③ The solution

As mentioned earlier, heating is caused by the combination of oxygen and micro-organisms. To limit the impact of oxygen, there are a number of silo management tips that should be followed such as:

- Improving the compaction process (using more weight to achieve a higher density with longer compaction times around the sides of the clamp)
- Covering the silage with a true oxygen barrier such as Silostop
- Adding more weight specifically on the seams and edges
- Don't uncover too much when feeding out and keep some weight on the face to limit oxygen penetration between silage and plastic
- Control vermin (if holes are detected)

Regardless of management practice, silage will always be exposed to a certain level of oxygen before being fed, so it is important to also combat the micro-organisms that use this oxygen. To do this, Biotal use the patented bacteria *L.buchneri* 40788 in their silage inoculant range due to its unique anti-fungal properties.

The metabolites produced by *L.buchneri* 40788 will inhibit the yeasts and moulds that initiate heating. This increases the aerobic stability of the silage and keep it cool for longer. For maize silage, which will naturally ferment quite easily (due to the low buffering capacity), aerobic stability should be the main focus.

④ What will I be saving?

TEMPERATURE INCREASE

Temp. in silage (°C)	D Value
cool	69
30-35	67
50-60	61
70-75	49

Over 35 °C nutritional value starts decreasing

There is an inverse relationship between silage temperature and D value (the content of digestible organic matter in the DM) When the silage temperature increases, the D-value of the silage will drop off, which causes a potential energy deficit in the cow

To keep yields and cow health where they need to be, this energy will have to be made up from other sources which will significantly impact the farm profitability.

LOSSES

Temp increase in silage above ambient temp (°C)	Daily DM losses (%)		
	20% DM	30% DM	50% DM
5	1.6	1.2	0.7
10	3.2	2.3	1.5
15	-	3.5	2.2
20	-	-	2.9
25	-	-	3.7

15th International Silage Conference, 2009

It's not just the feeding value of the crop that will be affected by a heating silage clamp; physical dry matter will also be lost over time. When opened, oxygen will generally penetrate up to 2m into the clamp face. In an average 30% DM maize clamp, this would represent 15.75 tonnes of dry matter. If the oxygen caused the silage to heat up by 10°C, this would create a loss of 362kg of dry matter every day. At £84 / tonne DM, the costs would add up over a 150 day feeding period!

Lallemand Animal Nutrition UK Ltd•Spring Lane North•Malvern Link•Worcestershire•WR14 1BU

