Silage Additives – The Facts

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Are silage additives useful and are they worth the cost? Yes to both. Most countries now encourage farmers and contractors to use silage additives as part of the ensiling process. This is because many years of research has refined the number and types of bacteria in inoculants, application rates, quality of inoculant production, development of safer organic acid products, etc. to ensure they are effective, on most occasions. Silage bacterial inoculants make up over eighty per cent of all silage additives available.

Despite the extensive use of additives overseas, there are still many questions in the minds of Australian farmers and contractors about these additives. "What are silage inoculants?" "How do they work?" "When should I use them?" "Will I make money if I use them?" "What are aerobic spoilage inhibitors?" "How do non-bacterial additives work", "Are organic acids still used?" and "Do they really work?" Discussed below are many answers to these and other questions.

What is the purpose of silage additives?
Various silage additives work in different ways but they all mainly work to lower the risk of poor fermentation quality, reduce dry matter and quality losses that may occur when ensiling problem or "at risk" forages. However, animal production has been improved where some additives have even been applied to forage ensiled under ideal conditions.

What are the main types of silage additives?
Additives can be classified into the following groups:-

a. Fermentation Enhancers or Stimulants: Encourages a desirable lactic acid fermentation. Mainly bacterial inoculants but also less effective enzymes and expensive molasses
b. Fermentation Inhibitors: Decreases the acidity of the forage or scavenges free oxygen both of which inhibits the growth of undesirable bacteria, moulds and yeasts. Mainly organic acids (Propionic, Formic, Acetic) and their acid salts (buffered acids) such as calcium propionate, sodium formate and a sulphur based + amylase product.
c. Aerobic Spoilage Inhibitors: Specifically developed to improve aerobic stability to reduce/delay aerobic spoilage (heating and moulding) when bales or stacks are opened. Mainly the above organic and buffered acids, the sulphur-based product and recently developed special purpose inoculants such as *Lactobacillus buchneri* 40788.
d. Combinations of the above: Designed to perform more than one function.

Fermentation enhancing bacterial inoculants: Their use produces a much quicker fermentation which results in less loss of energy, protein and dry matter in the silage. Inoculants are by far the biggest group of silage additives currently used in silage making. Bacterial inoculants are manufactured populations of certain strains of desirable lactic acid producing (LAB) bacteria. These are essential to produce the sweet smelling highly palatable silages that we know. These "good guys" bacteria are the *Lactobacillus* and *Pediococcus* species.

Silage fermentation is influenced by number and type of naturally occurring bacteria, the amount of soluble or fermentable sugars available at ensiling, the elimination of oxygen (compaction), silage dry matter content and the buffering capacity (the "resistance" of forage to becoming silage") of the forage being ensiled.

As the crop starts to ferment, "good" bacteria (LAB producing bacteria) and "bad" bacteria (*Enterobacteria*, *Clostridial* and other species) and yeasts and moulds all compete for the plant sugars, their food, to grow and enable reproduction. The greater the amount of oxygen

present and/or the wetter the forage, the poorer the fermentation and, if made too dry, the greater the aerobic deterioration. Both result in dry matter and quality losses of the final product.

Bacterial inoculants are non-corrosive but do rely on the forage not being too wet or too dry and that plant sugars are high as this is their "food."

Organic acids and their salts: Buffered or organic acid salts directly and immediately drop the acidity (pH) of forage (~pH 6.7 - 7.0) down to about pH 5.0 – 5.2 (baled silage) and pH 4.0 – 4.4 (chopped forage), restricting growth of the undesirable bacteria. Machinery should be washed after using these products. The original use of straight organic acids such as Formic, Sulphuric and Propionic, have been largely discontinued due to cost, corrosiveness, volatility and danger to operators.

Sulphur-based +enzyme product: This product produces a gas which scavenges the oxygen in the stack or bale and is quite effective. Works best in tight round or large rectangular bales and well covered stacks. However, it is a salt and recommended that equipment should be rinsed after use.

Aerobic spoilage inhibitor bacterial inoculant: Recent addition onto the market, a new bacteria, *Lactobacillus buchneri* 407888, either manufactured on its own or sometimes incorporated with other "traditional" fermentation enhancing-type bacteria inoculants, restrict the activity of yeasts and aerobic bacteria that cause deterioration (heating and moulding) of silage at opening and during feeding out.

They are most useful in maize and whole-crop cereal silages, where silage is fed out 3+ days at once, where stack face is too wide and where silage is left in a TMR mixer overnight.

Will I profit from additive use? Usually expect a return of at least $3 to $5 for each $1 spent, sometimes higher. This assumes that the additive has been applied at the correct rate, in the correct situation, is well mixed throughout the forage, has been stored correctly before and after mixing with water, (if in liquid form) and that town water (fluoridated) has not killed the bacteria, etc.

Can I see if the additive has worked?
Often you may pick the difference between additive-treated and non-treated silages by sight or smell and lack of mould growth or heating but often not!

When should I use additives? Use where a "wetter than desirable" crop needs to be ensiled quickly to avoid in-coming poor weather conditions. This may be a lightly wilted crop that has been on the ground for less than 2 – 3 days and should still have a reasonable level of plant sugars remaining for the inoculants to work.

They are also suited to crops being made in good harvesting conditions. They can be very beneficial where some dirt from pugging after a wet season, or dust, effectively inoculating with "bad" bacteria, is picked up during harvest operations.

For a crop that has been lying on the ground for several days, especially due to poor weather conditions, plant sugars remaining will be largely or completely depleted so bacteria cannot grow or multiply. Inoculant application is unlikely to be economical in this situation. An alternative silage additive such as buffered acids, sulphur + amylase-based product and others would do the job here.

Practical issues

- Store the new and unused inoculant in a cool, dry place and avoid leaving them in hot conditions such as the ute/tractor seat.
- Mix and apply as stipulated by each manufacturer.
- Granules are a dry form of the inoculants containing the same type of bacteria and more suited to bulk chopped (wetter forage allows more spread of bacteria) silage than the drier baled silages.
- Avoid using town water with inoculants as Chloride/Fluoride-treated water will kill the bugs.
- Also avoid, dirty, algae-affected water as this affects the ionic charge of inoculants
- Avoid mixing with hot water
- Ensure the inoculant stays in solution and does not settle to the tank bottom.

Remember, silage additives and especially inoculants, will not “fix up” a stuff up!