

Healthyhay - The re-invention of Sainfoin

Ensiling Sainfoin - Influence of variety, wilting, acidification and tannin content



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1 Project background

Home-grown protein sources are increasing in importance in animal feeds for political, environmental and economical reasons. The European Union supports this project about re-cultivation of Sainfoin within the Marie-Curie research training network program.



Ten European Universities in collaboration with agricultural companies are working together on a holistic assessment of this promising legume. One part of this research on nutritional and conservation characteristics which is done at SLU.

2 Introduction

Sainfoin was traditionally grown in Europe and Asia for centuries but has almost sunk into oblivion during the last 50 years. Ironically, this forage legume meets the challenging demands of modern dairy production as it:

- is high in protein
- improves protein utilization
- reduces N-losses
- anthelmintic
- improves soil quality

Good conservation characteristics can be improved by wilting and silage additives.

Some of the effects of Sainfoin are believed to be caused by a beneficial composition of condensed tannins, a group of secondary metabolites that has been the subject for discussion for many years.

A tannin-protein binding that is assumed to take place in the rumen under certain conditions is believed to be the reason for this effect.

3 Material & methods

The Sainfoin varieties were - Cotswold Common
- Reznos and
- Teruel.

A grass/clover mixture (1:1) served as a tannin-free control. The plants (80 g) were ensiled in mini-silos for 60 days at 20°C, in duplicates.

Treatments were:
- un-wilted or wilted to 50% dry matter (DM)
- application of PEG (Polyethylene glycol)
- acidification with ProMyr® NT 570 (Perstorp)

PEG was used as an indirect measure of tannin effect during ensiling. Total N, BSN, trichloroacetic acid non-precipitable N (NPN), α-amino acid-N (AA-N), NH₃, DM, extractable tannins (ET) and protein bound tannins (PBT) were measured. Tannins were measured by a modified method of Terrill et al. (1992).

4 Results

Total N ranged from 22 to 26 g/kg DM depending on variety and treatment. Cotswold Common had the highest total N, and Reznos had the overall lowest ratio of BSN:total N. PEG increased and acidification decreased the level of BSN in the silages (p<0.001). Acidification produced lower BSN, NPN and NH₃ (p<0.05) as compared with no additive. The effect of wilting and N-fractions was dependant on the variety. Correlations between tannin levels (ET and PBT) and BSN were poor in the non-PEG silages.

