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ONE OF THE PROBLEMS EXPERIENCED IN SILAGE MAKING IS KEEPING TRACK OF THE DIVERSITY OF FORAGES AVAILABLE. LOW SUGAR AND HIGH DRY MATTER FORAGES LIKE ALFALFA HAVE ALWAYS PROVED PROBLEMATIC- UNTIL NOW. A NEW SPECIFIC SILAGE INOCULANT HAS BEEN SHOWN TO IMPROVE FERMENTATION AND AEROBIC STABILITY IN ALFAFA. BY JULIEN SINDOU AND JUDIT PETER SZUCS.



Forages with low sugar and high protein and dry matter (DM) contents, such as alfalfa, present producers with two major conservation issues. First, the low sugar content will result in reduced acid production and a high final pH. This can then lead to the development of potentially harmful pathogens, butyric bacteria and proteolytic microorganisms, reducing the nutritive value of the forage and impairing DM intake and milk quality. Secondly, dry forage is more vulnerable to aerobic instability, due to the development of yeasts and moulds once the silage is opened to air during feedout. This can lead to high levels of silage losses (an estimated 10% DM loss in average), and again to lower intakes and the additional risks of alcoholic fermentation. To tackle those two issues, researchers have developed a new biological cocktail of lactic acid bacteria (*Pediococcus acidilactici* MA18/5M), enzymes (cellulase/hemicellulase), and anti-fungal bacteria (*Lactobacillus buchneri* strain NCIMB 40788) (Lalsil Dry, Lallemand Animal Nutrition, France). The first data are now available from trials using this new formula, conducted at the Animal Nutrition Science Department at the University of Szeged College of Agriculture (USZCA), in Hungary.

THE TRIAL

The trial took place between August and December 2004, in the fields and dairy farm of Hódmezugazda Rt., a large-scale enterprise with approximately 1800 cows and well-equipped facilities for forage conservation. Its aims were to study the effects of the inoculant on the fermentation dynamics of alfalfa silage and to test its

influence over aerobic stability up to 4 months following ensilage.

For the first part of the study, which examined the dynamics of the fermentation process, the 4th cut of alfalfa was harvested, wilted, chopped and ensiled in micro silos kept at a constant temperature of 20-22°C. To study aerobic stability, 3rd cut alfalfa was harvested, wilted and ensiled in large plastic wrapped round bales and kept in the farmyard for up to 122 days.

In both parts of the study, silos were either untreated (control) or inoculated with enzyme and bacterial inoculant at a rate of 5g/tonne of wilted alfalfa. All treated and control batches showed equivalent chemical composition and nutritive value parameters at the time of ensilage, before the study started. The average dry matter content was 36% for the 3rd cut and 45.5% for the 4th cut of wilted alfalfa.

FERMENTATION DYNAMICS

The micro silos used for this part of the study were airtight cylinders kept in a temperature-controlled environment (20-22°C), in order to prevent variations in external temperatures from influencing the fermentation process. In total, 32 micro silos were divided as follows: 16 control and 16 inoculated silages. For every time point (day 4, day 7, day 15 and day 45), four samples were tested for each treatment.

Figure 1 depicts the mean pH value from four replicates for each time point. The use of the bacterial/enzyme inoculant allows the fermentation process to 'quick off' earlier and quicker than in its absence. Moreover, the final pH at 45 days was significantly lower in the inoc-

TABLE 1 - FERMENTATION PARAMETERS AT 45 DAYS

Parameters	Control (mean)	Inoculant ¹ (mean)	Level of significance (%)
pH	4.62	4.48	0.1
Lactic acid (%DM)	4.5	5.3	5
Acetic acid (%DM)	1.60	1.26	NS*
Butyric acid (%DM)	0.044	0.044	NS
Ammonia (mg%)	330.1	269.4	5

*NS: not significant
¹Lalsil Dry, Lallemand Animal Nutrition, France

ulated than in the control silos, meaning that the treated silos were better preserved from other microbial activity.

