BON SILAGE

Grass Silage Handbook

A guide to successful grass silage

Contents

A guide to successful grass silage

1. Target values

This Grass Silage Handbook addresses all major management factors involved in producing grass silage of superior feed quality.

The target values for the most important parameters of outstanding grass silage are set out below.

Requirements for grass silages

Parameter		Target value
Dry matter	%	28-35
pH level (dependent on DM)		4.0-4.8
Sugar	% DM	< 4
CP	% DM	14-18
CF	% DM	23-26
NDF	% DM	42-48
CA	% DM	< 10
NH_3-N	% of total N	< 8
ESOM	% DM	> 68
Gas formation	ml/200 mg DM	> 50
Energy density	MJ NEL/kg DM	> 6.2

Note: High silage quality is the basis for optimal forage milk yield!

2. Grassland maintenance

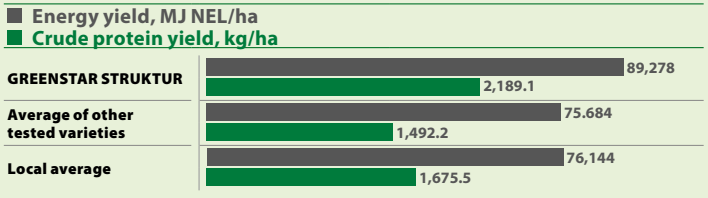
Effective grassland maintenance includes not only routine springtime works such as levelling and rolling, but also appropriate fertilisation and regular re-seeding in spring or autumn.

The sward is exposed to a number of possible sources of damage throughout any year of cultivation. Intensive use, late cuts, winter kill damage and damage caused by rodents, trampling and tyre tracks, for example, can all cause undesirable gaps in the sward. Both DM yields and energy concentrations decrease gradually over time.

Regular repair and re-seeding with grass and legume mixtures from SCHAUMANN's GREENSTAR range ensures high grassland quality.

GREENSTAR STRUKTUR with soft-leaf tall fescue is an excellent example for the high-performing GREENSTAR range, as extended three-year trials conducted by Landwirtschaftskammer Niedersachsen (Chamber of Agriculture) have shown.

Crude protein and energy yields – a comparison of field data



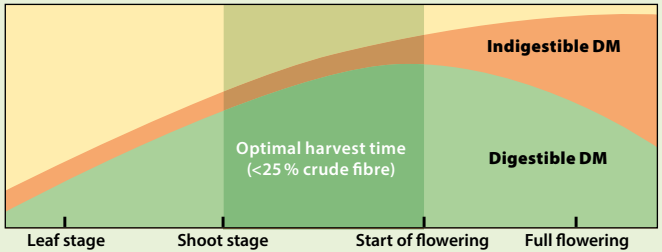
Source: Landwirtschaftskammer Niedersachsen (Chamber of Agriculture)

Note: Regular repair and re-seeding is a standard measure for maintaining consistently high grassland quality.

3. Cutting time

The optimal cutting time is just before panicle heading of the main crop grasses, which then have a crude fibre content of <25 % in DM. After this time, both digestibility and feed intake deteriorate gradually due to increasing lignin deposition. This effect is observed more acutely in extensively managed crops, as grasses then have a higher stalk content. In this case, the cutting time intervals are even shorter.

Change in grass dry matter digestibility during the vegetation stage



- During the main vegetation stage of the 1st growth, crude fibre content increases by 3-8 g/kg DM/day, causing a cow's theoretical performance potential to decrease by 150 kg milk/year.
- The optimal crude protein content is 16-18 % in DM with as little free nitrogen compounds as possible, as these act as buffers during the ensiling process.
- An early first cut establishes the basis for high quality of all subsequent cuts.

Note: Quality over quantity in every cut increases annual milk yields.

