

THE CURRENT SITUATION OF THE ROMANIAN GRASSLANDS AND THEIR MANAGEMENT AT THE EUROPEAN LEVEL

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Abstract. *The paper summarizes the current situation of permanent grasslands in Romania concerning the productivity and animal load. Due to the advanced state of degradation on the about 5 million ha, the current animal load reaches 0.3 LU/ha, due to the lack of fertilization with organic and chemical fertilizers, the invasion of harmful grassy and woody species, abandonment, minimum works of maintenance, etc. Through adequate management measures, the productivity of the grasslands and their animal load can increase at least three times in order to join the European developed countries from this point of view.*

Keywords: permanent grasslands green grass production, animal load, adequate management

1. Introduction

Romania's permanent grasslands, covering an area of almost 5 million ha, represents one of the most important renewable natural resources which deserve a high attention regarding biodiversity and optimal valorisation as complete as possible (Anghel et al., 1967, Motcă et al., 1994) [1, 7].

Before going into the essence of the problem expressed in the title, the question arises why such an analysis is necessary and for what is it used for?

Over the centuries, the natural conditions and the management of the pastoral fund in each country has left their mark on the biodiversity of the meadows.

In order to enrich and maintain biodiversity in Romania, the EU bodies have decided to pay substantial funds, especially since the primary grasslands (alpine, subalpine, forest-steppe and steppe) and the secondary ones after deforestation, because the countries with a high developed animal husbandry have suffered profound changes through reseeding and intensive fertilization.

In addition to biodiversity conservation, a high important has also the productivity of the permanent grasslands, respectively greengrass production and forage quality for animal husbandry (Pușcaru-Soroceanu et al., 1963, Bărbulescu, and Motcă, 1983, 1987) [9, 2, 3].

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A comparative study on grasslands productivity in Romania and in the countries with a high developed animal husbandry is necessary to be elaborated in order to know where we are at the moment.

It is also appropriate to highlight the specificity of the Romanian pastoral fund in comparison with the one in the EU in order to identify the differences that stimulates or aggravate animal husbandry.

Finally, an analysis on the optimal possibilities for loading animals at the actual production level of the permanent grasslands by bioclimate zones and stages is self-evident, with unsuspected possibilities to increase grass production after the application of measures for improvement, maintenance and rational use of this important renewable wealth at the European level.

In this context, the purpose of the paper was the analysis of the current situation of the grasslands in Romania and at the EU level in order to identify the possibility to increase grass production and animal load.

2. Materials and Methods

In order to know the current productivity of the Romanian meadows, the data referring to production and quality of the control (unimproved) plots were taken from the numerous experiments carried out in the last half century by the authors cited in the bibliography, who performed numerous syntheses such as: Puşcaru-Soroceanu et al. (1963) [9], Puia et al. (1976) [8], Bărbulescu and Motcă (1983 and 1987) [2, 3], Motcă et al. (1994) [7], Maruşca (2001 and 2016) [5, 16] and many others.

The data concerning the productivity of the meadows from Switzerland were collected from Caputa (1966) [4], and Simtea et al., (1972) [10].

Based on these results from the specialized literature and the statistical data of the current herbivorous livestock, the actual and potential loading with animals of the permanent meadows in our country was further estimated.

3. Results and discussions

3.1. The level of the permanent grasslands production

In order to know where we stand with grass production of the permanent mountains meadows expressed in dry matter (DM), we took as a basis the data from the specialized literature for Romania's grasslands in comparison with the meadows in Switzerland, an alpine country with a long tradition in grasslands management (Caputa 1966, Simtea et al., 1972, Puia et al., 1976, Maruşca, 2001) [4, 10, 8, 5] (Table 1).

From these data it results that the mountain grasslands in our country has a production almost 4 times lower, respectively by 25.4% compared to those in Switzerland, in average on the 600-2,000 m altitudinal range.

