

Energetic Potential of Romania's Grasslands

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Abstract

Permanent grasslands represent, all over the world, an asset that contributes to maintaining ecological balance in all other natural ecosystem, a never-ending reservoir of vegetal biomass that supplies most of the necessary food for animals and that can also be an important source of "green energy". In Romania, only 56% of the grassland area (i.e. 2,200,000 ha) would be enough to cover the necessary fibrous fodder for the cattle, while the rest of 44% (i.e. 1,700,000 ha) could be used to produce energy.

Keywords: biomass, cattle, energy, permanent grassland

1. Introduction

Permanent grasslands on the Earth cover over 3,000,000,000 ha; they are the main natural source of vegetal biomass, which supplies food for all wild animals and for an important share of domestic animals. There are numerous studies approaching the energetic dimension of grasslands, based on the quantity and quality of the plant species biodiversity in the floristic structure of these ecosystems and on the bio productive potential of these areas [1-5].

The paper points out the value of the energetic potential of grassland areas in Romania, from the point of view of the natural production of vegetal biomass.

2. Materials and methods

Permanent grasslands, together with the forests, cover almost 50% of the total area of Romania; they represent, due to their multifunctional complexity, Romania's "green lungs". One of these functions is the value or energetic dimension of primary vegetal production as a result of floristic activity. The energetic value of the amount of biomass of permanent grasslands was estimated based on some conversion coefficients used in literature (biogas, methane, electricity). Statistic data concerning areas and cattle are based on the agricultural census of 2011.

3. Results and discussion

Sustainability and functionality are the most important features of permanent grassland ecosystems as a result of specific food structures based on the multitude of natural resources of these ecosystems. From this perspective, the extremely large amount of food used as a

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relatively small share as feed for both wild and domestic animals can be an important source of “green energy” when natural hydrocarbon sources are exhausted. The energetic value of the grasslands comes from the huge amount of carbon produced by the vegetation of these areas and stored both in the soil, through the root system, and in the supra-terrestrial biomass.

Romania’s permanent grasslands cover at present about 4,900,000 ha (11% more than in 1990); they produce on the average 1.2-5.5 t/ha of dry matter, and an annual amount of biomass of 13,440,000 t of dry matter. Of the total area covered by grasslands, an area of about 18% (900,000 ha) are degraded grasslands as a result of limiting natural factors or of the lack of special management for the improvement of these areas (Table 1).

Table 1 Structure and potential productivity of Romania’s permanent grasslands

The permanent structure of the grassland	Mil. ha	Average production (t/ha SU)	The annual potential production of biomass (thousands of tons of SU)
Total, of which:	4.9 (100%)		
• Pastures	3.2 (65%)	1.2 – 5.5	13440
• Hay	1.7 (35%)		
Degradated grasslands (without vegetation, or with invasive species, or on inaccessible’s slopes)	0.9 (18%)	x	x

Vegetal biomass is the most important resource of grassland; it can supply part of the necessary feed for bovine, sheep, and goats. There is not always a direct relationship between this amount of vegetal feed and the number of cattle. At the beginning of 2012, there were, in Romania, about 2,240,000 bovines (60% less than in 1990) and 11,330,000

sheep and goats (25% less than in 1990). If we take into account the number of big cattle units (BCU), we can see that, among the E.U. countries, Romania has the lowest values in this synthesis indicator (on the average, 0.17 BCU/inhabitant, 0.23 BCU/ha of agricultural land, 0.69 BCU/ha of grassland) (Table 2).

Table 2 Structure of Romania’s cattle

The livestock structure	Livestock at 01.01.2012	U.V.M. (total)	U.V.M. reported at :		
			UVM/inhabitant	UVM/ha agricultural	UVM/ha grassland
Cattle	2239858	1791886	0.09	0.12	0.37
Sheep+Goats	11331000	1586340	0.08	0.11	0.32
Total	x	3378226	0.17	0.23	0.69

While grasslands supply about 40% of the necessary fibrous fodder for the cattle and 80% fibrous fodder for the sheep and goats (the difference is ensured from the areas cultivated on

arable land with forage plants), the area of permanent grassland necessary to cover this amount of biomass would be 2,200,000 ha, i.e. 56% of the total area covered by grasslands (Table 3).

Table 3 Annual necessary amounts of fodder for Romania’s cattle

The livestock structure	The annual requirement of forage (thousands of tons of SU)	How to ensure the feed (thousands of tons of SU/ %)		The grassland area required for livestock feeding (mil. ha/ %) ^{*)}
		From pastures	From arable crops	
Cattle	6800	2700 (40%)	4100 (60%)	0.8 (20%)
Sheep+Goats	6000	4800 (80%)	1200 (20%)	1.4 (36%)
Total	12800	7500 (59%)	5300 (41%)	2.2 (56%)

^{*)}% reported at the total area of grasslands which produce biomass: 3,9 mil. ha

Of the total area of 3,900,000 ha of permanent grasslands producing important amounts of

vegetal biomass, about 1,700,000 ha (i.e. 44%) could be valorised to produce energy. The

energetic conversion of this vegetal resource could be quantified in one of the following potential amounts of energetic nature: 2,360,000,000 m³/year of biogas (of which 2,006,000,000 m³ methane) or 1298·10³ MWh electric energy (Table

4). Natural conditions and optimal valorisation of agricultural resources can also supply the necessary reserves for the production of “green energy”.

Table 4 Potential energetic value of Romania’s permanent grasslands

Specification	Mil. ha	Thousands of tons S.U.	Mil. m ³ biogas	Mil. m ³ methane	M Wh
The grassland area available for energetic conversion	1,7	x	x	x	x
The potential annual quantity of grasslands biomass for energetic conversion	x	5900	x	x	x
The potential annual biogas quantity	x	x	2360	x	x
The potential annual gas quantity (85% from biogas)	x	x	x	2006	x
Conversion into electricity	x	x	x	x	1298·10 ³

^{*)} conversion factors from the literature:

- 1 t SU = 280-550 m³ biogas
- methan = 85% frm biogas
- 100 m³ biogas = 540-600 KWh

4. Conclusions

At present, to supply the necessary fibrous fodder for the bovine, sheep, and goats of Romania, we need a total area of permanent grasslands of only 2,200,000 ha (56% of the 3,900,000 ha producing vegetal biomass).

The difference of 1,700,000 ha (44%) of grasslands could be directed towards the production of biomass, as a non-polluting, cheap, and sustainable source of energy.

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