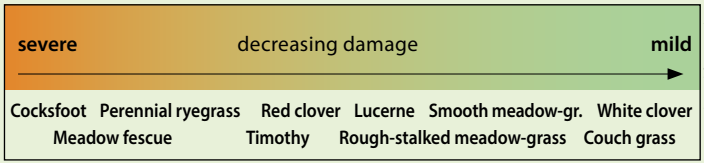
4. Cutting height

The minimum cutting height is 7 cm, but this can be increased depending on crop conditions and rodent populations. Adhering to this cutting height helps preserve the sward during subsequent work processes.

This minimum cutting height:

- Promotes rapid grass re-growth
- Reduces dirt and thus increases energy contents
- Reduces the introduction of unwanted spores
- Prevents the displacement of desirable grasses due to insufficient cutting heights

Degree of damage caused to a range of grass varieties when cut too short



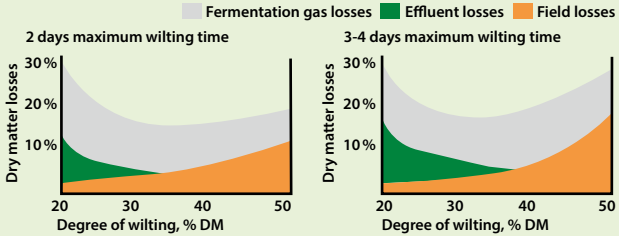
Source: adapted from Fisch, Buhr 2008

Note: Grass stock is improved sustainably in the long term by cutting and harvesting it more frequently with less damage to the sward.

5. Wilting

Keeping wilting times to 28-35 % DM as short as possible provides a basis for optimal ensiling with low losses and high feed intake (40-45 % DM in rations). Excessively wet silages result in butyric acid fermentation, while excessively dry silages are difficult to compact and therefore tend to spoil.

Relationship between the degree of wilting and losses



- Correct wilting improves suitability for ensiling and minimises losses.
- The wetter the silage (<30 % DM), the more buffering occurs during the ensiling process, which in turn increases the risk of contamination. In this case, specialist products such as BONSILAGE FORTE need to be added to prevent butyric acid fermentation.
- Energy preservation, optimisation of the ensiling process and protection against spoilage are most important within a range of 30-40 % DM, and the use of BONSILAGE products containing homofermentative and heterofermentative lactic acid bacteria is therefore recommended to achieve these goals.
- Adequate compaction can no longer be achieved above 45-50 % DM.

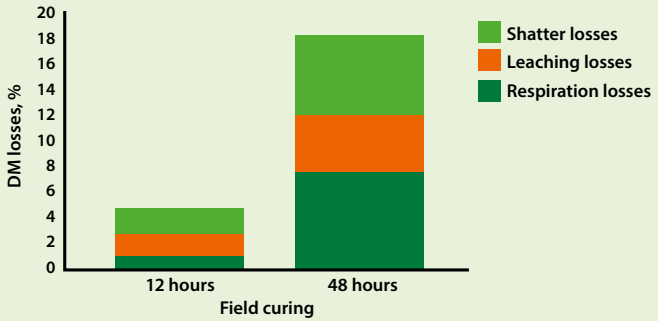
Note: Rapid wilting is the basis for minimal losses and optimal performance.

6. Field curing

Field curing should be limited to less than 24 hours to minimise energy losses, as any additional night in the field causes sugar losses due to respiration.

Weather risks (rain) are also reduced.

Dry matter losses relative to field curing times



Short field curing:

- Reduces respiration, shatter and leaching losses
- Prevents carbohydrate losses and promotes crop suitability for ensiling
- Reduces proteolysis and improves protein quality
- Improves energy density and digestibility
- The use of mower-conditioners accelerates wilting, and the optimal DM content in crops may be rapidly exceeded in warm weather.

Note: Short field curing optimises the energy yield per hectare.

7. Chop length

Optimum chop length for grass silage: 30-40 mm

Excessive chop length hampers compaction.

Blades and shear bars should be sharpened regularly.