Table 1. Production of dry matter from the semi-natural mountain grasslands in Romania and Switzerland (tons/ha)

| Altitude (m) | Romania (after, Puia, 1976) | Switzerland (after Caputa, 1966) | Differences \pm | % |
|------------------------------------------------|-----------------------------|----------------------------------|-------------------|------------|
| 1,801 – 2,000 | 0.9 | 3.5 | + 2.6 | 389 |
| 1,601 – 1,800 | 1.6 | 4.8 | + 3.2 | 300 |
| 1,401 – 1,600 | 1.3 | 5.4 | + 4.1 | 415 |
| 1,201 – 1,400 | 1.9 | 7.5 | + 5.6 | 395 |
| 1,001 – 1,200 | 1.9 | 7.8 | + 5.9 | 410 |
| 801 – 1,000 | 1.8 | 7.6 | + 5.8 | 422 |
| 601 – 800 | 1.7 | 7.8 | + 6.1 | 459 |
| Mean | 1.6 | 6.3 | + 4.7 | 394 |
| Average fertilization level Nitrogen units (N) | 20*) | 150**) | + 130 | 750 |

*) Approximately 20 kg N/ha mostly during the grazing at an optimal load and very little manure and almost no chemical fertilizer

***) Approximately 75 kg N/ha organic fertilizer + 75 kg/ha chemical fertilizer.

Any analysis we make and any explanation we find it is very clear that Swiss meadows are treated like the other agricultural crops, being organically and chemically fertilized with minimum 150 kg/ha N and other fertilizers (P, K, etc.), while ours do not carry out proper maintenance works and fertilizers are rarely used and in insignificant quantities.

By abandoning the mountain meadows today, grass production is even lower than in the past due to the replacement of the grassy carpet with woody vegetation harmful to animal husbandry (Marușca, 2016) [6].

In the hilly and plain area, the productivity of the meadows is even lower than in the mountain area due to the long periods of drought and the lack of maintenance.

3.2. Practical cultural differences, endowment and capitalization of the pastoral heritage

To explain the lower current state of the productivity of the pastoral heritage it is necessary to draw a parallel between the existing situation in Romania and the situation in the EU countries with developed animal husbandry (Table 2).

Table 2. Comparative situation of the pastoral heritage

| Romania with extensive underdeveloped animal husbandry | EU countries with advanced animal husbandry |
|-------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------|
| <i>Average climate conditions</i> | |
| - continental climate with warmer summers and frosty winters, low and unevenly precipitations | - milder oceanic climate with cooler summers, milder winters and more abundant and better distributed precipitations |
| <i>Grassu carpet</i> | |
| - natural and semi-natural meadows, often and in majority invaded by weeds and woody vegetation | - meadows sown wherever possible, highly productive |
| <i>Nitrogen fertilization level (N)</i> | |
| - N insignificant or missing | - N 200 – 300 kg/ha/year for many decades |
| <i>Hay harvesting and storage conditions</i> | |
| - much delayed, after seed ripening in general (June- July) | - the best time for perennial grasses and leguminous plants to bloom (April- May) |
| - most manual and mechanized in small proportions, loose hay under the open | - with fully mechanized means, baled hay, silage, properly stored |
| <i>Grazing intensity with animals</i> | |
| - extensively in majority, often with underload or abandon | - intensively, for decades on the entire surface |
| <i>Fencing and parceling the pastures</i> | |
| - almost non-existent, the animals move beyond the borders of the localities accompanied by shepherds | - all pastures are fenced, the animals graze rationally on the plots without shepherds |
| Romania with extensive underdeveloped animal husbandry | EU countries with developed animal husbandry |
| <i>Species and categories of grazing animals</i> | |
| - mixture of species and categories of animals | - subdivision by species, categories and production |
| <i>Water supply</i> | |
| - intermittent watering from natural sources | - permanent watering from arranged sources |
| <i>Shelters on pasture</i> | |
| - temporary shepherds with animals in open-air pens, crawling and supercrawling | - durable constructions provided with means for collecting and distributing manure |
| <i>Access on pasture</i> | |
| - unpaved roads and mountain paths, difficult to access | - roads arranged for car access and other means of transport |
| <i>Moving animals</i> | |
| - mainly walking on foot due to the lack of arranged access roads | - with mostly cars, less walking |
| <i>Processing of animal products</i> | |
| - in shepherds, often unhygienic, with unknown processing and provenance | - centralized, under hygienic conditions, under different standardized landmarks |

In the EU countries with developed animal husbandry, grasslands are formed especially of species of grasses and perennial leguminous of improved varieties which have gradually replaced by sowing the spontaneous flora. In other words, the sown meadows are spread everywhere it was possible to establish them, being treated like any other fodder crop.

