YIELD IN LIVEWEIGHT GAIN IN YOUNG FEMALE CALVES ON IMPROVED NARDUS PASTURES IN THE PERŞANI MOUNTAINS

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Abstract

Mountain meadows degraded by the invasion of the *Nardus stricta* species in the Perşani Mountains located in the Curve Carpathians, were improved by fertilization with manure 35 t/ha, variant A being natural grass cover, Variant B reseeded with a complex mixture and Variant C reseeded with a simple mixture of *Dactylis glomerata*, *Lolium perenne*, *Festuca pratensis* and *Phleum pratense* in proportion of 80% each in combination with 10% *Trifolium repens* and 10% *Lotus corniculatus*. Each variant was divided into eight plots for rational grazing with female calves averaging 17.5 months and 273 kg. The best results in the first two years were obtained in Variant B, complex grass mixture, where a gain of 4.6 kg/ha/day and 607 kg/ha live weight gain were achieved in the 133 days of the grazing season. Variant A was invaded by *Deschampsia caespitosa* and in Variant C with simple mixtures production decreased due to local varieties of *Lolium perenne* and *Festuca pratensis*, which reduced their participation in the grass cover. The highest yield per head was also achieved in Variant B with 9.18 g/head and an average consumption of 11.3 kg dry matter per 1 kg yield. In perspective, the improvement of the Nardus pastures is economically efficient.

Keywords: *Nardus stricta* pasture, improvement, grazing with young cattle, yield increase live weight

INTRODUCTION

Increasing the productive potential of grassland dominated by ryegrass (*Nardus stricta* L.) is an important problem to be tackled because of its wide distribution and especially its low forage value.

Due to the wide distribution of *Nardus stricta* on permanent grasslands in the temperate mountainous zone of Europe, extensive studies on it were carried out a century ago. (Coulon, 1923)

The invasive nature of this species, which is not valuable from a forage point of view, has required several studies in our country with the aim of improving them. (Obrejanu Gr., 1941; Puşcaru-Soroceanu, Puşcaru, 1969; Resmeriţă, 1969; Niedermaier, Maruşca,1970)

The methods of their improvement have gone through different stages, starting with the traditional ones based on fertilization with organic fertilizers and tillage, continuing then with fertilization with chemical fertilizers and more recently the radical restoration of the grass cover by different means. (Puşcaru şi colab. 1956)

Research carried out in different seasonal conditions in our country has highlighted the multiple possibilities of improving the Nardus pastures with the best results both in terms of increasing production and raising the quality of forage obtained.

In most of the research carried out, yield results have been presented in grass (green mass), hay and only in the last few years in dry matter. Some of these results are also accompanied by chemical analyses of the forage obtained, in particular protein and crude cellulose content.

Some references are also made to their possible stocking rate, expressed in livestock units per ha on unimproved and improved *Nardus stricta* grassland, without specifying the yield in animal products. (Safta și colab. 1962)

Although these ways of expressing grassland production have a certain scientific and practical value, they do not, however, give a finite form of the yield of a grassland which is mainly used for grazing animals.

This is why it was necessary to express the productivity of a grassland in animal products (live weight gain, milk, wool, etc.). (Maruşca,1974)

The author of the present work, after an alpage carried out in Switzerland in the summer of 1969 where he tracked experiments with animals on pasture, on his return to the country he introduced for the first time new research on the yield of pasture productivity in live weight in young cattle and sheep.

MATERIAL AND METHOD

For this purpose, experiments were started on a meadow of *Nardus stricta* in Vlădeni, Braşov county, located in the Perşani Mountains, at 585 m altitude, on a podzolic pseudogleyed soil with a water pH of 5.2.

