CLAAS corncracker expertise.
It's all about processing performance.
Optimal solutions for every requirement.

The search for new solutions to further improve the quality of maize silage for use as feed is a never-ending process. For biogas plant operators, it is all about obtaining energy more quickly from better processed substrate. At the same time, dairy and beef farmers need to optimise their feed rations to promote livestock health as well as to optimise the milk or beef yield. Although their end objectives are different, both groups are pursuing a common goal: to obtain as much available starch per hectare in order to reduce the cost of production.

It is above all in the area of chop processing that drastic differences in the practical requirements of each farm are to be found. The spectrum begins with fine chopped material with chop lengths of 3.5 to 12 mm and extends all the way up to long-chopped, intensively shredded material with chop lengths of up to 30 mm.

With the new, flexible MULTI CROP CRACKER (MCC) concept for the JAGUAR, CLAAS is in a position to satisfy these differing requirements. The three versions which make up the MCC concept provide optimal solutions for implementing short chop lengths, long chop lengths and the new SHREDLAGE process. This brochure provides details of these versions and how the new concept satisfies the current practical requirements not only of biogas plant operators, but also of dairy and beef farmers.

Georg Düring
Product Manager

Volker Buhlmann
Product Marketing
Corncracker technology – meeting growing requirements.
The factors that really count: chop length and processing.

Overview.

The requirements for silage chop length and processing differ widely depending on the individual farm and the purpose for which the silage is to be used. The spectrum extends from extremely short chop lengths of between 3.5 and 12 mm all the way up to the SHREDLAGE process with lengths greater than 25 mm. Broadly speaking, it is currently possible to define three groups.

Short-chopped silage.

Chop lengths of 3.5 to 12 mm fall into the short-chopped silage group. Short chopping is used both for silage destined for biogas facilities as well as for feed for dairy and beef cattle. The requirement here is for homogenous and short plant material with a very fine structure. An extremely high standard of kernel processing is also called for. This silage, which has low physical effectiveness, is used above all in the biogas sector. If it is used as cattle feed, it must be complemented with sufficient quantities of alternative material with a physically effective structure.

Long-chopped silage.

"Classic" long-chopped silage covers the chop length range from 12 to 22 mm and has been established in many countries for years. In addition to the processing of the kernels, the need here is for improved physical effectiveness; however, the different feed components are not shredded as intensively as they are in the SHREDLAGE process. Nevertheless, the improved physical effect of long-chopped silage still has positive consequences for the rumination process; only the packing density of the silage clamp proved to be a shortcoming in the past.
SHREDLAGE.

SHREDLAGE is a relatively recent feed conditioning process from North America which calls for extremely long chop lengths of up to 30 mm. Thanks to the very high degree of kernel processing and the powerful grinding effect, the proportion of starch – a source of energy – available in the rumen is increased. Furthermore, the plant stalks undergo highly intensive longitudinal processing, the aim being to produce silage with a structure which has a significantly greater physical effect and thereby improves rumination.
Proven 1000 times over: the MCC CLASSIC.

Ideal for chop lengths from 3.5 to 12 mm.

The diversity of the practical requirements which the chopped material has to satisfy places correspondingly varied demands on the technical equipment of the forage harvester. The correct choice of front attachment, chopping cylinder and corncracker is determined by the main purpose for which the forage is to be used: this is the factor which dictates how long the chop length needs to be and how intensively the forage needs to be processed.

This is why, with its MULTI CROP CRACKER (MCC) concept, CLAAS is offering a corncracker in which an extremely diverse range of corncracker rollers can be fitted. The multifunctionality of the MCC is based on the ease and speed with which it can be adapted to the different crops and field conditions. All the cracker components can be ordered for delivery ex works with the JAGUAR itself or for retrofitting. Swapping out cracker components is also a fast and straightforward process. The CLAAS MULTI CROP CRACKER (MCC) gives the JAGUAR the flexibility necessary to meet the extremely diverse requirements associated with short chop lengths, long chop lengths or SHREDLAGE.

The MCC CLASSIC L and M models are already in widespread use with customers. Both corncrackers have the familiar sawtooth roller profile. "L" stands for "Large" and a roller diameter of 250 mm while "M" stands for "Medium" and a 196 mm diameter.

