Silage additives

When forages or moist grain are ensiled under anaerobic condition, the aim is to end up with a feed that matches what went into the silo as closely as possible. This is however not possible because of some avoidable as well as the many unavoidable losses of nutrients that are bound to occur. When the process of ensilage is left to chance, i.e. without any additive, these losses are even higher. For example, the lactic bacteria in the standing crop may not dominate the fermentation quick enough to reduce the pH of the silo to level that will prevent the activities of the so called undesirable microbes like listeria, clostridia, enterobacteria, the bacillus sp. etc. Most of the losses of nutrient during the ensilage process takes place during the aerobic and fermentation phase (see the technical note on the ensiling process). The plant proteases are for example most active between pH 6 and 7, and only continue functioning at a much lower rate at pH values below 4. Hydrolysis of proteins during ensiling may also vary with plant species and could be as high as 60% in well preserved silages.

Avoidable losses can be reduced by treatments with silage additives. Some silage additives may also reduce unavoidable losses particularly those associated with the plant enzymes and micro organism or field losses.

Examples of the five main classes of silage additives are fermentation stimulants (bacteria culture and carbohydrate sources), fermentation inhibitors (acids, formaldehyde etc.), aerobic deterioration inhibitors (lactic acid bacteria, propionic acid etc.), nutrients (urea, ammonia etc.) and absorbents (barley, straw etc.) (McDonald *et al.*, 1991). However, none of the known classes of additives are without their own disadvantages.

With in some of these classes of additive, there can be as many as 100 or more different types that are marketed under different brand name. There are also additives that are combination of two or three of the classes. Understanding their limitations and possible side effects are therefore very important when deciding which one is best to use.

Formaldehyde was for example used in the past to help to reduce proteolysis both during ensiling and in the rumen. However when applied at high levels, formalin depresses DM digestibility and intake, whereas at low levels of application it tends to encourage growth of clostridia (McDonald *et al.*, 1991). Most organic acid based silage additive will have formic acid in it. Formic acid is also used to improve

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silage fermentation by instantly lowering the pH to level that will reduce the activities of plant proteases and the growth of undesirable microbes.

Although, improvement in ensiling technologies has made safe handling of chemical additives possible, bulk handling of these chemicals is hazardous and less toxic alternatives are being promoted for use on farms. It is therefore worth pointing out that both formaldehyde and formic acid are toxic chemicals which may cause severe skin, eye and respiratory irritation, and which may release toxic fumes. Formaldehyde is also potentially carcinogenic hence the reason for its ban in some countries.

Bacteria culture now dominates the silage additive market and there are increasing number of products that contains a mixture of bacteria culture, enzymes and inorganic/organic salts. It is important to note that it is difficult to have a broad-spectrum bacteria culture that will work under all condition and on all forages or moist grain. Most of the bacteria inoculant will have at least one strain of homofermenter mainly lactobacillus plantarum in them. When the biggest challenge is going to be aerobic stability or in cases where the forage has been badly contaminated by soil, it is important to know the limitation of microbial inoculants. Also when legumes and bi-crops (legumes and arable forage mixture) are being ensiled, it is important to recognize that they have lower sugar content and have high buffering capacity. Heterofermenters that are able to reduce lactic acid to acetic acid or propionic acid are commonly added to the inoculant preparation to help improve aerobic stability.

There is also the question of which is best to use between life and freeze dried preparation. Any of them will be better than not to use them all together. However, my argument for life preparation is that they are already active at the point of application. Therefore, they generally tend to dominate fermentation quicker and reduce the pH to level that will stabilize the silo faster.

Yeast and moulds are now becoming very common on farms. This is partly because silages are harvested drier than they use to be and partly because the right type of additive or preservative was not used. When the yeast and mould level in the standing crops is visibly high at harvest, as can sometime occur in arable silage, consider using organic acid preparation that contain antimycotic agents like propionic acid, benzoic acid, potassium sorbate etc. Such preservatives will act to stop the multiplication of yeast and mould during the ensilage process and at feed-out. Mycotoxins are very real and the cost of controlling there effect on

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performances is much higher than the cost of preventing it in the first instance. The quote “ones beaten twice smart” should apply to all farmers that are aware of the problems and not just those that have experienced mycotoxins problems before.

Enzyme is now routinely added to most silage additive. The main argument for the addition of enzyme is to improve the cell wall digestibility. This argument is however not as clear cut as it was made to look and there are as many research data that have reported lack of effect as those that showed some positive effect. There is also the argument about the acidity of silage being the main factor responsible for the breakdown of cell wall during the ensilage process rather than the enzyme that was added.

There is no doubt that additives can help to improve the feeding value of silage for ruminant animal. However, they shouldn’t be taken as a replacement for good management during the silo filling, after the silo has been sealed and at feed-out.

See the technical note on the ensilage process, moulds and mycotoxins for more information on the choice of silage additives.

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