The floristic composition of the permanent grassland before the start of the experiments (1970), consisting of 34 species, was as follows: *Nardus stricta* (62%); *Agrostis capillaris* (8%); *Holcus lanatus* (2%); *Anthoxantum odoratum* (2%); *Sieglingia decumbens* (1%); *Deschampsia caespitisa* (+); *Festuca rubra* (+); *Agrostis stolonifera* (+); *Carex pallescens* (8%); *Carex stellulata* (2%); *Carex flava* (+); *Luzula campestris* (+); *Juncus conglomeratus* (+); *Genista tinctoria* (3%); *Centaurea jacaea* (3%); *Succisa pratensis* (2%); *Achillea ptarmica* (1%); *Plantago lanceolata* (1%); *Plantago major* (+); *Prunella vulgaris* (+); *Chrysanthemum leucanthemum* (+); *Potentilla erecta* (+); *Mentha pulegium* (+); *Ajuga reptans* (+); *Viola canina* (+); *Stenactis annua* (+); *Leontodon hyspidus* (+); *Leontodon autumnale* (+); *Ranunculus polyanthemus* (+); *Ranunculus flammula* (+); *Achillea millefolium* (+); *Polygala vulgaris* (+); *Hypericum perforatum* (+); *Gentiana pneumonanthe* (+).

Preliminary experiments were carried out in the experimental field to find the best methods of radical restoration. On the basis of these results, three types of improved grassland were prepared to express the yield through animal production:

A – permanent grassland improved by surface measures (fertilisation);

B – meadow sown with a complex mixture of grasses consisting of: *Dactylis glomerata* 20%, *Lolium perenne* 20%, *Festuca pratensis* 20%, *Phleum pratense* 20%, *Trifolium repens* 10%, *Lotus corniculatus* 10%, after the radical milling of the celery;

C – meadow sown with simple mixtures of grasses, arranged in a conveyor belt:

1. *Dactylis glomerata* (Local of Banat) 80%, *Trifolium repens* 10%, *Lotus corniculatus* 10%.
2. *Lolium perene* (Local of Banat) 80%, *Trifolium repens* 10%, *Lotus corniculatus* 10%.

3. *Festuca pratensis* (Local of Braşov) 80%, *Trifolium repens* 10%, *Lotus corniculatus* 10%.
4. *Phleum pratense* (Local of Suceava) 80%, *Trifolium repens* 10%, *Lotus corniculatus* 10%, after the radical milling of the celery.

A quantity of 35t manure per ha was applied to the entire area of improved grassland in autumn 1970, after which the future grassland types B and C were tilled with FPP 1.3 at a depth of 10–12 cm.

In the spring of 1971, the sown meadow was established, the production of which was harvested by mowing at grazing height.

In the spring of 1972, the actual grazing was started with young female *Bălţata românească* cattle, to a group of 7 heads on each type of meadow.

In order to achieve rational grazing, each type of meadow was divided into 8 plots of 1980 square metres each, giving each group of animals an area of 15840 square metres. For group C, each simple mixture of the components of the meadow was reserved 2 plots, with groups A and B having a homogeneous grass cover in terms of floristic composition.

As a chemical fertilizer system, it was planned to apply P_{60} and K_{60} kg/ha in autumn (uniformly on the three types of grassland) and to apply fractional doses of N_{60} kg/ha during the growing season, in spring and after each grazing cycle. Thus N_{180} kg/ha was applied in 1972 and N_{300} kg/ha in 1973, i.e. 240 kg/ha N on average over the two years.

Dry matter (DM) production was determined for each individual plot and, each cycle, 2 m^2 in four points were sampled with a metric frame of the plot prior to grazing.

After grazing, in some cases, uneaten remnants were collected and weighed in their entirety and sampled for dry matter determination.

Observations were also made on floristic composition using the quantitative botanical method.

In order to determine the live weight gain of the animals, weighings were carried out at the beginning and end of grazing and at two-week intervals.

The animals were provided with a free-range, straw-bedded shelter. The water supply was continuous for each plot.

It should be noted that the animals were fed only on meadow products, grass and sometimes hay, without the addition of concentrates.

In fact, the working method was modelled on the experience in Vuissens-Switzerland in the Jura Mountains, where the author did a specialization internship as mentioned above. (Caputa, Lubienecki, 1972)

RESULTS AND DISCUSSIONS

Grass production consumed by the animals, expressed in SU t/ha, was quite high for the seasonal conditions under which the experiments were carried out (Table 1).

The type of permanent grassland improved by fertilization (A) evolved a lot in terms of floristic composition, with a greater participation of *Festuca rubra* in the first year and *Agrostis capillaris* in the second year, while the dominant species, *Nardus stricta*, disappeared from the grass cover.

It is also worth noting the appearance of white clover (*Ttifolium repens* L) in a fairly significant proportion, which can reach approx. 12%.