The meadows with species from spontaneous flora are less efficient in terms of production and quality compared to the meadows sown with improved grass mixtures which better respond to the means of intensifying production, especially fertilization.

The meadows from the countries with a more wetter and warmer climate from the Western and Southern Europe are dominated by perennial ryegrass (*Lolium perenne*) and white clover (*Trifolium repens*) and the ones from the North of the continent consists of thymophytic (*Phleum pratense*) and red clover (*Trifolium pratense*), species adapted at a colder climate.

The intensification of fodder production on meadows by setting up sown meadows and fertilizing them with N 200 – 300 kg/ha/year in average, many decades has resulted that many of the spontaneous flora to disappear from the grassy carpet.

Thus, there was a need to reduce the amount of fertilizers in the practice of organic farming up to the level of N 40 kg/ha/year and to eliminate the improved species from outside to enrich and maintain biodiversity with native species before intensifying production on meadows.

3.3. Loading animals of the permanent grasslands in Romania

Based on the literature of the last half century, according to a simple calculation, the average grass production at the lowest level is 6.3 tons per hectare with large differences between different bioclimatic areas, respectively from 1.5 tons in the area of steppe and alpine floor, up to 10 tons/ha in meadows and depressions (Table 3, 4 and 5).

Table 3. Loading of permanent grasslands with animals in the mountain area by bioclimatic zone

| Bioclimatic zone | | | Alpine floor | Subalpine floor (juniper) | Boreal floor (spruce) | Nemoral floor (beech and spruce) | Total |
|-----------------------------------|-----------------------|-------------------|--------------|---------------------------|-----------------------|----------------------------------|--------------------|
| Altitude thresholds (m) | | | Over 2,100 | 1,700-2,100 | 1,200-1,800 | 800 - 1,300 | 800 - 2,544 |
| Area (thousand ha) | | | 40 | 60 | 1,000 | 1,000 | 2,100 |
| Grass production | Average (t/ha) | | 1.5 | 3.0 | 6.0 | 9.0 | 7.3 |
| | Total (Thousand tons) | | 60 | 180 | 6,000 | 9,000 | 15,240 |
| Duration of grazing season (Days) | | | 50 | 80 | 110 | 140 | 124 |
| Loading with animals | Grazing season | Average (LU/ha) | 0.46 | 0.58 | 0.84 | 0.99 | 0.90 |
| | | Total (Thous. LU) | 18 | 35 | 840 | 990 | 1,883 |
| | For 365 days | Average (LU/ha) | 0.06 | 0.13 | 0.25 | 0.38 | 0.31 |
| | | Total (Thous. LU) | 2.4 | 7.8 | 250.0 | 380.0 | 640.2 |
| Distribution by zone (%) | | | 0.2 | 0.6 | 18.7 | 28.5 | 48.0 |

On large physical-geographical areas, the highest grass production is registered in the mountain area with 7.3 tons/ha, followed by the hill area with 6.5 tons /ha and the lowest we have in the plain with 2.5 tons/ha, being determined especially by the provision of humidity from atmospheric precipitation.

Although the average production per hectare is quite small, the total grass production of permanent grasslands in our country reaches 31,650 thousand tons.

The situation regarding the loading animals of the permanent grasslands in Romania by physical-geographical and bioclimatic areas is presented in Tables 3, 4, 5 and at the national level in Table 6.

