# Growing maize for silage?


Cut to Clamp

A **Volac** initiative

# Growing maize for silage?

Read our handy Cut to Clamp guide to help you get the most from this valuable forage.



## 1 Planning

**The high energy and starch content of forage maize make it a highly valuable silage. But it's also one of your riskiest forages in terms of preserving it.**

With its two opponents knocking on the door of: (1) aerobic spoilage (heating) caused by yeasts and moulds in the presence of air; and (2) risks to fermentation, especially when making greener, moister maize silage – it only takes one slip of management to significantly reduce its feed quality, or the tonnes of dry matter (DM) in your clamp.

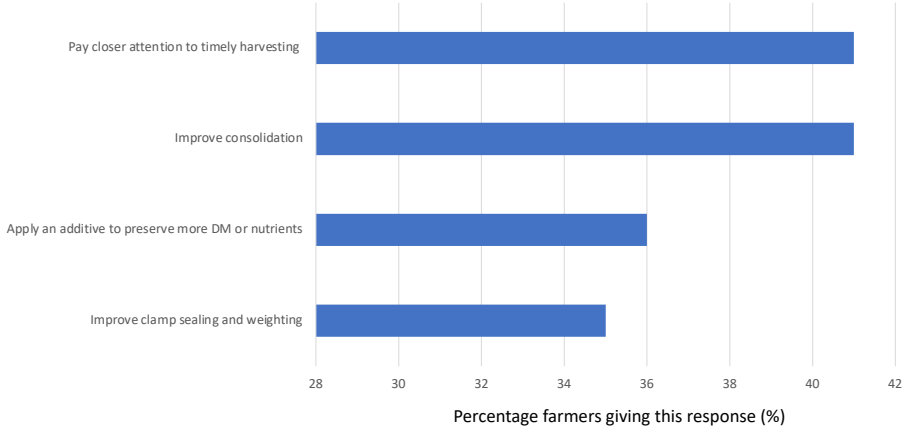
Indeed, surveys of farmers suggest there is huge scope for improving how maize silage is made.

A survey in 2020, for example, revealed that 80% of respondents growing maize were looking to improve the crop's conservation. Key ways they were looking to achieve this were: paying closer attention to timely harvesting so maize doesn't become over-ripe (41% of respondents); improving consolidation (41%); applying an additive to preserve more of its dry matter or nutrient content (36%); and improving clamp sealing and weighting (35% of respondents).

When planning your maize harvest, make sure you take the importance of good preservation into account, and that your contractor is lined up for your anticipated harvest date and has the appropriate additive.

If growing modern, 'stay green' varieties, they should not have died off (or dried off) by the time they are harvested.

### Examples of ways livestock farmers look to improve maize conservation




*Source: Volac survey of livestock farmers, 2020*

# 2 Harvesting

## Harvest at the optimum dry matter.

Harvesting maize at the wrong whole plant DM can result in reduced silage quality. Don't leave maize to die off before harvesting it, as many farmers do. Harvest instead according to the correct dry matter – for example, when the whole plant is at around 30-33% DM. However, don't leave it to get too dry as this makes it more difficult to consolidate in the clamp.

To help identify the % dry matter, the cob and kernel maturity, which directly correlate to DM, can roughly be assessed in the field in two steps.

1. Collect at least five representative cobs and pull back the outer leaves. Pressing your fingernail into the kernels should result in a soft cheese texture at top of the cob and leave no indentation in kernels in the middle and bottom.
2. Secondly, break the cobs in half to examine kernels. A visible line will indicate where the solid yellow starch changes to the milky white sugar portion of the kernel. One-third to one-half of the kernel should be yellow starch.

*These rough assessments should be confirmed with an oven or microwave DM test.*

## Use the optimum cutting height and chop length.

In addition to percent dry matter, get plant cutting height right. The bottom of a maize stalk has little nutritional value. Most of the energy and dry matter yield comes from the cob. So, set your cutting height based on the DM content and energy content you want to achieve. In all cases, always leave at least 15 cm of stubble to avoid soil contamination. The stem below this height is also likely to contain high levels of Fusarium – carrying the risk of mycotoxins.

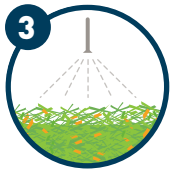
For chop lengths, while short chop lengths make consolidation easier in the clamp, they will have a direct impact on how the silage performs in the rumen.

Consider a chop length of 1.5 to 2 cm. Be aware, though, that longer chop lengths will make consolidation to remove air from the clamp more difficult, increasing the risk of aerobic spoilage (silage heating).



# Cob Ripeness

| Grain Description | Starch Level | Approx. Time until Harvest | Appearance of Grain/Cob | Approx. Whole Plant DM%* |
|---|---|---|---|---|
| **Clear Grains** | No Starch | 1 month+ |  | Less than 18% |
| **Milky Ripe** | Starch Kernel can be found | 2-3 weeks |  | 18-25% |
| **Soft Dough** | Good Gritty Starch | 7-10 days |  | 25-28% |
| **Firm Dough** | Smallest drop of moisture can be squeezed from grain | Harvest for Forage now |  | Approx. 30% |
| **Hard and Mature** | Floury Starch | Combine |  | More than 35% |




# Treating

**Maize silage can be prone to losses from inefficient fermentation. These losses are invisible and can run at about 8% for maize harvested at the recommended dry matter content. However in some cases they may be higher – e.g. with some suggestion that DM losses can be as high as 20-30% between the field (pre-harvest) and what finally ends up in the rumen.**

More recognisably, maize silage is also very prone to losses that occur when the silage heats up. These losses take place when naturally-occurring yeasts on the crop survive the fermentation process and initiate the process of aerobic spoilage (characterised by heating) once the clamp is opened. This affects the keeping quality and allows the growth of moulds that can potentially produce mycotoxins, which carry through to the ration.

Greener maize with a higher moisture content may need extra help with fermentation. That said, even if harvesting at the correct DM, the base of the plant is almost certainly starting to senesce, so will contain a lot of yeasts and moulds that will be introduced into the clamp.

