Perennial Legume Swards for Organic Farming System in Lithuania

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Introduction

The economic and ecological benefits of forage legumes are well known. While perennial legumes can be useful in various aspects (Ledgard 2001), some legumes have short persistence in swards (Frame *et al.*1998; Vaiciulyte and Bacenas 2008) which is undesirable for organic farms where no mineral nitrogen is applied. Early flowering red clover (*Trifolium pratense*), which is the most common legume in Lithuania, has high yields only in the first – second years of use. In the third year, it often disappears completely.

In Lithuania, fodder galega (*Galega orientalis*) is the most long lived legume exhibiting the best overwinter survival (Balezentiene and Mikulioniene 2006). For this study we selected a mixture of legumes, less commonly used than red clover: common sainfoin (*Onobrychis viciifolia*), fodder galega (*Galega orientalis*) and alfalfa (*Medicago sativa*). The objective of our research was to study the productivity and persistence of more long lived legume species on an organic farm as a pure crop and in mixtures with other legumes and grasses under an extensive (2-3 cuts) management regime.

Materials and Methods

Field experiments were carried out on a sod gleyic loamy soil (Cambisol) in the central part of Lithuania (lat. 55º 24′ N, 23º 52′ E). The soil characteristics were as follows: pH_{KCl} 7.0, soluble P 67-80 mg/kg, K 106-112 mg/kg determined by Egner-Riem-Domingo method. The swards did not receive any mineral or organic fertilisation. The swards (Table 1) were used for nine years and were cut either two or three times per season.

The first cut was taken within the first days of June at the beginning (3-cut management) or at mass flowering (2-cut management) stage in the middle of June. The second cut was taken in the middle of July (at the beginning of flowering, 3-cut management) or beginning of August (at mass flowering, 2-cut management). The last cut was taken in the middle of October (3-cut management).

For the assessment of forage quality, chemical analyses of dry matter were performed for: crude protein, by determining the amount of nitrogen and multiplying by 6.25, crude fibre by the Hennerberg-Stohmann method, crude fat by the Rushkovski method, crude ash, by combustion. The differences in metabolisable energy were calculated on the basis of the chemical composition of DM, using digestibility coefficients and full value coefficients. The experimental data (herbage dry matter yield, metabolisable energy, crude and digestible protein) were analysed by two-factor analysis of variance (A factor-swards, B factor –cutting time), applying the ANOVA procedure.

Results and Discussion

In the first year of use when the swards were cut two or three times ,the highest dry matter yield 6.87 t/ha was produced by a mixed sward composed of alfalfa, fodder galega and hybrid *Festulolium* [*Lolium multiflorum x Festuca pratensis*] (Table 1). Due to the weak development in the first year fodder galega had lowest yields. Similar results were reported from Estonia (Raig and Nommsalu 2001). In the third year of use the swards produced the highest yields. Pure-sown fodder galega produced significantly lower yield than mixtures. Other researchers confirm this mixture effect (Adamovich 2000; Balezentiene and Mikulioniene 2006). The swards of pure sainfoin or mixed with other grasses were similar to those of alfalfa or its mixtures. Non fertilized legume swards yielded satisfactorily in the dry fifth year of use. The herbage yield in the wet sixth year of use was markedly higher than in the previous. In the drier seventh year of use the yield of all tested swards declined and varied around 3 t/ha. The data averaged over nine years suggest that the highest dry matter yield (4.79 t/ha) was obtained when cutting 2 or 3 times the swards (Factor A), sown with mixture composed of fodder galega, alfalfa and *Festulolium*, or pure alfalfa (4.58 t/ha). The variation (standard deviation) of productivity was high between years. This was influenced by the droughts that occurred during the growing season in the first, second, fifth and seventh years of use. A trend of sward productivity reduction was observed with increasing sward age, from the third year of use.

The amount of metabolisable energy accumulated in the swards varied similarly to that of dry matter (Table 2). When the swards were cut twice or three times, a similar herbage yield was produced, however, when cutting less frequently, higher contents of legumes, especially alfalfa and sainfoin persisted in the sward. When the sward was cut three times, protein content was significantly higher than that of the sward cut twice.

