FORAGE CHICORY (*CICHORIUM INTYBUS* L.): AN ALTERNATIVE SOURCE FOR LIVESTOCK FEEDING

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Abstract: *Forage chicory (Cichorium intybus L.) is a perennial species of the Asteraceae family with a wide ecological plasticity encountered in natural grassland ecosystems. The creation of numerous varieties, intended for animal feed, has revealed a number of characteristics of production, quality and resistance to the natural conditions of forage chicory, compared to other species. The researches carried out have demonstrated the potential for high production and quality of forage chicory compared to some perennial legumes species (Medicago sativa, Trifolium pratense, Trifolium repens, Lotus corniculatus). On average, chicory had a production of 6.59 t/ha compared to only 5.12 t/ha obtained by legumes, in non-fertilized variants, and 8.54 t/ha compared to only 5.81 t/ha attained by legumes, in fertilized N_{100} variants. Also, the crude protein content in chicory was 22.62% in the control (N0) and 25.06% in the fertilized variants (N_{100}), compared to the legumes of 20.31% (N0), respectively, 18.11% (N_{100}).*

Keywords: *Cichorium intybus, grassland legumes, dry matter, crude protein*

INTRODUCTION

Chicory (*Cichorium intybus* L.) is one of the most well-known species in human food and as a medicinal plant, but less as fodder value. In the past decades, several studies have been conducted to highlight the fodder quantity and quality of chicory, the results of which have shown that chicory has a high nutritional value, high nutrient content, high consumption and digestibility (GAO AND MA, 1991; MOLONEY AND MILNE, 1993; SANDERSON ET. AL., 2003; STIZIA ET. AL., 2006; MORARU, 2014). Forage chicory strongly influences both animal production and its quality, as well as animal health (BARRY, 1998; CHAPMAN ET. AL., 2008; MARLEY ET. AL., 2013; KEMP ET.AL., 2010).

The paper presents the production capacity and fodder quality of the chicory in comparison to some grassland legumes.

MATERIAL AND METHODS

The research was carried out between 2012 and 2014 at the USAMVB Timișoara (Center for Research on Grassland and Fodder Plants), under the conditions of a mild saline and gleyed chernozem soil with a Ph of 6.41.

The experiment included a bifactorial experience (5x2) with the following experimental factors: Species (*Cichorium intybus, Medicago sativa, Trifolium pratense, Trifolium repens, Lotus corniculatus*) and Nitrogen fertilization (N_0, N_{100}). As a biological material, were used legume seeds from native varieties and chicory seeds from the Puma variety (New Zealand Origin).

During vegetation years, was evaluated the dry matter production, also, laboratory tests were performed to determine the total nitrogen content of plants and to highlight the content and amount of crude protein.

RESULTS AND DICUSSIONS

Chicory (*Cichorium intybus* L.) has become a feedstuff for animal feeding in the last decades, due to creation of high-performance varieties, with the following features: adaptation to various environmental conditions (slightly acidic or slightly alkaline soils, drought resistance and wintering), high productivity, ability to associate with other grassland perennial species, high quality and digestibility (FRASER ET. AL., 1988; MATTHEWS ET. AL., 1990; NIEZEN ET. AL., 1993; HUME ET.AL., 1995; HOSKIN ET.AL., 1995).