## Select the right additive.

**When it comes to selecting an additive there are two areas to be addressed: the fermentation and aerobic spoilage (heating).** Treating to improve the fermentation can certainly pay dividends, as the more efficient bacteria in Ecosyl (*Lactobacillus plantarum* MTD/1) will help to overcome the high levels of poor bacteria that can be present – e.g. in the leaf joints and on any damaged or dying leaves. Improving the fermentation has also been shown to improve animal performance and should be the basis of any treatment.


If heating is considered a risk, then using a combination product combining MTD/1 with either a second bacterium such as *Lactobacillus buchneri* PJB/1 (as in the product Ecocool) or with a chemical preservative, will also help to keep the clamp cooler for longer.

MTD/1

MTD/1 PJB/1

Some examples of the benefits of including *Lactobacillus plantarum* MTD/1 bacteria to produce a faster, more efficient initial fermentation:

- Makes better use of available sugars
- Preserves more nitrogen as true protein
- Reduces fermentation DM losses
- Minimises undesirable microbial activity
- Animal performance

Some examples of the benefits of including *Lactobacillus buchneri* PJB/1 bacteria to inhibit the activities of the yeasts and moulds that cause aerobic spoilage:

- Less heating
- Lower DM losses
- Less physical waste
- Higher energy feed
- Less risk of mycotoxins

An example of an additive containing both of these beneficial bacteria is Ecocool.


## Benefits of Ultra Low Volume (ULV) application

Certain bacterial additives can be applied in ultra-low volumes of water – down to just 20 ml/tonne of forage.

Compared with traditional, higher water volumes, ULV can offer a number of benefits to both the contractor applying the additive and to the farmer whose crop is being treated:

- Much less fetching and carrying of water – allowing more time to be spent at the clamp e.g. on consolidation, which is also important for producing good silage
- Less mixing and fewer stoppages in the field to fill up – leading to time savings
- More acres harvested per day – leading to increased chance of harvesting crops in optimum condition e.g. if the weather breaks

Before using this method, check first whether your additive is approved / suitable for ULV application. Some additives (e.g. Ecocool) are suitable, but others are not.


# Clamping

## Preparation

Always clean clamps out before refilling.

Next, line the clamp walls with polythene sheeting – leaving a large overlap to ensure proper sealing with the top sheet. Thorough sheeting is vital to keep oxygen out of the clamp because this is what is required for the yeasts that cause aerobic spoilage (characterised by heating) to grow. It is important to take steps to prevent them growing at every stage of silage-making, otherwise they will continue growing and cause major problems later.

Also, keep the area surrounding the clamp clean to avoid soil contamination brought in by machinery. Soil introduces more spoilage organisms into the clamp.

Clamps also need to be filled and sealed within 2 days of cutting to get the fermentation process started and to minimise air exposure.

## Consolidation

Filling the clamp evenly in thin layers of a maximum of 15 cm will help with consolidation, since this is the maximum depth that can be compressed effectively.

Use single wheeled packers, and roll continuously for increased packing pressure. And make sure packers can keep up with the speed of arrival of new loads into the clamp. Don't compromise consolidation, because this is essential for preventing air ingress.

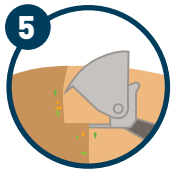
Ideally, calculate the weight of machinery needed to achieve a target bulk density of maize in the clamp of around 750 kg of fresh weight per cubic metre. As an example, estimates suggest that even having two, 14-tonne tractors rolling continuously wouldn't be enough to achieve this with a fairly typical harvest rate of 120 tonnes per hour.

After filling, in order to protect the shoulders and clamp surface, which are particularly vulnerable to aerobic spoilage, apply salt and fork into the top few inches.

## Sheeting

To help keep clamps airtight, seriously consider an oxygen barrier film if you don't already use one. On top of this, to make the most of resources while getting a tight seal, use two 500-gauge polythene sheets, for example with the bottom layer being new and the top recycled from the previous year's clamp. Alternatively, a single 1000-gauge sheet can also be used.

After sealing with the plastic sheets, protect them from damage with a woven sheet and weigh down well. Use plenty of mats, gravel bags, touching tyres or silage bales, as the more weight on top the less chance of losses in the top of the clamp. Skimping on this final task can be costly later. Finally, use netting over the top to stop birds pecking through the sheets, and bait to ensure you keep rodents at bay.




# Feeding

**After sealing maize in the clamp, leave for the required amount of time (at least three weeks) before opening so that it has time to consolidate fully and stabilise.**

## Face care

While air exposure can't be avoided completely once it's time for the clamp to be opened, its damage can be minimised by using a block cutter or shear grab to keep the face tidy.

In addition, to minimise the period of exposure to air, move the clamp face back quickly at feedout – at a minimum of a metre per week in cooler seasons, and more in the summer. To aid rapid progression across the face, use narrow clamps wherever possible – for example, consider dividing wider clamps into two.

To prevent mould, never leave the sheet hanging over the face, since this creates a microclimate that encourages mould growth. Cut or roll the sheet back as you progress through the clamp, keeping weights on the front edge. Silage that falls off the face should also be cleaned up, since mouldy spores can blow up and contaminate the clamp.

## TMR

Once out of the clamp, maize silage being fed as part of a total mixed ration (TMR) may benefit from using an additive with yeast and mould-inhibiting components at feedout to combat spoilage and keep it fresh.



# What is aerobic spoilage?

# What is aerobic spoilage?

**On exposure to air silage can begin to break down resulting in heating and high DM losses. This process is known as aerobic spoilage.**

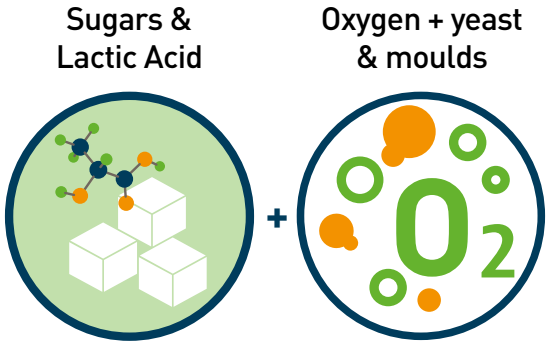
Aerobic spoilage is initiated mainly by yeasts which can grow using a variety of different substances particularly residual sugars and lactic acid.

