Legumes--A High Quality Protein Source in Latvian Animal Feeds

Baiba Osmane
Latvia University of Agriculture, Latvia

Imants Jansons
Latvia University of Agriculture, Latvia

Aleksandrs Jemeljanovs
Latvia University of Agriculture, Latvia

Sallija Cerina
Latvia University of Agriculture, Latvia

Liga Proskina
Latvia University of Agriculture, Latvia

The 22nd International Grassland Congress (Revitalising Grasslands to Sustain Our Communities) took place in Sydney, Australia from September 15 through September 19, 2013.

Proceedings Editors: David L. Michalk, Geoffrey D. Millar, Warwick B. Badgery, and Kim M. Broadfoot

Publisher: New South Wales Department of Primary Industry, Kite St., Orange New South Wales, Australia

Legumes – a high quality protein source in Latvian animal feeds

Baiba Osmane, Imants Jansons, Aleksandrs Jemeljanovs, Sallija Cerina and Liga Proskina

Latvia University of Agriculture, Research Institute of Biotechnology and Veterinary Medicine "Sigra", Sigulda, Latvia
www.sigra.lv
Contact email: sigra@lis.lv

Keywords: Protein plants, qualitative feed.

Introduction

Farms in Latvia have an insufficient amount of protein in a feed for herbivorous animals. To tackle this issue, plants containing high protein content should be cultivated in grass mixtures. Legumes are rich in protein and play an important role on farms with dairy livestock. It is advisable to have at least 30-50% of legumes in mixtures with grass for grazing animals and to conserve fodder for the winter period, which lasts from November to May. As well as being rich in protein, legumes have a high dry matter digestibility (TDN) and high energy content (NEL). While legumes during the optimal mowing period (early flowering) have a high-buffer capacity (BC) of 600 - 700 mEq/kg and a low fermentation coefficient (FC) of 13 - 18, they contain less carbohydrates than grasses and consequently, have poor fermentability (Osmane *et al.* 2008, Jemeljanovs 2006, Mustafa *et al.* 2003, Wilkins *et al.* 2000). Therefore, they need to be included with grasses to make silage or hay. Latvian farmers use legumes in grass mixtures about from 20 species of different clover (*Trifolium*), alfalfa (*Medicago sativa*), eastern galega (*Galega orientalis*) and the annual legumes, peas (*Pisum sativum*), vetch (*Vicia sativa*) and cowpeas (*Phaseolus vulgaris*), each with a varied biochemical and microbial composition and requiring different requirements for cultivation and fodder conservation.

Methods

Surveys were conducted on 6 randomly selected farmers' fields that used both organic and conventional systems in Latvia during summer (2006 – 2011). We analysed chemical composition of different legumes at different plant development stages for feed value, buffering capacity (BC) and fermentation coefficient (FC) (n=60). Statistical analyses were performed using SPSS 17.0 software, with treatment differences considered significant at the $P<0.05$ level.

Results

Biochemical composition of grasses and legumes changed during vegetative growth (Tables1-3). When the amount of legumes in swards increased from 45-60%, composition of protein in feed DM increased from 19-23%, furthermore, improving the composition of protein by non-essential amino acids. The ensilibility of the red clover–timothy fresh material was satisfactory in the budding stage (F-35). Accordingly, preserving of the amino acid amount observed in the silage was high – from 92.7-97.1% during vegetative growth. The inclusion of clover in combination with grasses in mixtures increased the amount of feed intake, because it contained lower fibre content. If white clover content in swards is 50%, the amount of forage intake increased by 10-20%.

Table 1. Feed value parameters of legume green herbage at the start of blooming (n = 16 fields).

Legume	Dry matter (%)	NEL (MJ/kg)	Crude protein (g/kg)	Crude fibre (g/kg)
Red clover	23.0	6.7	173	255
White clover	19.1	6.2	184	251
Alsike clover	22.4	5.9	166	274
Alfalfa	21.7	5.7	183	293
Galega	31.0	5.9	224	346
Trefoil	18.6	6.9	240	217

In Table 1 it can be seen that the highest NEL was for red clover and trefoil at the start of blooming, but DM was higher for galega and red clover. Galega also had the highest crude protein content. Accordingly the ensilage result will be better with this legume at the start of blooming.

In Table 2 it can be seen that better quality silage is obtained from all herbage types at the flowering stage of vegetation, when buffer capacity was lower and the ratio of crude protein and carbohydrate was more balanced.

According to Table 3, the indicated mixtures have a good fermentability after drying, so the quality of silage should be high. Pea silage and soybean silage have a similar ruminal degradability of DM (average 69%), crude protein (83%) and NDF (average 35%). Significant differences were detected between pea and bean compared with grass mixture protein content (data not presented).

Conclusion

Grass-legume mixtures have good fermentability after drying, so the quality of silage made from them is likely to be high. Cows should be fed additionally with a smaller amount of peas and beans mixed with oats to improve the provision of protein in feed rations.

Table 2. Indicators of fermentability and fermentation for green herbage of red clover, eastern galega and a timothy-red-clover mixture at budding and flowering (n = 16).

Herbage type	Development phase	Buffer capacity (mEq/kg)	Fermentation coefficient	Crude protein: carbohydrate ratio	Fermentability
Red clover	Budding	536	40	1.0 : 0.8	Poor
	Flowering	294	64	1.0 : 1.0	Good
Eastern galega	Budding	655	35	1.0 : 0.5	Very poor
	Flowering	549	39	1.0 : 0.6	Poor
50% Timothy-50% red clover mixture	Budding	498	42	1.0 : 0.8	Average
	Flowering	365	55	1.0 : 1.0	Very good

Table 3. Fermentability parameters of green herbage of grass-legume mixtures (n = 16).

Mixture type	Type of green herbage	Dry matter %	Buffer capacity (mEq/kg)	Fermentation coefficient	Carbohydrates (g/kg)
50% Timothy-50% red clover mixture	Fresh	20	543	40	130
	Dried	30	270	54	143
50% perennial ryegrass -50% white clover mixture	Fresh	20	492	44	114
	Dried	35	236	55	121
50 % mixed grass-50% clover mixture	Fresh	20	504	42	156
	Dried	35	218	57	161

Acknowledgments

This work was conducted at the Research Institute of Biotechnology and Veterinary Medicine “Sigra” of Latvia University of Agriculture and has been supported by the European Regional Development Fund, Research and technology development activity 2.1.1.2: Support to science and research (Agreement No. 2010/0197/2DP/2.1.1.2.0 /10/ APIA/VIAA/016).

References

Jemeljanovs A (2006) Agricultural animals and its production in organic farming systems. Sigulda, Latvija pp.1-285.

Osmane B, Miculis J, Cerina S (2008) Qualitative and cheap grass feed. Proceedings of 13th International conference forage conservation, Nitra, Slovak Republic. pp. 172–173.

Mustafa A, Seguin P (2003) Characteristics and in situ degradability of whole crop faba bean, pea, and soybean silages. *Canadian Journal of Animal Science* **83**,793-799.

Wilkins RJ, Jones R (2000) Alternative home-grown protein sources for ruminants in the United Kingdom. A*nimal Feed Science Technology* **85**, 23-32.