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CONTRIBUTIONS ON THE ESTABLISHMENT OF PRODUCTIVITY INDICATORS FOR COW MILK PRODUCED IN THE CARPATHIAN MOUNTAINS

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Abstract. *Assessing the productivity of a pasture in animal product, such as live weight gain or milk production, is very important for establishing creditworthiness levels, planning, valorisation, fees, subsidies, etc. In an experience with dairy cows on an improved pasture, in the Bucegi Mountains, located at 1,800 m altitude, after 20 years, a coefficient of correlation statistically assured between pastoral value and milk production in the grazing season has been determined. Using this coefficient of 51.24 by multiplying it by the pastoral value, it is possible to directly estimate the milk yield per hectare of an improved pasture exploited in a rational way. For the mountain area with usual precipitations, this coefficient has a gradient of - 4.5 / 100 m altitude, respectively from 98, for 600 - 800 m with a duration of 160 grazing days, to 35 for 2,000 – 2,200 m m, where dairy cows graze for an average of 55 summering days*.

Keywords: pastoral value, grazing, cows, milk production coefficient, altitudinal gradient

1. Introduction

The mountain pastures in the Carpathians represent the main fodder source for raising sheep and cattle (Bărbulescu, Motcă 1983, Burcea et al. 2007) [1,2].
The expression of the productivity of pastures utilised by grazing in animal production is the most faithful economic indicator. In this sense, experiments were initiated with young bulls in which the increase in live weight was recorded (Vladeni, Persani Mountains 600 m alt.) And with cows in which milk was measured (Moroieni, Bucegi Mountains, 1,800 m alt.) (Maruşca 1973 , Maruşca et al. 2002) [4,5].

Obviously, these animal experiments are more difficult to carry out in the mountain area, so it is necessary to evaluate animal production by indirect means

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such as floristic composition and the calculation of pastoral value. Such a case-by-case approach set out to present this paper.

2. Material and Method

In order to achieve the proposed objectives, the data of the animal experience started in 1996 in Bucegi were analyzed. These trials are continuing at the moment.

By comparing the pastoral value calculated on the basis of floristic composition, with the milk cow production in the grazing season, the statistically ensured coefficient 51.24 was established (Maruşca et al.2018) [6].

Thus, by multiplying the pastoral value by 51.24 established for the subalpine pastures from 1,800 m, it is possible to evaluate with quite high accuracy the milk production per hectare in the conditions of management and rational use of these permanent grasslands. From the level of 1,800 m above sea level (a.s.l.) where the long-term experience with dairy cows has been established, gradients were outlined up and down for each 100 m, during the grazing season and the milk production coefficient.

The case study for the application of this transformation coefficient in milk production were the associations of permanent sub mountain and mountain grasslands in Northern Oltenia (Ionescu et al.2001) [3].

This application demonstrates the validity of this assesement system of animal production in mountain pastures.

3. Results and Discussions

The duration of the optimal grazing season at 600 - 800 m alt. it is about 160 days and decreases by 7.5 days for every 100 m altitude to 2,000 - 2,200 m, where it reaches only 55 days (Table 1).

Table 1. Production of cow milk for an average pastoral value of 50, depending on altitude

Altitude	Grazing season length, (days)	Correlation coefficient	Milk production (L / ha)
2,000 - 2,200	55	35	1,750
1,800 - 2,000	70	44	2,200
1,600 - 1,800	85	53	2,650
1,400 - 1,600	100	62	3,100
1,200 - 1,400	115	71	3,550
1,000 - 1,200	130	80	4,000
800 - 1,000	145	89	4,450
600 - 800	160	98	4,900
Gradients / 100 m	- 7.5	- 4.5	- 225

On the same altitudinal amplitude, the coefficient of transformation of the pastoral value in milk production varies from 98 at 600 - 800 m to 35 at 2,000 - 2,200 m, with a gradient of - 4.5 / 100 m altitude.

If the pastoral value were 50 on the entire altitudinal amplitude of 1,400 m, applying the transformation coefficient for milk production it reaches 4,900 liters / hectare at 600 - 800 m up to 1,750 l / ha at 2,000 - 2,200 m, with a gradient of - 225 liters / 100 m alt.

For example, in order to express the pastoral value in cow milk production, it is presented for the associations of sub mountain and mountain pastures in Northern Oltenia (Table 2).

Table 2. Evaluation of cow milk production for the main associations of sub mountain and mountain pastures in Northern Oltenia

Phytosociological association	Pastoral Value (VP)	Milk Production (L/ha)	Relative Production (%)
A. Mountain grasslands (600 - 1,600 m alt.), 130 grazing season days and 80 coefficient of transformation into milk			
1. *Trifolio(repenti)- Lolietum perennis*	86.7	6,935	141
2. *Festuco (rubrae) - Agrostitetum capillaris*	63.8	5,105	104
3.*Danthonio - Festucetum rubrae*	59.9	4,790	97
4. *Agrosti(capillaris) - Chrysopogonetum grylli*	46.3	3,945	80
5. *Agrosti(capillaris) - Festucetum rubrae*	57.8	4,625	94
6. *Agrosti(capillaris) - Genistelletum*	51.6	4,130	84
Average A:	61.5	4,920	100
B. Subalpine and alpine pastures (1,600 - 2,200 m alt.), 70 grazing season days and 44 medium coefficient of transformation into milk			
1. *Potentillo (ternatae) - Festucetum airoides*	46.1	2,030	135
2. *Scorzonero (rosae) - Festucetum nigrescentis*	33.4	1,470	98
3. *Seslerio (coerulantis) - Festucetum saxatilis*	38.3	1,685	112
4. *Seslerio (bielzii) - Caricetum sempervirentis*	34.3	1,510	100
5. *Primulo (minimae) - Caricetum curvulae*	39.6	1,740	114
6. *Violo (declinatae) - Nardetum strictae*	13.5	595	40
Average B:	34.2	1,505	100
Difference B - A: + , - →	- 27.3	- 3,415	x
% →	56	69	x
General Average AB	47.8	3,210	x

From these data it results that the type of *Lolium perenne* with *Trifolium repens* grasslands from riversides with a pastoral value of 86.7 can produce over 6,900 liters of cow milk per hectare under appropriate management and utilization conditions, similar to Western European productions.

At the opposite pole is the type of grass degraded by *Nardus stricta* species in the high mountains with a pastoral value of 13.5 and a milk production close of 600 liters per hectare.

Under normal conditions of maintenance and operation, mountain pastures can provide on average 4,900 l / ha and on subalpine and alpine ones 1,500 l / ha, more than 3 times less.

On the entire amplitude from 600 to 2,200 m a.s.l., the pastoral value average of permanent pastures in northern Oltenia is close to 50 and the possible milk production reaches 3,200 l / ha, under normal management conditions.

Conclusions

(1). The evaluation of cow milk production achieved on pastures during the grazing season is an important indicator for the pastoral economy.

(2). By applying a coefficient of transformation after establishing the pastoral value based on the floristic composition, it is possible to predict with sufficient accuracy the milk production potential, per hectare of pasture.

(3). The production of cow milk on the pastures in northern Oltenia varies between 600 liters per hectare on the associations with *Nardus stricta* species, from the high mountains, up to 6,900 liters per hectare on the association *Lolium perenne* with *Trifolium repens* species from riversides.

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