Fresh herbage		Total N		BSN		NPN		AA-N		NH ₃ -N		ET		PBT	
Un-wilted	g/kg DM	g/kg N	g/kg N	g/kg N	g/kg N	g/kg N	g/kg N	g/kg N	g/kg N	g/kg N	g/kg N	g/kg N	g/kg N	g/kg N	g/kg N
Cotswold Com m on	22.6± 0.2	190± 2.5	-	-	-	-	-	-	-	-	-	32.2± 7.7	35.0± 6.5	-	-
Reznos	21.8± 0.1	182± 1.3	-	-	-	-	-	-	-	-	-	41.2± 4.8	24.4± 0.9	-	-
Teruel	22.3± 0.7	218± 2.0	-	-	-	-	-	-	-	-	-	42.4± 5.1	17.9± 0.1	-	-
Wilted		g/kg DM		g/kg N		g/kg N		g/kg N		g/kg N		g/kg N		g/kg N	
Cotswold Com m on	25.7± 0.0	284± 5.1	-	-	-	-	-	-	-	-	-	50.4± 1.1	33.3± 2.8	-	-
Reznos	24.2± 0.6	299± 16.4	-	-	-	-	-	-	-	-	-	41.2± 1.0	15.9± 8.2	-	-
Teruel	21.9± 0.4	259± 10.9	-	-	-	-	-	-	-	-	-	57.8± 0.2	22.1± 8.9	-	-
Ensiled, un-wilted herbage		g/kg DM		g/kg N		g/kg N		g/kg N		g/kg N		g/kg N		g/kg N	
No additive		g/kg DM		g/kg N		g/kg N		g/kg N		g/kg N		g/kg N		g/kg N	
Cotswold Com m on	24.0± 0.4	310± 11.5	273± 11.4	375± 2.4	64.3± 2.2	18.5± 1.9	35.3± 7.3	-	-	-	-	-	-	-	-
Reznos	23.7± 0.3	250± 16.6	227± 28.3	443± 23.3	78.2± 1.1	12.2± 2.7	38.8± 0.6	-	-	-	-	-	-	-	-
Teruel	23.9± 0.5	327± 49.9	279± 19.6	395± 20.4	74.1± 1.5	11.8± 0.3	20.9± 3.4	-	-	-	-	-	-	-	-
Acidified		g/kg DM		g/kg N		g/kg N		g/kg N		g/kg N		g/kg N		g/kg N	
Cotswold Com m on	24.7± 2.1	244± 13.6	167± 53.8	317± 3.0	61.9± n.a.	17.4± 0.5	32.6± 5.4	-	-	-	-	-	-	-	-
Reznos	22.3± 0.4	206± 8.8	201± 2.4	372± 6.5	30.6± 3.6	13.9± 2.5	26.8± 13.3	-	-	-	-	-	-	-	-
Teruel	22.3± 1.8	244± 8.7	216± 6.1	326± 2.7	32.9± 5.2	9.6± 4.2	16.7± 2.4	-	-	-	-	-	-	-	-
Ensiled, wilted herbage		g/kg DM		g/kg N		g/kg N		g/kg N		g/kg N		g/kg N		g/kg N	
No additive		g/kg DM		g/kg N		g/kg N		g/kg N		g/kg N		g/kg N		g/kg N	
Cotswold Com m on	26.4± 0.4	335± 10.8	333± 2.1	329± 43.9	63.5± 7.1	17.7± 0.1	51.7± 5.6	-	-	-	-	-	-	-	-
Reznos	25.7± 0.1	346± 1.3	334± 0.9	219± 23.5	75.3± 7.9	12.0± 5.1	27.6± 2.8	-	-	-	-	-	-	-	-
Teruel	24.3± 0.3	289± 1.5	257± 2.7	362± n.a.	41.3± 0.0	14.3± 0.2	25.0± 0.3	-	-	-	-	-	-	-	-
Acidified		g/kg DM		g/kg N		g/kg N		g/kg N		g/kg N		g/kg N		g/kg N	
Cotswold Com m on	26.0± 0.1	326± 8.7	275± 74.4	375± 13.3	42.9± 1.6	17.1± 2.9	59.4± 8.0	-	-	-	-	-	-	-	-
Reznos	26.6± 0.5	309± 14	305± 8.2	336± 17.3	62.1± 16.7	12.2± 4.0	22.3± 0.7	-	-	-	-	-	-	-	-
Teruel	23.5± 0.1	280± 6.3	248± 3.6	253± 4.2	39.9± 0.3	17.4± 3.7	25.0± n.a.	-	-	-	-	-	-	-	-

5 Conclusion

Acidification lowered silage BSN contents while the effect of wilting was dependant on variety. PEG treated Sainfoin showed higher silage BSN content, suggesting a tannin-protein binding effect which was particularly pronounced in the Cotswold Common sample. However, the correlation between tannin content and silage N-fractions were poor in the non-PEG treatments, indicating qualitative attributes of tannins, rather than quantitative.

6 Summary

Sainfoin is a promising tanniferous legume in ruminant nutrition. Three varieties were ensiled and the effect of acidification, variety, wilting and tannin content was assessed. Acidification benefited the ensiling process while the positive effect of wilting was dependant on the variety. The PEG treated silage confirmed an effect of tannins on N fractions, although the correlation between tannin concentration and N solubility was weak.

Literature

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Acknowledgement

We want to thank the Marie-Curie Research Training Network for funding this project.

Further information



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