Table 1.
Total dry matter production and yield per hectare expressed as liveweight gain in young cattle

Year	Plot (lot)	Total production SU t/ha	Refusals SU t/ha	Animal consumption SU t/ha	Live weight gain in 133 days		
					Kg/ha	%	Kg/ha/day
1972	A	6.52	1.88	4.54	606	100	4.6
	B	7.21	1.39	5.82	673	111	5.1
	C	**7.73**	**1.17**	**6.56**	**714**	**118**	**5.4**
1973	A	4.46	1.23	3.23	426	100	3.2
	B	**6.45**	**1.94**	**4.51**	**541**	**127**	**4.1**
	C	6.32	1.95	4.37	488	115	3.7
AVERAGE	A	5.49	1.56	3.92	516	101	3.9
	B	**6.83**	**1.67**	**5.16**	**607**	**118**	**4.6**
	C	7.02	1.56	5.46	601	116	4.5

Less encouraging is the emergence in the last year of poor forage species and weeds such as: *Deschampsia caespitosa*, *Ranunculus sp.*, and others which reach an average participation rate of 28%.

This evolution also explains, to some extent, the level of SU production achieved last year which is only 4.46 t/ha, 31.6% lower than the first year when 6.52 t/ha was recorded, although the amount of nitrogen fertiliser was higher in the second year.

In terms of the phasing of SU production, the first cycle is found to have a lower level than the immediately following cycles, with the highest productive level in the second cycle (Table 2).

Table 2. Production of SU t/ha of grassland types
at Vlădeni – Brașov and its distribution by use cycle in 1973

Meadow type	Cycle of use							Total
	I	II	III	IV	V	VI	VII	
SU t/ha production								
A	0.61	1.26	0.67	0.59	0.33	0.40	0.60	4.46
B	1.69	0.94	0.79	1.01	0.89	0.75	0.38	6.45
C	1.72	0.92	0.82	1.07	0.86	0.63	0.30	6.32
Production breakdown by cycle (%)								
A	14	28	15	13	7	9	14	100
B	26	15	12	16	14	12	6	100
C	27	15	13	16	14	10	5	100

In cycles 5 and 6 during the dry period, permanent grassland yields are lower than sown grassland. In cycle 7 the same SU production is achieved as in cycle 1 grazing.

The type of grassland sown with a complex mixture (B) had almost 20% higher yields in the two years than natural grassland improved by fertilisation alone. In the second year

of use, due to a lack of snow in some periods accompanied by heavy frosts, the *Lolium perenne* species and *Festuca pratensis*, components of the original complex mixture, were damaged, so that the botanical composition was mainly represented by *Dactylis glomerata* and *Phleum pratense* species.

Similarly, leguminous species in the mix have almost completely disappeared during these years of use, although in the first year of vegetation they represented more than 15% of the floristic composition.

As far as the staggering of SU production is concerned, a higher level is observed in the first cycle compared to the following cycles, when greater difficulties are encountered with grazing due to the species *Dactylis glomerata* which is known to have a shorter optimal period of use.

The type of grassland sown with simple mixtures sown in a conveyor (C) recorded 7.73 t/ha SU in 1972, the highest production in these two years.

Simple mixtures of *Lolium perenne* and *Festuca pratensis* also suffered in winter leading to lower production levels in the last year.

Grazing valorization was also facilitated by this conveyor of simple mixtures with different vegetation periods.

Production data expressed in SU refers only to the quantity actually consumed (utilised by the animals).

This was calculated by subtracting the uneaten residues from the initial production determined by mowing before the animals entered the plot to be grazed. The amount of uneaten clippings (Table 1) is quite high, although precautions have been taken to assess the grass clippings as accurately as possible, still the method used does not give satisfactory results.

It is quite difficult to estimate the height at which to sew the clippings so that it corresponds exactly to the height at which the animal grazes.

Most of the time, the mowing is below the normal grazing height, resulting in higher than actual amounts of debris, which was also the case here.

The percentage of SU contained in unconsumed plants, which are often in a more advanced stage of vegetation and sometimes dry, also contributes to the increased amount of waste.

