in 1-2 weeks in June, and the fruits ripen in July-August. It appears as a sign of decay or in abandoned fields. It is a permanent component of the pastures of the hills of Central Asia. It is rarely grazed directly and is usually harvested for silage and winter fodder. The average yield biomass is 0.6-0.7 t/ha, yet in improved *Artemisia*-ephemeroid pastures it can reach 1.0-1.5 t/ha (Islamov et al. 2020).

In this study, we aimed to determine the chemical composition and nutritional value of the biomass produced by pastures of arid areas in the southwestern region of Uzbekistan, especially in the meadows dominated by *A. diffusa* and *C. resinosa*. We also evaluated the effect of feeding such plants on the milk yield of goats grazed in these pastures. We expected the results of this study might serve as baseline information to increase the diversity of additional feed sources for livestock in Uzbekistan.

MATERIALS AND METHODS

Study area

The research area is the pastures in Karnobchul, Kushrabod, and Konimeh in arid regions of southwestern Uzbekistan (Figure 1). Data collection was conducted on three observation stations, which were selected based on the differences in pasture altitude and climatic parameters, including temperature and humidity. A complete description of the sampling station is shown in Figure 2 and Table 1.

Determination of pasture productivity

Pasture biomass productivity was determined using the cutting method. At each station, five square plots with a size of 20 m^2 (5×4 m) each were established at pastures dominated by *A. diffusa* (Figure 2.A) and *C. resinosa* (Figure 2.B), resulting in a total of 30 sampling plots established. The distance between the fields was at least 800 meters. Biomass of all plants in the field that could be used as fodder for livestock was harvested, dried, and weighed on a scale. The obtained results were calculated for one hectare by making a proportion. Biomass productivity of pastures was determined in four seasons of the year in the selected stations.

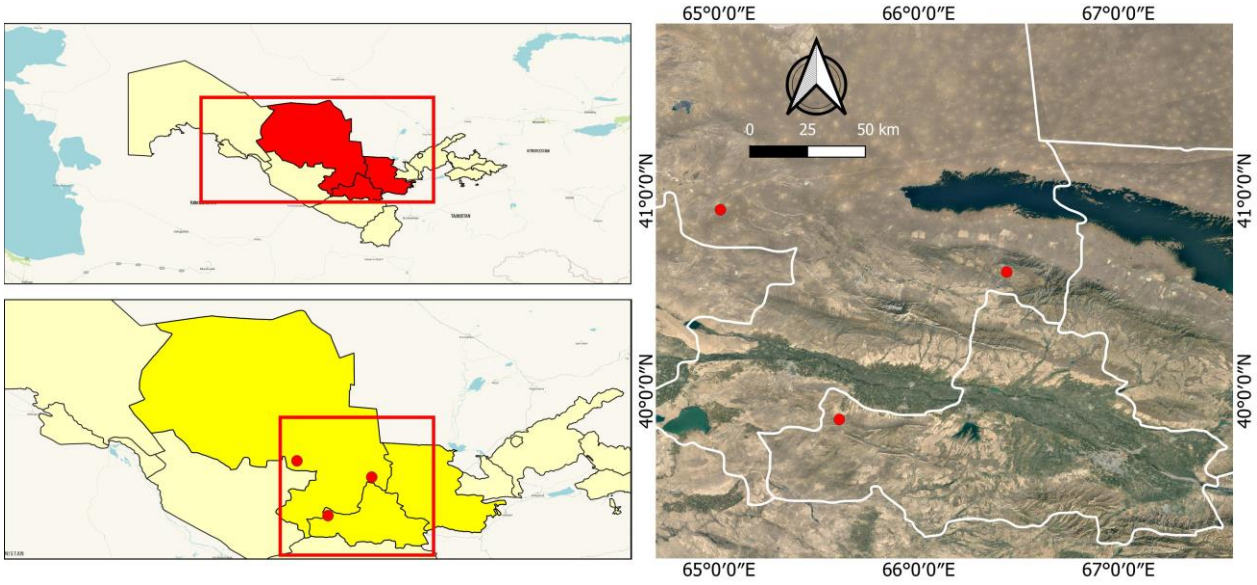

Figure 1. Map of the study area in arid lands of south-western Uzbekistan showing three stations located on pastures consisting of *A. diffusa* and *C. resinosa*