The different roller diameters are matched to the average throughput of the various JAGUAR models. On the basis of many years of experience in the field, it has been established that the MCC CLASSIC M delivers a perfect result with the highest possible efficiency in machines with an engine output of up to 626 hp. For machines above 626 hp, the MCC CLASSIC L with a diameter of 250 mm is required to ensure ideal crop processing even at very high throughput rates.

The flexible MULTI CROP CRACKER concept allows the corncracker rollers to be replaced quickly.

At international level, the MCC CLASSIC is also used in the long chop length sector but only allows the classic degree of crop processing to be attained.

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**Equipment for classic short-chopped silage with the MCC CLASSIC.**

<table>
<thead>
<tr>
<th>Cylinder</th>
<th>V28 / V36</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cracker</td>
<td>MCC CLASSIC L, 125 / 125 teeth</td>
</tr>
<tr>
<td></td>
<td>MCC CLASSIC M, 100 / 100 teeth with 30% speed differential</td>
</tr>
<tr>
<td>ORBIS front attachment speed</td>
<td>Slow</td>
</tr>
<tr>
<td>Assessment</td>
<td>Short, homogenous chopped material, 3.5 to 12 mm chop length</td>
</tr>
<tr>
<td></td>
<td>Good kernel processing</td>
</tr>
</tbody>
</table>

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V36 chopping cylinder  V28 chopping cylinder  Classic sawtooth roller profile
NEW: The MCC MAX with additional cutting effect.

For chop lengths from 7 to 22 mm.

It follows that farms or contractors who have to meet very diverse requirements require a particularly flexible solution. Whether using a long or short-chop configuration, the aim is to produce forage which meets the highest standards with regard to kernel processing across the widest possible dry matter and chop length range.

In order to cater for these requirements, CLAAS has extended its range with the new MULTI CROP CRACKER MAX. The MCC MAX has a special technical feature in the form of 15 smaller and 15 larger annular segments which are equipped respectively with 120 and 130 slanting grinding teeth and which are arranged in pairs on the cracker rollers in such a way that each small segment faces a large segment on the opposite roller. This gives the MCC MAX a total grinding surface area 10% larger than that of conventional corncrackers. The rollers are configured to turn with a relative speed difference of 30%.

Also new are the additional cutting edges formed by the transitions between the large and small annular segments. Parts of plant stalks which pass through the cracker longitudinally and which were only compressed by the traditional roller/disc cracker concepts are cut and shredded. Stem pieces which pass through the processor transversely are broken under the effect of the intensive application of powerful forces.

Thanks to the geometry of the grinding and cutting surfaces of the new MCC MAX, the processing of the crop involves more than just an enhanced grinding action; cutting and shearing actions also play a significant role. The resulting maize silage not only has an increased feed value, but also has a positive physical effect thanks to its structure.
The MCC MAX can be used across a wide chop length range from 7 to 22 mm, as well as in the usual dry matter content range from 27% to 50%. As a result of the more intensive processing, it is possible to chop material that is up to 50% longer in order to obtain sieve fractions comparable to those produced by a conventional corncracker. At the same time, the greater degree of crop shredding is able to provide the desired proportion of large plant surfaces which enable maize silage to be used in the biogas sector or as a dual-purpose "cattle feed and biogas" resource.

In this way, farmers who supply dairy cattle and biogas facilities with material from the same clamp can produce silage with an optimal structure for both applications. At the same time, the MCC MAX provides contractors, machinery rings and farms with a technical solution which allows them to meet the most diverse customer requirements for chop length and dry matter ranges without having to change their machines’ equipment.
Practical experiences: getting more energy from feed.

Farmer Klaus Tiedmann and contractor Friedel Kausemann share their experiences.

Klaus Tiedmann farms 85 hectares in Witzhelden in the hilly Rheinisch-Bergisch district. He has a herd of 150 cows (average annual milk yield 10,200 l) and his own dairy breeding programme.

In 2014, various publications prompted extensive discussions about long-chopped maize silage on the Tiedmann farm. At the same time, the farm was reappraising its approach to livestock health, shed inspections and milk yield.

