Some important considerations when buying silage inoculants

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"The bugs in their silage inoculant product won't work compared to those in mine". "My silage doesn't look any different with inoculant use so why apply it?" "Some manufacturers claim that a million CFU's are needed while others say 300,000 CFU's are enough and others only 100, 000". "The labels can be very confusing and vary in detail and units between products". The list goes on…..

Microbial inoculants can make silage fermentation more efficient, thereby preserving more nutrients and dry matter and often improve animal performance. Recently some inoculants have also been developed to specifically improve aerobic stability. Both categories of inoculant are important in substantially reducing nutrient and dry matter (DM) losses in silage stacks and bales.

However, there are so many silage inoculants and claims about them it is not surprising farmers and contractors are often confused. Be aware there are some other products which use other means (efficient fermentation, delayed spoilage). Here are a few tips that might help you make a more informed choice

All the above issues and many others make comparing products very difficult, and to sort out which product would work for you or not. Confusion is increased due to misinformation promulgated by some additive sales people. Even among the reputable manufacturers of the various silage additives there is healthy competition as each espouses the pros of their products and about the cons of other companies' products.

To help minimise some confusion, following are some key factors to consider when buying a silage inoculants.

1. Type of bacteria
2. Number of effective bacteria
3. Availability of independent research
4. Purpose of the additive
5. Suitability of product form dry vs wet vs pre-incubation
6. Quality of packaging

1. Type of bacteria: Fermentation enhancing inoculants usually include homolactic, heterolactic, and sometimes, Propionibacteria bacteria. I'm not going to confuse you further by explaining these terms. The bugs most commonly used in silage inoculants include the classical homolactic acid bacteria such as *Lactobacillus plantarum*, *Enterococcus faecium*, and several species of *Pediococci.* These improve the initial fermentation stages by speeding up the production of lactic acid and constraining the production of undesirable end products that may reduce the efficiency of fermentation.

Some silages are prone to aerobic deterioration resulting in large dry matter and nutritive values losses in a silage storage is actually due to poor shelf life (not just fermentation losses). Many studies have been conducted to improve the aerobic stability of silages. To date, and this could change with further research, of the heterolactic acid bacteria studied, only *Lactobacillus buchneri* has been proven by independent research to be an effective inoculant to delay the onset of aerobic deterioration. *Lactobacillus buchneri* on its own has minimal effects on the initial fermentation process, but converts moderate amounts of lactic acid to moderate amounts of acetic acid during storage, which inhibits the growth of yeasts and moulds.

Some silage inoculants contain a mixture of bacteria which, in some research, have led to improved efficacy, but not all combination of inoculants are better than an inoculant with only one organism. However, recent research with products containing the homolactic acid bacteria and the heterolactic organism *L. buchneri* to provide stimulation of early fermentation and prolonged shelf life during storage and feedout have been successful.

2. Number of effective bacteria: This can be very confusing. To be effective silage inoculants must be applied at a rate high enough to compete against detrimental bacteria, moulds, yeasts, etc. and dominate the fermentation process.

For homolactic acid bacteria, the industry recommends a minimum final application rate of 100,000 colony forming units per gram(cfu/g) of fresh forage. A colony forming unit describes the number of bacterial colonies that can be counted on a pre-defined area on a culture plate.

In some inoculants containing *L. buchneri*, the recommended application rates needed are 400,000 cfu/g for pasture silages and 600,000 cfu/g for high-moisture corn.

Never add half the recommended rate to save money as you have substantially decreased the probability of the product working. Also don’t add more product than recommended as this now makes the inoculant needlessly expensive.

Ensure the correct rate per fresh tonne is applied, especially when forage is on the wet side.

The number of bacteria is referred to in several ways by different companies and in terms such as logarithms or log (measures used by scientists), adding to the confusion. The use of logarithms provides microbiologists with a method to easily indicate cfu/g without having to write out the number in typical numerical form. Logarithms (logs) are written in the following fashion: For example 400,000 cfu/g would be expressed as $4 \text{ X } 10^5$ or $4 \text{ X } 10^5$ where the number 10 is the number of "0’s" to the right of the number before the 10 (four in this case). Sorry for the technical terminology but it may be useful for you when determining application rates on various inoculant packages.

3. Availability of independent research. An effective silage inoculant will have undergone independent (non-company) research with the results suitably analysed and published with data to support its use. Due to a large variation in research results for many reasons, the greater the support data available, the more credible is the product.

Be aware brochures from some companies show “research data” from many university studies that have not been published. No inoculant works all the time, but the better ones do work a high proportion of the time. Companies with high integrity will discuss both the positive and negative results and the pros and cons of their product with you.

4. Purpose of the additive: Many companies have developed specific bacteria, bacterial mixes and some even have specific strains of bacteria in their products. The reputable companies have developed these and often, but not always, with specific crops in mind. This would have been based on their own and usually independent research. Don’t just assume that anything with “inoculant” in the name will necessarily do the job.

5. Suitability of product form: Inoculants come in various forms – liquid (Figure 1), dry granules (Figure 2a and b) or a product needing pre-incubation. Research has shown dry granular inoculants to be satisfactory until the dry matter content exceeds about 50 per cent DM (50 per cent moisture). Liquid types cover the material more evenly and starts the fermentation process more rapidly as it is already in liquid compared to granules relying on the being moistened by forage juices before they grow. The granular form is less ideal on balers as some is likely to be lost through the bottom of the pick-up or throat of the baler. Although all inoculants must be handled strictly as instructed, products which require pre-incubation, i.e. mixing in a supplied substrate and left for a specific time period before application, may need extra attention to detail. Most liquid products once mixed, usually need to be used within 24 hours. Rarely is the excess turfed out and most commonly a fresh batch is added to the last day's mix and if done often, will result in a build-up of dead bacteria and may affect spray jets.

6. Quality of packaging. Look closely at the packaging. Are the containers sewn or heat-sealed? (Figure 3). Sewn bags can allow moisture in, which is detrimental to the bacteria. The product should be packaged in moisture proof packaging for long-lasting shelf-life. Importantly, check expiration dates, date of manufacture, and lot numbers. These show professionalism of the manufacturer by taking special care in tracking the age of the product. Be aware that products containing live bacteria do expire, regardless of the type of packaging.

This article has not discussed the many management factors that are also major causes of inoculant failures.

Figure 1. Inoculant sprayed from above and jetted from below

Figure 2a. Granular Inoculant

Figure 2b. Granular Inoculant Applicator

Figure 3. Inoculant sprayed from above and jetted from below