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LONGEVITY OF RESEEDED GRASS SPECIES USED FOR RESTORING THE DEGRADED SUBALPINE MEADOWS

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Abstract. *In the summer of 1996, a degraded grassland, invaded by Nardus stricta species, located at 1,800 m altitude from subalpine level of Bucegi Mountains, after total herbicide with glyphosate, liming using CaO at* 2/3 Ah *(in autumn 1995) and paddocking with sheep* (5 nights, 1 sheep/m^2) *has been over-seeded or reseeded. The grass seed mixture was composed of Phleum pratense 40%; Festuca* pratensis 25%; *Lolium perenne* 5%, *Lotus corniculatus* 15% *and Trifolium hybridum* 15%. *A part of the variants have been fertilized with chemical fertilizers with doses of* N 150 K P50 50 kg/ha *and other plots have been fertilized with organic fertilizer by paddocking system applied before the reseeded grassland establishment. In 2004 and 2011 an organic fertilizing by cattle paddocking, has been practiced. In addition to the dry matter production has followed the evolution in time of wild grasses sown. The reseeded species that do not reach the maturity remain a much longer period of time than is known in the technical literature, this being of* 2-3 *times greater in the high mountains than in the lowlands and hills. In the grassy carpet the Phleum pratense species survives in large proportion, even after* 20 years *of sowing.*

Keywords: degraded grassland, herbicide, fertilizer, over-seeding, reseeding.

Introduction

Mountain pastures, used by grazing for many years, are exposed to processes of degradation of floristic composition, if not properly maintained, fertilized and used rationally (Barbulescu, Motca, 1983).

By applying organic (paddocking system) and chemical fertilizers, degraded mountain grasslands, invaded by strict *Nardus stricta* species, can turn into valuable pastures, dominated by *Festuca rubra* and *Agrostis capillaris* (Puşcaru et al., 1956). One of the most effective ways to improve *Nardus stricta* degraded grasslands is by total sward destruction (herbicides, harrowing, milling, plowing, etc.), followed by the establishment of reseeded pastures with high quality and production (Maruşca, 1977).

Such research work to improve more effectively the *Nardus stricta* grasslands has been conducted in sub-alpine altitudinal level in the last 20 years (Maruşca et al., 2015).

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One such long-term research activity at the sub-alpine level intended to determine the survival duration of some species of perennial sown grasses that it is different from the conditions at lower altitudinal levels, a topic presented in this paper.

Material and Method

At the Research Mountain Grasslands Base from the Bucegi Massive, located at 1,800 m altitude on a degraded pasture, with participation of *Nardus stricta* species over 60%, in the autumn of 1996, the grassy carpet was sprayed with 5 litres/ha Roundup product (glyphosate).

After two weeks were applied 7.5 tons per ha of lime (CaO) to correct 2/3 Ah of soil acidity (hydrolytic acidity**).**

On June 1996, after sheep climbing the mountain, it paddocked a sheep 5 nights/1 m^2, after which the land was harrowing at 2-3 cm deep and sown with a mixture of: *Phleum pratense* 40% *Festuca pratensis* 25% *Lolium perenne* 5%, *Lotus corniculatus* 15% and *Trifolium hybridum* 15%, all missing species of wild flora.

In the organically fertilized variant, paddocking was repeated, in the same rate, with sheep in 2004, and with cows in 2012.

Similarly, for comparison, the same mixture of grasses with chemical fertilizers N 150 P 50 K 50 kg/ha, during 1996-1998, 2004-2006 and 2012-2014 was fertilized.

After sampling for dry matter (DM) and chemical analysis, the pasture was used by grazing with cows. The sown species were not able to multiply by self-seeding, because they had not reached maturity. Annually, between 1997-2016, flora observations using the KLAPP-ELEMBERG method of participation percentage in phytomass, were made.

Results and Discussion

Following the floristic observations, over 20 years, every two years, it was possible to provide an overview of the dynamics of the sown and spontaneous species in the chemically fertilized variant (Table 1).

From this data it results that the best representation of sown species of 86% was in 1999-2000 and the lowest of 21% in 2011-2012.

The basic *Phleum pratense* species was maintained at a rate of 21-66% in grassy carpet, being the only species that has resisted for 20 years.