Table 1. The effect of different legume swards (Factor A) on the annual dry matter yield t/ha (Sward was cut 2 and 3 times each year).

Sward	Year of sward use									Mean	Variation
	I	II	III	IV	V	VI	VII	VIII	IX		%
Galega orientalis (G)	3.56	2.77	4.88	5.39	2.18	4.20	3.22	2.76	3.22	3.58	30.9
Medicago sativa (M)	6.41	4.77	9.03	5.05	3.33	4.07	3.09	2.51	2.93	4.58	40.4
Onobrychis viciifolia (O)	5.05	3.69	8.94	3.97	3.77	5.31	3.21	2.99	2.74	4.41	40.3
G + M + Festulolium (F)	6.87	5.31	8.41	5.66	4.09	4.65	3.16	2.30	2.66	4.79	32.3
G + O + F	5.67	3.81	8.34	4.14	3.07	4.68	3.05	2.83	3.02	4.29	39.7
G+M+T. pratense + F	6.32	5.04	7.25	5.18	3.43	3.94	2.88	2.09	2.74	4.32	32.3
G + O + T. repens + F	5.74	3.85	8.07	4.15	2.72	3.88	2.76	2.47	2.87	4.06	42.4
LSD_{05} (FA)	0.35	0.24	0.74	0.27	0.16	0.37	0.31	0.15	0.17	0.35	

Table 2. The effect of cutting regime (Factor B) on dry matter yield, crude and digestible protein, and the metabolisable energy in swards (averaged data over nine years of sward use).

Cutting regime	Dry matter yield (t/ha)	Metabolisable energy (GJ/ha)	Crude protein (kg/ha)	Digestible protein (kg/ha)
3 cuts	4.41	42.2	670	436
2 cuts	4.19	42.0	630	404
LSD_{05} (FB)	0.25	1.6	23	21

Botanical composition of swards depended on the cutting frequency and sward age. In our experiments, in the first year of use, fodder galega accounted for 51-53 % in the dry matter yield of herbage. Alfalfa and sainfoin in pure stands accounted for 83-89%, respectively. In the first year of use, *Festulolium* dominated by 53-84 % in the mixed swards. In the second year of use legumes prevailed in all swards. When cut three times, legumes accounted for 60-86% of the dry matter, and under the two-cut management for 78-95%. In the ninth year of use, alfalfa and more frequently cut sainfoin swards were more thinned out. Sainfoin was more affected by a high cutting frequency. There was a higher infestation of forbs of which *Taraxacum officinale* prevailed. Higher percent-age of galega survived in pure swards in comparison with mixtures.

Conclusions

In an organic farming system the highest herbage dry matter yield was produced by the swards composed of galega, alfalfa and *Festulolium* or pure alfalfa. Pure fodder galega swards produced significantly lower herbage yield, compared with alfalfa and sainfoin. Under the two-cut and three-cut management the swards produced similar yields, however, under the management involving less frequent cutting legumes persisted better.

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References

Adamovich A (2000) Productivity of eastern galega (*Galega orientalis* Lam.) grass swards. *Grassland Science in Europe* **5**,100-103.

Balezentiene L and Mikulioniene S (2006) Chemical composition of galega mixtures silages. *Agronomy Research* **4**(2), 483-492.

Frame J, Charlton JFL and Laidlaw AS (1998) Temperate forage legumes. CAB International.

Ledgard S.F. (2001) Nitrogen cycling in low input legume based agriculture, with emphasis on legume grass pastures. *Plant and Soil* **228**, 43-59.

Raig H and Nommsalu H (2001) Biological characterisation of fodder galega. In: Nommsalu H. (ed.) Fodder galega. Saku, pp. 15-22.

Vaiciulyte R and Bacenas R (2008) The productivity and feeding value of mixtures of legumes with *Festulolium. Zemdirbyste-Agriculture* **95**, No. 4, 153-171.