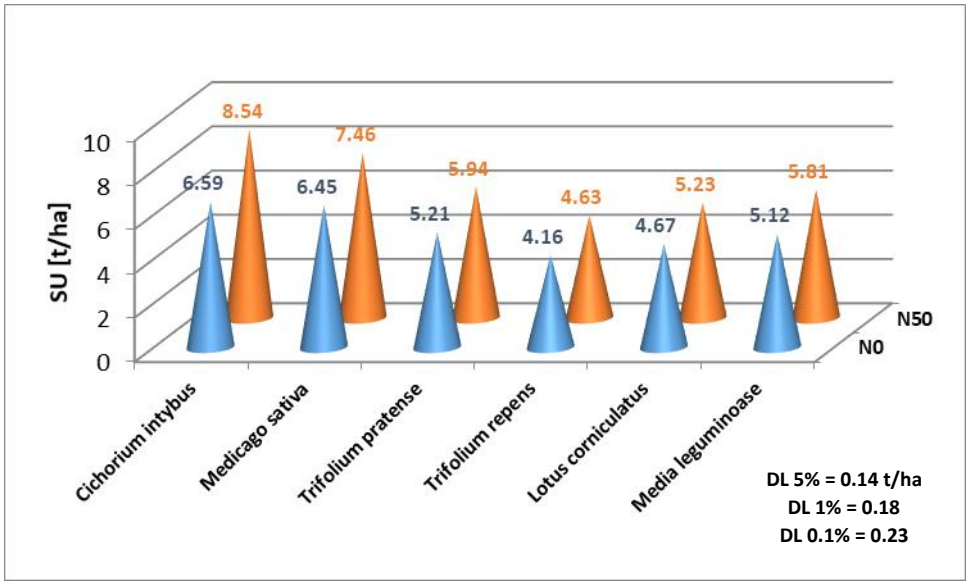

Figure 1. Behavior of forage chicory and some grassland perennial legumes in the specific conditions of south-western Romania plains

The production potential of chicory under the experimental conditions is highlighted in Figure 1. On average, during the three years, forage chicory has achieved an average production of 6.59 t/ha of dry matter, in unfertilized variants, and 8.54 t/ha, at variants fertilized with N_{100}. The other perennial fodder legumes recorded lower yields of 10-40% compared to forage chicory in unfertilized variants and of 20-50% for N_{100} fertilized variants.

Fertilization with N_{100} resulted in an increase in production of about 2 t/ha of dry matter, compared to the average of all legumes species with an increase of only 0.69 t/ha, due to fertilization.

Table 1.

Performance of forage chicory and grassland legumes during the production years

Fertilization	Species	2012	2013	2014
N_0	*Cichorium intybus*	4.59 (100%)	7.00 (152%)	8.17 (178%)
	Medicago sativa	4.16 (100%)	6.83 (164%)	8.37 (201%)
	Trifolium pretense	3.46 (100%)	6.35 (183%)	5.82 (168%)
	Trifolium repens	2.86 (100%)	4.63 (162%)	4.98 (174%)
	Lotus corniculatus	3.05 (100%)	5.58 (183%)	5.39 (177%)
	Legumes average	3.38 (100%)	5.85 (173%)	6.14 (182%)
N_{100}	*Cichorium intybus*	5.68 (100%)	9.62 (169%)	10.34 (182%)
	Medicago sativa	5.08 (100%)	7.92 (156%)	9.38 (185%)

	Trifolium pretense	4.36 (100%)	7.00 (160%)	6.47 (148%)
	Trifolium repens	3.22 (100%)	5.56 (173%)	5.12 (159%)
	Lotus corniculatus	3.29 (100%)	6.42 (195%)	5.97 (181%)
	Legumes average	3.98 (100%)	6.72 (169%)	6.73 (169%)

During the production years, both in unfertilized and fertilized variants with N_{100}, chicory recorded a progressive increase in production by the third year, with an average increase of 52-69% in the second year and 78- 82% in the third year (Table 1.)

Table 2.

Protein value of chicory and some grassland perennial legumes

Fertilization	Species	Nt. (%)	PB (%)	PB (kg)
N_0	*Cichorium intybus*	3.62	22.62 (100%)	1490
	Medicago sativa	3.74	23.37 (143%)	1507
	Trifolium pretense	3.31	20.68 (91%)	1077
	Trifolium repens	3.06	19.12 (84%)	795
	Lotus corniculatus	2.89	18.06 (80%)	843
	Legumes average	3.25	20.31 (90%)	1040
N_{100}	*Cichorium intybus*	4.01	25.06 (100%)	2140
	Medicago sativa	3.09	19.31 (77%)	1440
	Trifolium pretense	2.94	18.37 (73%)	1091
	Trifolium repens	2.74	17.12 (68%)	792
	Lotus corniculatus	2.82	17.62 (70%)	921
	Legumes average	2.90	18.11 (72%)	1052