Table 4. Loading of permanent grasslands with animals in the hill area by bioclimatic zone

| Bioclimatic zone | | | Nemoral floor (beech and gorun) | Nemoral floor (gorun) | Nemoral zone (mesophilic oaks) | Meadows and depressions | Total |
|-----------------------------------|--------------------------|-------------------------|---------------------------------------|--------------------------|--------------------------------------|-------------------------------|----------------------|
| Altitude thresholds (m) | | | 500-800 | 300 - 600 | 200-400 | - | 200 - 800 |
| Area (thousand ha) | | | 800 | 900 | 200 | 400 | 2,300 |
| Grass production | Average (t/ha) | | 7.0 | 5.0 | 4.0 | 10.0 | 6.5 |
| | Total (Thousand tons) | | 5,600 | 4,500 | 800 | 4,000 | 14,900 |
| Duration of grazing season (Days) | | | 170 | 150 | 130 | 200 | 167 |
| Loading with animals | Grazing season | Average (LU/ha) | 0.64 | 0.51 | 0.48 | 0.77 | 0.6 |
| | | Total (Thous. LU) | 512 | 459 | 96 | 308 | 1,375 |
| | For 365 days | Average (LU/ha) | 0.30 | 0.21 | 0.17 | 0.42 | 0.27 |
| | | Total (Thous. LU) | 240.0 | 189.0 | 34.0 | 168.0 | 631.0 |
| Distribution by zone (%) | | | 18.0 | 14.2 | 2.5 | 12.6 | 47.8 |

In the condition of a temperate climate with continental influence and mountainous altitude stratification, the normal grazing season on permanent grasslands with primary vegetation from the steppe zone and the alpine floor is only 50 days, and in the meadows and depressions from the plain area and hills with assured humidity reaches 200 days.

Between these two extremes is the rest of the optimal grazing seasons with a national average of 140 days.

In the mountain area, the grazing time is between the melting of the snow in spring and the falling of snow in winter, when animals have something to graze, without

the possibility to be prolonged, forcing the animals to descend further down the valley.

Table 5. Loading of permanent grasslands with animals in the plain area by bioclimatic zone

| Bioclimatic zone | | | Nemoral zone (thermophilic oaks) | Forest-steppe zone | Steppe zone | Salty zone | Sandy zone | Total |
|-----------------------------------|-----------------------|-------------------|-------------------------------------|--------------------|-------------|------------|------------|-----------------|
| Altitude thresholds (m) | | | 100 - 200 | 50-150 | 20-100 | - | - | 20 - 200 |
| Area (thousand ha) | | | 200 | 250 | 90 | 50 | 10 | 600 |
| Grass production | Average (t/ha) | | 3.0 | 2.0 | 1.5 | 5.0 | 2.0 | 2.5 |
| | Total (Thousand tons) | | 600 | 500 | 140 | 250 | 20 | 1,510 |
| Duration of grazing season (Days) | | | 110 | 80 | 50 | 80 | 50 | 84 |
| Loading with animals | Grazing season | Average (LU/ha) | 0.42 | 0.39 | 0.46 | 0.96 | 0.62 | 0.46 |
| | | Total (Thous. LU) | 84 | 98 | 41 | 48 | 6 | 277 |
| | For 365 days | Average (LU/ha) | 0.13 | 0.08 | 0.06 | 0.21 | 0.08 | 0.11 |
| | | Total (Thous. LU) | 26.0 | 20.0 | 5.5 | 10.5 | 0.8 | 62.8 |
| Distribution by zone (%) | | | 1.9 | 1.5 | 0.4 | 0.8 | 0.1 | 4.7 |

Table 6. Loading of permanent grasslands with animals in all the physical-geographical and bioclimatic areas of Romania

| | | | TOTAL |
|-----------------------------------|-----------------------|-------------------|----------------|
| Area (thousand ha) | | | 5,000 |
| Grass production | Average (t/ha) | | 6.3 |
| | Total (Thousand tons) | | 31,650 |
| Duration of grazing season (Days) | | | 140 |
| Loading with animals | Grazing season | Average (LU/ha) | 0.70 |
| | | Total (Thous. LU) | 3,535 |
| | For 365 days | Average (LU/ha) | 0.27 |
| | | Total (Thous. LU) | 1,334.0 |
| Distribution by zone (%) | | | 100.0 |

On contrast, on the plain area and hills lacked of a permanent snow straw for long time, the grazing period is much longer than normal.

