New corn silage field survey highlights the importance of good practice

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Key parameter	Effect	Recommendation
Speed of harvest	Is directly correlated to silo density	To be adapted to packing capacity at the silo
Silo type	Pile silos show the lowest average density(162), followed by semi-bunkers (181) and bunkers (217)	Bunker silos allow optimal packing
Packing	Correlated to the presence of O_2 within bunkers	Use of appropriate tractor weight according to harvest speed
Silo size	Correlated to density and natural compaction capacity	The silos >1.8m show higher average density
Chop length	Longer chop length are linked to lower density	To be adapted following DM content at harvest (drier = shorter)
Use of an inoculant	L. buchneri NCIMB 40788 prevents moulds and fungus growth in the silo and limits losses and heating at feedout	Use of L. buchneri NCIMB 40788 at 300,000 CFU/g
Feedout rate	Slow feed out increases aerobic spoilage	Silo face should advance by 10cm/day

Table 1. Some practical recommendations from the survey to ensure optimal corn silage aerobic stability.

Each year, tons of corn silage dry matter (and money) disappear into thin air. If part of this loss can not be prevented, due to the fermentation process itself that warrants silage preservation, important losses could be avoided, linked to unwanted fermentation and spoilage during desiling.

When the silage temperature rises, dry matter is literally burnt out: it is as much as 1% DM that disappears every day when the silo temperature is only 2°C above the ambient temperature. In today's economic context the question is:

how to keep these losses down with, on the other hand, increasing constraints on speed of harvest and silage making?

In order to try answering this question, Lallemand Animal Nutrition has developed a tool to easily assess silage quality and help the producer and contractor in their decision making at harvest.

The company then conducted a large scale farm survey to validate this tool in the field and get a picture of today's silage quality and practices. This survey that encompassed 55 dairy farms gave good information about some of the parameters that influence silage preservation and allowed some practical recommendations to be drawn up.

It also confirmed that, in addition to good silage practices, the use at harvest of an adapted anti-fungal inoculant can help further preserve silage quality and limit DM losses.

On average, the silos treated with the inoculant were 1°C above the ambient temperature, while the non-treated silos were on average 8°C warmer than ambient temperature.

Aerobic stability

If it is true that due to its high sugar content corn silage acidification poses few problems, it is at feedout that spoilage occurs. The major problem of corn silage is its poor aerobic stability: when the silo is

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Fig. 1. Combined effect of density and Lalsil Fresh treatment on average silage temperature.

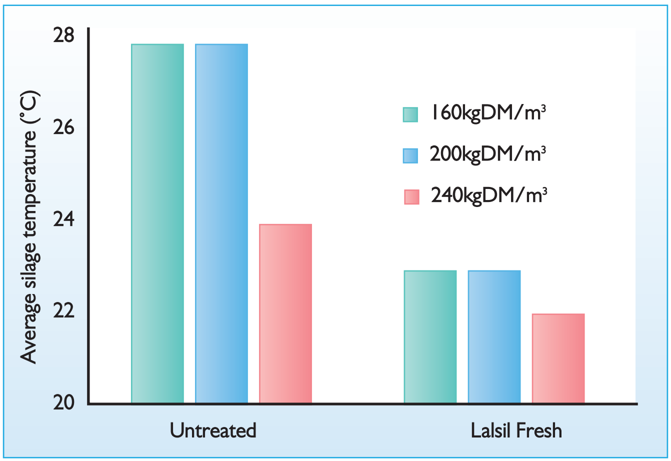
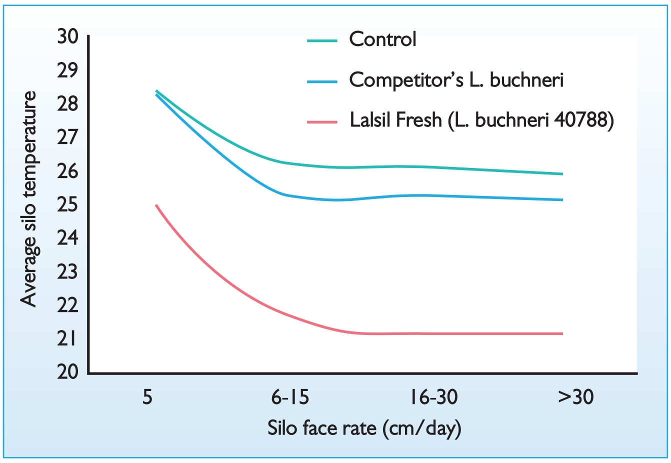


Fig. 2. Effects of feedout rate and inoculant on corn silo aerobic stability.



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opened, oxygen penetrates the first layers of material and the aerobic micro-organisms present on the crop are revived and start developing again, such as yeast and mould, which in turn rises the pH and allows the growth of unwanted bacteria that are repressed at low pH, such as butyric bacteria and coliforms, which will impact dairy production and health.

The direct visible sign of aerobic spoilage is the heat: forage is literally burnt out. It has been estimated that for a corn with 30% dry matter (DM) content, a rise in temperature of 5°C above ambient temperature leads to 1.2% loss of DM/day. This figure goes up to 2.3% for 10°C.

An important factor of aerobic stability is silage density: the more packed the less space for oxygen penetration. It is estimated that the optimal silo density should be 240kg MS/m³.

The Corn Silage Investigation (CSI) toolbox

In order to get a better idea of silage preservation quality at farm level and the potential scope for improvements, Lallemand has developed the Corn Silage Investigation (CSI) kit, which comprises a set of tools to measure key parameters: temperature, pH and density, and an accompanying software (available also for mobile tablets and smartphones).

