The Effect of Dry Matter Content and Inoculation with Lactic Acid Bacteria on the Residual Water Soluble Carbohydrate Content of Silages Prepared from a High Sugar Grass Cultivar

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Introduction The introduction of new perennial ryegrass cultivars bred for high water soluble carbohydrate (WSC) content has created opportunities for improving the quality of grass silage, by not only providing adequate WSC for a good fermentation, but also sufficient to leave a higher residual level of WSC in the mature silage. High WSC silages have the potential to provide readily available energy during the early stages of rumen fermentation to balance energy and nitrogen supply and optimise rumen microbial growth. (Merry *et al*. 2002). The aim was to examine the effect of wilting and silage inoculants on the residual WSC content of grass silage.

Materials and methods A first cut of perennial ryegrass (cv. Aberdart) was mown, chopped and wilted for different periods of time to achieve dry matter (DM) levels of approximately 200, 250, 300 and 350 g DM/kg FM. The wilted herbages were ensiled in glass laboratory silos, either untreated or after application of 2 different silage inoculants (In 1) Pioneer (10^5 cfu/g FM containing homo- and heterofermentative lactic acid bacteria [LAB]) or (In 2) Powerstart, (10^6 cfu/g FM, containing only homo-fermentative LAB). Three replicates were prepared for each treatment and the silages were stored at 18-20^{o}C for 90 days, before destructive sampling and analysis of chemical composition. Statistical analysis was carried out using the Anova package in Genstat.

Results After wilting DM levels of 223, 250, 282 and 358 were achieved, with respective WSC contents of 272, 285, 287 and 267 g/kg DM and a mean N content of 15.3 (0.57) g/kg DM (± SE). The chemical composition of the 20%, 30% and 35% DM silages is shown in Table 1. The 25% DM silage has been omitted but the full data set will be presented at the conference. pH values were significantly lower (P<0.001) and lactic acid concentrations higher (P<0.001) for Inoculant 2 silage than for the control or Inoculant 1 silages at all DM levels. There were significantly lower ammonia-N (P<0.001) concentrations in all of the Inoculant 2 silages compared to other treatments. Residual WSC content was high and >60 g/kg DM in both the control and Inoculant 2 silages at all DM levels and as DM increased above 243 g/kg FM values increased for all treatments, but were significantly higher (P<0.001) for Inoculant 2, with over 60% of the original WSC retained in the silage. The lowest WSC concentrations were observed with Inoculant 1 at all DM levels, with only 11% of WSC remaining.

Table 1 Chemical analysis of silages harvested at different DM contents and ensiled with or without inoculants

Target DM	20% DM			30% DM			35% DM			s.e.d.
	C	In 1	In 2	C	In 1	In 2	C	In 1	In 2	
pH	3.91	4.15	3.50	3.99	3.97	3.57	4.38	4.14	3.67	0.020
Dry Matter (g/kg FM)	201	197	205	251	250	257	330	336	334	
Lactic acid	76.4	27.7	119.7	64.4	40.1	97.5	39.8	23.7	78.1	3.80
Acetic acid	8.4	72.0	5.7	2.5	66.0	4.9	2.9	52.5	4.6	5.98
Butyric acid	6.2	ND	0.3	6.6	0.3	0.5	2.4	ND	0.6	0.83
Ammonia-N (g/kg TN)	98.6	84.4	45.5	88.1	72.4	37.3	67.8	85.7	41.3	7.22
WSC	68.2	15.4	70.2	113.8	37.8	160.5	67.0	31.5	174.9	9.49

All values are in g/kg DM unless otherwise stated. C = Untreated control; In 1= Inoculant 1; In 2 = Inoculant 2. WSC = Water soluble carbohydrate. DM = Dry matter.

Conclusions A high quality grass silage with exceptionally high residual WSC content can be prepared using a combination of wilting (to >23% DM) and treatment with a homo-fermentative lactic acid bacterial inoculant. Such high sugar silages have the potential to increase N use efficiency by the rumen microbial population.

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References

Merry, R.J., D.K. Leemans & D.R. Davies (2002). Improving the efficiency of silage-N utilisation in the rumen through the use of grasses high in water soluble carbohydrate content. In: *Proceedings of The XIIIth International Silage Conference*, Auchincruive, Scotland eds. L.M. Gechie and C. Thomas.