The special biological ensiling agent range for energy plants
How SILASIL ENERGY.XD® works

SILASIL ENERGY.XD combines the three lactic bacteria strains Lactobacillus diolivorans, Lactobacillus rhamnosus and Lactobacillus buchneri in a highly effective manner. Its production relies on special technology. The combination of these three strains provides a particular metabolic synergy that ensures that carbohydrate-rich energy crops are preserved more rapidly for biogas production. The metabolism of L. diolivorans determines the effectiveness of SILASIL ENERGY.XD. Short generation times and substantial competitive strength give the selected strains of bacteria clear advantages over harmful natural microbes. The rapid formation of lactic acid in the early fermentation phase creates the basis for the synthesis of additional metabolites with preserving effects (e.g. acetic acid, 1-propanol). These heterofermentative processes ensure that high-quality silage can be protected substantially more quickly against energy losses caused by moulds and yeasts. All of the synergistic metabolic processes of this combination of bacteria strains only consume minimum energy for themselves.

Typical development of specific fermentation products in maize silage treated with SILASIL ENERGY.XD

Area of use

SILASIL ENERGY.XD is highly recommended wherever shortened silage ripening periods of 2-6 weeks are required!

<table>
<thead>
<tr>
<th>Crop Type</th>
<th>DM Content</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maize whole crop silage</td>
<td>28–40 %</td>
</tr>
<tr>
<td>Maize grain products (e.g. CCM)</td>
<td>55–65 %</td>
</tr>
<tr>
<td>Cereal WCS (as energy plant silage)</td>
<td>28–40 %</td>
</tr>
<tr>
<td>Energy grass</td>
<td>30–45 %</td>
</tr>
<tr>
<td>Sorghum</td>
<td>&gt; 25 %</td>
</tr>
</tbody>
</table>

Result

- controls ensiling processes
- shortens silage ripening periods
- reduces process-related energy losses
- improves silage stability both at the face and in intermediate storage
Faster protection against spoilage

Characteristic fermentation product of L. diolivorans

1-propanol

% in DM

Silage ripening period (days)

1-propanol

Strong inhibitory effect against yeasts due to the rapid formation of acetic acid

Yeast population

Day 20

Aerobic stability after 20 days of silage ripening

Heat (°C)

Air ingress (hours)

Improved stability

Recommended use for accelerating silage ripening periods

SILASIL ENERGY

Silage ripening period > 8 weeks

SILASIL ENERGY.XD

Silage ripening period > 2 weeks

In silo partitions

8 weeks

In small parallel silos
**How SILASIL ENERGY.XD® works**

SILASIL ENERGY® acts through bacterial strains specially selected for biogas production and creates a specific fermentation pattern. Fast-acting homofermentative bacterial strains start off the fermentation process. After that, the heterofermentative lactic acid bacterial strains act to promote acetic acid fermentation. The special fermentation pattern minimises energy losses in storage and increases the biogas yield per tonne of fresh matter or per hectare of arable land area.

**Area of use**

SILASIL ENERGY® is the biological ensiling agent specially for high-carbohydrate energy plants:

<table>
<thead>
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</tr>
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<td>30 – 45% DM</td>
</tr>
<tr>
<td>Sorghum</td>
<td>&gt; 25% DM</td>
</tr>
</tbody>
</table>

**Result**

SILASIL ENERGY® controls the ensiling process with two perceptible effects:

- **Energy protection in the silo**
  
  The special fermentation pattern reduces the risk of aerobic instability, heating up, fungal infection and rotting in the silage, thus providing optimum protection for the energy and nutrients.

- **More energy in the fermenter**
  
  Silage treated with SILASIL ENERGY® is easier to hydrolyse. Biogas formation starts perceptibly earlier and the overall degradation to biogas is faster.
Economic efficiency

Using SILASIL ENERGY® increases the area efficiency of the biogas plant. Because of the energy conservation and increased bi-availability of the substrate, the area requirement can be reduced with correct ensiling techniques and product application.