After the initial yeast activity, moulds join in. They are able to grow on a wider range of substances so spoilage accelerates. Such silages will also have reduced palatability.

Example of aerobic spoilage

# Aerobic spoilage - the process

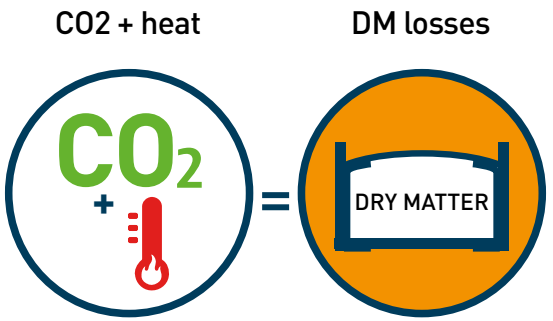
## Silage




### Aerobic spoilage: process

In the presence oxygen yeasts break down sugars and lactic acid in the silage, raising the ph. This in turn allows moulds to grow.

## Heating Silage




### Consequences

The growth of yeasts and moulds generates heat and CO2, resulting in high DM losses, reduced palatability and nutritional value, and increased mycotoxin risk.

# What are the major influences on aerobic spoilage?

### Ensiling

- Yeasts and moulds present at ensiling
- Several factors influence the exposure to air, including
  - Crop DM
  - Speed of filling
  - Compaction
  - Effective sealing

### Feedout

- Feedout rate and technique
- Silages with high yeasts at opening
- Silages high in sugars
- Silages fed in warm weather
- Aerated silages, eg mixed in TMR



# How do we minimise aerobic spoilage?

**Minimise spoilage from harvest to feed out:**

Short chopping

Can improve compaction and exclude air

+

Ecocool inoculant to help with aerobic stability


Inhibits spoilage from micro-organisms

+

Good Sealing & Weighting

To exclude air

+

Good Clamp Management

Face management & Feed out techique

# What is Ecocool?

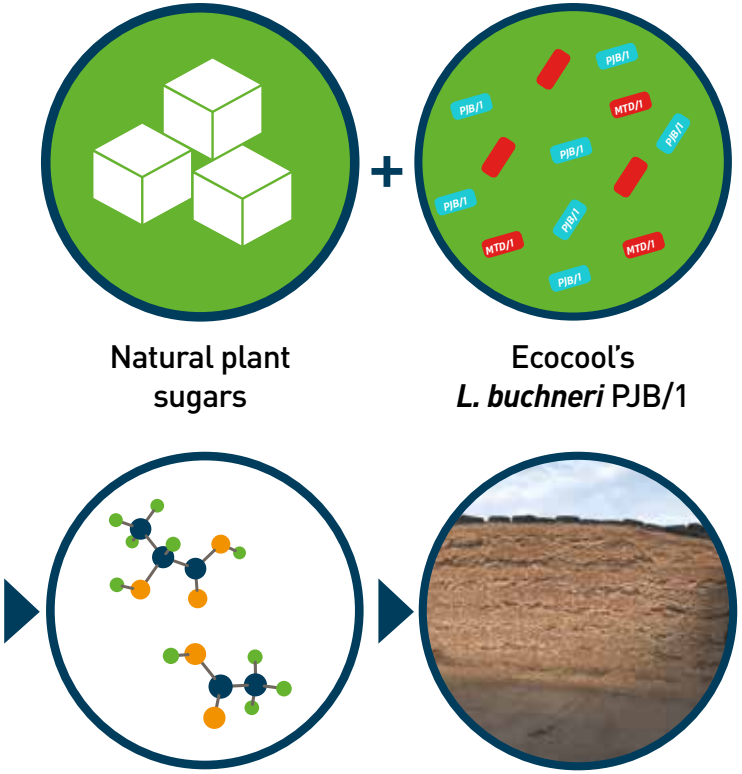
## Specially formulated to control aerobic spoilage and fermentation.


- It provides two specially selected high-performance bacterial strains PJB/1 and MTD/1
- PJB/1 for aerobic stability: PJB/1 is a unique strain of Lactobacillus buchneri
- MTD/1 for fermentation: MTD/1 is a unique strain of Lactobacillus plantarum

## How does Ecocool minimise aerobic spoilage?

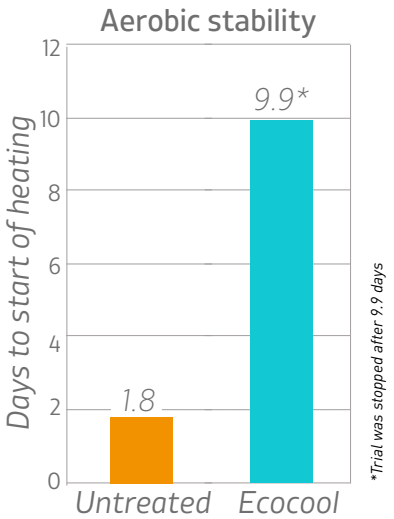
- Ecocool contains L. buchneri which produces acetic acid.
- Acetic acid is very effective at reducing the levels of yeasts and moulds
- Reducing yeast levels leads to less heating and lower aerobic DM losses when exposed to air.