Optimum chop length is essential for:

- Precise compaction, efficient silo utilisation and reduced losses
- Improved plant cell digestion and thus more intensive and rapid lactic acid fermentation
- Reduced gas exchange after silo opening and thus reduced risk of secondary fermentation
- Improved feed intake

Note: Optimum chop length forms the basis for thorough compaction, intensive fermentation and high feed intake.

8. Silage additive – BONSILAGE BASIC

An effective fermentation process is promoted by adhering to the fundamental principles of ensiling and can be further enhanced by applying silage additives for a range of action categories.

BON SILAGE FORTE

The professional silage additive for wet silages

Categories 1b, 5a

Active ingredients: homofermentative lactic acid bacteria
Purpose: rapid, stable pH reduction, utilisation of the full carbohydrate spectrum, inhibition of the growth of clostridia
Field of application: ryegrass 18-30 % DM, other grasses 22-30 % DM, clover grass 25-30 % DM, lucerne 25-35 % DM
Package size: granules 25 kg, liquid 100 g
Application rate/t: granules 0.5 kg, liquid 2 g
Recommended compaction: min. 180-270 kg DM/m³ depending on DM
Minimum storage period: 3 weeks

BON SILAGE PLUS

For greater stability and energy

Categories 1c, 2, 4b

Active ingredients: combination of homofermentative and heterofermentative lactic acid bacteria
Purpose: rapid lactic acid formation, more digestible energy, aerobic stability
Field of application: grass, clover grass, lucerne, WCS: >28 % DM
Package size: granules 25 kg, liquid 50 g
Application rate/t: granules 0,5 kg, liquid 1 g
Recommended compaction: min. 180-270 kg DM/m³ depending on DM
Minimum storage period: 8 weeks

BON SILAGE ALFA

Special combination for lucerne silages (clover grass)

Active ingredients: combination of homofermentative and heterofermentative lactic acid bacteria
Purpose: reliable pH reduction in material that is difficult to ensile, improved palatability, protection against butyric acid formation and heating
Field of application: lucerne, clover grass with 25-40 % DM
Package size: liquid 100 g
Application rate/t: liquid 2 g
Recommended compaction min. 180-270 kg DM/m³ depending on DM
Minimum storage period: 8 weeks

All BONSILAGE products are approved for organic farming.

8. Silage additive – BONSILAGE SPEED NEW

BONSILAGE SPEED accelerates the ensiling process markedly.

The new *Lactobacillus diolivorans* strain in SPEED products accelerates silage maturity to two weeks while minimising losses and maximising energy contents.

Active ingredients: combination of homofermentative and heterofermentative lactic acid bacteria
Purpose: rapid silage maturity within two weeks, high stability of grass, clover grass, lucerne and forage rye silages
Field of application: grass, clover grass, forage rye, lucerne with 28-50 % DM
Package size: liquid 100 g
Application rate/t: liquid 2 g
Recommended compaction: min. 190-270 kg DM/m^3 depending on DM
Minimum storage period: 2 weeks

8. Silage additive – BONSILAGE FIT NEW

BONSILAGE FIT delivers a marked increase in cow fitness.

FIT products shift fermentation acid patterns towards more acetic acid and propylene glycol while maintaining excellent aerobic stability. Metabolic stability is optimised.

Active ingredients: combination of homofermentative and heterofermentative lactic acid bacteria
Purpose: high aerobic stability in energy-rich grass silages, improved cow fitness
Field of application: grass and clover grass with 28-50 % DM
Package size: liquid 100 g
Application rate/t: liquid 2 g
Recommended compaction: min. 190-270 kg DM/m^3 depending on DM
Minimum storage period: 8 weeks

A highly effective combination for the targeted protection of silage

Active ingredients: combination of active ingredients comprising potassium sorbate, sodium benzoate and sodium formate
Purpose: minimal losses at silage surfaces and edges, protection against moulds and yeasts, rapid protection, easy application
Field of application: silage surfaces and edges
Package size: 25 kg
Application rate/t: grass and maize silage and others: 200 g/m² or 2 kg/t; industrial by-products (e.g. brewers grains, stillage): 300-500 g/m² or 2-5 kg/t

