# The latest thinking on silage inoculants for dairy cows

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Silage represents a major source of ruminant feed in the world today. Ensiling is a biological process and, as such, its success and quality depends on many variables that will finally influence the end product's nutritive quality and safety.

The very concept of using silage inoculants to orientate the fermentation process is not new and can be considered to be as old as the ensiling technique itself. This article gives an overview of recent developments in silage inoculants and offers a glimpse at what the inoculants of tomorrow could be, always with the same objectives in mind – optimal feed quality and nutritional value.

## The ensiling process

The ensiling process starts with the fermentation phase when, in absence of oxygen, anaerobic bacteria develop and turn sugars from the forage into acids (lactic, volatile fatty acids – VFAs). The pH drops and the growth of most of the unwanted micro-organisms is inhibited (for example listeria, butyric, coliforms, but also protein degrading bacteria that would spoil the forage nutritive value).

Until very recently, the only role of silage inoculants was to speed up lactic fermentation, in order to offer optimal preservation. Such inoculants generally consisted of a single homofermentative lactic acid bacteria; a type of bacteria which ferments sugars from the forage into lactic acid only.

About 20 years ago, the story of silage inoculants took a different turn. The first major change was to associate different strains of bacteria with complementary properties, in order to limit the variability of product efficiency that is often observed in the field. This was possible by taking into account the various growth conditions (temperature, pH, substrate) of each of the selected bacterial strains.

Later on, major progress was made with the addition of enzymes to break down some of the forage fibres. Indeed, during the fermentation phase, the forage soluble sugar content plays a central role. With a high sugar content (corn for example), the acidification process is optimal, while forages poorer in sugars and higher in proteins take longer to reach low pH, and silage safety and feed value can be affected. The addition of enzymes compensates for the low sugar content of certain types of forage and can also enhance their digestibility. Such inoculants are of particular interest to kickstart the fermentation of high fibre, low sugar forages such as grass or alfalfa.

Finally, the most recent technological breakthrough in the world of silage inoculants was the discovery of a very particular lactic acid bacteria: Lactobacillus buchneri NCIMB 40788. This strain, whose application in silage inoculants is patented, was first isolated from a naturally stable silage.

It finally allowed the unsolved issue of silage aerobic stability to be addressed. Indeed, at the time of desiling, there is a shift in the silage microbial balance with exposure to oxygen. Aerobic micro-organisms start to develop. This is mainly the case of yeast and moulds, with various consequences. Each year, an estimated 10% dry matter is lost to mould, representing 500 million tons of fresh forage in Europe and North America! But this is only the tip of the iceberg.

Moulds can produce mycotoxins and aerobic fermentation mould development also leads to heating and increased pH, leading to the development of unwanted bacteria, loss of feed value and palatability.

Silage aerobic instability has become all the more important an issue today as ensiling operations are conducted increasingly rapidly and forage dry matter content gets higher.

As a result, silage compaction can be less optimal, increasing the risk of heating and aerobic degradation.

## Inoculants of the future

As silage management is evolving (evolutions of crops, equipment and analysis techniques), and modern animals are increasingly sensitive, the next generations of inoculants will offer a specific solution to various precise farming issues.

Today, there is already a range of specific products on the market adapted to a variety of forages (from ryegrass with 30% DM content to sugar cane silage through to high moisture corn silage for pig feed). The all-for-one inoculant is already a thing of the past.

*Continued on page 13*

*Continued from page 11*

A possible path for development would be, for instance, to orientate the fermentations towards certain VFA profiles or the production of certain fermentation products, adapted to the needs of highly productive dairy cows.

For example, recent scientific publications have shown that Lactobacillus buchneri NCIMB 40788 has the ability to produce significant amounts of propylene glycol in the silage. Propylene glycol represents a highly available energy source, of particular interest in early lactation.

Another possible area of development is the fight against mycotoxins. Once again, some of the studies conducted with

Lactobacillus buchneri NCIMB 40788 have shown that this bacteria, by keeping fungi growth under control, is able to reduce the additional synthesis of mycotoxins which occurs during storage and desiling.

Future generations of inoculants could then also be able to detoxify the forages, decreasing the level of toxins already present at harvest (produced in the fields), which are still present at feed-out.

While waiting for these evolutions, it is nevertheless certain that the products available to farmers today finally meet some of their expectations which were still unsatisfied just a decade ago.

Indeed, the market has experienced a sustained growth since the arrival of inoculants based on Lactobacillus buchneri NCIMB 40788.

## Key to good practice

Around 20 years ago, the application of an inoculant was considered as a constraint for the farmers. Today, they have become a key factor of good ensiling practices and many farmers cannot think of ensiling without an inoculant. This generalisation is well illustrated by the presence of applicators on the latest generations of forage choppers.

Finally, in the future, one of the key points to consider is the new regulatory status of silage inoculants in Europe. In the past, only a few territories were regulating the marketing of silage inoculants by means of official and independent trials. Once the products were authorised, they were followed-up by regular field testings (this was the case in France or Switzerland for example).

Some quality labels had also been developed by certain trade associations, but they had no legal value (for example DLG in Germany, UKASTA in the UK).

Today, each active ingredient used in the formulation of an inoculant is a feed additive under European law (European regulation 1831/2003). The final product is designated as a premix of additives.

This new regulation, which requires the ingredients to demonstrate their identity, safety, stability and efficacy, shall clear the market of products of unequal quality.

On the other hand, such regulations could delay the arrival of major innovations on the European market, since a registration dossier will have to be filed for every new technology. ■