# Ecocool mode of action

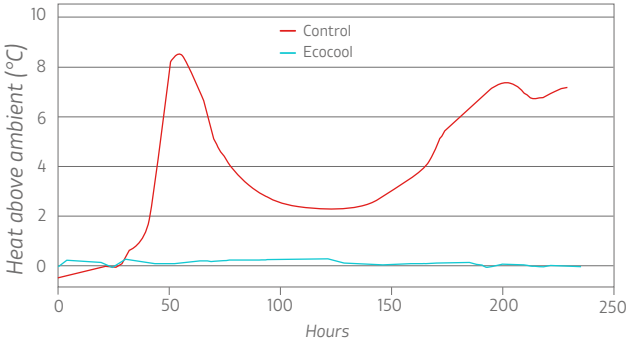


# PJB/1 for aerobic stability

**Maize (37% DM)**



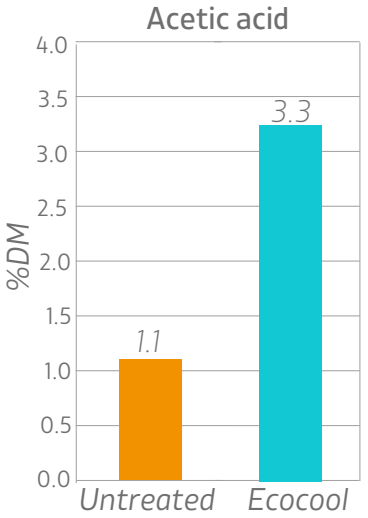

- The Ecocool treated silage remained completely stable throughout the trial*

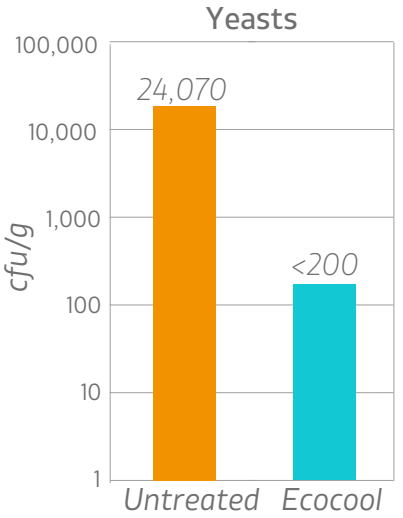



- Ecocool significantly reduced heating relative to the untreated silage

# Ecocool vs Untreated trial work

**Maize (37% DM)**




- *L. buchneri* in Ecocool generated more acetic acid than untreated silage
- The higher acetic acid levels in Ecocool silage reduced yeasts by more than 100 fold

Cut to Clamp

A Volac initiative

# Maize silage boost from new initiative

With grass silage stocks under severe pressure, Volac's latest Cut to Clamp initiative for maize silage could not have come at a better time.

Put 1,000 tonnes of maize into your clamp and, typically, you might only end up with 700t for feeding livestock, says Volac product manager Jackie Bradley.

Many of those missing tonnes will have effectively provided a meal for undesirable micro-organisms, she says, and all at your expense.

"About 80 of those tonnes are typically lost due to inefficient bacterial fermentation in the clamp, while another 200 are typically lost to yeasts and moulds causing aerobic spoilage, commonly detected as heating. But losses can be much higher.

"The serious point is that many farms would not want those typical losses in a good forage year, let alone a bad year such as this one. Plus, it is not only quantity at stake. There can be quality losses too."

While losses cannot be eliminated entirely, Mrs Bradley says they can be cut. This is what the new Cut to Clamp Maize initiative is all about.

Mrs Bradley says: "There is no single answer to achieve this. Instead, Cut to Clamp Maize guides farmers through five important loss-reducing steps: planning, harvesting, treating, clamping and feeding.

"Help is available via literature, a dedicated website, and free on-farm silage consultations."

**Making good maize silage could offer a lifeline for many farms this winter.**

"IT IS NOT ONLY QUANTITY AT STAKE. THERE CAN BE QUALITY LOSSES TOO

**Jackie Bradley**

## 1. PLANNING

THE starting point to cutting losses is to understand what causes them, says Mrs Bradley.

She says: "Successful silage production starts with rapid production of acidic conditions in the clamp through fermentation. These acidic conditions, in turn, 'pickle' the forage.

"Fermentation happens naturally, but the problem with a natural fermentation is there are both good and bad bacteria present.

"Bad bacteria will ferment sugar in the crop into lactic acid, which you want, but also to carbon dioxide, which waste's your silage's energy.

"They also produce unwanted weaker acid at this stage, which allows undesirable micro-organisms to feed on your silage for longer.

"By comparison, good bacteria, such as Lactobacillus plantarum MTD/1, ferment sugar only to stronger lactic acid, which rapidly inhibits the undesirable micro-organisms. They also don't produce carbon dioxide, so there is less loss of dry matter."

That said, this is only part of the picture, says Mrs Bradley, because maize is also susceptible to aerobic spoilage (heating), in which undesirable yeasts survive the initial fermentation, feeding on the lactic acid when exposed to air, and further reducing tonnes of dry matter through production of carbon dioxide and heat. It can also lead to reduced silage palatability and mycotoxin production, she notes.

**Lining the clamp walls with side sheets before filling the clamp is a key step to reducing air ingress.**

"As well as ensuring a good fermentation in maize, it is therefore vital to stop these yeasts, by both reducing their numbers early on and keeping out the air they need.

"Planning is about laying the foundations for this. Minimise contamination from last year's mouldy silage by cleaning the clamp and surrounding area. Start to make the clamp airtight by lining walls with polythene, a better barrier than concrete."

Other planning tasks include informing your contractor of anticipated harvest date, she says, rather than only calling on the day. That way, you'll have a better chance of harvesting the crop on time.

## 2. HARVESTING

THE aims at harvest are to harvest the crop at the optimum dry matter, using the optimum cutting height and optimum chop length, says Mrs Bradley.

### Optimum dry matter

She says: "Aim to harvest at a whole plant dry matter of 30-33%. Harvest too early and starch in the kernels won't be fully formed. Harvest too dry, and it is more difficult to consolidate and remove air from the clamp, increasing the risk of heating.

"To gauge the optimum dry matter, collect at least five representative cobs. Pressing your fingernail into exposed kernels should result in a soft cheese texture at top of the cob, but leave no indentation in kernels at the middle and bottom. Next, break cobs in half. A visible line will indicate where the milky white sugar portion in the kernels changes to solid yellow starch. You want one-third to one-half of the kernel as yellow starch. Confirm dry matter results using an oven or microwave test.

"If growing 'stay green' varieties, the cob may be ready even if the plant does not look it. If you wait until the plant looks mature, it may be past its best."

### Optimum cutting height

Even if looking for extra bulk this harvest, don't be tempted to cut plants too low, says Mrs Bradley. The base of the stalk has little nutritional value and mould spores often start here, plus it increases the risks of soil contamination and mycotoxins, she explains.