**Methane yield tests** (batch trials) with three different maize silages

<table>
<thead>
<tr>
<th>Silo maize 1</th>
<th>Silo maize 2</th>
<th>Silo maize 3</th>
<th>Average of 3 silages</th>
</tr>
</thead>
<tbody>
<tr>
<td>+4% more yield</td>
<td>+16% more yield</td>
<td>+9% more yield</td>
<td>Av. +9.8% more yield</td>
</tr>
</tbody>
</table>

Control

SILASIL ENERGY®

**Possible area saving with optimised ensiling management and SILASIL ENERGY®**

Example of a biogas plant with 500 kWel installed capacity

<table>
<thead>
<tr>
<th>Yield level</th>
<th>low</th>
<th>average</th>
<th>high</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yields per hectare t FM/ha</td>
<td>38</td>
<td>46</td>
<td>62</td>
</tr>
<tr>
<td>Area requirement [ha] 1,300 kWel./t DM (minimum losses with SILASIL ENERGY®)</td>
<td>292</td>
<td>241</td>
<td>177</td>
</tr>
<tr>
<td>Area requirement [ha] with defective ensiling management (15% losses)</td>
<td>326</td>
<td>269</td>
<td>198</td>
</tr>
<tr>
<td>Area saving [ha] Losses cut from 15% to 5%</td>
<td>34.3</td>
<td>28</td>
<td>20.8</td>
</tr>
</tbody>
</table>
How SILASIL ENERGY.BG® works

SILASIL ENERGY.BG® contains homofermentative lactic acid bacteria specially selected for biogas production to protect wet, high-protein, low-sugar energy plants.

The homofermentative fermentation pattern provides effective protection against energy losses through low pH values and a high lactic acid content.

Area of use

SILASIL ENERGY.BG® is the biological ensiling agent specially for wet, high-protein, low-sugar plants with 20-35% DM.

Result

- Energy protection in the silo

The controlled inhibiting effect of SILASIL ENERGY.BG® on proteolytic and saccharolytic anaerobic fermentation pests protects the crop from energy losses and formation of toxic metabolites during the ensiling phases. SILASIL ENERGY.BG® thus optimally conserves the energy from the storage process until use in the fermenter.
Precise, high-performance micro-dosing system for SILASIL ENERGY ensiling agents

Designed for an easy use, this compact dosing unit features easily adjustable dosing parameters for precise application and a variety of control functions.

**SCHAUMANN MD**

- Precise micro-dosing
- No additional water tanks
- Alternating concentrate tanks
- Effective control of application
- 400 t with a standard tank fill (10 l)
- Easy-to-use

**Strong performance**

Separate water tanks are no longer needed. Featuring a broad range of dosage rates even in the latest generation of harvesters with a high output rate of 700 t/h a precise micro-dosage is possible. The ensiling agent is applied as an aerosol directly into the intake flow.

**More reliable application**

Flow control and nozzle monitoring with optical and acoustic signals enable the application to be controlled effectively from the operator’s cab.
**SILASIL ENERGY.C® for biogas production and animal feed**

SILASIL ENERGY.C®, the special combination of one heterofermentative and two homofermentative lactic acid bacterial strains, protects the silage from energy-consuming pests and promotes both ruminant feed intake and the fermenter biogas yield.

With its combination of bacterial strains that promotes feed intake SILASIL ENERGY.C® enables both the biogas plant and the herd to be supplied efficiently from a single batch of silage.

Using SILASIL ENERGY.C® in maize silage maintains feed intake and milk production at an equally high level as using BONSILAGE MAIS (the biological silage additive specifically for fodder silages).

**Area of use**

SILASIL ENERGY.C® is a biological silage additive developed for high-carbohydrate ensiled material with 25 – 40 % DM for universal use in biogas production and animal feeding:

- Silo maize
- Cereal WCS
- Sweet sorghum
- Energy grass

**Result**

- **Protection against loss of energy and nutrient degradation**

  SILASIL ENERGY.C® protects against energy loss and nutrient degradation and breaks up the silage for high methane yields. Owing to the specifically adjusted fermentation pattern and the ‘feed intake plus effect’, silages treated with SILASIL ENERGY.C® are universally suitable for biogas generation and for animal feeding.
SILASIL ENERGY.G® for biogas production and animal feed

SILASIL ENERGY.G® activates the protective mechanisms of the purely homofermentative lactic acid bacteria for high-protein, low-sugar plants with a high moisture content. Effective control of the pH value with a high lactic acid concentration gives the silage long-term protection against undesirable nutrient degradation. SILASIL ENERGY.G® controls the ensiling process because its special lactic acid bacteria produce a specific fermentation pattern with a strong lactic emphasis. The substrate hygiene achieved is the basis of successful animal feeding and a smoothrunning biogas process.