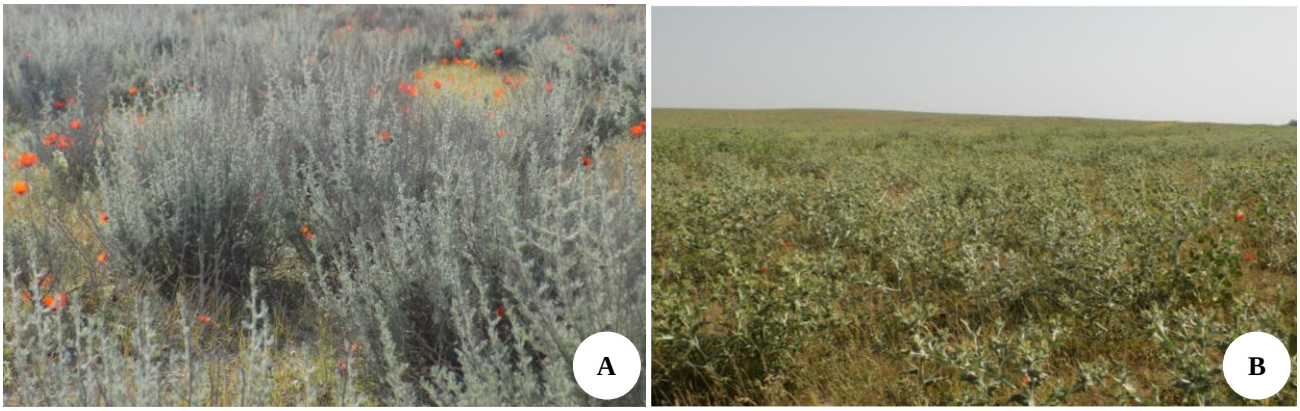

Figure 2. View of pastures consisting of A. *Artemisia diffusa;* and B. *C. resinosa* in arid lands, southwestern Uzbekistan

Table 1. Sampling site of pastures consisting of *A. diffusa* and *C. resinosa* in arid lands, southwestern Uzbekistan

Name of station	Location	Coordinate	Altitude (m asl.)
Station I	Karnobchul	39°51'32.2"N, 65°36'10.6"E	610
Station II	Kushrabod	40°35'40.9"N, 66°26'28.7"E	1344
Station III	Konimeh	40°54'18.6"N, 65°00'27.4"E	220

Determination of chemical composition and nutritional value of pastures

The methods of Rajamuradova et al. (2022), Okukenu et al. (2020), Evitayani et al. (2004) were used to calculate the chemical composition and nutritional value of plant biomass in pastures. Samples of above-ground parts of plants (stems and leaves) were taken and examined from experimental plots in selected regions in four seasons of the year. In our experiments, the primary moisture was determined by drying the samples at a temperature of 65°C to a relatively dry state, hydro moisture by drying the samples at a temperature of 105°C to an absolutely dry state, and by calculating the dry matter, ash content by burning the samples in muffle furnaces at a temperature of 500-600°C, organic matter by separating the amount of ash from the dry matter in the samples, total nitrogen by the Keldahl method, humus-by the Soxhlet method, raw fiber-by Genneber and Stomann, nitrogen-free extracts from organic matter by subtracting protein, fat, fiber, trace elements were determined by trigonometric and photo colorimetric methods.

Experiment of feeding to livestock

A feeding experiment was conducted on dairy Zaanen goats at private goat farms in Karnobchul, Kushrabod, and Konimeh. Five goats with an age of not less than 2 years old were used in each group of control and experimental options. In the control group, goats were fed exclusively on farm rations. Goats in the experimental group were grazed in the pasture along with feeding with farm ration.

Evaluation of milk productivity and quality

The method of Akin (2019) was used to determine the yield and quality parameters of goat milk. Milk productivity was determined as the amount of milk obtained by milking by hand at 14-day intervals during the entire lactation period. The density of milk and the average value of skimmed milk residue was determined by proportion to the number of milkings during the entire lactation period.