### Optimum chop length

"As with cutting date, chop length is about achieving the correct balance. Short chop lengths will make consolidation to remove air from the clamp easier, but will impact on how silage performs in the rumen. Consider chopping to 1.5-2cm," she suggests.

## 3. TREATING

THE reason we treat is to take control of the clamp's microbial processes, Mrs Bradley says.

"You control other stages, such as liming, analysing silage and balancing the ration. But people don't take control of the preservation.

"Decisions at ensiling can affect the quantity and quality of the silage you feed for 200 days of the year.

"For maximum control, choose an additive targeted at both improving fermentation and reducing heating.

"Ecocool, for example, contains wϕ strains of beneficial bacteria; one for each of these issues. In trial work, while the temperature of untreated silage climbed to 8degC above ambient just 55 hours after air exposure, Ecocool-treated silage showed no heating for more than nine days."

**Use an additive to improve fermentation efficiency and keep maize cool.**

## 4. CLAMPING

DURING clamping, says Mrs Bradley, you want the best fermentation and to starve spoilage organisms of air.

She says: "Fill the clamp in horizontal layers no more than 15cm deep, which is the maximum that can be consolidated effectively to squeeze air out. Many people still fill using a wedge, but this makes it difficult to maintain 15cm layers, with many clamps not consolidated enough.

"Calculate the weight of machinery needed to pack to a density of 750kg/cu.metre of fresh maize.

"As an illustration, two 14t tractors rolling continuously would not be enough to achieve this with a typical harvest rate of 120t/hour."

Once the clamp is filled, start the sealing process with an oxygen barrier film on top, suggests Mrs Bradley.

"On top of that, use a single 1000-gauge or two 500-gauge polythene sheets, then pull tight and fold together with the side sheets to create a seal.

"To prevent damage, put a woven sheet over the top, then weight with mats, gravel bags, touching tyres or bales. Net to stop birds, and bait to stop rodents."

## 5. FEEDING

THE feeding stage is about continuing to protect silage quality, says Mrs Bradley, and keeping it cool once exposed to air.

**Remove old maize silage to minimise spoilage spores contaminating the rest of the clamp.**

She says: "Minimise air ingress into the open clamp by using a block cutter or shear grab to keep the face tidy and move the face back quickly.

"Never leave the top sheet hanging over the face. It gets extremely hot under there on warmer days, encouraging mould.

"Instead, roll the top sheet back, and do it so it diverts rain water on top of the clamp away from the face. Rain getting into silage causes fluctuations in percentage dry matter, and cows like stable dry matters.

"Any silage that falls off the face should be cleaned up to minimise mould spores."

For more information on Volac's Cut to Clamp initiative, visit **cuttoclamp.com**

Cut to Clamp

A Volac initiative

# Preserving the milk value of maize

Want more milk from your maize silage? The microbial processes in maize clamps have a huge impact on its nutritional value. So understanding them is key.

Picture the scene – trailers full of freshly-harvested maize entering your farmyard.

But every so often, rather than unloading the sweet-smelling forage into your clamp, two or three out of every 10 trailers simply peel off and dump it in the slurry pit, rendering it worthless. Far-fetched?

According to Volac silage microbiologist, Dr Mark Leggett, this is about the scale of loss that can occur in maize clamps through a combination of inefficient fermentation and aerobic spoilage (heating). Both are caused by unwanted micro-organisms, as Dr Leggett explains.

"A lot of investment goes into growing a maize crop so there is no point in letting its nutritional value go to waste."

**A lot of investment goes into a maize crop, so there is no point in letting its nutritional value go to waste, says silage microbiologist Dr Mark Leggett.**

## Hidden losses

Worryingly, Dr Leggett says it is not just detectable problems, such as heating and visible wastage, that cause losses. A clamp may look fine but suffer from substantial hidden losses.

Equally, it is not just tonnes of dry matter at stake. The feed quality of the silage that remains will be depleted, and fungal contamination can make silage unpalatable, leading to cows rejecting it, he adds. So what can be done?

Firstly, Dr Leggett says it is important to really understand the unwanted microbial processes, so you can focus on controlling them.

He explains: "Fermentation losses, which are typically about 8%, or roughly equal to one trailer load in 10 being lost, occur because the primary fermentation is simply not efficient enough. This is important because fermentation is essentially the 'pickling' process that preserves the silage.

"Meanwhile, losses from aerobic spoilage, which can reach 20% or two trailer loads in 10, are caused when yeasts and moulds that are present naturally on maize plants are allowed to survive in the clamp and proliferate on exposure to air. This leads to heating, as the energy in the maize is 'burned up'. Alternatively, if you see mould growth, losses are likely to be even higher."

To give maize the best protection, Dr Leggett urges farmers to tackle both problems before irreversible damage is done.

**Farmers have no control over the number of good and bad micro-organisms present on maize at harvest.**

## Improve fermentation

A key step to successful ensiling, says Dr Leggett, is the rapid production of acidic conditions (low pH) in the clamp.

This process of fermentation is carried out by lactic acid bacteria, he says, and is important in order to quickly inhibit spoilage bacteria. However, not all lactic acid bacteria are the same.

"While some bacteria will ferment the sugars in maize purely to beneficial lactic acid, others will also ferment the sugars to other materials. These include carbon dioxide, which is not good because the carbon in carbon dioxide is a direct loss of dry matter.

"While you cannot control the types of bacteria naturally present on the crop at harvest, you can do various things to set maize up for a better preservation *(see panel, right)*. You can also take better control of the process by adding beneficial bacteria to dominate the fermentation.

"By applying a quality additive in this way, it not only provides beneficial bacteria but also a strain of them, such as Lactobacillus plantarum MTD/1, specially-selected to be highly efficient at lactic acid production.

"By achieving a more efficient fermentation, the benefits can include lower dry matter losses and faster inhibition of unwanted spoilage bacteria," he points out.

## Tackle aerobic spoilage

Unfortunately, no matter how efficient the fermentation, it cannot inhibit all spoilage micro-organisms in maize clamps, explains Dr Leggett.

This is because certain yeasts can survive in low pH conditions, he says, and then grow on lactic acid when the clamp is exposed to air – causing aerobic spoilage.