The highest amount of grass clippings not consumed by the animals on average over the two years is recorded for permanent grassland (28.2%) and the lowest for grassland sown with simple mixtures (23%). In the latter type of grassland (C), only 15.2% of clippings were not consumed in the first year, an indicator which allows the conclusion to be drawn that simple mixtures were in this case better consumed by the animals, providing a more varied and at the same time more tender forage.

Mowing of the debris proved necessary so that in the first cycle were mowed plots 5–8 and in the second cycle pasture plots 1–4.

The main indicator followed in the experiment was the evolution of live weight gain (Table 3).

In the first part of the grazing period there is not much difference between the daily gains recorded, which are maintained at an average level of over 1kg. Differences in yield start to become more pronounced towards the end of the grazing period, when climatic conditions are also less favourable for grazing.

Table 3.
Evolution of the average live weight gain of young female cattle during grazing (g/day) in 1973

Group of animals	Data and weighing ranges							
	4V-18V (14 days)	18V-1VI (14 days)	1VI-15VI (14 days)	15VI-29VI (14 days)	29VI-13VII (14 days)	13VII-27VII (14 days)	27VII-10VIII (14 days)	10VIII-14IX (35 days)
A	1031	1122	2122	622	602	755	612	1
B	1663	1224	1755	663	663	1907	449	131
C	1010	1337	1439	806	888	1857	10	224

It was only in the last month of grazing between August and September that important changes in the evolution of the spore occurred, a period which also coincides with the onset of an unusual prolonged drought. Even under these conditions the sown pasture regenerated better, while ensuring a satisfactory production for the animals. The group of animals which grazed on grassland sown with the complex mixture (B) achieved the highest yields from the start, in 1973 almost 200 g/day more than group A.

In terms of average weight gain, cumulated since the beginning of the grazing period for 1973 (Graph), it can be seen that all groups of animals achieve average gains of over 1 kg by the end of July, after which animals in group A achieve yields below this limit.

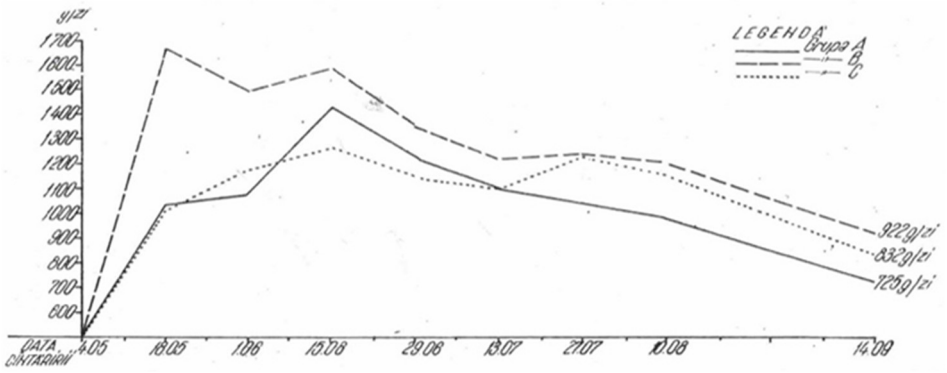

Figure 1. Evolution of cumulative weight gain of young female cattle since the beginning of the grazing period (1973)

At the end of grazing, group A achieves 725 g/day, group B 922 g/day and group C 832 g/day, average live weight gain over the whole period of 133 days.

Differences were found between individuals of the same group of animals, but they did not deviate much from the average. (Table 4)

In group A only one animal exceeded 800 g/day gain in weight, 5 heads were in the 600–800 g/day range, with only one animal below this limit.

Group C animals in terms of weight gain per individual have the same arrangement in the table, but with a 100 g/day higher level.

Group B, which also recorded the highest gain, had 5 animals in the 700–1000 g/day range and 2 animals above 1 kg average daily gain.

Table 4
Distribution of young cattle according to average weight gain (g/head/day) on pasture, 1973

Average increase intervals achieved between 4V and 14IX (133 days)	Group of animals			Head count	%
	A	B	C		
1101–1200		*		1	4.8
1001–1100		*		1	4.8
901–1000		**	*	3	14.2
801–900	*	*	***	5	23.9
701–800	***	**	**	7	33.3
601–700	**		*	3	14.2
501–600	*			1	4.8

A = permanent grassland; B = grassland sown with complex mixture; C = grassland sown with simple grass mixtures

Given the particular burdens of animal experimentation, the number of animal experiments is therefore kept to a minimum. Differences between animals in the same group are mainly due to genetic origins, maintenance status before grazing, age, body weight and others. When selecting these animals before grazing, body weight and average age were taken into account (Table 5).