T:0800 731 0005 • www.biotal.co.uk • @biotaluk

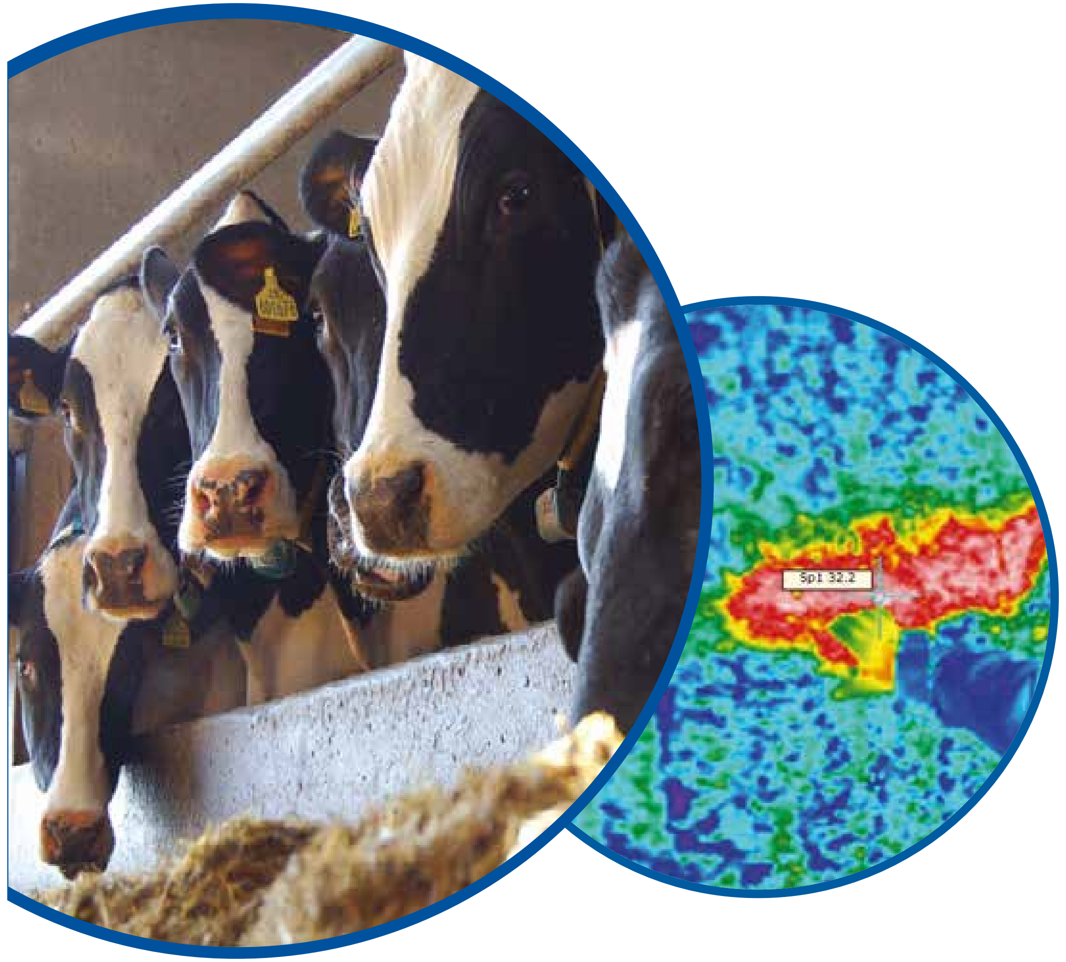
LALLEMAND

LALLEMAND ANIMAL NUTRITION

TECHNICAL BULLETIN

BIOTAL

Keeping your maize cool



Unleashing the value of your forage

① Description

***IT HEATS** = heating is the result of a fermentation event resulting in a rise in temperature.*
***IT'S WARM** = there may be a higher temperature (compared to the ambient temperature) without a heating event.*

Heating can occur at two distinct events during the ensiling process:

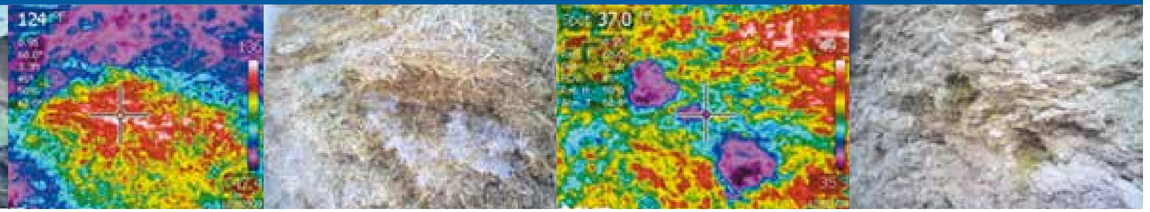
1. Silage after closure

At harvest the naturally occurring organisms which are trapped within the silage start to ferment the available sugars. This process will generate heat which is unavoidable, but the extent of the temperature rise will be influenced by the bacterial profile brought in with the crop. Ideally lactic producing bacteria will dominate and the temperature will only rise to about 30 – 35°C, but there will also be potentially high numbers of spoilage organisms. If the spoilage organisms start to proliferate, especially if there is excess oxygen in the clamp, their metabolic activity can generate much higher temperatures, up to 50 – 60°C with significant losses of energy and protein quality in the silage.

The final temperature will depend on oxygen quantity, micro-organism contamination and also of the initial temperature of forage at harvest (which can vary from 20° to 35°C for instance).

Once this heating phase is complete, the silage doesn't cool instantly. The time required to cool down the mass to around 20°-30°C depends on: maximum temperature reached, quantity of silage, density (thermal inertia) and ambient temperature.

2. Silage after opening (aerobic instability)



At opening, exposure to oxygen reactivates aerobic fermentations that produce heat (yeasts and moulds). (NB: clostridia is anaerobic) This heating is often correlated with an increase in pH (lactic acid consumption by yeasts), at which point, the temperatures can reach up to 50°C.

The intensity and speed of this heating depend on: nutrients available, silage density, level of yeasts and moulds, speed of feed out and external conditions (temperature, humidity…) This heating phase can continue even after it is fed out in the TMR.

Consequences are: increased DM losses (2% / day for +10°C), feeding value losses (energy, protein and digestibility), drop in fermentation quality (increase in butyric acid, for instance), mycotoxins and a decreased of palatability.

② My silage is heating!!!

Diagnosis

Visible: aerobic stability has to be assessed with objective data (thermometer) and not perceptions. For instance: silage at 20°C when ambient temperature is below 0 will feel warm!

Silage is heating behind the face?
Not on the sides/top/face?

- **yes** — **< 2 months after harvest**
  - **yes** — **Normal**
  - **no** — **If you take out 10kg of silage, does the temperature rise in 24h?**
    - **yes** — **Instability**
    - **no** — **Residual**
- **no** — **Silage heats on top and sides** Not specifically on the face
  - **yes** — **Oxygen penetration**
  - **no** — **Heats on face or in the trough** → **Instability**

Normal = "normal" heating after closure
Oxygen penetration = heating after closure continues due to permanent oxygen penetration
Instability = heating after opening caused by fermentation due to aerobic conditions
Residual = residual temperature