



SCHAUMANN

FEEDS SUCCESS



Maize Silage Handbook

A guide for a successful 2023 maize silage



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Dear Farmers,

For many years, our Maize Silage Handbook has been a trusty companion and handy reference for everything to do with maize silage. For the 2023 maize season, we are proud to present our new-look BONSILAGE Silage Handbook. We hope you enjoy reading and wish you a successful maize silage season.

For your **success in the barn**
The SCHAUMANN Team

At a glance!

Maize silages have low protein contents, high energy values and are usually good for ensiling. However, there is a high potential for silage heating due to the easy conversion of nutrients in combination with increasing field yeast loads, which need to be observed, and therefore a higher risk of silage spoilage.

Important key figures and target values for ensiling and silage.

When all the target values for the most important parameters are met, top-quality maize silage is produced.

Silage management – Key values for maize silage	
DM content	Whole plant: 29 - 34 %, Kernel: 56 - 60 %
Cutting height	Min. 30 cm
Chop length	4 - 8 mm, depending on the dry matter
Kernel crushing	All kernels should be at least quartered, simply bashing the kernels once is not enough.
Silage additive	BONSILAGE for increasing aerobic stability
Deposited layers	Layer thickness of max. 15 - 20 cm. The higher the degree of ripeness and the dry matter content, the thinner the layers should be.
Compaction tractor weight	Rolling weight in t = $\frac{\text{Pick-up rate in t FM per hour}}{4}$ Target compaction (kg DM per m ³) = (8 x DM (%)) + 6 Example with 33 % DM = 270 kg DM/m ³
Coverage	Base, side, edge and top sheeting Protective silo mesh, silo sandbags
Removal rate	2 m per week
Tyre pressure	To increase contact surface pressure, the tyre pressure should be set to the maximum. Twin tyres work against an increase in contact surface pressure.

Parameter	Maize WPS	CCM
Dry matter (%)	28 - 35	60 - 65
pH value (depends on the DM)	3.8 - 4.2	3.8 - 4.2
Starch (% DM)	> 30	> 65
CP (% DM)	7 - 8	9 - 10
CF (% DM)	< 20	2.5 - 3.5
NDF (% DM)	35 - 40	10 - 12
XA (% DM)	< 4.5	< 2.5
NH3-N (% of total N)	< 6	< 6
ESOM (% DM)	> 70	> 79
Energy density (MJ NEL/kg DM)	> 6.5	> 15.5 MJ ME (pigs) > 8.2 MJ NEL (cows)



High-quality silage is the foundation for the best basic ration quality!
The individual harvesting cuts must be precisely coordinated.

Harvest management - Maize whole plant

An optimal harvest time and appropriate chop length are essential for a successful ensiling and for obtaining the best possible nutrient levels and energy contents.

The optimal harvesting window is when:

- The DM content of the whole plant is between 29 % and 34 %
- There is a high cob proportion and the rest of the plant is easily digestible
- The plants are ready for ensiling when the dry matter in the kernels has reached 56 - 60 %
- The starch deposition in the kernel is complete

Optimal chop length:

Cattle farming: 4 - 8 mm **Biogas production:** 4 - 6 mm

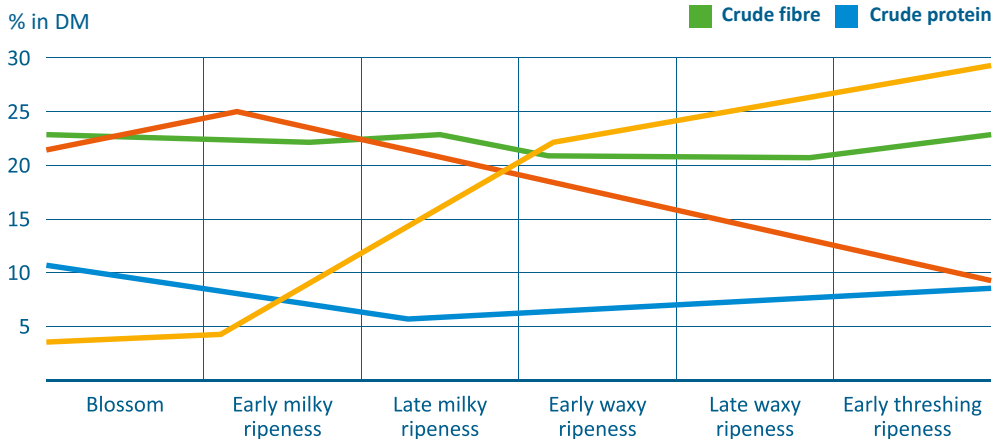


In principle: the dryer and riper the material, the shorter the chop length.

