Ensiling of Different Legumes Compared to Grass

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ENSILING OF DIFFERENT LEGUMES COMPARED TO GRASS

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Abstract

The objective of this study was to examine the ensiling characteristics of four different forage legumes: galega (*Galega orientalis*), lucerne (*Medicago sativa)*, white clover (*Trifolium repens*) and red clover (*Trifolium pratense*), and compare these with perennial rye-grass (*Lolium perenne*), using different additives. The crops were mowed using a sickle bar mower and chopped using a precision chop harvester. The crops were ensiled either direct cut or wilted to 35-45% DM. Wilting took place on a barn drier. Forages were ensiled either untreated or with addition of formic acid, Promyr or Ecosyl. The silos were stored for 100 days before opening. Silages were generally well fermented, but application of Promyr or formic acid lowered the ammonia content of the silages.

Keywords: Legumes, grass, silage, additives

Introduction

Legumes are interesting alternatives to grasses since they do not need nitrogen fertilisation and their protein content is usually higher than that of grass (McDonald *et al*, 1991). Organic farming is increasing in Western Europe and in that system the farmer is totally dependent on the legumes as a source of nitrogen. The interest for legumes is therefore increasing. Legumes are, however, considered more difficult to ensile. This is

mainly due to their, compared to grass, lower content of water soluble carbohydrates (WSC), higher buffering capacity and lower DM (McDonald *et al*, 1991). The aim of this trial was to compare the ensiling characteristics of four legumes: galega, lucerne, white clover and red clover with one grass, perennial rye grass, ensiled with or without additives.

Material and Methods

The crops were chopped and ensiled either direct cut (20-25% DM) or wilted to 35-45% DM. Three samples were taken from each crop and analysed for DM, metabolizable energy (ME) (Lindgren, 1979), crude protein (CP) using Kjeldahl technique (Bremner and Breitenbeck, 1983) and WSC determined enzymatically (Larsson and Bengtsson, 1983). The crops were ensiled either untreated or with addition of formic acid (85%), Promyr (45% formic acid, 21% propionic acid, 6% ammonia and 28% water) or Ecosyl (bacterial inoculant). All additives were applied by hand using spray bottles to ensure proper dosage distribution of the additives. Formic acid was applied at 6 litres/tonne FM in the low DM and at 3 litres/tonne in the higher DM forage. Promyr was applied at 4 litres/tonne FM and Ecosyl, dissolved in water, to ensure addition of 10^5 LAB/g FM. The crop was ensiled in 1.7 litre glass jars equipped with water-seals.After a storage of 100 days at 25ºC, the silos were weighed, opened and sampled.

The following analyses were made on the samples: DM, pH, fatty acids and ethanol - using HPLC technique (Andersson and Hedlund, 1983) and ammonia determined by direct distillation on a Kjeltec autosystem 1030.

Results and Discussion

Nutritive values for the crops are presented in table 1.

As expected, the content of CP was higher in the legumes than in the grass, and the WSC content was higher in the grass than in the legumes. This indicates that the legumes might be more difficult to ensile. Energy contents were generally quite high except in the high DM grass. Why the grass lost so much energy during wilting is not known. Unfavourable weather conditions can not be an explanation since the crop was wilted indoors. White clover had the highest energy and CP contents as well as the highest WSC content of the legumes.

Despite the low WSC contents of the legumes there seemed to be no difference among the legume silages after 100 days of storage (table 2). Butyric acid was only detected in three silages and there was no particular pattern in its occurrence. All additives lowered the pH in the low DM silages. In high DM silages, Ecosyl resulted in a lower pH then other additives. Ammonia content was generally low with the exception of untreated lucerne and ryegrass, either untreated or treated with Ecosyl. Application of acids seemed to lower the ammonia content of silages. Content of lactate was, as expected, lower in silages treated with acids and, usually, higher in silages treated with Ecosyl. This indicates that fermentability does not pose a major obstacle for the preservation of these forage legumes. In areas that are suitable for their cultivation, legumes can present an interesting alternative to grass.

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Table 1 – Dry matter, crude protein, water soluble carbohydrate and metabolizable energy of fresh crops.

Crop	DM (%)	CP (%DM)	WSC (%DM)	ME (MJ/kg DM)
Galega	43,0	20,90	9,00	10,57
Galega	21,8	19,83	8,06	10,73
Lucern	41,9	14,33	9,80	10,33
Lucern	24,6	14,40	8,00	10,37
Red clover	35,6	18,83	10,60	10,47
Red clover	21,5	18,60	10,83	10,50
Rye grass	42,0	10,06	17,83	9,73
Rye grass	25,9	7,90	22,90	10,53
White clover	44,7	22,63	9,20	11,17
White clover	20,9	22,33	11,13	10,96
LSD		0,72	1,08	0,13

Table 2 - pH and content of Lactate and NH_3-N in the silages.

Crop	DM %	Additive	pH	Lactate % of DM	NH_3-N g/kg Tot N
Galega	43,0	Control	4,46	2,84	43,3
Galega	43,0	Ecocyl	4,41	3,38	57
Galega	43,0	Formic acid	4,49	1,16	37,7
Galega	43,0	Promyr	4,51	1,92	39,2
Galega	21,8	Control	4,08	6,20	48,7
Galega	21,8	Ecocyl	3,94	7,51	43,4
Galega	21,8	Formic acid	3,93	2,22	32,6
Galega	21,8	Promyr	3,96	5,64	30,4
Lucern	41,9	Control	4,66	3,58	41,2
Lucern	41,9	Ecocyl	4,26	5,80	58,3
Lucern	41,9	Formic acid	4,67	1,15	56,2
Lucern	24,6	Control	4,11	9,34	98,8
Lucern	24,6	Ecocyl	4,16	7,55	67,2
Lucern	24,6	Formic acid	3,99	4,01	36,9
Lucern	24,6	Promyr	3,99	8,85	38,7
Red clover	35,6	Control	4,36	5,11	35,3
Red clover	35,6	Ecocyl	3,98	8,65	39,3
Red clover	35,6	Formic acid	4,35	2,07	26,3
Red clover	35,6	Promyr	4,48	3,25	48,0
Red clover	21,5	Control	3,94	10,52	41,7
Red clover	21,5	Ecocyl	3,80	12,68	40,0
Red clover	21,5	Formic acid	3,95	0,55	21,8
Red clover	21,5	Promyr	3,96	7,35	23,5
Rye grass	42,0	Control	4,47	3,78	51,7
Rye grass	42,0	Ecocyl	4,30	4,49	59,1
Rye grass	42,0	Formic acid	4,48	2,44	41,9
Rye grass	42,0	Promyr	4,44	3,29	60,0
Rye grass	25,9	Control	3,71	9,60	81,5
Rye grass	25,9	Ecocyl	3,71	9,93	91,4
Rye grass	25,9	Formic acid	3,81	2,25	38,1
Rye grass	25,9	Promyr	3,74	8,30	40,4
White clover	44,7	Control	4,56	4,91	58,0
White clover	44,7	Ecocyl	4,37	6,33	63,7
White clover	44,7	Formic acid	4,56	1,38	45,5
White clover	44,7	Promyr	4,57	2,89	48,6
White clover	20,9	Control	3,97	11,34	51,9
White clover	20,9	Ecocyl	3,90	12,72	44,2
White clover	20,9	Formic acid	3,94	1,65	21,6
White clover	20,9	Promyr	3,95	9,35	34,3
LSD			0,08	1,03	17,5