"By feeding on the lactic acid, they reduce the silage's dry matter through production of carbon dioxide and release of heat. But also, because lactic acid is being used up, the pH rises again.

"This allows other fungi, such as Aspergillus and Penicillium, to grow. Other consequences include reductions in nutritional value and palatability, and potentially mycotoxin production."

Just as with naturally-occurring bacteria on maize, Dr Leggett says farmers have little control over the numbers of these yeasts present on the crop at harvest. What is achievable, however, is to limit their growth in the silage.

"You do this with best practice clamp filling followed by good consolidation and sealing to deprive them of air.

"Similarly, you can put yourself in much better control by including something to inhibit them. This can be a preservative-based chemical, such as sorbate, or an additional beneficial bacterial strain, such as Lactobacillus buchneri, which generates acetic acid that has anti-yeast properties.

"As an example, the dual-acting additive Ecocool contains the PJB/1 strain of Lactobacillus buchneri. It also contains Lactobacillus plantarum MTD/1, which is proven to produce a rapid fermentation.

"Treatment with Ecocool has been shown to both reduce yeast levels and keep silage taken out of the clamp cool and stable for more than 10 days."

### Examples of efficient and less efficient fermentations

SUGAR → Efficient bacteria eg, *L. plantarum* MTD/1 → Lactic acid + Lactic acid

SUGAR → Less efficient bacteria → Lactic acid + Acetic acid + $CO_2$ ($CO_2$ = lost dry matter)

### SETTING UP MAIZE FOR BETTER PRESERVATION

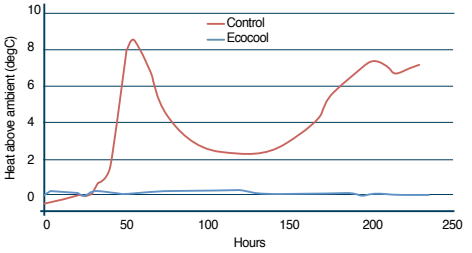
- Harvest the crop at 30-33% dry matter – it optimises starch content and, by avoiding it being too dry, it makes the crop easier to consolidate to remove air
- Don't cut too low – the base of the crop contains more mould spores, which contribute to aerobic spoilage (heating)
- Consider a chop length of 1.5-2cm to aid consolidation
- Make use of a dual-acting additive to improve fermentation and control heating by inhibiting yeasts and moulds
- Fill clamps in horizontal layers a maximum of 15cm deep – the most that can be consolidated effectively
- Compact to a density of 700kg of fresh maize per cubic metre and sheet thoroughly to create an airtight seal

### Inhibition of yeasts with Ecocool

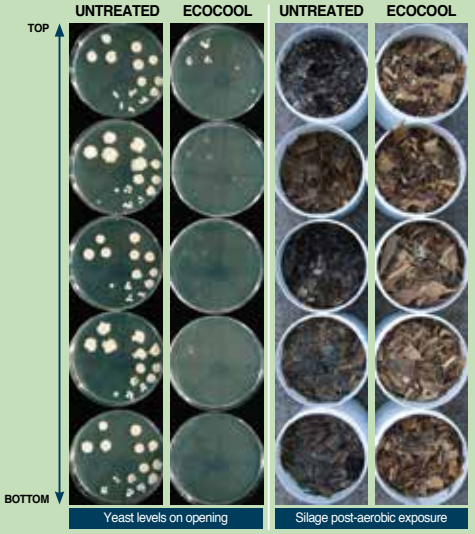
| | No additive | With Ecocool |
|---|---|---|
| | Number of yeasts (colony forming units per gram of forage) | |
| After ensiling | 1,500,000 | <1,000 |
| After air exposure | 440,000,000 | <1,000 |

### Benefit of Ecocool for keeping maize cool (37% DM)

Ecocool-treated silage remained stable for more than 10 days upon opening




### Effects of Ecocool for reducing fungal growth in different parts of the clamp

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# Making maize silage to fill grass shortfalls

Reduced grass silage yields in the first half of the year are set to make producing good maize silage even more important this season. So how do you achieve the best maize preservation?

Good maize preservation could be vital this year to make up for low grass stocks.

There are at least three reasons why preserving plenty of good maize silage will be even more important this season, says Volac silage specialist Ken Stroud:

- Reduced amounts of grass silage made during the dry spring.
- Reduced grass for grazing during spring, meaning some farms had to 'dip into' grass clamps to buffer feed.
- Silage alternatives, such as brewers grains, have been in short supply.

Mr Stroud says: "All these factors point to it being vital to leave no stone unturned to conserve as much dry matter (DM) and nutrient content as possible from this year's maize crops.

"Even in a normal situation, bought-in feeds can account for up to half the overall costs of production on high input dairy farms. If silage stocks are tight, requiring extra bought-in feed, that figure will obviously increase.

"Theoretically, there is enough energy in a hectare of fresh forage maize to support about 30,000 litres of milk production, assuming animal maintenance needs are already met. However, there is only one opportunity to conserve maize correctly.

"Actions taken on the day of ensiling have long-term consequences for how well the resulting maize silage will keep through winter and how much will be lost."

## Potential losses

So how much loss is at stake in maize?

Mr Stroud says: "Putting a precise figure on this is difficult, but figures can be 15% or even more of the DM ensiled.

"Losses are caused by inefficient fermentation and heating [aerobic spoilage] due to the growth of undesirable micro-organisms.

"But it is not just quantity which suffers. Feed value is also lost as the micro-organisms feed on the silage's nutrients. Spoiled silage is also less palatable, leading to waste from cows rejecting it and can contain mycotoxins."

## What can be done?

To preserve maximum maize quantity and quality, Mr Stroud points to five steps in Cut to Clamp, an initiative designed to provide a blueprint for consistently better silage:

### 1. Planning

The importance of planning ahead cannot be underestimated, says Mr Stroud.

"A key aim of planning is to take steps to minimise undesirable micro-organisms growing in the silage from the outset and to maximise the good micro-organisms.