By sticking to these guidelines, you will:

- Achieve an optimised compaction (over 230 kg DM/m³ silage)
- Minimise energy losses during ensiling and removal caused by heating and mould formation
- Improve digestibility (larger attack surface for rumen microorganisms)

Changes to the contents during the maize ripening



Harvest management - Cereal whole plant

Tips for making cereal whole plant silage

- The optimal harvesting time is between late milky ripeness and early waxy ripeness. A thumb nail test is one method you can use to see if the plants are ready. Press your thumb nail down lightly in the centre of the cereal grain, the contents should squirt out. Another indication of when to harvest is when the straw starts to change colour even through the stem nodes, awns and the upper two thirds of leaves are still green. The dry matter content of the whole plant should be 32 - 38 %. Remember, the crude fibre content should not exceed 24 % of the DM, otherwise the energy density and ensilability of the plants will deteriorate due to an increase in the straw content.
- Cutting heights of min. 30 cm have proven effective for creating a grain/straw ratio of 1:1. Higher cuts can help to increase the silage's energy content. However, this is usually at the expense of the mass yield. The higher the cut height, the lower the load of unwanted germs.
- The optimal chop length is between 4 mm and 8 mm max. Only then is good compaction possible. Stems and stem nodes must be split open. If this is not done, the pipe-like structure of the stems can prevent a low-loss compaction and ensiling from happening.
- We recommended using a cracker during the harvesting to break down the cereals so that they can be digested as best possible and the animals can make optimal use of the nutrients that they contain.
- Optimal compaction of cereal whole plant silages can help to prevent heating. The aim is to achieve a compaction of at least 230 kg DM/m³ from a starting material with a dry matter content of 35 %. With 45 % DM, you should aim for a compaction of at least 260 kg DM/m³.



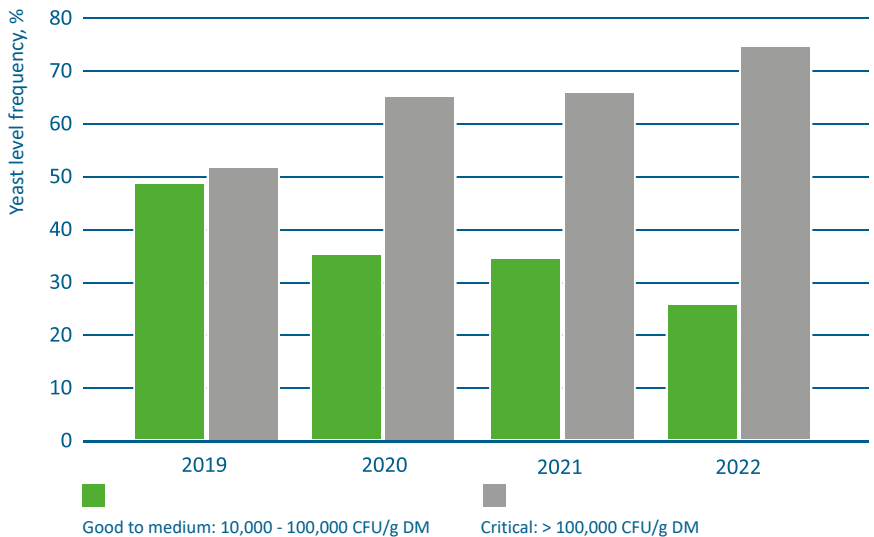
Yeast in maize silage

The risk of yeast and mould developing in maize crops has increased over the past few years. High loads are often not visible to the naked eye but can result in significant problems during ensiling and feeding. You often seen an uninhibited growth of these harmful organisms in untreated silage.

The silage tests carried out as part of last year’s Lower Saxony Chamber of Agriculture Silage Competition confirmed this. Each year, this competition awards prizes to the best grass and maize silages. LUFA Nord-West tests the silage samples to check the hygiene status, amongst other things, and particularly the yeast and mould contents. Figure 1 shows the increase in the amount of yeast in the sent-off maize samples over the last few years. In 2022, over 70 % of the samples showed significantly increased or critical yeast contents.

Results like this form the basis for the official advice to use silage additives to improve the aerobic stability of your silage.

1 Increasing yeast levels in maize silage from 2019 to 2022 (results from the Lower Saxony Chamber of Agriculture Silage Competition).



Source: based on data from the Lower Saxony Chamber of Agriculture



Quality not quantity will help to increase annual milk yields.

Fresh maize samples

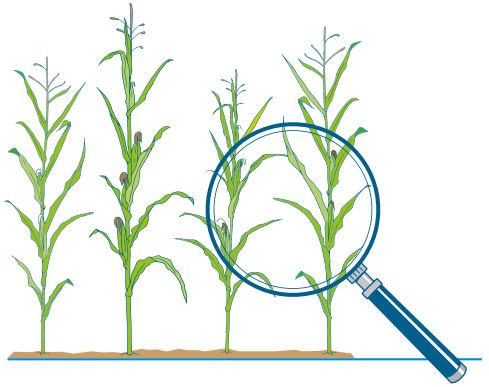
By sampling maize in the weeks before the harvest to check for crude nutrients, yeast and mould, you can create a secure basis for decision-making when it comes to planning your harvesting dates, determining the cut height and choosing the right BONSILAGE products. It also helps you to reduce yeast and mould in a targeted way.

