Tech note

Issue: May 2008 # 9

How Bacterial Silage Inoculants Work.

Silage is high quality fodder offering improved performance for dairy and beef cattle, however silage making is not a simple process. Even using good techniques, silage can be made to look and smell perfect without inoculant.

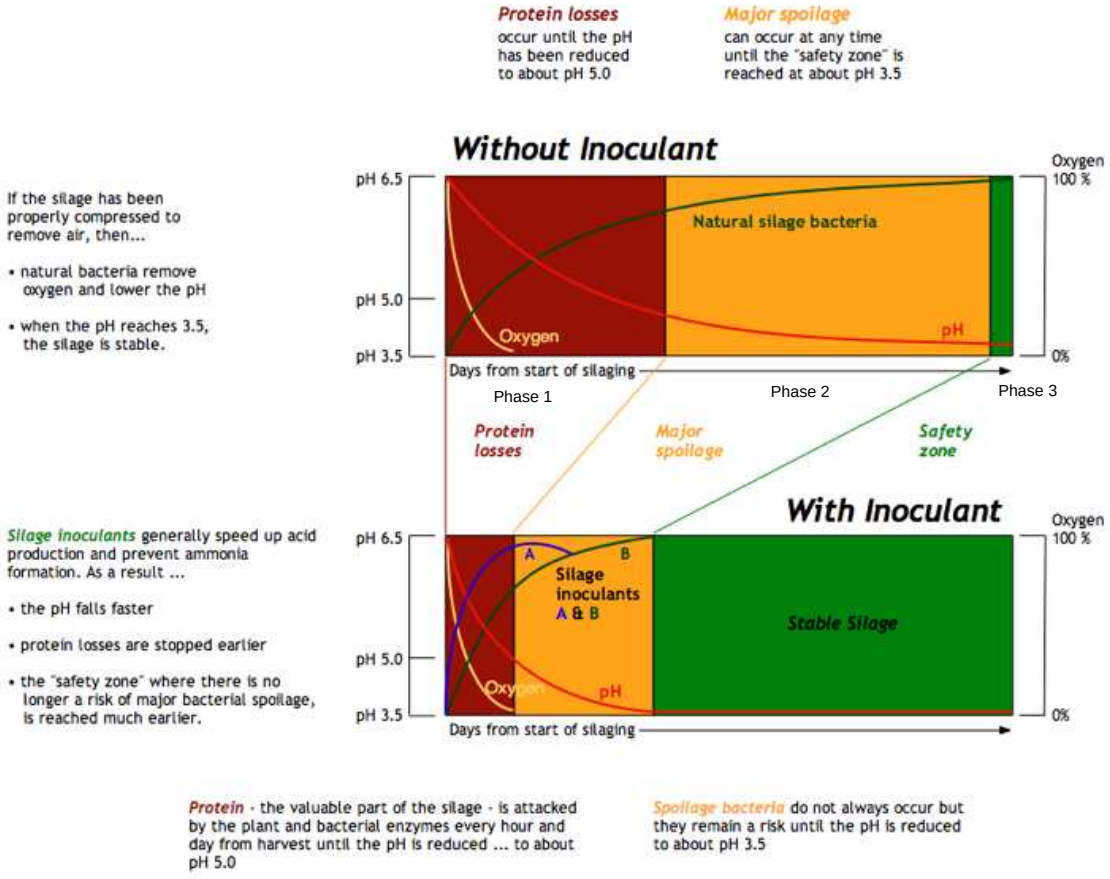
Much research has been carried out in Australia and overseas to show that silage inoculants improve the net profit from using silage, even when untreated looks perfect. How does this happen? All silage suffers some loss of protein and feed value during the time taken to complete the silaging process. The longer ensiling takes, the greater the loss of protein and feed value. Silage inoculants reduce spoilage by reducing the time taken to complete this process.

Since silage inoculants have been shown to reduce the time required for completion of silaging in a wide range of crops (1, 2), it follows that all silage makers will benefit from using silage inoculants by saving the dollars represented by that lost protein.