"This can be done directly. For example, clean the clamp of last year's silage thoroughly to reduce mould spores. Also, ensure you have enough of the correct type of additive: a dual-acting one designed to improve fermentation and inhibit yeast and moulds. However, it also includes other best practices. For example, line clamp walls with polythene, which is a better barrier against air than bare concrete.

"This is important because airtight conditions both aid fermentation and reduce yeast and mould activity.

"The other aim of planning ahead is to get yourself into a position so the crop will be harvested in peak condition, both nutritionally and for ensiling."

### 2. Harvesting

Maize should be harvested when the whole plant reaches a sweet spot of 30-33% DM, says Mr Stroud.

This is essential for two reasons.

Firstly, harvest too early and starch in the cobs is not fully formed. Secondly, harvest too late, when the crop is drier, and it becomes more difficult to consolidate in the clamp, increasing the risk of losses from heating.

Mr Stroud says: "Monitoring maize crops regularly, so you can keep your contractor informed as the optimum % DM approaches, will be particularly important this year. Otherwise, if you call them on the last minute and they cannot get to you immediately, you risk crops becoming over-ripe.

"Remember also that modern maize varieties stay green, so may be ready to harvest before they look like it. To asses % DM, you have to examine the cobs."

To do this, Mr Stroud says collect at least 10 consecutive cobs along a row and press your thumbnail into the exposed kernels. When ready to harvest, this should leave no indentation in kernels at the bottom of the cob, but show a soft cheese texture in kernels at the top.

Additionally, break cobs in half and check for a visible line where the milky white sugar portion in the kernels changes to solid yellow starch. When ready to harvest, one-third to one-half of the kernel should be yellow starch.

He continues: "Other important steps to aid maize preservation are to ensure the crop is cut at the correct height and chopped to the correct length.

"If looking to make up for silage shortfalls it can be tempting to cut a bit lower, but the base of the stem is low in nutritional value and risks contaminating the clamp with soil and mould spores.

"Always leave at least 15 cm of stubble. Also at harvest, consider a chop length of 1.5–2cm to aid consolidation, but avoid chopping too short as this will compromise how silage performs in the rumen."

Ken Stroud

### 3. Treating

Whenever silage is made, it is at the mercy of micro-organisms, says Mr Stroud. By treating, you take greater control of these microbial processes.

"There is an argument that greener, more moist maize needs extra help with fermentation, while in more mature maize, yeast and mould levels increase.

"By using a dual-purpose additive you are covering both issues. Ecocool, for example, applies two strains of beneficial bacteria – one to produce a rapid fermentation and one which inhibits yeast and mould growth.

"Scientific studies have shown clear reductions in losses of maize silage freshweight by treating with Ecocool. In other work, while the temperature of untreated silage rose by 8degC after two days, Ecocool-treated silage remained cool for more than 10 days."

### 4. Clamping

Maize preservation can go badly wrong during clamping, says Mr Stroud, because there is pressure to finish the job quickly. However, this is a crucial step, so take the time to consolidate and seal the clamp correctly, he urges, to create and maintain airtight conditions.

"Maize needs consolidating to a density of 700kg of freshweight/cu.m. Do not underestimate how much weight is needed to achieve this. Two 14-tonne tractors rolling continuously would not be enough with a typical harvest rate of 120t/hour. To aid consolidation, fill clamps in layers no more than 15cm deep, which is the most that can be consolidated effectively. And fill in horizontal layers rather in a wedge, which is more difficult to compact.

"For sealing, start with an oxygen barrier film on top of the maize. Fold the side sheets over the top, allowing a minimum one- to two-metre overlap, followed by a top sheet pulled tight, then a woven sheet to protect against damage.

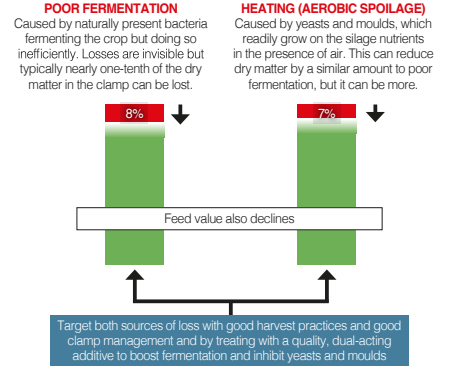
"Weight with mats, gravel bags, touching tyres or bales. Finally, place a net over the top to prevent birds pecking through and control rodents."

### 5. Feeding

Having gone to the trouble of conserving good maize silage, do not allow losses and wastage at feedout, says Mr Stroud.

"Minimise the amount of air which can get into the open face by keeping the face smooth using a block cutter or shear grab and moving across the clamp quickly so each newly created face is exposed to air for the minimum time. In addition, do not pull the top sheet back over the face as this creates a warm humid environment that yeasts thrive in. And remove old silage which falls off the face promptly. Otherwise, it becomes a source of mould spores."

**Figure 2:** How the tonnes of dry matter can be lost from maize clamps

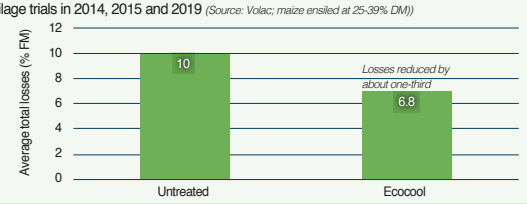



## LATEST MAIZE PRESERVATION RESEARCH

Latest findings from three years of trials have revealed that compared with leaving silage untreated, treating with Ecocool at ensiling slashed total freshweight losses in maize (from fermentation plus aerobic spoilage) by around one- third.

Mr Stroud says: "In this case, preservation of freshweight was measured, rather than preservation of DM. Nevertheless, the work underlines an important principle: treating would have resulted in more material to feed."

**Figure 1:** Average total losses (fermentation and aerobic spoilage) from five maize silage trials in 2014, 2015 and 2019 *(Source: Volac; maize ensiled at 25-39% DM))*

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Cut to Clamp

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Buoyant milk prices and high bought-in feed costs provide added reasons to do a great job of making maize silage this season.

# Maize silage offers good opportunity with high prices

With soaring feed costs it makes a lot of sense to maximise milk production from home-grown forage, says Volac silage scientist Dr Mark Leggett. Moreover, healthy milk prices add to this argument.