How to take the samples:

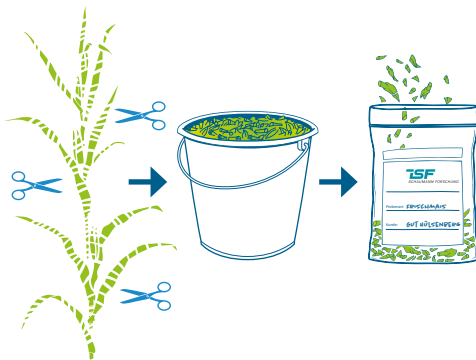
- 1** Remove a few plants from the stock by cutting them at the planned cut height.



- 2** Observe the different stages of development across the cultivation area and take different plants.



- 3** Shred the plants and create a representative composite sample to send to the lab.



- 4** Collect and send the sample at the start of the week to keep the time between sending and the analysis as short as possible.

MO	TUES	WED	THURS	FRI	SAT	SUN

Finding the right BONSILAGE silage additive

The quality of the starting material, maize, varies wildly depending on the weather conditions. The most important parameter is the DM content of the whole plant. For silage maize crops, this should be 35 % maximum. When it comes to choosing the right silage additive, the part of the plant that is to be ensiled is decisive. The available silage ripening time or the formation of propylene glycol are also important factors that must be taken into consideration.



< 27 % DM



Silage maize



> 27 % DM

Quicker ensiling

Increased cow fitness



> 55 % DM



CCM/
Whole grain
maize silage



Max. 70 % DM



Compaction

If oxygen infiltrates the silage this can result in heating and mould formation and thus energy and DM losses. The better compacted the silage is, the less residual oxygen there will be in the silo and so the less aerial oxygen will infiltrate when silage is removed. The weight of the compaction tractor determines the speed of the harvesting process.

Rule of thumb for pick-up rate:

$$\text{Compaction tractor weight} = \frac{\text{Pick-up rate in t FM per hour}}{4}$$

Rule of thumb for exact compaction:

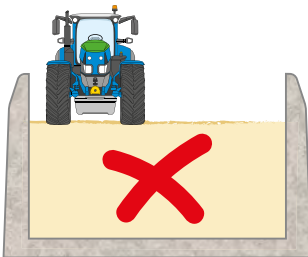
$$\text{Target compaction (kg per m}^3\text{)} = (8 \times \text{DM (\%)}) + 6$$

Example: $(33 \times 8) + 6 = 270 \text{ kg/m}^3$

Measures for optimal compaction:

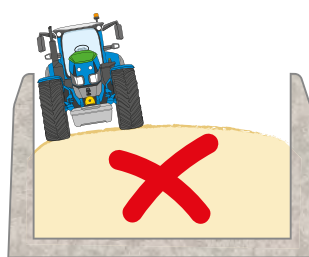
- Layer thickness of max. 15 - 20 cm.
- The higher the crude fibre and dry matter content, the thinner the layers should be.
- Tyre pressure of at least 2 bar and as high as possible.
- No twin tyres.
- Max compaction speed of 3 - 4 km/h.
- Compact from the very start, otherwise the effect will remain superficial.
- No excessive compacting at the end because of the pumping effect caused by the ensiled plants springing back.
- Steep access ramps or side walls (with free-standing silage heaps) make compaction more difficult.

! Well compacted silage minimises the risk of heating and mould formation.



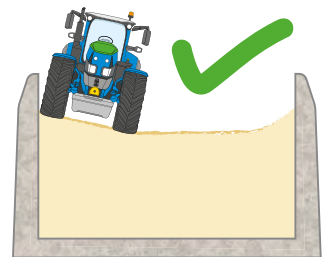
Wrong

Protruding vehicle parts prevent compaction near the walls.



Wrong

The edges cannot be compacted due to the inclination of the tractor.

