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THE NEED FOR THE CONSERVATION AND EXTENSION OF THE AGROSILVOPASTORAL SYSTEM WITH DOWNY OAK (*QUERCUS PUBESCENS* Willd.) IN DOBROGEA, ROMANIA

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Abstract. *On fairly large areas of the Dobrogean Plateau we can find agroforestry systems, respectively dry grasslands with isolated trees of downy oak or other tree species (e.g. Carpinus orientalis, Quercus pedunculiflora), which provides shade for animals. Our study shows a higher level of nutrients in the soil under the oaks, due to organic fertilizers resulting from animals sheltering in the shade. Also, in the vegetal layer under the oaks, the participation of forage species represents 56%, by 20% higher than in the treeless grassland. Therefore, the pastoral value of the grassland under the oaks reaches 37 points, almost 16 points higher than in the open field. Also, the fodder production exceeds 4t / ha of green mass, more than double that of the grassland located outside the shade of the trees. To these advantages regarding the productivity of the grasslands from the agrosilvopastoral system we can add the acorn production of the oaks and the beneficial effect of the shade for the animals. All these results argue for the conservation and expansion of the agroforestry system in the context of global warming.*

Keywords: agrosilvopastoral system, dry grasslands, pastoral value, feed production

1. Introduction

Global warming has accelerated research on agroforestry or agrosilvopastoral systems as a measure to prevent the effects of high temperatures and lack of rainfall [1,8,9].

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In our country the agrosilvopastoral systems are more extensive in Dobrogea, as a result of the deforestation of the oak forests concessioned by the English from the Ottoman Empire, from the middle of the 19th century [10].

During that period, given the arid climate, some of the downy oaks were left on the meadows to provide shade for the animals.

Although it is an effective method of counteracting the effects of global warming [3,6], at national level there are few studies and research on the interaction between grasslands and scattered trees, a combination assimilated with the agroforestry system [4, 5].

Thus, the increasing warming of the climate in areas with higher aridity such as Dobrogea, raised the issue of initiating and deepening the research on existing agrosilvopastoral systems and their improvement and expansion.

2. Materials and methods

The studies were carried out on the grasslands with downy oaks from the commune of Cerna, the village of General Praporgescu, located at the confluence of the North Dobrogean Plateau with the Măcin Mountains.

We analyzed 14 plots, of wich 7 areas with well-developed downy oaks, for each of them being evaluated a control area located in a permanent grassland without trees from the immediate vicinity.

Floristic surveys were carried out under the canopy of oaks and in open land on 100 sq m each, the participation of the species in the composition of the vegetal layer being appreciated directly in percentages.

For the plots located under oaks, 4 soil samples were collected at a depth of 0-10 cm from half the distance between the edge of the canopy and the trunk of the trees, as well as from the edge of the canopy, on a circular sample surface. For the plots in the grasslands without trees, 4 soil samples were also collected on the diagonals of the sample surface (10 x 10 m). Soil samples were collected using a soil corer with an inside diameter of 25 mm. The sampled material was analyzed in the laboratory according to the usual methodology for soil agrochemical analyzes [2].

Due to the excessive drought and the overgrazing in August, it was not possible to take fodder samples.

The pastoral value and the production of green mass of fodder were evaluated based on floristic surveys carried out under downy oaks and in open field grasslands, according to the new method proposed by Maruşca in 2019 [6].

3. Results and discussions

The soil analysis showed that under the trees the content of fertilizers is higher than on the dry grasslands located in open field. (Table 1).

Table 1. Main agrochemical and physical values of grassland soil from open field and under trees

Specification	*UM*	*1. Open land*	*2. Under canopy*	*Dif. 2-1 +, -*	*%*
pH in H_2O	ind.	7.20	6.85	-0.35	95
Base saturation BS	%	100.0	96.3	-3.8	96
Humus	%	7.07	7.42	+0.35	105
Nitrogen index	%	7.07	7.14	+0.07	101
Mobile phosphorus (P)	ppm	31.0	54.0	+23.0	174
Mobile potassium (K)	ppm	>400	>400	0	100
Carbonates	%	2.85	-	x	x
Rocks with a diameter <25 mm	%	13.1	4.4	-8.7	34
Roots on 0-10 cm depth	%	1.2	1.9	+0.7	158

From these data it results that under the trees the soil reaction has a slight decrease, the humus content and the nitrogen index increase by 1-5% and that of mobile phosphorus by 74% on a very well supplied background in potassium.

Among the physical components, under trees the rock content below 25 mm is one third lower than on open field grasslands, probably due to the protection offered by the canopy to the soil layer against erosion factors.

Compared to the vegetal layer in uncovered land, the more favorable content in fertilizer elements under the trees improved the floristic composition with good forage species. (Table 2).

Table 2. Floristic composition and productivity of grasslands in open field (L) and under downy oaks (U) in Cerna commune, Tulcea county, 260 m of altitude

Species	*Presence (class)*		*Participation %*			*%*	*Index*	
	L	*U*	*L*	*U*	*Dif.+ -*		*F**	*M***
Vegetation cover	x	x	86.4	68.7	-17.7	80	x	x
Poaceae								
Botrichloa ischaemum	V	III	37.4	1.3	-36.1	3	3	0
Cynodon dactylon	III	V	20.1	21.1	+1.0	105	6	2
Festuca valesiaca	III	V	6.7	18.3	+11.6	272	5	3
Stipa capillata	II	IV	1.0	1.1	+0.1	114	3	0
Eragrostis minor	I	II	0.1	0.6	+0.4	400	3	0
Chrysopogon gryllus	I	-	4.3	-	x	x	4	7
Bombicilena erecta	I	-	0.1	-	x	x	6	6