Liquid, pH-neutral concentrate for improved aerobic stability

Active ingredients: combination of active ingredients comprising sodium benzoate, potassium sorbate and sodium acetate
Purpose: effective prevention of heating through inhibition of moulds and yeasts. Non-corrosive and user-friendly
Field of application: grass, maize and cereal WCS silages, CCM and high-moisture maize meal, industrial by-products
Application rate/t: complete treatment: depending on silage type and DM content: 1.5-2.5 l/t
Minimum storage period: 2 weeks

Reliable dosing technology for successful ensiling

LAB products can only be effective if they are precisely dosed. The precise, controlled application of lactic acid bacteria is essential if silage is to be successfully treated. Micro-dosers such as the SCHAUMANN MD have long become the industry standard in view of increasing yields and higher efficacy of modern high-performance forage harvesters. However, proven, conventional forms of applying silage additives from a water tank or granule spreader also continue to be used, especially with silage trailers and baling presses. The SCHAUMANN dosing technology range offers practical solutions that have proven their worth in the field with any harvest technology.

SCHAUMANN dosing systems ensure the precise application of any BONSILAGE and SILASIL ENERGY products.

SCHAUMANN MD 150/300/700

Application: Liquid

Design: Compact micro-doser with 10 l tank and operating terminal. Various control functions such as nozzle monitoring and flow control. Dosing via ultra-fine atomisation. Ready to use with all fittings.

Dosing rate: Up to a max. of 530 t/h

Motor: 12 V DC

Field of application: Forage harvesters

LACTOSPRAYER JUNIOR E

Application: Liquid

Design: Self-priming pump with filter, flow meter and speed controller

Dosing rate: 16-160 l/h

Motor: 12 V DC

Field of application: Silage trailers and baling presses

LACTOSPRAYER 100 ST /200 ST

Application: Liquid

Design: 100/200 l tank with holder, pump with filter, 2-point drainage (residue-free drainage), flow meter Ready to use with all fittings.

Dosing rate: 16 bis 160 l/h

Motor: 12 V DC

Field of application: Forage harvesters, silage trailers and baling presses

SILAMAT SPEZIAL / SILAMAT KOMBI (with agitator)

Application: Granules

Design: Corrosion-resistant VA tank with mounting brackets and electronic speed controller Ready to use with all fittings.

Dosing rate: Up to 150 kg/h

Motor: 12 V DC

Field of application: Forage harvesters, silage trailers and baling presses

10. Compaction

The entry of oxygen into silage causes heating and thus losses of energy and DM. The better silage is therefore compacted, the less oxygen is able to enter from the air whenever silage is removed.

The weight of the compaction tractor determines the speed of the harvest chain.

Rule of thumb:

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

* for forage harvesters; for silage trailers = 3

Target values Compaction:

DM	Density
25 %	177.50 kg DM/m³
40 %	230.00 kg DM/m³

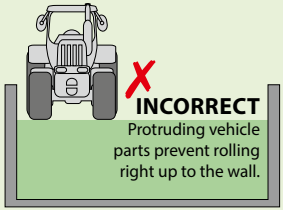
Rule of thumb for compaction:

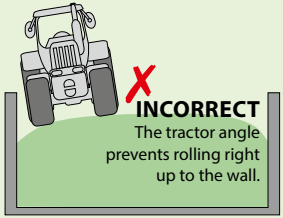
(3.5 • DM [%]) + 90

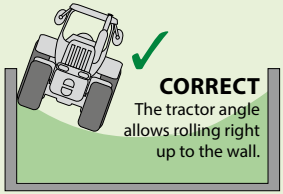
Example: *(3.5 • 40) + 90 = 230 kg DM/m³*

Measures for optimal compaction:

- Max. 15-20 cm layer depth
- The higher the crude fibre and dry matter contents, the smaller the layer depths.
- Tyre pressure at least 2 bar and as high as possible
- No twin tyres
- Max. 3-4 km/h rolling speed
- Rolling from the start, as the remains superficial otherwise
- No excessive rolling towards the end, as this can cause a pumping effect due to silage springing back.