But there is another reason why it is important to retain as much feed value as possible when ensiling maize crops this season.

Higher fuel and fertiliser costs mean maize has cost more to grow this year. So any losses in dry matter (DM) and nutrient content which are allowed to occur will steal some of that extra investment, he adds.

Dr Leggett says: "With its high starch content, maize is an ideal source of home-grown metabolisable energy compared with buying-in energy from extra concentrate.

Maize is an ideal source of home-grown metabolisable energy, says Dr Mark Leggett.

"However, a key challenge is that maize plants play host to a lot of undesirable micro-organisms – in the form of bacteria, yeasts and moulds *[see infographic, above right]*.

"If allowed to multiply in the clamp, these can cause significant feed value reductions, both during storage and when the resulting silage is fed out."

> A key challenge is that maize plants play host to a lot of undesirable micro-organisms
>
> ***DR MARK LEGGETT***

## Typical losses

Although difficult to quantify precisely, Dr Leggett says even typical losses in maize clamps equate to about one in every 10 trailer-loads of DM ensiled being lost, but they can be higher, for example two out of every 10 trailer loads if clamp management is not up to scratch.

When spoilage occurs in the vulnerable top and shoulders of the clamp, he says half the DM in these areas can go to waste, or more.

Dr Leggett says: "The other important point to stress is that it is the most digestible parts of the DM that undesirable microbes feed on first – the sugars and starches.

### Dr Mark Leggett's tips for making better maize silage

| Maize tips | Why do this? |
|---|---|
| Clean the clamp before harvest | To remove undesirable bacteria, yeasts and moulds surviving on old silage and in cracks |
| Harvest maize promptly at 30-33% dry matter (DM) | To provide a balance of:<br>● Starch content in cobs – for energy<br>● Foliage that is still green – for digestibility<br>● Crop still sufficiently 'soft' for consolidation |
| Leave at least 15cm of maize stubble | Because the stem base is:<br>● Low in nutritional value<br>● At risk from soil bacteria that interfere with fermentation<br>● At risk from yeasts and moulds |
| Chop to the optimum length (1.5-2cm) | So the maize is:<br>● Short enough to aid clamp consolidation<br>● Long enough to perform in the rumen |
| Treat with a dual-acting additive | ● To reduce fermentation losses (due to inefficient fermentation bacteria naturally present on the crop)<br>● To target the yeasts and moulds that cause losses from heating |
| Fill the clamp in maximum 15cm layers, roll with sufficient weight and sheet thoroughly (side sheets, an $O_2$ barrier film and well-weighted top sheet) | ● To aid consolidation and keep air out: oxygen trapped in silage allows yeasts and moulds to thrive (Typically, maize at 30% DM requires 25% of its weight arriving at the clamp/hour to consolidate it. So 100 tonnes/hour requires 25t rolling constantly) |

"So not only is there less DM available to feed, but the DM that remains contains less energy for the cow."

As an example, Dr Leggett says maize is notoriously prone to losses from aerobic spoilage (heating), caused by yeasts and moulds feeding on the silage in the presence of air.

But it is not just losses from heating which maize suffers from. Invisible losses from poor quality fermentations can account for as much as half the overall DM losses in maize clamps, he says.

So when planning how best to conserve maize, it is important to consider both problems.

## Dual-acting

Dr Leggett says: "Preserving maize silage is not a single-step process. It requires a joined-up approach *[see table, above]*. This starts even before harvest by thoroughly cleaning the clamp to remove contamination from old silage.

"It doesn't end until you can see the silage at feed-out is staying cool.

"Fortunately, some steps, such as achieving a good consolidation, can benefit not only the fermentation but also help in reducing aerobic heating losses. An integral part is also to choose the correct type of additive. To target both sources of loss, I would advocate an additive which is dual-acting.

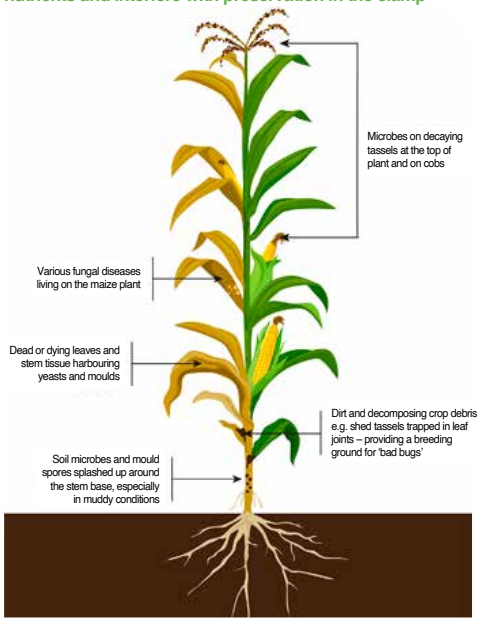
"The additive Ecocool, for example, contains two types of beneficial bacteria. The first, Lactobacillus plantarum MTD/1, which is also found in Ecosyl, is targeted at improving fermentation.

"But in Ecocool, MTD/1 is blended with a second bacterial strain, Lactobacillus buchneri PJB/1, which is included to inhibit yeast and mould growth. In trials, compared with untreated maize silage which contained 440 million colony-forming yeast units per gram after exposure to air, maize silage made with Ecocool contained less than 1,000.

"Ecocool has also been shown to keep maize silage cool and stable for more than 10 days after removal from the clamp.

"With a lot at stake with high feed and milk prices, an additive looks a worthwhile investment."

### Potential sources of undesirable microbes (bacteria, yeasts and moulds) on maize plants which feed on nutrients and interfere with preservation in the clamp




### OTHER COSTS OF BAD MICROBES

MAIZE silage heating is a sign that dry matter (DM) and nutrients are being 'burned up' by yeasts and moulds.

But besides heating, bad microbes can cause other problems.

Dr Leggett says: "Palatability can also be reduced, resulting in lower DM intake and greater rejection, which will push up bought-in feed requirements.

"Additionally, moulds can cause mycotoxins, requiring remedial action. Both of these are added reasons to pay close attention to crop and clamp management and additive choice from the outset.

"Prevention is certainly better than cure."

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