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The effect of adding a lactic acid bacterial inoculant to big round-bale oat silage on intake, milk production and milk composition of Jersey cows.

R. Meeske#, C.W. Cruywagen, G.D. Van der Merwe and J.F. Greyling
Department of Economic affairs, Agriculture and Tourism, Western Cape, P.O. Box 249, George,6530
#Email: Robinm@wcape.agric.za

Introduction

Big round bale silage is an important feed source for dairy cattle in the Western Cape. Oats is often ensiled in big round bales. The quality of silage depends on the quality of the crop at ensiling, type of fermentation, rate of pH decrease, moisture content of the crop and anaerobic conditions. The rate of pH drop is determined by the level of water-soluble carbohydrates and the epiphytic bacteria present on the crop prior to ensiling. If insufficient lactic acid bacteria are present on the crop at ensiling this will result in a slow drop in pH. The pH should drop rapidly below 5 to prevent the growth of *Clostridium tyributyricum*. These are anaerobic bacteria that break down protein and produce butyric acid. This will lower the palatability and intake of silage. Anaerobic conditions are reached within 24 hours after bales are wrapped. Compaction in the big round bale is very important to limit infiltration of air into the bale. The use of a lactic acid bacterial inoculant may improve the fermentation of silage and animal production. In this study the effect of adding an inoculant (Sil-all) to big bale oat silage on intake, milk production and milk composition of Jersey cows was determined.

Material and methods

Oats was planted on the 30th of April 1998 on 2 hectare under dryland conditions on the farm of Mr Josua Human near Bredasdorp (20° 02' S, 34° 30' E; altitude 153m). The pH (KCl) of the soil was 5.5, phosphorous 42 ppm and potassium 230 ppm. Before planting 175 kg of 3:2:0 was applied per hectare. Oats (cv Sederberg) was planted with a 12 metre Amason planter at 120 kg $ha^{-1.}$ Seven weeks after planting 125 kg Kysan (Limestone ammonium nitrate plus sulphur, 27% N, 3.7% Ca and 3.5% S) was applied per hectare. On the 3rd of September, the oats was cut at the early flowering stage, wilted to a dry matter content of 33%, baled with a Krone KR130 baler and wrapped with a Kverneland wrapper using Silawrap. The inoculant, Sil-all (Supplied by Alltech Biotechnology Pty Ltd) contained *Lactobacillus plantarum, Steptococcus faecium* and *Pediococcus acidilactici* together with the enzymes, cellulase, hemicellulase and amylase was applied during the baling process at 10g per ton of dry matter. Bales were stored for nine months, transported to Outeniqua Experimental farm and fed to Jersey cows in an intake and production study. Twenty two multiparous cows were blocked in pairs according to milk production (previous 4 weeks), days in milk, lactation number, live weight and condition score. Within each pair cows were randomly allocated to the control or inoculated silage treatment. The experimental period consisted of an adaptation period of 10 days followed by a measurement period of 21 days. Silage was chopped with a Selbourne mixer wagon and was fed individually to cows at *ad lib.* plus 10%. Dry matter intake was determined on a daily basis. Samples of control silage, inoculated silage and concentrate were taken on Monday, Wednesday and Friday during the measurement period. These samples were pooled for each week and frozen at -4°C. Composite samples were dried at 60°C for 72 hours. Cows were milked two times per day at 07h00 and 15h30 and 3kg of concentrate was fed after each milking to all cows. Silage was fed from 8h00 to 12h00 and from 16h30 to 20h30. Cows were held in a small rest camp with access to water only from 12h00 to 15h30 and from 20h30 to 07h00. The crude protein content and energy content of the concentrate was 23% and 12 MJ ME/kg respectively. Cows were weighed at 08h00 on two consecutive days at the start and the end of the experimental period. A composite milk sample of the morning and afternoon milking was taken on a weekly basis during the experimental period to determine the protein, butterfat and milk urea nitrogen value. The silage was analysed as descibed by Meeske *et al.* (1999). Statistical analysis was done using the paired t-test (McCall, 1970).

Results and Discussion

Seventy two bales were harvested with an average weight of 690 ± 38kg. The yield was 6.5 ± 0.24 ton dry matter per hectare (n = 4) The composition (% of DM) of dairy concentrate, control oat silage and inoculated oat silage (n = 3) was: *in vitro* organic matter digestibility: 85.5 ± 0.9%, 67.2 ± 0.8% and 67.6 ± 1.7; TDN: 75.5 ± 0.2%, 60.4 ± 1.1% and 60.2 ± 0.5%; crude protein: 25.8 ± 0.9%, 9.5 ± 0.9% and 9.2 ± 0.9%; NDF: 22.3 ± 0.7%, 56.4 ± 0.9% and 55.9 ± 0.3%; ADF: 8.0 ± 0.3%, 35.3 ± 0.7% and 35.1 ± 1.1%; Ca: 1.4 ± 1.1%, 0.5 ± 0.01% and

0.5 ± 0.01%; P: 0.8 ± 0.3%, 0.3 ± 0.01% and 0.3 ± 0.01% respectively. The pH was 4.56 ± 0.05 and 4.52 ± 0.08, water soluble carbohydrate content 4.94 ± 1.45% and 6.05 ± 0.93%, lactic acid 2.44 ± 0.33% and 2.82 ± 1.12%, acetic acid 0.64 ± 0.13% and 0.64 ± 0.07%, n-butyric acid 0.72 ± 0.14% and 0.50 ± 0.05% for the untreated and inoculated silage respectively. The adding of the inoculant did result in lower levels of n-butyric acid compared to untreated silage. This indicates that the rate of pH decrease may have been faster in the inoculated silage.

Table 1 The effect of an inoculant added to big round bale oat silage on intake, milk production and milk composition of Jersey cows.

	Control	Inoculant	P-value
Intake			
Silage (kg DM/day)	11.7	12.3	0.09
Concentrate (kg DM/day)	5.5	5.5	
Total (kg DM/day)	17.2	17.8	
Dry matter intake (% of Liveweight)	4.51	4.96	
Liveweight (kg)	381	359	
Milk production (kg/day)	16.7	17.7	0.05
Fat corrected milk production (kg/day)	19.2	19.9	0.11
Butterfat %	5.06	4.96	0.26
Protein %	3.47	3.46	0.42
Milk urea nitrogen (mg/dl)	15.1	12.0	0.01

The inoculant treatment of big round bale silage resulted in a significant increase in milk production of 1 kg per cow per day. The intake of inoculated silage tended (P = 0.09) to be higher than that of the control silage. The total intake of dry matter as silage and concentrate was very high. Care should be taken not to underestimate the intake potential of Jersey cows. The chopping of the big bale silage before feeding may have contributed to the high silage intakes (4.5 to 4.9% of liveweight). The adding of inoculant had no significant effect on butterfat and protein content of the milk but it did result in a lower milk urea nitrogen content compared to the control silage. This indicates that less protein breakdown may have occurred in the inoculated silage. The milk urea nitrogen value indicates that the level of protein feeding was adequate. Both the control and inoculated silages were stable when exposed to air and no heating of silage occurred.

Conclusions

The adding of a lactic acid bacterial inoculant to big bale oat silage resulted in a significant increase in milk production of Jersey cows from 16.7 to 17.7 kg.

References

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