The remaining species have disappeared at different times, namely: *Festuca pratensis* after12 years, *Lolium perenne* after 4 years, *Trifolium hybridum* after 10 years and *Lotus corniculatus* after 8 years.

In the grassy carpet appeared the *Poa pratensis* species, from spontaneous flora, only 15 years after the start of the improvement work and *Taraxacum officinale* after 7 years. The pastoral value of reseeded pastures, chemically fertilized, is 61-83 and it is good to very good.

On the variant organically fertilized by the paddocking system, the success of sown species is greater than the chemical fertilization, being of 90% in the period 1997-1998 and 22% in 2015-2016 (Table 2). During the 20 years of observations, the only species that survived in this case was the *Phleum pratense* species, in a variable proportion of 22-55%.

In this case *Festuca pratensis* disappeared after 16 years, *Lolium perenne* after 6 years and the *Trifolium hybridum* species after 10 years, a little more enduring than the chemically fertilized variant.

Instead, in the paddocked variant, in the first year, from spontaneous flora, the *Taraxacum officinale* was established and after the 7th year *Poa pratensis* maintained around 5%.

Pastoral value of organic variant has indices between 74 and 90, being superior to chemical alternative.

A comparison of the influence of the type of chemical to organic fertilizer is presented in Table 3.

These data show that organic fertilization has favoured the sown species *Phleum pratense*, *Festuca pratensis* and *Trifolium hybridum* and spontaneous species *Trifolium repens* and *Poa pratensis*.

The viability of the sown species, fertilized organically is longer than the chemical variant, with 2 years for *Lolium perenne* and with 4 years for *Festuca pratensis.*

Similarly, in the organic variant, the *Poa pratensis* species appears faster with 8 years and *Taraxacum officinale* with 6 years compared to the chemical solution. In general, the index of the forage value of organic variant is 9 times higher than the chemical variant.

Conclusions

❖ In the sub-alpine high mountains there are few species of perennial grasses and forage legumes adapted to these soil and climate conditions less favourable to plant growth;

❖ By providing optimal conditions of soil and fertilizer, timothy (*Phleum pratense*) manages to survive more than 20 years in a rate of 37% in the chemically fertilized variant and 33% in organic fertilization (paddocking) compared to 40% at sowing;

❖ The longevity of perennial sown grasses and legumes at high mountain altitude is at least two times higher than in the case of those sown at lower altitude in the plains;

❖ Paddocking by animals has favoured the sown species *Festuca pratensis* and *Trifolium hybridum* compared to chemical fertilization that has favoured the *Phleum pratense* species;

❖ From spontaneous flora *Poa pratensis*, *Trifolium repens* and *Taraxacum officinale* are stimulated by paddocking and *Festuca nigrescens* by chemical fertilization.

Table 1. The evolution of the floristic composition of sown pastures, fertilized chemically, Blana- Bucegi Mountains 1997 – 2016, (% Participation in aboveground phytomass)

Specii	1997-1998	1999-2000	2001-2002	2003-2004	2005-2006	2007-2008	2009-2010	2011-2012	2013-2014	2015-2016
SOWN SPECIES	**64**	**86**	**53**	**57**	**55**	**37**	**29**	**21**	**34**	**24**
Perennial grasses										
Phleum pratense	30	66	41	45	49	33	29	21	34	24
Festuca pratensis	12	4	2	2	4	4	.	.	.	.
Lolium perenne	9	+	.	.	.	.	.	.	.	.
Perennial forage legumes										
Trifolium hybridum	12	16	10	10	2	.	.	.	.	.
Lotus corniculatus	1	+	+	+	.	.	.	.	.	.
SPONTANEOUS SPECIES	**36**	**14**	**47**	**43**	**45**	**63**	**71**	**79**	**66**	**76**
Perennial grasses										
Agrostis capillaris	8	4	15	14	17	33	34	27	20	23
Festuca nigrescens	7	1	12	8	5	6	8	11	14	9
Poa pratensis	.	.	.	.	.	.	.	1	3	4
Alte graminee	16	3	7	10	9	11	15	21	13	21
Perennial forage legumes										
Trifolium repens	4	4	10	6	7	10	11	10	7	10
Others families										
Ligusticum mutelina	+	1	+	+	1	2	2	5	3	4
Potentilla ternata	1	+	+	1	1	1	1	2	5	2
Taraxacum officinale	.	.	.	+	2	+	+	1	+	+
Alte specii	+	1	3	4	3	+	+	1	1	3
PASTORAL VALUE	**77**	**83**	**77**	**76**	**78**	**73**	**68**	**61**	**67**	**62**