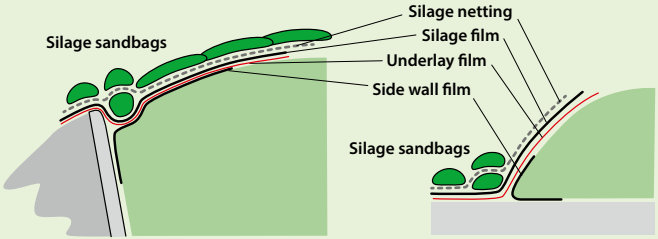
Note: Well compacted silage minimises the risk of heating.

11. Cover

Ensure that the silage is appropriately sealed as soon as rolling has been completed.

- Underlay film, adheres directly to silage (strength: 40-50 µ).
- Main film, must be gas-tight (strength: 150-250 µ).
- SCHAUMANN silage netting; protects films against mechanical damage and provides additional weight.
- SCHAUMANN silage sandbags as additional weights for a snug fit. SCHAUMANN silage sandbags allow air-tight barriers to be created at 5 m intervals to prevent air entering at silo faces.
- Side walls should be covered with side wall film, where applicable.

Examples of good silage sealing:

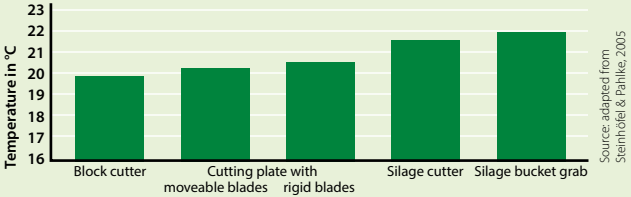


Bunker silo **Silage clamp**

12. Silo face

The minimum weekly removal rate should be 1.5 m in winter and 2.5 m in summer to avoid heating. Machines used for removing silage should keep the silage face as intact as possible in order to minimise air ingress.

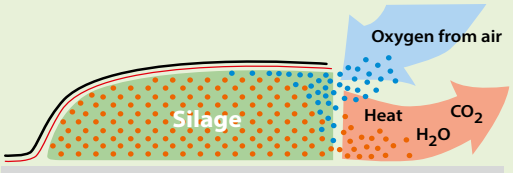
Impact of removal machinery on silage face temperatures (after 20 hours, 20 cm behind the face)



How to prevent heating

- Create summer silos with smaller face areas.
- Ensure that the silo face is away from the prevailing wind direction.
- Remove as little silage film as possible in advance.
- Calculate silo length and removal based on herd size.
- Optimise removal technology.

Air flow at an opened silo

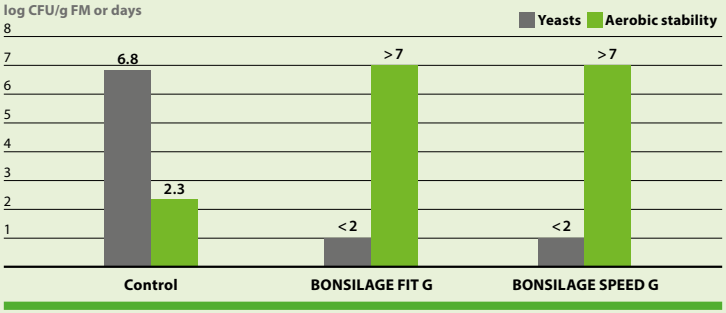


Note: Tailor the silo face to farm needs to prevent heating.