The Chay-Canul method (2020) was used to determine the amount of goat milk quality components. The average value of the amount of dry matter, fat, total proteins, whey proteins, and lactose in milk milked by hand at 14-day intervals during the entire lactation period was determined by proportioning it to the number of milkings during the entire lactation period. Goats were hand-milked every 14 days and samples of 100 mL were used for milk composition analysis. Analyses of fat, protein, and lactose percentages were performed by duplicate using an automatic milk analyzer (Lactoscan LS-60). The equipment was calibrated for fat by the Gerber method and for protein by a total nitrogen determination, according to the Dumas method using a LECO CNS-2000 series 3740 analyzer.

RESULTS AND DISCUSSION

Pasture productivity

The results of the analysis show that dry mass productivity of the biomass produced by plants in pastures consisting of *A. diffusa* and *C. resinosa* differed across seasons and stations, indicating varying altitudes (Table 2). The tendency of pasture productivity to be high in summer and low in winter was observed in all the regions we studied. In the pastures located on a hill (610 m asl) where the dominant species was *A. diffusa*, the highest dry mass productivity was recorded in the summer (2.2±0.7 c/ha), while the lowest was in the winter (0.9±0.2 c/ha). In mountain pastures (1344 m asl) with the dominant species *A. diffusa*, the dry mass yield varied from 0.7 c/ha to 2.2 c/ha depending on the seasons, with the highest productivity corresponding to the summer season, and the lowest corresponded to the winter season. In the desert pastures (210 m asl) with the dominant species *A. diffusa*, the highest productivity was 2.4±0.2 c/ha, and the lowest was 0.8±0.2 c/ha.

Table 2. Pasture productivity in terms of biomass dry matter of pastures consisting of *Artemisia diffusa* and *Cousinia resinosa* in arid lands in southwestern Uzbekistan

Season	Meadows dominated by *Artemisia diffusa*			Meadows dominated by *Cousinia resinosa*		
	Station I	Station II	Station III	Station I	Station II	Station III
Winter	0.9±0.2	0.7±0,1	0.8±0.2	0.8±0.3	0.7±0.2	0.7±0.2
Spring	1.6±0.2	1.8±0,2	1.7±0.3	1.4±0.4	1.5±0.3	1.5±0.4
Summer	2.2±0.7	2.2±0,3	2.4±0.2	2.0±0.3	2.1±0.3	2.0±0.3
Autumn	2.0±0.6	1.9±0,4	2.1±0.5	1.7±0.2	1.8±0.1	1.8±0.4

Notes: Yield/productivity is in centner/hectare (c/ha); number of plots of each experiment (n) = 5; *- statistically significant at P≤0.05

In addition, it was noted that the dry biomass yield of plants in the pastures with the dominant species of *C. resinosa* was 7-12% lower than in the pastures with the dominant species of *A. diffusa*. In the hill pastures dominated by *C. resinosa*, the highest dry mass yield was recorded in the summer (2.0±0.3 c/ha), while the lowest was in the winter (0.8±0.2 c/ha). In the mountain pastures dominated by *C. resinosa*, the dry mass yield varied from 0.7 c/ha to 2.1 c/ha, depending on the seasons. In the desert pastures with dominant species of *C. resinosa*, the highest dry mass productivity was 2.0±0.3 c/ha, and the lowest was 0.7±0.2 c/ha. Previous studies showed that dry mass productivity in pastures of arid regions is explained by climate factors, plant species that make up the pastures, and anthropogenic factors. For example, Churchill et al. (2022) showed in field experiments that high levels of cold and drought significantly reduce the biomass yield of pasture plants. Research in the Guinea Savanna agroecological zone in Ghana has shown that regular livestock grazing causes negative changes in rangelands (Maxwell et al. 2018). It has been noted by experts that *A. diffusa* biomass productivity varies depending on climatic parameters and that the variability of biomass productivity of this plant is one of the main criteria in the assessment of pasture degradation (Rajabov et al. 2022).