Table 2. The evolution of the floristic composition of sown pastures, organic fertilized by paddocking, Blana- Bucegi Mountains, 1997 – 2016 (% Participation in aboveground phytomass)

Species	1997-1998	1999-2000	2001-2002	2003-2004	2005-2006	2007-2008	2009-2010	2011-2012	2013-2014	2015-2016
SOWN SPECIES	**90**	**76**	**52**	**56**	**67**	**53**	**29**	**24**	**24**	**22**
Perennial grasses										
Phleum pratense	22	33	35	45	55	42	25	23	24	22
Festuca pratensis	20	7	3	6	10	11	4	1	.	.
Lolium perenne	9	1	+	.	.	.	.	.	.	.
Perennial forage legumes										
Trifolium hybridum	38	35	14	5	2	.	.	.	.	.
Lotus corniculatus	1	+	+	.	.	.	.	.	.	.
SPONTANEOUS SPECIES	**10**	**24**	**48**	**44**	**33**	**47**	**71**	**76**	**76**	**78**
Perennial grasses										
Agrostis capillaris	1	8	12	13	17	28	34	32	20	25
Festuca nigrescens	1	1	1	5	1	+	1	1	2	5
Poa pratensis	.	.	.	2	3	4	5	4	5	5
Other grasses	2	1	14	8	2	1	5	8	5	8
Perennial forage legumes										
Trifolium repens	6	13	14	12	8	8	16	22	30	24
Others families										
Taraxacum officinale	+	+	1	2	1	2	5	4	7	5
Ligusticum mutelina	+	1	2	1	1	2	3	3	3	3
Potentilla ternata	+	+	1	1	+	1	1	1	2	1
Others species	+	+	3	+	+	1	1	1	2	1
PASTORAL VALUE	**90**	**88**	**76**	**82**	**89**	**84**	**76**	**75**	**79**	**74**

Table 3. Comparative data on the effect of fertilizer on species type and their longevity **in the grassy carpet Blana - Bucegi 1997 - 2016**

Specii	Semănat 1996	Media 1997 - 2016			Durată specie (ani)		
		Chimic	Organic	Dif. + -	Chimic	Organic	Dif. + -
SOWN SPECIES	**100**	**46,0**	**49,3**	**+ 3,3**	**.**	**.**	**.**
Perennial grasses							
Phleum pratense	40	37,2	32,6	- 4,6	20	20	0
Festuca pratensis	25	2,8	6,2	+ 3,4	12	16	+ 4
Lolium perenne	5	0,9	1,0	+ 0,1	4	6	+ 2
Perennial forage legumes							
Trifolium hybridum	15	5,0	9,4	+ 4,4	10	10	0
Lotus corniculatus	15	0,1	0,1	0	8	6	- 2
SPONTANEOUS SPECIES	**0**	**54,0**	**50,7**	**- 3,3**	**.**	**.**	**.**
Perennial grasses							
Agrostis capillaris	X	19,5	19,0	- 0,5	20	20	0
Festuca nigrescens	X	8,1	1,9	- 6,2	20	20	0
Poa pratensis	X	0,8	2,8	+ 2,0	6	14	+ 8
Other grasses	X	12,6	5,4	- 7,2	20	20	0
Perennial forage legumes							
Trifolium repens	X	7,9	15,3	+ 7,4	20	20	0
Others families							
Ligusticum mutelina	X	1,8	1,9	+ 0,1	20	20	0
Potentilla ternata	X	1,4	0,8	- 0,6	20	20	0
Taraxacum officinale	X	0,3	2,7	+ 2,4	14	20	+ 6
Others species	X	1,6	0,9	- 0,7	20	20	0
PASTORAL VALUE	**94**	**72**	**81**	**+ 9**	**X**	**X**	**X**

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