This easy to use toolbox allows silage preservation to be assessed and evaluates potential room for technical and financial improvement before a new campaign.

The software, based on up-to-date data from the literature, can also be used to perform simulations and to evaluate the impact of various factors (harvest rate, weight of packing tractors, silo size and shape, silo face progression) on silage quality and can help take the best decisions when planning the harvest or designing a new silo for example.

A large scale field survey

The field survey encompassed 55 farms spread across different production areas in France. The farms varied in terms of size, yield and practices. In particular, 25 farms did not use any inoculant, 21 used the whole crop corn specific inoculant Lalsil Fresh (L. buchneri NCIMB 40788 at 300,000 CFU/g of forage), and the other nine used a competitor's L. buchneri at 100,000CFU/g of forage.

The farm production parameters (dairy performance, diet) and silage making characteristics (crop variety, type of harvester, harvest speed, yield, packing, silo shape and size) were all recorded and taken into account in the survey statistical analysis.

All the silos were then assessed between June and August 2011:

- With the CSI diagnostic tools: temperature and density at six different points spread across the silo face, pH (see inset).
- Samples were collected for chemical analysis: MPG, feed value, fermentation profiles.

Parameter	Control	Lalsil Fresh 300,000 cfu/g	Competitor L. buchneri 100,000 cfu/g
PH	4.0	4.0	4.0
Lactic acid (g/kg)	50.3	45.9	44.6
Acetic acid (g/kg)	13.5	29.5	22.9
Propionic acid (g.kg)	0.8	3.7	0.7

Table 2. Silo fermentation profiles.

Practical conclusions

First of all, this survey shows great heterogeneity in terms of practices and corn silage preservation.

One of the findings in this survey is the illustration of the role of silage density (linked to appropriate packing, but also chop length, silo size and shape etc) on aerobic stability, in particular in the case of untreated silages: the more packed, the more stable at feedout (Fig. 1).

Altogether, the average rise of temperature in the untreated silos was 8°C above the ambient temperature.

Another important factor is the rate of feedout. The survey confirms that slow rate of silo face leads to silage heating in the untreated silos (Fig. 2). It is thus important that the silo size is adapted to feed consumption and herd size.

The statistical treatment of the survey data helps us draw some practical recommendations for optimal corn silage quality. These are summarised in Table 1.

Validation of Lalsil Fresh

Due to the high number of farms surveyed using either Lalsil Fresh (21) or no inoculant (25), this survey is also a great opportunity to further validate the effects of this scientifically proven inoculant at farm level across a variety of conditions of use. As expected, the silos treated with Lalsil Fresh showed the best aerobic stability.

On average the treated silage were only 1°C above ambient temperature (average value of six measurements/bunker) vs. 8°C for the control silos and 2°C for the other inoculant.

The maximal temperature attained was 21°C, vs. 51°C for the non-treated silage (42°C for the competitor's L. buchneri). All of the 21 silos treated with Lalsil Fresh showed an increase of temperature above ambient below 3°C, while only 40% of the untreated silos were in this category (Fig. 3).

Regarding the effect of density (Fig. 1), it appeared to be less important when L. buchneri NCIMB NCIMB 40788 was used.

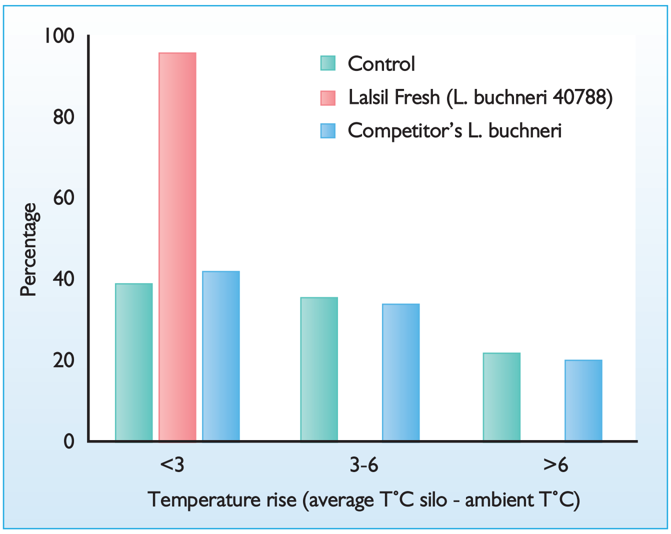
The impact of feedout rate was also diminished when Lalsil Fresh was used in the silo (Fig. 2): even at an average feedout rate of 5cm/day, the silo temperature was still more stable than for untreated silos with a high feedout rate (up to 30cm/day) (Fig. 2).

Hence, the stabilising effect of the inoculant can compensate for slow feedout rate but also allow for preparing and distributing the feed in advance, since the mixed ration stays cool as well.

Finally, the chemical analysis of the silos confirmed that the effect of L. buchneri NCIMB 40788 is linked to its fermentation profile.

The levels of acetic and propionic acids, both recognised for their anti-fungal properties, are higher on average in the L. buchneri NCIMB 40788 treated silos than in the other silos (Table 2).

Fig. 3. Repartition of the various silos according to the average rise in temperature at desiling.



Conclusion

This large scale field survey confirmed that, in farm conditions, L. buchneri NCIMB 40788 (Lalsil Fresh) controls corn silo aerobic stability, whatever the condition and practices.

However, its effect is optimal when combined with good silage practices which lead to optimal density and appropriate feed out rate in particular.

This survey was also very useful to validate and optimise the CSI tool in farm practices and all Lalsil sales and technical agent in the field are now equipped with this system to help farmers and contractors achieve the best results and keep track of their results and performance. ■