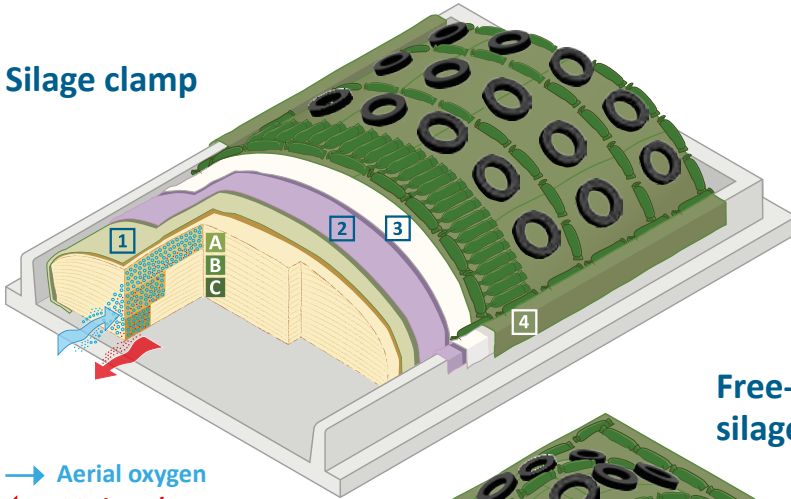


Correct

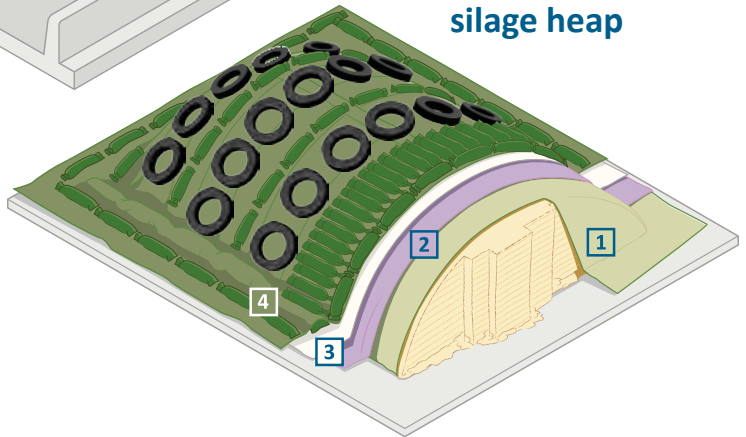
The inclination means that the the area directly next to the silo wall can be compacted.

How to correctly cover your silo

Silage clamp



Free-standing silage heap



→ Aerial oxygen
← CO₂ heat/water

* See table on page 9

- 1 Side or edge sheet
- 2 Base sheet
- 3 Silage sheet
- 4 Protective silo mesh

Cover

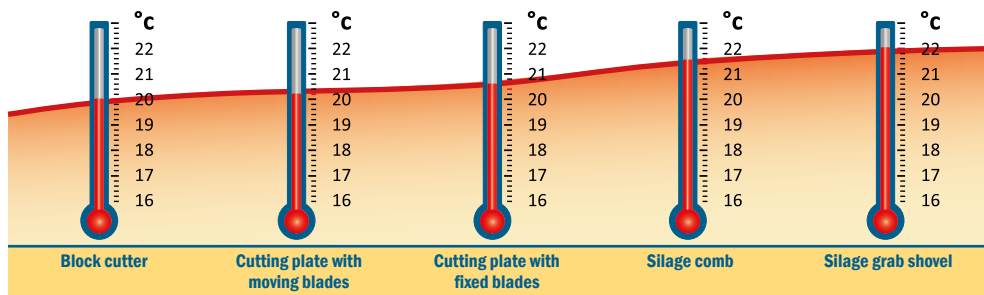
Make sure that the silage is covered correctly as soon as the compacting is finished.

- Base sheet (thickness: 40 - 50 µm): suctions itself to the silage.
- Top sheet (thickness: 150 - 250 µm): must be gas-tight, flexible, UV-resistant and acid-proof.
- Protective silo mesh: protects the sheets from mechanical damage and weighs them down.
- Silo sandbags: used as ballast for targeted adjustments.
- With a silage clamp, a side sheet should be used but with free-standing silage heaps an edge sheet should be used.
- Compact from the very start, otherwise the effect will remain superficial.
- With longer (overnight) breaks in the ensiling, an intermediate cover must be provided.

Silo face and removal rate

The minimum removal rate to avoid heating in properly compacted silage is 2 m per week. The ideal silo length for year-round silage feeding is 105 m. The silage removal equipment should damage the silo face as little as possible in order to minimise air infiltration.

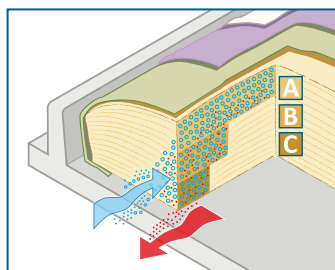
Influence of the removal equipment on the temperature at the silo face (After 20 hours, 20 cm behind the face)



Source: changed by Steinhöfel and Pahlke, 2005

* Effect of compaction on air infiltration at the silo face

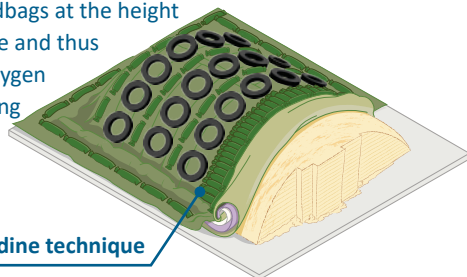
	Compaction	Penetration of the air
A	120 kg DM/m ³	60 to 100 cm
B	180 kg DM/m ³	20 to 60 cm
C	270 kg DM/m ³	15 to 20 cm



→ Aerial oxygen
← CO₂ heat/water

To prevent heating:

- Create summer silos with smaller silo faces.
- Ensure that the silo face is away from the prevailing wind direction.
- Cover the silo as late as possible.
- Calculate the silo length and removal rate according to the number of animals/feed requirements.
- Optimise the removal equipment used.
- Weighing down the silo sheet at the silo face with an additional horizontal barrier (sardine technique) made from silo sandbags at the height of the silo face and thus preventing oxygen from infiltrating the silage.



Sardine technique



A silo face size that corresponds of the feed requirements helps to prevent heating and mould formation.

Find out more in the video! Scan here:



Hülseberg Estate

Maize crop inspection



Hülseberg Estate

Maize silo management

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BONSILAGE silage additives – real added value for you!