Chemical composition and nutritional value of pastures

The study results show that the amount of inorganic and organic substances in both pastures (i.e., meadows dominated by *A. diffusa* and *C. resinosa*) were higher in the mountain pastures (Table 3). In addition, it was observed that the percentage of chemical composition varied according to the seasons, increasing from winter to summer in all study areas, reaching a maximum value in summer, and slightly decreasing in autumn. A high percentage of protein (5.4%) and lipid (1.3%) in the biomass was recorded in the mountain pastures dominated by *C. resinosa*. It should be noted that in the studied sites, the amount of protein in the biomass of pasture plants increased to a certain extent from winter to autumn. The high amount of fiber in the biomass of pasture plants corresponded to the winter season, decreased to a minimum level in the summer, and slightly increased in the autumn season. The maximum amount of fiber (25.9%) was observed in the mountain pastures dominated by *C. resinosa*, while the minimum amount (9.5%) was accumulated in the desert and mountain pastures dominated by *A. diffusa*.

The change in the amount of nitrogen-free extractive substance in the biomass produced by plants in pastures with dominant species *A. diffusa* and *C. resinosa* is related to the change of fiber according to the seasons. However, in all the studied sites, it was noted that the accumulation of nitrogen-free extractive substances in high amounts coincided with the autumn season. The accumulation of other components (ash, calcium, phosphorus, sulfur) in the biomass of pasture plants was high in the autumn and winter seasons. The situation can be explained by the high level of humidity in these periods of the year. Similar results were also shown by other studies aimed at determining the chemical composition of natural grasslands in Ogun State in the southwestern part of Nigeria (Okukenu et al. 2020) and grasslands in different regions of New Zealand (Cosgrove et al. 2014).

The results of the analysis show that the nutritional value of pastures also changed according to the seasons. As can be seen in Table 4, the indicators determining the nutritional value (dry matter, exchangeable energy, energy food unit, crude protein, digestible protein, carotene) in pastures dominated by *A. diffusa* and *C. resinosa* differed in the mountain pastures compared to desert and hill pastures across the seasons. In particular, the amount of dry matter of the biomass of plants in pastures dominated by *A. diffusa* increased to 60.4-61.5% in winter, 38.3-40.6% in spring, 30.4-32.0% in summer, and 55.3% in autumn. It was equal to -56.9%. In the pastures dominated by *C. resinosa*, this indicator was lower by 1.0% than in the pastures with the dominant species of *A. diffusa*. The amount of exchangeable energy in the biomass of the pastures dominated by *C. resinosa* was 3.5-3.7 mDj in winter, 2.3-2.5 mDj in spring, 1.9-2.1 mDj in summer, and 3.0-3.3 mDj in autumn. It was found that this indicator was slightly higher in pastures with *A. diffusa* as the dominant species than in pastures with *C. resinosa* as the dominant species. It was reasoned that the amount of crude protein in the biomass produced by plants in pastures with dominant species *A. diffusa* and *C. resinosa* was in the range of 27.8-31.3 g during the year, and its high amount can be accumulated in autumn. It was noted that the same trend was repeated in the change of the amount of digestible protein in the biomass. It was found that the amount of carotene in the biomass produced by plants in pastures with the dominant species *A. diffusa* and *C. resinosa* increased from winter to the beginning of autumn, and in autumn, it decreased up to 3 times in summer (Table 4).

Table 3. Chemical composition of pastures consisting of *Artemisia diffusa* and *Cousinia resinosa* in arid lands, southwestern Uzbekistan