The feed quality of all studied species was revealed by determining the total nitrogen (Nt) content of plants and the crude protein content (PB). Thus, in non-fertilized variants the content of PB in chicory was 22.62%, lower than alfalfa (23.37%), but higher than all the other grassland legumes studied (18.06-20.68%). On average, for legumes species, PB content was 18.06%, with 10% lower than forage chicory. In the fertilization conditions, with nitrogen fertilizers (N_{100}), chicory recorded the highest increase of PB, at 25.06%, compared to the other legumes, where there was a decrease in the PB content, from 20.31% to 18.11%. This decrease, with the exception of chicory, was also found in alfalfa, from 23.37% to 19.31% (by 17% lower). As we can see, the increase in the PB content in chicory is similar to the grassland grass species, fertilized with nitrogen, but in chicory this growth rate starts from a much higher level of PB (over 22%), existing under the non-fertilization conditions, compared to grasses (> 12%) (Table 2.).

CONCLUSIONS

The average results of the three years of production reveal a dry matter production of 6.59 t/ha, in non-fertilized variants, and of 8.54 t/ha, in N_{100} fertilized variants;

During the production years, fodder chicory recorded, compared to the first year, an increase in dry matter production by 52-69% higher in the second year and by 78-82% higher in the third year;

The PB content is 22.62% in the unfertilized variant and 25.06% in the variant fertilized with N_{100}, being higher by 10-28% compared to the average of all the studied grassland legumes.

BIBLIOGRAPHY

1. BARRY T. N., 1998, Journal of Agricultural Science, Cambridge, 131, p. 251-257
2. CHAPMAN G., BORK E., DONKOR N., HUDSON R., 2008, Forage yield and quality of chicory, birdsfoot trefoil, and alfalfa during the establishment year, The Open Agriculture Journel, p. 68-74
3. FRASER T. J., COSGROVE G. P., THOMAS W. J., 1988; Performance of Grasslands Puna chicory, Proceedings of the New Zealand Grassland Association, v. 49, p. 193-196
4. GAO H., MA M., 1991, Introduction and Culture of *Cichorium Intybus* L. J. Grassland of China 12: 14-16
5. HOSKIN S. O., STAFFORD K. J., BARRY T. N., 1995, Digestion, rumen fermentation and chewing behavior of red deer fed fresh chicory and perennial ryegrass, Journal of Agricultural Science, 124, p. 289-295
6. HUME D. E., LYONS T. B., HAY R. J. M., 1995, Evaluation of Graasslands Puna chicory (*Cichorium intybus* L.) in various grass mixtures under sheep grazing, NZ J. Agric. Res. 38, p. 317-328
7. KEMP D. P., KENYON R. P., MORRIS T. S., 2010, The use of legume and herb forage species to create high performance pastures for sheep and cattle grazing systems, Revista Brasileira de Zootecnia, v. 39, p. 169-174
8. MARLEY C. L., FYCHAN R., SCOTT M. B., DAVIES J. W., SANDERSON R., 2013, Trace element content of chicory compared with perennial ryegrass, red clover and white clover over two harvest years, Grassland Science in Europe, vol. 18, p. 252-254
9. MATTHEWS P. N. P., KEMP P. D., AUSTIN G. M., 1990, The effect of grazing management on the growth and reproductive development of chicory, Proceedings of Agronomy Society of New Zealand 20, p. 41-43
10. MORARU NICOLETA ALINA, 2014 - Research regarding temporary meadow production and quality with chicory (*Cichorium intybus* L.) – Thesis, USAMVB Timișoara
11. MOLONEY S. C., MILNE G. D., 1993, Establishment and management of Grasslands Puna chicory used as a specialist, high quality forage herb, Proceedings of the New Zealand Grassland Association 55, p. 113-118
12. NIEZEN J. H., BARRY T. N., HODGSON J., WILSON P. R., ATAJA A. M., PARKER W. J., HOLMES C. W., 1993, Growth responses in red deer calves and hinds grazing red clover, chicory or perennial ryegrass white clover swards during lactation, Journal of Agricultural Science, 121, p. 255-263
13. SANDERSON M. A., LABREVEUX MARIA, HALL M. H., ELWINGER G. F., 2003, Nutritive value of chicory and english plantain forage, Crop Sci. 43, p. 1797-1804
14. SITZIA M., LIGIOS S., FOIS N., 2006, Sulla and chicory production and quality under sheep grazing management, Grassland Science in Europe, vol. 11. P. 441-443