While pH is an easy to measure and primordial parameter, reflecting the dynamic of the acidification process in silages, other parameters should also be taken into account in order to monitor the preservation of the silage. For every sample, therefore, lactic, acetic propionic and butyric acid and ammonia contents were also measured at each time point. *Table 1* shows these parameters at the final time point, 45 days

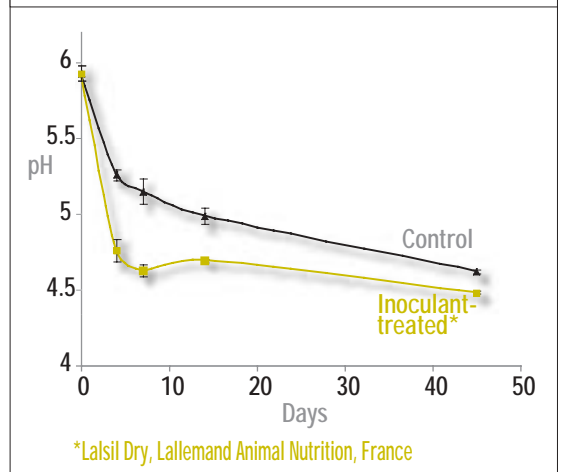
The lactic acid level at 45 days was higher in the presence of the inoculant, demonstrating that the accelerated acidification observed in *Figure 1* was indeed the result of lactic bacteria fermentation. Butyric acid levels exhibited no difference with or without the inoculant, butyric acid contamination being very low in the control silages. No conclusion can thus be drawn on the inhibitive effect of the inoculant on butyric bacteria, because butyric bacteria activity was not important enough in the control.

The presence of ammonia in silage is the residual prod-

Protection in practice

When comparing the experimental procedure to practical field conditions, it is important to note that experts recommend that silage is stored for at least two months (60 days) before opening, which means that the protective effects reported here are similar to what could be observed in practical operation, providing that good management practices are followed.

FIGURE 1 - PH OF CONTROL AND INOCULANT*-TREATED SILAGES. EACH POINT REPRESENTS THE MEAN PH FOR FOUR REPLICATES.



uct of microbial proteolytic activity and does impair the nutritive value of forages. In presence of the inoculant, we noticed a significant ($p < 0.05$) reduction in ammonia contamination, which implies that the inoculant reduced the growth of proteolytic bacteria, helping to preserve the nutritive value of the feed.

AEROBIC STABILITY

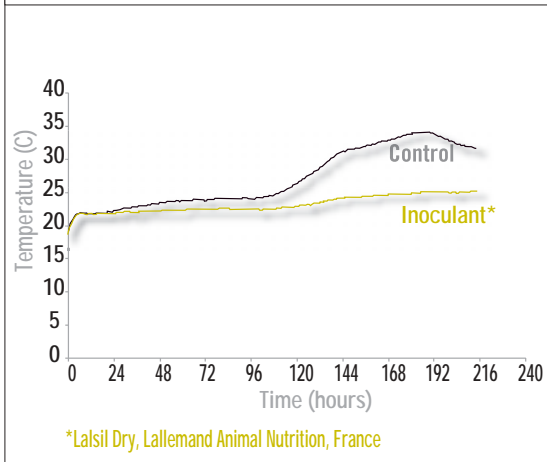
The main parameters used to monitor aerobic stability of silages are i) the presence of mould growth on the surface of the silo and ii) an increase in temperature when exposed to air (oxygen).

Plastic wrapped haylages were used for this part of the study. Batches were opened at 45, 60, 67 and 122 days after ensilage (3 controls and 3 treated for each time

FIGURE 2 - ALFAFA SILAGE AFTER EXPOSURE TO AIR AT 20-22°C, EITHER IN ABSENCE (A) OR PRESENCE (B) OF SILAGE INOCULANT*



FIGURE 3 - DEVELOPMENT OF TEMPERATURE IN HAYLAGES OPENED AFTER 122 DAYS OF STORAGE



point). Mould growth was easily assessed visually (Figure 2). The untreated controls were visibly mouldy; whereas inoculant-treated samples had no visible signs of mould growth. Temperature was measured every hour within each hay-

lage for a period of up to two weeks. Figure 3 shows the development of temperature in the haylages. The haylages were opened after 122 days of storage, simulating typical silage management practice. Untreated silos began heating after a few days, with the temperature increasing by as much as 15°C overall. Inoculated haylage did not heat above ambient temperature over the two-week period of the study. These observations are consistent with the earlier mould observations; heating of the silos being the result of yeast and mould activity. After 122 days of storage and at the end of the nine-day monitoring period, pH and ammonia content within the haylages were also measured in order to monitor microbial activity in aerobic conditions. In the inoculant-treated silage, the pH remained very low after air exposure compared to the control, where pH could rise as high as 8. In these conditions, non lactic acid bacteria are no longer inhibited and start proliferating, as was the case here with proteolytic bacteria, shown by the rise in ammonia content in the untreated silos. By preventing a pH increase after opening the silos, the inoculant inhibited the proteolytic degradation that impairs the nutritive value of the silage. <-