The optimum duration of grazing season is equal to the duration of the days with average daily temperatures ranging between 10 – 15⁰C. At average daily

temperatures below 10⁰C and over 15⁰C, the growing conditions of the grass are totally unfavorable and it is not wise to graze with animals.

Loading animals is less studied, but it is of the highest importance together with the optimal duration of the grazing season if we intend to superiorly capitalize grass production of the permanent meadows. From the very beginning we will have to clarify how many kinds of this load of animals are and what is the need for grass for a day per head of LU, the "common denominator" of all species and categories of animals.

The loading of a meadow with animals can be of two types: respectively for the actual grazing season and for the whole year of 365 days.

The average daily grass requirement for an LU is considered to be 65 kg/ LU/day of which 50 kg grass (10 kg dry matter) is actually consumed by animals. The difference in additional 15 kg of grass between the sample determined by mowing and that actually consumed by the animals is predicted due to climatic fluctuations with repercussions on the dynamics of seasonal or annual production as well as the degree of consumability depending on the quality of the grass.

Once these three parameters have been established, the grass production, the grazing duration and the daily grass requirement for a LU, the animal load can be determined, both in the actual season called grazing capacity and for a whole year which we will call in premiere for the literature, the forage capacity of the meadow.

In the territory of the 5 million hectares, approx. 1/3 of the surface of permanent meadows, is used in hay and the remaining 2/3 as pasture. The meadows of over 1,200 - 1,400 m altitude, above the permanently inhabited area of the Carpathians, are used exclusively as pastures.

For the grazing season, the load with animals varies between 0.39 LU/ha during 80 days in the forest-steppe area up to 0.99 LU/ha during 140 days in the floor of the mixed forests (beech + spruce + fir) located between 800 - 1,300 m altitude, the grazing capacity being on average 0.70 LU/ha.

If we take into account the loading with animals for the whole year regardless whether we graze directly or mow for canned fodder (hay, silage etc) necessary in the cold season, the forage capacity varies between 0.06 LU/ha in the steppe area and the alpine and 0.42 LU/ha in meadows and depressions, respectively 7 times higher. At the level of permanent grasslands in our country, this parameter is 0.27 LU/ha/year, respectively 1,334 thousand LU can be easily maintained only with the feed provided by permanent grasslands. This calculation on the average forage capacity of permanent pastures was the basis for establishing the mandatory

minimum level of pasture loading of 0.3 LU/ha (one cow per 3 hectares or 2 sheep per hectare).

Through the usual maintenance and fertilization works at an average level of 100 kg/ha nitrogen active substance, the grass production would increase substantially, this load would reach almost 1 LU/ha, respectively the livestock that would rationally capitalize the permanent meadows would be tripled, the cheapest feed resource.

Conclusions

(1). The permanent meadows of Romania have a surface of about 5 million ha and a very low productivity compared to other EU countries with high developed animal husbandry.

(2). The causes of the production and lower forage quality of our meadows are determined by the chronic lack of fertilizers, current care work, chaotic grazing in terms of duration and load, and last but not least, the concept of most breeders who believe that grass grows to yourself and you have nothing to do than to graze it with the animals.

(3). Increasing grass production by raising the level of fertilization from approx. N 20 to at least N 100 kg/ha/year of organic and chemical fertilizers, provision of access roads, water supply, fences for rational use, shade and animal shelters, civilized conditions for caretakers, animal processing centers, etc., inscribed in pastoral arrangements are absolutely necessary for the not too distant future if we really want to join the European civilization of meadows.

(4). The improvement, endowment and rational use of the pastoral heritage at European level can triple in perspective the number of herbivorous animals, which capitalize on permanent pastures from 1.3 to 4 million LU throughout the year or from 3.5 to 10 million LU for the grazing season, being a real revolution in animal husbandry.

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