13. Aerobic stability

BONSILAGE products with Lactobacillus buchneri promote the increased formation of acetic acid and 1,2-propanediol (propylene glycol), depending on strain composition. The growth of moulds and yeasts is strongly inhibited, resulting in a highly significant increase in the aerobic stability of silage, also when compared to chemical treatments.

Number of yeasts and aerobic stability after 90 days of storage, comparison between an untreated control and BONSILAGE FIT G in grass silage (first cut, 32 % DM)



Heating losses are thus minimised sustainably and more cost effectively compared to chemical treatment. At the same time, high silage feed intake is achieved for maximum forage milk yields.

14. Economic efficiency

BON SILAGE PLUS

For greater stability and energy

Categories 1c, 2, 4b

A model calculation illustrates the increased profitability of grass silage production using the example of BONSILAGE PLUS silage additive.
This calculation does not take protein quality into account.
Harvest yield from first and second cut: 23 t fresh mass (FM) grass per hectare with 35 % DM, equivalent to 8.05 t DM per hectare
Energy content: Grass 1st/2nd cut: 6.3 MJ NEL/kg DM

Increase in energy yield in MJ NEL/ha by using BONSILAGE PLUS
DM losses: reduced by 7 % with the use of BONSILAGE PLUS
Higher energy content is not taken into account.
1 kg milk = 3.3 MJ NEL

	Control		BONSILAGE PLUS	
	Energy MJ NEL/ha	Milk kg/ha	Energy MJ NEL/ha	Milk kg/ha
Harvest yield	50,715	15,368	50,715	15,368
Losses	6,087	1,845	2,536	768
Yield	44,628	13,523	48,179	14,600
Yield increase			**+ 3,551**	**+ 1,076**

Dairy concentrate (DC) savings potential

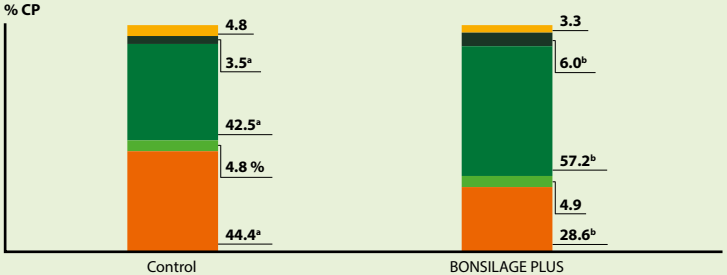
DC savings potential with 7.0 MJ NEL/kg	3.551 : 7 = 507 kg	
Cost reduction with DC prices of	€ 24.00/quintal € 122.00	€ 17.00/quintal € 86.00
Silage additive costs	- € 40.00/ha	- € 40.00/ha
Additional yield from using BONSILAGE PLUS	**+ € 82.00/ha**	**+ € 46.00/ha**

For detailed calculations, please do not hesitate to ask your SCHAUMANN consultant.

BONSILAGE products improve protein quality

Results from trials conducted by Hohenheim University and Landwirtschaftskammer Niedersachsen (Chamber of Agriculture) have shown that the use of BONSILAGE products for ensiling reduces proteolysis of NPN compounds and therefore increases UDP contents by 2-5 %.

BONSILAGE PLUS reduces proteolysis (DM range between 30 and 40 % DM)



C =protein, no availability in the rumen and small intestine **B_3** = membrane-bound protein, slow availability **B_2** = protein, medium availability **B_1** = protein, rapid availability **A** = NPN compounds

Effect of improved protein quality in grass silage treated with BONSILAGE, using a sample ration per cow and day*

UDP content in grass silage	+ 4 %
Soy/oilseed rape savings	0.28 kg = 8.4 ct
BONSILAGE costs	3.4 ct
Savings potential with BONSILAGE	**5.0 ct ****

* Assumptions: 33 kg milk; 18 kg FM intake of grass silage; 18 kg FM intake of maize silage; performance-related supplementation with soy/oilseed rape; soy/oilseed rape (50/50) costs = €30/quintal; BONSILAGE costs = €1.70/t ** Effects of reduced DM losses and substantially higher energy contents are not taken into account

BONSILAGE products reduce the contents of biogenic amines. Protein digestion, for example during the ensiling process, produces substances such as biogenic amines, which are causally related to depressed feed intake and metabolic strain when affected silages are fed. Silage should therefore contain as little biogenic amines as possible.