Table 5. Age, weight, daily gain and consumption per 1 kg weight gain of experimental animals in 133 days

Year	Group	Age at grazing start (months)	Initial weight (kg/head)	Average growth (g/head/day)	SU consumption per 1 kg weight gain (g)
1972	A	15.2	250.7	976	10.76
	B	15.0	250.6	915	10.72
	C	15.4	249.0	935	10.83
1973	A	20.3	296.6	725	11.69
	B	19.9	296.6	922	11.90
	C	20.3	296.6	832	12.91
AVERAGE	A	17.8	273.7	850	11.23
	B	17.5	273.6	918	11.31
	C	17.2	272.8	884	11.87

The best production per ha in 1973 was obtained – as expected – by group B which achieved 541.7 kg live weight per ha.

This result is not a limit and it can be considered that, in a normal rainfall year, quantities of more than 600 kg/ha can easily be obtained.

In order to have a comparison between the two years of experimentation, the yield intensity was determined, which is between 3.2–4.3 kg/ha/day.

Existing experimental data allow to determine the amount of SU consumed (kg) by animals to achieve 1 kg live weight.

The average consumption of SU in the two years to achieve 1 kg live weight is between 11.23 kg SU in group A and 11.87 kg SU with 6% more in group C, due more to the undergrazing of animals per hectare of grassland.

These results highlight the superiority of sown grassland over permanent grassland, plus an even more obvious differentiation in later years, caused by the strong impoverishment of permanent grassland that would require regeneration.

The difference between the two types of sown grassland is small, in which case the grassland with simple mixtures arranged in a conveyor is preferred.

This type of grassland is easier to graze and the poor frost resistance of *Lolium perenne* and *Festuca pratensis* species prevented better results.

With the emergence of improved varieties that are more resistant to frost and more productive, this drawback can be eliminated, in which case the complex mixture conveyor will prove its superiority.

This research will be complemented by chemical analysis of the forage obtained on the pasture in order to determine by calculation the amount of protein, cellulose, P, K, Ca and other constituents necessary to achieve a kg weight gain in young cattle.

In the future, these experiments will include more detailed analyses of the soil, plants and physiological indices of animal nutrition in order to detect and correct in time – by various known means – any deficiencies that occur in these environments, thus contributing to higher yields.

Behavioural research will also be carried out in order to establish a scientific daily programme based on the biological needs of the animals, using the pastoral ethology study method first developed in Switzerland (CAPUTA, MARUȘCA, 1970).

Introducing animals from tested monozygotic twin births into experimentation would remove some of the errors that arise due to their genetic background.

All these clarifications could lead to increased animal yields on pasture and to the removal of some experimental errors that currently exist.

Research highlights the great potential for practitioners to achieve significant gains in animal weight during the grazing period even in low-productivity pastures such as *Nardus stricta*.

The gains achieved on grassland production alone, without the addition of concentrates, which exceed 900 g/day on average, are instructive in this respect. In the choice of improvement technology for degraded pastures invaded by *Nardus stricta*, the data obtained highlight the superiority of root replanting and the establishment of pastures sown with complex mixtures, which can be staggered in the field based on the precocity of the dominant grass in the mixture.

The extension of these results into production will bring about significant changes in the current systems of maintaining young bulls for breeding in which the use of pasture, sown and used rationally, will play a primary role.

CONCLUSIONS

Degraded mountain meadows invaded by *Nardus stricta* need to be improved and used rationally.

Radical re-grassing, fertilising with manure, sowing simple or complex grass mixtures and rotational grazing on livestock fields give the best results.

Young female cattle on improved Nardus grasslands in a season of 130–150 grazing days can achieve 800–900 g/head/day gain in live weight with a consumption of around 11 kg SU (dry matter) per 1 kg gain and finally over 600 kg/ha gain at a rate of 3.9–4.6 kg/ha/day with very economically efficient pasture grass alone.

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