Research by universities and farm scale trials have shown that bacterial inoculants consistently improve:

- Fermentation efficiency
- Dry matter recovery
- Feed to weight gain ratio
- Liveweight gain per tonne of crop ensiled
- Profitability

The silaging process with & without bacterial inoculation.



Grevillia Ag
PO Box 5510 Brendale QLD 4500
Ph: 07 3205 1788 Fax: 07 3205 4327

PROUDLY AUSTRALIAN

www.grevilliaag.com.au

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Microbial attack and defence during silage making.

Silage making is a method of preserving fodder using microbial defences to complete against attacks by destructive microbes. The silage making process has 3 phases.

In phase 1, attacks come from spoilage by composting bacteria such as Enterobacteria (1) and by the proteases released by the herbage on harvesting. The defence against phase 1 attacks is the elimination of air and reduction of the pH to about 5, which is done by microbes such as *Enterococcus faecium*(A*).* Silage inoculants generally speed up acid production and prevent ammonia formation(3), minimizing protein losses. Improving the speed of ensiling should deliver improvements during phase 1 to all silage makers.

In phase 2, it is essential for the pH to be reduced to the lowest value (generally to about pH 3.5) as soon as possible. This is generally achieved by adding *Lactobacillus plantarum*(B)**.** Failure to achieve phase 2 allows the growth of Clostridium, which attacks the silage in two waves – the first wave of Clostridium raises the pH and produces butyric acid, which reduces palatability. The second wave of Clostridium produces ammonia and proteases which cause extensive destruction of silage. Although extensive phase 2 attacks are not common, a strong level of *Lactobacillus plantarum* in a silage inoculant is essential.

A third bacteria, *Lactobacillus buchneri* has a two fold purpose in high value silage making. By consuming oxygen both within the silage and on the peripheries of pits and bales, the conditions for *Enterococcus faecium* and *Lactobacillus plantarum* are enhanced, further reducing the likelihood of spoilage bacteria attacking the silage, and significantly reducing spoilage losses where silage meets the open air. The buchneri bacteria also assists to reduce heating at feed-out in both pit silage and round bale silage.

In Phase 3, the silage will have reached pH 3.5 and be stable.

Difficulties in using and storing silage inoculant in Australia.

Compared with Europe and the USA where most silage inoculant have been developed, Australia has more extreme temperatures and longer distance. Bacterial inoculants are biological products that can be compromised or destroyed by improper handling and storage. Many people have had bad experiences with products that due to the improper handling have simply died during importation, storage and transportation.

In the laboratory, scientists can preserve bacteria for many years by a combination of freeze drying and sealing under vacuum(4). The success of this procedure is affected by the cryoprotectants used to preserve the bacteria and the effectiveness of the vacuum sealing.

To overcome these problems and maximize the effectiveness of your silage inoculant, follow these points:

- Use a bacterial inoculant containing *Enterococcus faecium, Lactobacillus plantarum,* and *Lactobacillus buchneri.*(Si-Lac® Extra; Fodder-Kool®)
- Use a freshly cultured bacterial product as they have been shown to produce a much stronger quicker fermentation in the silage compared to powdered inoculants.
- Avoid using Components found to be of doubtful value, including proprionibacteria and enzymes (Kung 1997).
- Ensure that the inoculant chosen is manufactured to best suit Australian conditions.
- Always transport and store your silage inoculants in cool dry conditions, keeping the temperature below 25 degrees , or ideally in a cool room and portable refrigerator.
- Don't add urea or anhydrous ammonia as they can adversely affect the quality of the silage.

References:

1. Selmer-Olsen et al. 1993. Grass & Forage Science 48: 45-54
2. Cussen et al. 1995. Grass & Forage Science 50: 249-258
3. Keady & Steen. 1994. Grass & Forage Science 49: 438-446
4. Stanier et al. 1996. General Microbiology. 2nd ed., p315.
5. Limin Kung; Univ. Delaware. 1997 webpage.

For more information on silage making and Si-Lac® Silage Inoculants contact Grevillia Ag or your local Ag retailer

www.grevilliaag.com.au