Added value



Using BONSILAGE

To achieve a good basic ration quality, having an optimal silage quality is key. Here the BONSILAGE silage programme provides significant support for maize ensiling. With a wide range of solution-oriented products, SCHAUMANN has the perfect biological silage additive for all areas of maize ensiling as well as all ensiling situations and practical requirements. They combine the latest scientific insights with many years of practical experience. By using BONSILAGE silage additives, you can control the fermentation process in a targeted way by producing lactic acids, acetic acids, propylene glycol and suppressing unwanted microorganisms.

This and other factors improve:

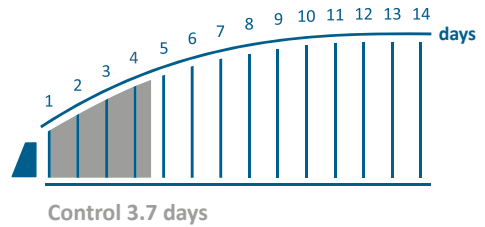
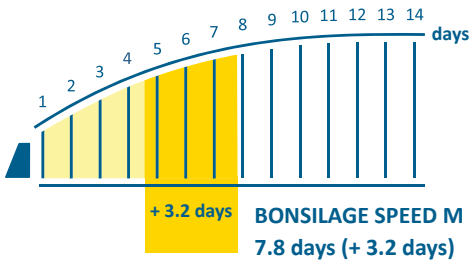
- The fermentation process
- The aerobic stability
- Nutrient use and energy conversion
- The eating qualities of the silage such as palatability and digestibility

Aerobic stability

BONSILAGE silage additives effectively suppress unwanted microorganisms and support a safe fermentation process. A controlled formation of acetic acids helps to stabilise the silage and significantly reduces heating and DM losses. To achieve this, intensive fermentation during the first weeks of the ensiling is essential. The special strain combinations in the BONSILAGE silage additives prevent consumption-reducing aerobic spoilage processes and heating.

Safe silo opening after just 14 days:

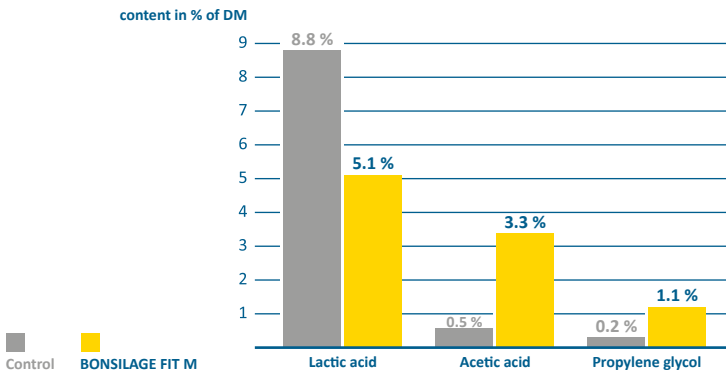
BONSILAGE SPEED M extends aerobic stability by around 3 days.



Source: DLG test centre for farm equipment and inputs, 2022

Depending on the strain combination, BONSILAGE products with *Lactobacillus buchneri* show increased formation of acetic acids and propylene glycol. Results from ISF Schaumann Research have shown that silages treated with BONSILAGE produce significantly more stabilising fermented products that are also gentle on the rumen. Yeast and moulds are effectively suppressed thanks to the increased levels of fermentation acid and the stability of the silage significantly improved.

BONSILAGE FIT M – The silage additive for high stability, energy-rich maize and whole plant silage and measurably more cow fitness.

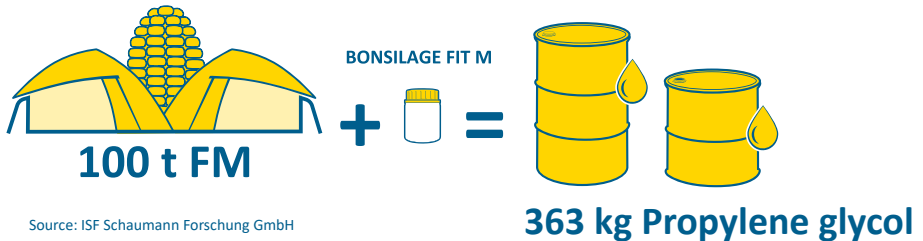


Source: ISF Schaumann Forschung GmbH

Higher energy conversion

In energy-rich maize and whole plant silage, a special combination of homo- and heterofermentative lactic acid bacteria strains provides additional propylene glycol as a high-quality source of energy. This supports the metabolism and fitness of dairy cows and reduces the risk of ketosis and acidosis.

On average, one container of BONSILAGE FIT M produces one and a half barrels of propylene glycol.