"Today (2015), we use sensors on the animal to monitor the rumination process, we have renewed the feed mixing equipment to maintain the structure of the feed which gives it its physical effectiveness, and we have also redefined our approach to the chopped material", says farmer Tiedmann. During the 2014 maize silage harvesting season, chop lengths of as much as 21 mm were used for the first time. Tiedmann’s contractor, Friedel Kausemann from Wipperfürth, did this using a new JAGUAR – equipped with the V-MAX 24 chopping cylinder as well as the new MCC MAX corncracker. Kausemann is always interested in new developments and findings, although his customers’ requirements always have priority.
Contractor Friedel Kausemann also uses the new MCC MAX for the biogas sector. “Until now, we always used very short chop lengths of 4 to 5 mm for the biogas facilities around here. Following several chop length tests, in which they were surprised by the extremely intensive processing of the chopped material, a few biogas facilities asked for a chop length of 7 to 8 mm last year. But rather than the absolute chop length, it is the significantly larger substrate surfaces, which offer a greater ‘attack area’ for the microorganisms in the biogas system, that are the decisive factor” – a view which Friedel Kausemann’s biogas clients share with him.

Both farmer and contractor were equally impressed by the quality of the “new” silage. “The coarser, but homogenous feed structure and the high degree of kernel processing led to demonstrably more intensive rumination by our cows. We cut grass four to five times annually and used to have a mix that was about 50:50 grass and maize silage with relatively little physically effective structure in the feed ration. Now, with long-chopped maize, we get significantly more energy out of the feed and at the same time are able to reduce the quantity of supplemental straw in the feed ration by 20%”, says Tiedmann. The improved feed efficiency, now rated at 1.5 instead of 1.4, has an obvious effect in the form of increased milk yield. Moreover, on removing the silage from the clamp, it was clear that the “new” forage could be compressed very effectively there.
The trend is for greater chop lengths.

More available starch per hectare.

Kernel processing is recognised as the decisive factor when it comes to obtaining high energy levels from maize silage. Failure to process the maize kernels sufficiently results in a monetary loss as the missing energy has to be made up with an alternative feed source, such as grain maize.

A calculation example shows the monetary consequences of an increase in kernel processing of just 1%:

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fresh mass yield</td>
<td>45 t/ha, 33% dry matter</td>
</tr>
<tr>
<td>Dry matter yield</td>
<td>15 t/ha</td>
</tr>
<tr>
<td>Starch content in the DM</td>
<td>33%</td>
</tr>
<tr>
<td>Starch yield</td>
<td>5 t/ha</td>
</tr>
<tr>
<td>1% better starch processing</td>
<td>50 kg/ha</td>
</tr>
<tr>
<td>Market price of dry grain maize</td>
<td>180 €/t, 0.18 €/kg</td>
</tr>
<tr>
<td>Monetary benefit</td>
<td>9.60 €/ha</td>
</tr>
</tbody>
</table>

1 In this example, the improved kernel processing results in a monetary benefit of about 9 €/ha.

Studies conducted by Dr Thaysen of the Schleswig-Holstein Chamber of Agriculture show that, compared with the MCC CLASSIC (250 mm roller diameter, 100 / 125 teeth), the MCC MAX does in fact deliver improved kernel processing with the same gap settings and speed differentials. This results in a higher per-hectare yield of available starch which can be evaluated using an assumed equivalent value for buying in grain maize.

The example (see graph) shows that the MCC MAX brings advantages even with a narrow cracker gap setting of 1 mm: with a 3.5% greater proportion of processed starch, there is a gain of 31.50 €/ha across the chop length range from 7 to 22 mm. As no whole kernels were counted for the MCC CLASSIC either (with one exception within the measurement tolerance range: two kernels at a chop length of 22 mm), this cracker also delivers a good processing result, but even this is surpassed by the new MCC MAX.
Compression in the clamp is also good.

Studies by the University of Kiel show that, with comparable input material, losses of organic dry matter content (oDM) with the MCC MAX are 2 to 5% lower than with a standard intensive cracker. The studies were conducted with silage prepared using the AG-BAG bag-based silage system. Table 1 shows the results obtained with the samples from the different sections of the silage bag. Despite the greater chop length of 17 mm compared with 9 mm, the MCC MAX achieved a comparable degree of compression with 231 kg DM/m³ (see Table 2) for the same duration.

Table 1: Organic dry matter content (oDM as % of FM) and losses of organic dry matter content (oDM losses as % of oDM sample weight).

