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Silage Additives

Due to a growing confusion in the market place, there needs to be some demarcation drawn in the increasing range of silage additives. I think, basically there are two groups; simply 'additives', to the goal generally, of preservation. That is; prevention of microbial spoilage, eg mold etc. The second group is silage inoculants which involve, not the addition of chemicals, but natural and conducive fermentation bacteria.

Additives have been around in various forms for many years, even hundreds of years. Whereas, inoculants are a relatively new generation technology of adding fermentation enhancing bacteria, to not just preserve forage through their capacity to lower pH very rapidly, to a point where undesirable microbial activity cannot function; but also enhance palatability/intake (lactic acid), and even more, enhance conversion efficiency through improved nutrient retention, reduced protein degradation and rumen digestion of the treated forage. Kung et al (Uni of Delaware USA) classifies lactic acid bacterial inoculants as "Stimulators of Fermentation" – 'Silage Science and Technology', p 306. Most other additives are of 'inhibitative' activity.

Perhaps the most effective preservative is potassium sorbate. Due to its hygroscopic (takes up moisture from air readily), it is not recommended in granular products. European ensiling conditions are more subject to the need for this protection.

Enzymes have been used in both inoculants and inhibitative additives to the goal of cell wall degradation to improve the supply of carbohydrates and increase lactic acid production where clostridial fermentations (more common in Europe) producing butyric acid and ammonia, is a higher risk. This usually occurs in very wet silage, and unlikely under Australian conditions where silage moisture range is generally between 50% and 65%. It is also problematic in that the release of carbohydrates would need to be synchronized with fermentation. Kung et al (1991b). British research has concluded that the number of enzymes required to be affective could be prohibitive from a cost perspective. There appears a number of issues relating to enzyme efficiency that need further research as reported in the above text.

Plant maturity at ensiling is sighted as the greatest negative influence on silage quality *per se*. In a maturity experiment (Harrison, 2002, unpublished data), four silage additives were used to treat silage over a range of maturities. 1) control, 2) lactic acid bacteria (100,000 cfu/gm), 3) fibrolytic enzyme, and 4) lactic acid bacteria plus fibrolytic enzyme. Harrison

comments: "Of particular note was that the greatest reduction of pH was due to the addition of lactic acid bacteria, suggesting that an adequate supply of silage bacteria was first limiting (and not soluble carbohydrates) for ensiling of forage across maturities."

There has been a large number of chemical additives over the years, some effective but far too costly to be commercially viable, some dangerous to operators, eliminating them, and others that are beneficial lactic producing acid bacteria. One such chemical additive is sodium metabisulphite. On contact with moisture it converts to sulphur dioxide and salts. Sulphur dioxide is a powerful antimicrobial agent and uses up large amounts of oxygen encouraging rapid anaerobic conditions.

However, it has been shown this chemical discriminates against heterofermentative lactic acid bacteria in pure cultures (Woodford, 1978). This is going to be to the detriment of good lactic acid content in silage. Active lactic acid bacteria producing copious amounts of lactic acid is the most desirable outcome of silage preservation.

Fermentation analysis, now readily available through Weston Technologies in Sydney, in conjunction with NIR feed tests, has proven a boom in assessing silage quality. NIR analysis equips us with energy, protein, NDF etc, and some indication of protein breakdown, but in the past, predicting cow intake potential has been sheer guesswork. From fermentation analysis we can assess lactic acid content which equates to palatability (lactic acid is sweet and very attractive to cows), other acid contents tell us about the type of fermentation that has occurred. From this we can assess what has gone wrong during ensiling. Finally, pH tells us the silage's stability; essentially, its life span before it has deteriorated to a far less valuable feed. At a pH of 4.5 or less, silage is very stable in the sense, any further fermentation is highly unlikely.

Kung & Muck, 1997, identified three inoculants that had substantial trial data indicating, one bacteria strain in particular, with better retention of true protein during ensiling, increased rumen microbial biomass production and improved efficiency of N utilization. Further in-depth silage and rumen studies are underway to explain why.

There is a growing number of silage additives on the Australian market. There is abundant evidence of the benefits of high quality products in not just fermentation quality, but also animal performance; milk, meat and fibre. The key issue is choosing a product that does achieve these benefits. Simply speaking, ask for trial and research data to support advertising claims. The Australian market is too small from a global perspective to supply much research data on silage additives, however, there are very reputable independent universities worldwide who have conducted, and continue to conduct research into this valuable science, both actual forage changes during fermentation, rumen microbial and production responses to treated forage.