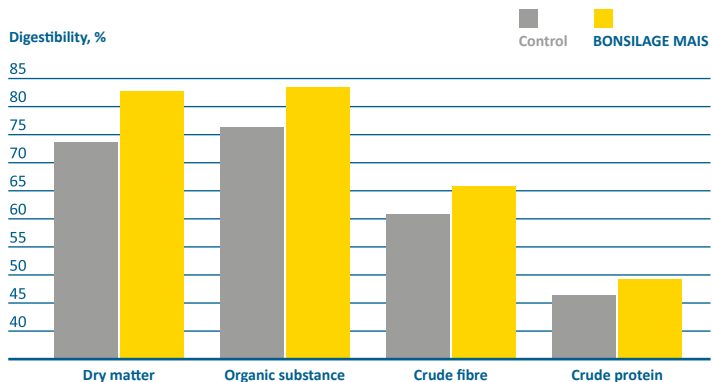


Source: ISF Schaumann Forschung GmbH

Improved digestibility

A rapid reduction of the pH value of the silage reduces nutrient loss during the ensiling and increases nutrient use. Trials carried out by the Baden-Württemberg Centre for Agriculture (LAZBW) in Aulendorf and the North Rhine-Westphalia Chamber of Agriculture (LKW NRW) in Haus Riswick proved that BONSILAGE helped to improve the digestibility of maize silage. During the trials, an increase in the energy content of + 0.27 MJ NEL/kg DM on average was detected.

BONSILAGE MAIS increases the digestibility of the crude nutrients and thus the energy density of the maize silage.



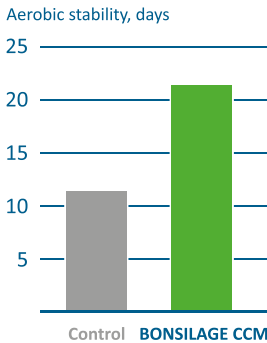
Source: LAZBW Aulendorf, LWK NRW Haus Riswick

Ensiling of CCM, maize ear silage and whole grain maize silage

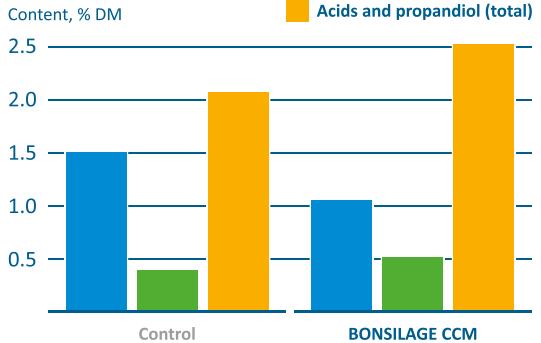
When it comes to ensiling CCM, maize ear silage and whole grain maize silage, the suppression of yeast and moulds is a top priority. Tests have shown that the yeast load of harvest-fresh maize cobs and maize kernels is often very high.

Particularly stable silages, an effective formation of lactic and acetic acid for an outstanding palatability with BONSILAGE CMM.

BONSILAGE CCM – Aerobic stability



BONSILAGE CCM – Fermentation acid content

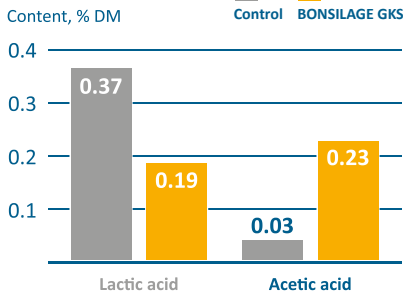


Source: ISF Schaumann Forschung GmbH

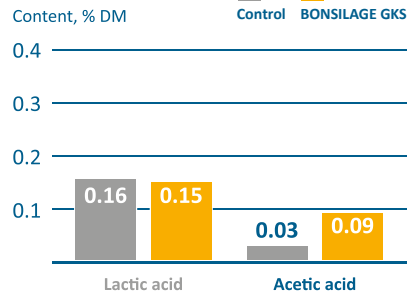
BONSILAGE prevents the uncontrolled proliferation of yeast and moulds. The homo- and heterofermentative lactic acid bacteria strains that it contains form more acetic acid and propandiol and suppress harmful organisms. The lactic acids formed improve the palatability of the silage. In addition, ensiling with BONSILAGE offers an affordable alternative to chemical conservation with improved palatability.

BONSILAGE GKS forms more acetic acid and increases the stability of whole grain maize silage.