<table>
<thead>
<tr>
<th>Ensilaged grass</th>
<th>pH</th>
<th>Acetic acid</th>
<th>Lactic acid</th>
<th>Butyric acid</th>
<th>NH₃-N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Guideline values for animal nutrition</td>
<td>&lt; 4.3</td>
<td>&lt; 2.0</td>
<td>&gt; 5.0</td>
<td>&lt; 0.3</td>
<td>&lt; 10</td>
</tr>
<tr>
<td>SILASIL ENERGY.G®</td>
<td>4.0</td>
<td>1.4</td>
<td>12.7</td>
<td>0.1</td>
<td>7.5</td>
</tr>
</tbody>
</table>

**Area of use**

SILASIL ENERGY.G® is the biological ensiling agent specifically for wet, high-protein, low-sugar plants with 20 – 35 % DM for universal use in biogas production and animal feeding:

- Grass
- Clover-grass
- Green rye
- Alfalfa
- Intercrops

**Result**

**Energy protection in the silo**

The special fermentation pattern reduces the risk of anaerobic instability due to Clostridia and the production of process inhibitors such as ammonia and endotoxins. SILASIL ENERGY.G® thus optimally protects the energy and nutrients in the silage.
**BC.ACID programme**

BC.ACID 1, BC.ACID 2 and BC.ACID STAR HD are acid mixtures designed to preserve freshly harvested, moist and pumpable biogas substrates. Their strong antimicrobial effect prevents the development of moulds and bacteria during storage.

**BC.ACID STAR HD**

- Special highly concentrated, liquid product which reliably prevents reheating caused by variations in silage quality
- The product is particularly user-friendly, being pH-neutral and non-corrosive
- Suitable for the complete treatment of whole sugar beet, moist maize meal and maize-cob-mix, industrial by-products such as brewer’s grains and pressed sugar beet pulp and very dry grass, whole-crop and maize silage

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**Silage treatments**

*BC.ACID STAR HD*

Lowers the pH level rapidly and permanently

![Graph showing pH value over ensiling time](image)

<table>
<thead>
<tr>
<th>Ensiling time, days</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
</tr>
<tr>
<td>6,5</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>pH-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>6,5</td>
</tr>
</tbody>
</table>

Efficacy of BC.ACID STAR HD in %
**BC.ACID 1**
- Acid mix for the preservation of pumpable biogas substrates when stored as pulp
- Suitable for milled cereal, maize-cob mix and other substrates stored in liquid form
- Stable, low-loss storage of substrates in storage vessels, even with fluctuating water content

**BC.ACID 2**
- Acid mix for the preservation of free-flowing biogas substrates during storage
- Suitable for freshly harvested whole-grain cereals and other free-flowing secondary raw materials
- High impact during storage and particular user-friendly thanks to its low evaporation rate

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**BC.ACID 2 – actively reduces the total aerobic count (TAC) significantly (wheat, 14% humidity)**

<table>
<thead>
<tr>
<th>Duration (d)</th>
<th>Control</th>
<th>BC.ACID 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.5 months</td>
<td>100,000,000</td>
<td>10,000,000</td>
</tr>
<tr>
<td>3 months</td>
<td>10,000,000</td>
<td>1,000,000</td>
</tr>
<tr>
<td>6 months</td>
<td>1,000,000</td>
<td>100,000</td>
</tr>
<tr>
<td>12 months</td>
<td>100,000</td>
<td>10,000</td>
</tr>
</tbody>
</table>

**BC.ACID 2 – lower CO₂ respiration activity confirms the reduction in harmful organisms and the associated lower breakdown of nutrients**

<table>
<thead>
<tr>
<th>% CO₂ in sealed vessel</th>
<th>Control</th>
<th>BC.ACID 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>25</td>
<td>20</td>
</tr>
<tr>
<td>2</td>
<td>20</td>
<td>15</td>
</tr>
<tr>
<td>4</td>
<td>15</td>
<td>10</td>
</tr>
<tr>
<td>6</td>
<td>10</td>
<td>5</td>
</tr>
<tr>
<td>8</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
SILASIL ENERGY® – the first ensiling agent range for energy plants

- Controls the ensiling process
- Protects the ingredients
- Increases the methane yield

Recommended quantities for liquid application

2 g powder in 0.05 – 2.0 l water/t ensiled material, corresponds to min. 200,000 CFU/g ensiled material, container quantity for 100 t FM, for biogas production

1 g powder in 0.05 – 2.0 l water/t ensiled material, corresponds to min. 200,000 CFU/g ensiled material, container quantity for 100 t FM, for biogas production and animal feed

All products are suitable for ultra-precise application.