Lolium perenne	-	III	-	7.3	x	x	9	8
Brachypodium sylvaticum	-	II	-	3.7	x	x	5	7
Dactylis polygama	-	II	-	0.3	x	x	7	7
Melica ciliata	-	I	-	0.3	x	x	4	2
Koeleria lobata	-	I	-	0.1	x	x	5	3
Hordeum hystrix	-	I	-	0.1	x	x	5	3
Fabaceae								
Lotus corniculatus	I	-	0.1	-	x	x	8	6
Other plant families								
Teucrium chamaedrys	III	IV	3.1	1.1	-2.0	36	3	0
Artemisia austriaca	III	IV	1.7	1.1	-0.6	67	2	0
Potentilla argentea	III	IV	0.7	0.9	+0.1	120	4	2
Petrorhagia prolifera	III	III	0.9	0.4	-0.4	50	3	0
Fragaria vesca	III	II	0.9	1.1	+0.3	133	5	1
Teucrium polium	III	I	1.1	0.1	-1.0	13	3	0
Crataegus monogyna	II	V	0.6	2.3	1.7	400	3	0
Achillea millefolium	II	IV	0.4	1.1	0.7	267	6	4
Centaurea diffusa	II	II	0.3	0.3	0.0	100	2	0
Carthamus lanatus	II	I	0.4	0.1	-0.3	33	3	0
Marrubium peregrinum	II	I	0.4	0.7	+0.3	167	3	0
Plantago lanceolata	I	III	0.1	0.4	0.3	300	6	1
Asperula cynanchica	I	II	0.1	0.6	0.4	400	3	0
Chenopodium album	I	II	0.1	0.3	0.1	200	5	6
Scleranthus annuus	I	I	0.1	0.1	0.0	100	3	0
Chondrilla juncea	IV	-	0.6	-	x	x	3	0
Eryngium campestre	III	-	0.6	-	x	x	3	0
Taraxacum serotinum	II	-	0.6	-	x	x	5	2
Thymus pannonicus	II	-	0.6	-	x	x	4	2
Thymus zygioides	II	-	0.6	-	x	x	4	1
Carduus kerneri	I	-	0.1	-	x	x	2	0
Cichorium intybus	I	-	0.1	-	x	x	5	6
Convolvulus cantabricus	I	-	0.1	-	x	x	3	0
Helichrisum arenarium	I	-	0.3	-	x	x	3	0
Orlaya grandiflora	I	-	0.7	-	x	x	3	0
Rosa canina	I	-	0.1	-	x	x	3	0
Salsola kali ruthenica	I	-	0.1	-	x	x	3	0
Satureja coerulea	I	-	0.3	-	x	x	3	0
Torillis arvensis	I	-	0.3	-	x	x	3	0
Verbascum phoeniceum	I	-	0.1	-	x	x	3	0
Agrimonia eupatoria	-	II	-	0.6	x	x	3	0
Carpinus orientalis (juv)	-	II	-	1.7	x	x	3	0
Achillea pannonica	-	I	-	0.4	x	x	6	5
Alyssum alyssoides	-	I	-	0.1	x	x	3	0
Heliotropium europeus	-	I	-	0.1	x	x	3	0
Hypericum perforatum	-	I	-	0.1	x	x	3	0
Polygonum aviculare	-	I	-	0.1	x	x	5	3
Galium verum	-	I	-	0.3	x	x	5	4

Total species(nr.)	**38**	**34**	**-4**	**89**	**x**	**x**
From wich: - fodder	**14**	**16**	**+2**	**114**	**x**	**x**
- not fodder	**24**	**18**	**-6**	**75**	**x**	**x**
Participation of fodder species	**35.6**	**56.0**	**+20.4**	**157**	**x**	**x**
Participation of harmful species	**50.8**	**12.7**	**-38.1**	**25**	**x**	**x**
Bare soil	**13.6**	**31.3**	**+17.7**	**230**	**x**	**x**
Pastoral value (PV)	**21.4**	**36.9**	**+15.5**	**172**	**x**	**x**
Phytomass index	**1.00**	**1.98**	**+0.98**	**198**	**x**	**x**
Fodder production (GM t/ha)	**1.91**	**4.16**	**+2.25**	**218**	**x**	**x**

*) F – Feed value index
**) M – Useful green mass index

From these data it results that the main non-valuable forage species *Botriochloa ischaemum* which appears in open field in proportion of over 37% decreases under oaks to almost 1%. Instead of this weed, in the shade of oaks, the proportion of forage species such as *Festuca valesiaca* increases by 12% and *Lolium perenne* by 7%, species that have a decisive role in increasing the productivity of these steppe grasslands.

Under the trees, where the animals rest in the shade and the insolation is lower, the forage species participate in proportion of 56% in the composition of vegetal layer, with 20% more than in open field.

Thus, the pastoral value under trees reaches 37 points compared to 21 in the open field and the production of green mass of fodder exceeds 4 t/ha under oaks, more than double what was evaluated on the open field grasslands.

All these data confirm the superiority of the vegetal layer under the downy oaks compared to that of the open field grasslands. In addition, the production of acorns can be valued as feed for sheep and goats, the animals that benefit from the shade produce from 20 to 40% more milk and meat and the pastoral landscape with trees is more attractive.

Conclusions

(1) The agroforestry system with downy oak is superior in all aspects: productive, protective and aesthetic compared to the steppe grasslands without trees.

(2) The conservation of the current agroforestry systems and the extension of the trees on the permanent dry grasslands are measures that can prevent aridization and desertification in an already affected area, such as Dobrogea.

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