67 % DM



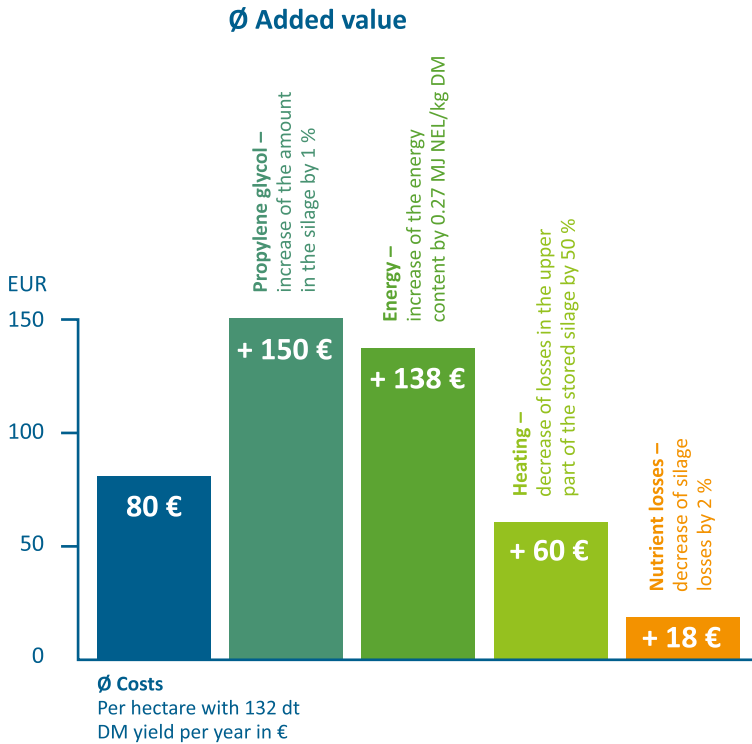
72 % DM



Source: LfL Grub

Profitability

With BONSILAGE silage additives, you can control the value-determining performance parameters of your silage. A simple calculation and the balance sheet derived from this have shown that using BONSILAGE silage additives can help to achieve significantly more added value in the valuable performance parameters.



Enjoy the benefits of BONSILAGE!

Not only do the BONSILAGE products provide you with better nutrient protection, by using the right silage additive, you can obtain a more high-quality source of energy thanks to things like an additional formation of propylene glycol. In addition, by increasing digestibility, you will no longer need to purchase expensive additional feed.



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CATEGORY 2

**CONTINUOUS
MONITORING
SUPPLEMENTARY TEST**

✓ For early silo
opening

DLG Certificate 7285

**Dinner
for winner!**

Finding the right BONSILAGE silage additive



5 steps to choosing the right BONSILAGE silage additive

- 1. Harvesting methods**
Whole grain or Cob/Kernel
- 2. Dry matter content**
Wring or thumb nail test/
Microwave
- 3. Yeast and mould load**
Fresh maize samples
- 4. Planned storage time**
Min. 2 weeks,
8 weeks or
3 months
- 5. Desired effect of the additive**
More propylene glycol, quicker ensiling




	DLG Quality Seal	Area of application	DM	Target	Organic Available as B BONSILAGE
		Whole plant maize silage, whole plant cereal silage	28 - 45 %	Optimised fermentation process, increased energy density, aerobic stability	
		CCM, maize kernel silage, maize ear silage		Optimised fermentation acid profile, secure energy conservation, high degree of storage stability. Protects against the uncontrolled proliferation of yeast	
		Whole grain maize silage for storage in gas-tight tower silos		Hygienically flawless whole grain maize silage, better palatability, fewer losses	
		All starch-rich silages (maize, whole plant cereal silage, etc.)	25 - 45 %	Shorter ripening time of 14 days and high aerobic stability of maize and whole plant silages	
		All starch-rich silages (maize, whole plant cereal silage, etc.)	25 - 45 %	High aerobic stability of energy-rich maize and whole plant silage to support cow fitness	



B BONSILAGE PRODUCTS are included in the **Input List for Organic Agriculture in Germany**. The products can be used in organic production in accordance with Regulations (EU) 2018/848 and (EU) 2021/1165. Controlled/certified through AT-BIO-301.

Ensiling with acid salts and acids

Conservation with acid salts and acids is another way to secure the feed quality of CCM, maize ear and whole grain maize silages. The effective acid combinations from SCHAUMANN reduce bacteria, mould and yeast loads until they are below detectable levels, resulting in high-quality feeds.

			
	SCHAUMASIL EXTRA is a highly active liquid combination of organic acids and can also be used on organic farms.	The SCHAUMASIL SUPRA NK acid combination is particularly material- and user-friendly.	With a highly concentrated combination of sodium benzoate, potassium sorbate and sodium acetate, SILOSTAR LIQUID HD effectively improves the aerobic stability of silage.
Area of application	Conservation of CCM and maize kernel silage	Conservation of CCM and maize kernel silage	Grass, maize and cereal whole plant silages and industry level products
Dosage/t	5 - 8 l with sheet storage	5 - 8 l with sheet storage	1.5 - 2.5 l depending on the type of silage
Container size	210 or 1,000 kg of liquid	30, 210 or 1,000 kg of liquid	210 or 1,000 kg of liquid

Technical tips for ensiling with acid salts and acids

A precise determination of the dry matter content of the starting material is essential for successful ensiling or preservation. As a general rule, the moisture content of any incoming batch of material must be determined.

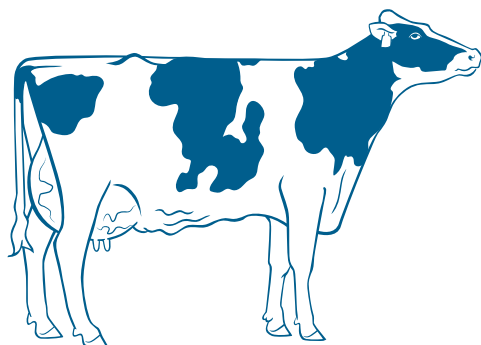
- Acid must always be applied with acid-proof dosing devices.
- The dosing devices must be accurately adjusted (calibrated) before use.
- Always comply with the regulations in the safety data sheets (HACCP plan).
- Any walls and floors that come into contact with treated silage must be protected with acid-proof paint or a layer of acid-proof sheeting.
- Excessive heating during the milling process must be avoided in order to prevent heat-induced spoilage reactions (brown or black discoloration of the maize product; Maillard reaction).
- If the starting material has been hygienically compromised (e.g. corn smut) or contaminated, the application rate must be increased by 0.1 - 0.3 %.