Indicator	Winter			Spring			Summer			Autumn		
	Station I	Station II	Station III	Station I	Station II	Station III	Station I	Station II	Station III	Station I	Station II	Station III
Meadows dominated by *Artemisia diffusa*												
Total humidity	37.9	39.2	38.8	60.5	62.6	61.2	68.7	69.7	69.6	44.8	45.9	45
Protein	4.4	4.9	4.7	3.9	4	4	4.4	4.5	4.3	4.9	4.7	4.8
Lipids	1.5	1.4	1.4	1.1	1.2	1.1	1	1.1	1.1	1.1	1.2	1.1
Fiber	25.5	24.7	25	11.9	11.2	11.7	9.9	9.5	9.5	20.2	19.9	20
Nitrogen-free extractive substance	23.7	23	23.1	18.5	17.4	18.4	13.5	12.5	13.1	23.3	23	23.4
Ash	6.2	6	6.2	3.5	3.1	3	2.2	2.2	2.2	5.1	5	5.2
Calcium	0.66	0.68	0.65	0.38	0.4	0.39	0.24	0.26	0.24	0.5	0.4	0.5
Phosphorus	0.09	0.08	0.09	0.07	0.07	0.07	0.08	0.07	0.07	0.08	0.09	0.09
Sulfur	0.07	0.07	0.07	0.06	0.07	0.06	0.08	0.07	0.08	0.07	0.07	0.07
Meadows dominated by *Cousinia resinosa*												
Total humidity	36.9	38.1	37.5	58.4	60.2	59	64.6	65.5	65.1	41.7	42.8	42.4
Protein	4.9	5.1	4.8	4.8	4.9	4.8	4.8	4.8	4.7	5.1	5.4	5
Lipids	1.5	1.4	1.4	1.2	1.2	1.2	1	1.1	1.1	1.2	1.3	1
Fiber	25.9	25.6	25.7	12.9	12.2	12.7	10.9	10.5	10.5	21.3	21	21.5
Nitrogen-free extractive substance	23.8	23	23.7	18.6	17.7	18.3	15.5	14.5	15.1	24.4	23.9	24.1
Ash	6.1	6	6.1	3.6	3.3	3.4	2.7	2.9	2.7	5.5	5	5.2
Calcium	0.68	0.7	0.7	0.38	0.41	0.39	0.29	0.31	0.3	0.5	0.4	0.61
Phosphorus	0.09	0.08	0.08	0.07	0.08	0.08	0.08	0.08	0.07	0.09	0.08	0.08
Sulfur	0.08	0.07	0.08	0.06	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07

Notes: The measurement unit is in %

Table 4. Nutritional value of pastures consisting of *Artemisia diffusa* and *Cousinia resinosa* in arid lands in southwestern Uzbekistan

Indicator	Winter			Spring			Summer			Autumn		
	Station I	Station II	Station III	Station I	Station II	Station III	Station I	Station II	Station III	Station I	Station II	Station III
Meadows dominated by *Artemisia diffusa*												
Dry matter, %	60.4±0.5	61.5±0.4	61.0±0.5	38.3±0.7	40.6±0.8	39.2±0.8	30.4±0.5	32.0±0.6	31.3±0.6	55.3±1.0	56.9±0.8	56.1±0.9
Exchangeable energy, mDj	3.7±0.2	3.9±0.3	3.7±0.3	2.5±0.3	2.7±0.2	2.6±0.2	2.0±0.2	2.2±0.4	2.1±0.2	3.2±0.3	3.5±0.2	3.2±0.2
Energy food unit	0.23±0.01	0.28±0.01	0.24±0.01	0.15±0.01	0.17±0.01	0.17±0.01	0.20±0.01	0.22±0.01	0.20±0.01	0.24±0.01	0.26±0.01	0.24±0.01
Crude protein, g	27.8±1.2	29.1±1.0	28.4±0.9	28.4±1.0	28.9±0.7	28.6±0.9	27.2±0.6	27.9±0.8	27.6±1.1	30.9±1.0	31.8±0.9	31.3±1.0
Digestible protein, g	17.5±1.0	18.7±1.1	17.9±0.8	19.8±1.0	20.9±1.0	20.3±1.2	21.9±0.8	22.7±0.9	22.6±1.2	20.4±0.9	22.1±1.1	21.2±1.0
Carotene, mg	4.1±0.3	4.7±0.4	4.3±0.6	21.5±1.2	23.4±0.9	22.2±1.0	29.6±1.4	30.9±1.1	29.4±0.9	9.5±1.0	10.8±1.0	9.8±0.9
Meadows dominated by *Cousinia resinosa*												
Dry matter, %	59.5±0.4	60.7±0.6	60.0±0.6	37.5±0.8	39.4±0.7	38.1±0.7	29.3±0.6	31.2±0.8	31.0±0.6	53.8±1.1	55.7±1.5	54.9±1.0
Exchangeable energy, mDj	3.5±0.3	3.7±0.2	3.5±0.3	2.3±0.3	2.5±0.2	2.4±0.3	1.9±0.2	2.1±0.3	2.0±0.3	3.0±0.3	3.3±0.3	3.1±0.3
Energy food unit	0.22±0.01	0.27±0.01	0.23±0.01	0.13±0.01	0.15±0.01	0.16±0.01	0.19±0.01	0.20±0.01	0.19±0.01	0.22±0.01	0.24±0.01	0.21±0.01
Crude protein, g	27.7±1.0	29.7±1.1	28.2±1.0	28.3±1.1	28.7±0.8	28.4±1.0	27.0±0.6	27.7±0.9	27.4±1.0	30.6±1.1	31.5±1.0	31.1±0.9
Digestible protein, g	17.4±1.1	18.6±1.0	17.7±0.9	19.6±0.9	20.7±1.1	20.1±1.0	21.8±1.0	22.6±0.8	22.5±1.0	20.6±1.0	22.0±1.0	21.0±1.1
Carotene, mg	4.0±0.2	4.4±0.3	4.1±0.3	21.3±1.0	23.2±1.0	22.0±0.6	29.4±1.0	30.5±1.0	29.1±1.1	9.4±1.0	10.9±1.1	9.6±1.0