Effect of BONSILAGE FORTE on biogenic amine contents in silage produced from a 1st cut of perennial ryegrass (Halle University, 2015)

		Control	BONSILAGE FORTE
DM	%	27.2	28.2
Lactic acid	% DM	3.92	4.12
Acetic acid	% DM	0.72	0.62 *
Butyric acid	% DM	0	0
pH		4.59	4.29 *
DLG fermentation quality rating		1	1
Biogenic amines, total	g/kg DM	5.45	4.25 **
GABA	g/kg DM	12.07	11.29

* $p < 0.05$ ** $p < 0.01$

BONSILAGE FORTE reduces biogenic amine contents to a highly significant extent, by 15 %, even when compared to the excellent fermentation quality obtained from the untreated control. This ensures higher feed intake and healthier cows.

17. Product overview for grasses

BONSILAGE FORTE
For any forage silage in the lower DM range.
Inhibits clostridia.

Categories 1b, 5a

BONSILAGE PLUS
For any forage silage in the upper DM range.
Improves stability and digestibility.

Categories 1c, 2, 4b

BONSILAGE ALFA
Special combination of strains for lucerne and clover grass silages.

BONSILAGE SPEED G (liquid)
Rapid silage maturity and high aerobic stability for grass, clover grass, lucerne and forage rye silages.

NEW

BONSILAGE FIT G (liquid)
Reliable protein quality and high aerobic stability in energy-rich grass silages

NEW

SILOSTAR PROTECT
For silage surface and edge treatment.
Inhibits moulds and yeasts along edges.

SILOSTAR LIQUID
Special liquid, pH-neutral product for improved aerobic stability.

SILOSTAR LIQUID HD
Concentrate for improved aerobic stability.
Liquid, pH-neutral and user-friendly.

18. Product overview for maize and cereals

BONSILAGE MAIS
For maize silages and WCS.
Improves stability and digestibility.

Category 2

BONSILAGE CCM
For maize grain meal and CCM. Protects against uncontrolled yeast proliferation.

Category 2

BONSILAGE GKS
For treating whole-kernel maize silages in gas-tight tower silos.

BONSILAGE SPEED M
Rapid silage maturity and high aerobic stability for maize silages and WCS.

NEW

BONSILAGE FIT M
High aerobic stability for energy-rich maize and WCS silages.

NEW

SILOSTAR MAIS
Biological/chemical silage additive for maize, CCM and WCS. Accelerates silage maturity.

SILOSTAR PROTECT
For silage surface and edge treatment. Inhibits moulds and yeasts along edges.

SILOSTAR LIQUID
Special liquid, pH-neutral product for improved aerobic stability.

SILOSTAR LIQUID HD
Concentrate for improved aerobic stability.
Liquid, pH-neutral and user-friendly.

For further information please visit **www.bonsilage.com**

GERMANY
An der Mühlenau 4 · 25421 Pinneberg
Tel. +49 4101 218-2000 · Fax +49 4101 218-2299
info@schaumann.de · www.schaumann.de

AUSTRIA
Jakob Fuchs-Gasse 25-27 · 2345 Brunn am Gebirge
Tel. +43 2236 31641-0 · Fax +43 2236 31641-49
info@schaumann.at · www.schaumann.at

SWITZERLAND
Murgenthalstraße 67 b · 4900 Langenthal
Tel. +41 62 91910-20 · Fax +41 62 91910-29
info@schaumann.ch · www.schaumann.ch

170706GB

SCHAUMANN
– Erfolg im Stall