Stabilising the TMR

In addition to the factors required to achieve good basic ration quality during ensiling, managing the face of your maize silage is another important measure that will help to maintain the stability of your silage. Open silos are frequently exposed to the elements, particularly in autumn and winter. Rain and snow often lead to soiling on the silo face as well as dubious silage hygiene. In summer, the high temperatures and stronger solar radiation leads to a higher risk of losses.



Your SCHAUMANN consultant will be happy to give you more useful tips and information about how to use stabilising feed additives.

Potential effects of mould and yeast



- Weakened immune system
- High cell counts
- Poor feed intake
- Declining milk yield
- Hoof problems
- Poor feed efficiency

Acid combinations to stabilise the total mixed ration (TMR)

	SCHAUMASIL TMR UNI	SILOSTAR TMR PROTECT	SCHAUMASIL 5.0
			
Formulation	liquid	granulated	liquid
Dosage	up to 250 g/animal and day in the TMR	2 - 3 kg/t in the TMR	2 - 3 kg/t in the TMR
Description	acid combination to stabilise and increase the energy in the ration in a targeted way	easy-to-use acid granulate made from potassium sorbate and sodium formate to stabilise the TMR	material- and user-friendly preservative with a pH-value of 5.0
Stabilisation benefit	■ ■	■ ■ ■	■ ■ ■

Dosing equipment

BONSILAGE silage additives can only take effect exactly where they have been applied. As such, a precise, controlled application of the lactic acid bacteria is the secret to success for your treated silage. Due to increasing yields and the growing vigour of modern harvesting processes, micro-dosers such as the Schaumann MD have long since become the production standard. The SCHAUMANN range of dosing equipment offers practical solutions for all your harvesting machines.

SCHAUMANN dosing devices ensure a precise dosing of all BONSILAGE products.



SCHAUMANN MD 150/300/700
(only for biological silage additives)

Application: Liquid
Design: Compact micro-doser with a 10 l canister and operating terminal. Various control functions such as nozzle monitoring and flow control. Dosing via fine misting. Ready to use, including all fittings.
Dosing rate: Up to max. 530 t/h
Motor: 12V DC
Area of application: Forage harvesters



LACTOSPRAYER 60 ST/100 ST/200 ST
(only for biological silage additives)

Application: Liquid
Design: 60/100/200 l tank with bracket, pump with filter, 2-point suction (complete emptying), flowmeter. Ready to use, including all fittings.
Dosing rate: 15–150 l/h
Motor: 12V DC
Area of application: Forage harvesters, forage wagons and big balers. The pump unit is also available separately as the Lactosprayer Junior E.



SDG 400 E/SDG 800 E
(only for silage additives containing acids)

Application: Liquid
Design: Self-priming pump with flowmeter, 3.5 m suction hose with foot filter, 5 m pressure hose with nozzle brackets and nozzle set. All parts are made from stainless steel, with On/Off and Emergency Stop switch.
Dosing rate:
SDG E: 40 - 400 l/h
SDG 800 E: 80 - 800 l/h
Motor: 230 V AC
Area of application: Mixing and conveying screws

Mixing instructions for BONSilAGE products



Fig. 1.

Fill the mixing container up to the mark or the bucket with clean, cold water (10 - 20°C).



Fig. 1a. Fill the bucket:

- When using a 100 g container of BONSILAGE, add 2.5 litres of water per container
- When using a 400 g container of BONSILAGE, add 10 litres of water.

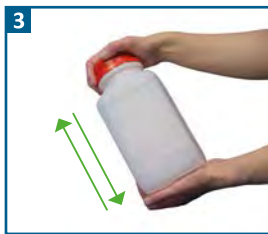


Fig. 2. u. 2a.

Tip the BONSILAGE powder into the mixing container or bucket.



Fig. 3. Shake the solution vigorously for approx. 15 seconds.

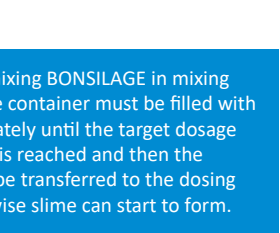
Fig. 3a. Use a whisk or spiral mixer to evenly dissolve the BONSILAGE in the bucket

Tip: Avoid spilling If using a spiral mixer on a cordless drill, only set it to a low to medium speed.



Fig. 4. 4a, 4b. Transfer the stirred BONSILAGE into the dosing container and, as needed, add the required number of doses for the desired crop quantity, fill with the required quantity of water (see dosing instructions), then give it another good shake.

Tip: Use a filtering funnel to fill the dosing container without making a mess



Note: When mixing BONSILAGE in mixing containers, the container must be filled with water immediately until the target dosage concentration is reached and then the mixture must be transferred to the dosing device, otherwise slime can start to form.



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Find out more at:
www.bonsilage.de/en