Notes: 1 kg of grass in natural moisture (n=3); *- statistically significant at $P \leq 0.05$

Other studies showed that the nutritional value of the biomass produced by the plants in the pastures changes following the change in the amount of substances in its composition. In a study to assess seasonal changes in the nutritional value of some grass species in Indonesia, it has been shown that the potential nutritional value of common grasses collected locally varies between dry and rainy seasons (Evitayani et al. 2004). Darma et al. (2023) found that legume leaves contained crude protein (12.44% to 26.9%), crude fiber (16.13% to 27.38%), and total digestible nutrients (71.10 % to 88.17%).

Milk productivity and quality

We investigated the effect of grazing on pastures dominated by *A. diffusa* and *C. resinosa* on the yield and quality of milk goats during the entire lactation period. The results show that grazing on pastures dominated by *A. diffusa* and *C. resinosa* positively affected the yield and quality of the milk. It can be seen from Table 5 that the milk yield of goats fed on pastures with the dominant species of *A. diffusa* during the lactation period was 354.4-360.7 kg. This figure is 9-10% higher than the milk yield of captive goats fed by conventional farm rations. The milk yield of goats fed on pastures with dominant species of *C. resinosa* (345.4-251.4 kg) also revealed that the above trend was repeated (Table 5). It was observed that other indicators of milk productivity (density, skimmed milk residue) in goats raised on pastures did not differ from the control treatment. In addition, it was noted that the amount of milk content (dry matter, fat, total proteins, casein, whey proteins, lactose) in goats raised on pastures with dominant species *A. diffusa* and *C. resinosa* was 8-17% higher than the control (Table 6).

In a study conducted on 26 dairy farms in Northern Ireland, it was observed that with increased milk yield in cows, milk solids increased, milk fat and milk protein concentrations decreased, and nitrogen and energy utilization efficiency improved (Craig et al. 2022). McKay et al. (2022) reported the effects of total mixed ration or pasture-based feeding on milk yield and milk composition parameters of dairy cows in the early stages of lactation. The importance of improving the feed ratio in increasing the milk yield in Holstein cows has been found by Muller et al. (2014). Hayes et al. (2023) compared the milk yield and milk composition of cattle reared in dry and high-rainfall climates and reported changes in milk yield and milk composition as a function of climate.

Table 5. Yield parameters of milk of goats raised in pastures consisting of *Artemisia diffusa* and *Cousinia resinosa* in arid lands, southwestern Uzbekistan.

