Sustained aerobic stability of by-products silage stored as a total mixed ration

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Introduction Ensiling a total mixed ration (TMR) has been practiced in Japan when high-moisture by-products are used as ruminant feed. Wet brewers grains (BG) are a common feed resource and approximately one million t are produced annually. Nishino *et al*. (2003; 2004) reported that, although silage would easily deteriorate in the presence of air when wet BG were ensiled alone, the spoilage could be avoided when stored as a TMR. Interestingly, the resistance to deterioration was consistently found whether high (>10^6 cfu/g) or no (<10^2 cfu/g) yeasts were detected at unloading. In this study, changes during ensilage and after exposure to air were examined in fermentation products and microbial composition of wet BG stored as a TMR.

Materials and methods Wet BG were mixed with lucerne hay, dried beet pulp, cracked maize, wheat bran and molasses at a ratio of 5:1:1:1:1:1 on a fresh weight basis. A 400 g mixture was ensiled in plastic pouches with and without inoculation of *Lactobacillus casei* (10^5 cfu/g) or *Lactobacillus buchneri* (10^5 cfu/g). *L. casei* and *L. buchneri* were used to impair and fortify the aerobic stability of silage, respectively. Silage was sampled at 14 d, because around this time high numbers of yeasts can be found after which numbers may decrease (Nishino *et al*., 2004). A 200 g sub-sample of the silage from each treatment was put into a 0.5 l polyethylene bottle and subjected to aerobic deterioration for 14 d. Chemical and microbial compositions were determined at 1, 3, 5, 7 and 14 d. There were three replicates of each treatment.

Results Lactic acid dominated the fermentation in untreated TMR silage. Addition of *L. casei* increased the acid production, while that of *L. buchneri* enhanced acetic acid and produced small amounts of 1,2-propanediol (12 g/kg DM). Although more than 10^5 cfu/g of yeasts and acetic acid bacteria were detected at unloading, no heating was observed in untreated and *L. casei*-treated silage for 14 and 7 d respectively. Yeasts were not found (<10^2 cfu/g) in *L. buchneri*-treated silage, while the numbers of acetic acid bacteria were comparable to other silages. Chemical and microbial composition appeared stable in untreated TMR silage during the deterioration test for 14 d; the acids, alcohols and yeasts were almost unchanged while the acetic acid bacteria decreased as the air exposure was extended. In *L. casei*-treated silage, yeast numbers increased steadily after unloading while the pH increased rapidly after 7 d. Yeast numbers were below the detectable level in *L. buchneri*-treated silage; no apparent changes were found in the chemical composition for 14 d after exposure to air.

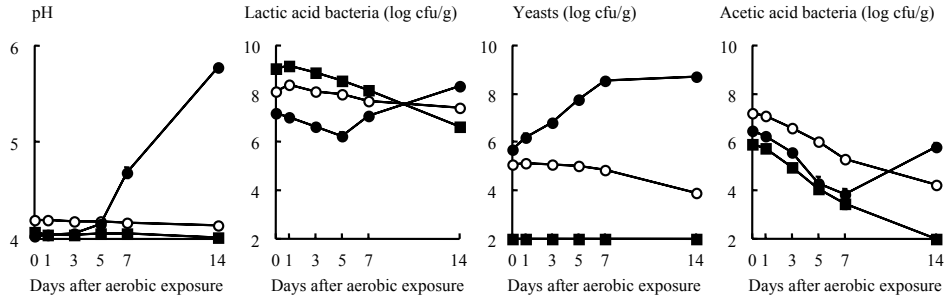

Figure 1 Changes during aerobic deterioration in pH and numbers of lactic acid bacteria, yeasts and acetic acid bacteria in TMR silage inoculated without (○) and with *L. casei* (●) or *L. buchneri* (■) at ensiling

Conclusions Ensiling as a total mixed ration can be a good option to preserve by-products with high stability in the presence of air. The stability is sustained even when high population of yeasts and acetic acid bacteria are counted.

References

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