Indicator	Control			Experiment		
	Station I	Station II	Station III	Station I	Station II	Station III
Meadows dominated by *Artemisia diffusa*						
Milk productivity, kg	326.0 ±9.4	336.2 ±7.5	330.0 ± 8.0	354.4±6.0	360.7±8.1	358.6±7.2
Density, kg/m^3	1028.7±0.2	1029.1±0.3	1028.3±0.3	1028.4±0.3	1028.1±0.4	1028.9±0.2
Skimmed milk residue, %	8.2±0.3	8.0±0.2	8.2±0.2	8.4±0.3	8.4±0.2	8.4±0.2
Meadows dominated by *Cousinia resinosa*						
Milk productivity, kg	323.0 ±7.6	330.1 ±8.9	326.0 ±7.0	345.4±9.0	351.4±7.7	348.2±7.0
Density, kg/m^3	1028.1±0.3	1028.8±0.2	1028.2±0.2	1028.2±0.3	1028.5±0.4	1028.1±0.3
Skimmed milk residue, %	8.1±0.2	8.2±0.3	8.2±0.3	8.4±0.2	8.4±0.3	8.4±0.3

Notes: number of plots (n) = 5; *- statistically significant at P≤0.05

Table 6. Quality parameters of milk of goats raised in pastures consisting of *Artemisia diffusa* and *Cousinia resinosa* in arid lands, southwestern Uzbekistan.

Indicator	Control			Experiment		
	Station I	Station II	Station III	Station I	Station II	Station III
Meadows dominated by *Artemisia diffusa*						
Dry matter	12.2±0.1	12.9±0.2	12.4±0.2	14.7±0.2	15.4±0.1	14.9±0.2
Fat	4.5±0.1	4.6±0.1	4.5±0.1	5.4±0.1	6.2±0.1	5.8±0.2
Total proteins	3.5±0.1	3.6±0.1	3.4±0.1	4.3±0.1	4.5±0.1	4.3±0.1
Casein	3.5±0.1	3.6±0.1	3.6±0.1	3.7±0.1	3.8±0.2	3.8±0.1
Whey proteins	1.0±0.1	1.1±0.1	1.0±0.1	0.9±0.1	0.9±0.1	0.9±0.1
Lactose	4.6±0.4	4.8±0.3	4.5±0.3	5.0±0.2	5.2±0.1	5.0±0.2
Meadows dominated by *Cousinia resinosa*						
Dry matter	12.0±0.1	12.6±0.2	12.3±0.1	14.3±0.2	15.0±0.1	14.6±0.2
Fat	4.1±0.1	4.4±0.1	4.1±0.1	5.0±0.1	6.1±0.1	5.7±0.2
Total proteins	3.4±0.1	3.5±0.1	3.3±0.1	4.2±0.1	4.4±0.1	4.2±0.1
Casein	3.4±0.1	3.5±0.1	3.5±0.1	3.6±0.1	3.7±0.2	3.6±0.1
Whey proteins	1.0±0.1	1.1±0.1	1.0±0.1	1.0±0.1	0.9±0.1	1.0±0.1
Lactose	4.4±0.4	4.6±0.3	4.4±0.2	4.8±0.2	5.0±0.1	5.0±0.1

Notes: measurement unit is in kg; *- statistically significant at P≤0.05

To conclude, in the pastures with *A. diffusa* and *C. resinosa* plants in the arid regions of southwestern Uzbekistan, dry biomass productivity varied depending on the elevation, climatic factors, and plant species that make up the pastures. Such factors also affected the chemical composition and nutritional value of the plant biomass of the pastures. Mountain pastures with dominant species of *A. diffusa* and *C. resinosa* had higher chemical composition and nutritional value than desert and hill pastures. In goats raised in pastures with dominant species *A. diffusa* and *C. resinosa*, the milk yield and milk content (dry matter, fat, total proteins, casein, whey proteins, lactose) during the entire lactation period were 9-10% and 8-17% higher, respectively than the milk yield of goats fed with traditional farm rations. The findings of the study suggest that pastures consisting of *A. diffusa* and *C. resinosa* in the arid regions of Uzbekistan are potential sources for feeding livestock, including goats.

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