<table>
<thead>
<tr>
<th>Section of silage bag</th>
<th>MCC CLASSIC Chop length 9 mm</th>
<th>MCC MAX Chop length 17 mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Day 0; oDM (%)</td>
<td>A 33.6 B 34.7 C 34.2</td>
<td>A 31.5 B 32.5 C 34.1</td>
</tr>
<tr>
<td>Day 134; oDM (%)</td>
<td>31.8 31.9 31.0</td>
<td>30.2 31.2 30.3</td>
</tr>
<tr>
<td>oDM loss (%)</td>
<td>6.0 9.5 10.2 4.0 4.5 11.8</td>
<td></td>
</tr>
</tbody>
</table>

1 Mean values from two (Section C) to three (Sections A, B) laboratory-scale silage bags (day 134)
2 Mean values differ significantly (Mann-Whitney Test, p < 0.05)
3 Not included in assessment because of uncontrolled oxygen influx

Table 2: Chop lengths and compression figures.

<table>
<thead>
<tr>
<th>Processed by</th>
<th>Chop length (mm)</th>
<th>Silage quantity (kg)</th>
<th>Silage bag length (m)</th>
<th>Silage quantity (t/m)</th>
<th>Density (kg DM/m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MCC CLASSIC</td>
<td>9</td>
<td>111400</td>
<td>30</td>
<td>3.0</td>
<td>230</td>
</tr>
<tr>
<td>MCC MAX</td>
<td>17</td>
<td>110950</td>
<td>28</td>
<td>3.9</td>
<td>231</td>
</tr>
</tbody>
</table>

Table 3: Percentages of shredded plant content for different chop lengths.

<table>
<thead>
<tr>
<th>Chop length</th>
<th>7 mm</th>
<th>12 mm</th>
<th>17 mm</th>
<th>22 mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>MCC CLASSIC</td>
<td>&gt; 80</td>
<td>&gt; 60</td>
<td>&gt; 40</td>
<td>&gt; 25</td>
</tr>
<tr>
<td>MCC MAX</td>
<td>&gt; 90</td>
<td>&gt; 70</td>
<td>&gt; 60</td>
<td>&gt; 35</td>
</tr>
</tbody>
</table>

1 Mean values for 1 mm and 2 mm gap settings on basis of Fraction 3 (10 mm x 10 mm)²

Dr Thaysen of the Schleswig-Holstein Chamber of Agriculture values the oDM losses per hectare at 14 € for 1% oDM loss (Bauernblatt SH, 25.08.2012, page 41). On this basis, therefore, it is possible to calculate that the reduction of at least 2% in the oDM losses shown in the study results for rows A and B of the silage bags (Table 1) represents a gain of 28 €/ha in favour of the MCC MAX.

In order to assess the effect on silage structure, Dr Thaysen also determined the proportion of shredded plant content (in percentage terms) for different chop lengths (Table 3). This analysis showed that this content was at least 10% greater in the samples of the silage processed by the MCC MAX than in the comparison samples from the classic cracker.

Improved physical effects of silage.

Grass, lucerne (alfalfa) and even straw are usually used as sources of supplemental structural content for the feed ration. In rations with a high degree of maize content, the maize itself should provide this structure in the form of longer cut, shredded material, thereby doing away with the need for supplemental structural content. This has benefits in terms of both work efficiency and costs. Whereas the production cost of maize silage is about 20 cents/10 MJ NEL, the production cost of grass silage is greater than 30 cents/10 MJ NEL (see Forum Milchproduktion, Dr Spiekers, 06/2013).
SHREDLAGE: for chop lengths up to 30 mm.

Better digestibility, more structure.

It may sound like a new trend to many a European dairy farmer, but it has been used on a large scale in the US for several years now: the SHREDLAGE process. Large dairy farms in the East and West use it to produce up to 54 litres of milk per cow, per day.

What is so special about it? The crop is chopped to a length of up to 30 mm. At the same time, the special SHREDLAGE comcracker delivers very good kernel processing performance as well as longitudinal processing of the stalks. Later, during digestion in the cow’s stomach, the larger surfaces of the chopped material offer the rumen bacteria more "attack areas" to break down the plant cells. In this way, SHREDLAGE enhances the digestibility and physical effectiveness of maize silage. This leads to a greater milk yield and improves animal health.

The experience in America shows that the SHREDLAGE process can be used with chop lengths of 26 to 30 mm in the 30 to 34% DM range without any difficulties. For DM content of 36 to 40%, the maximum chop length is reduced to 21 mm in order to prevent the silage from being sorted in the feed trough.

Thanks to the SHREDLAGE process, many dairy farmers have been able to increase the maize silage content in the feed ration while simultaneously reducing the proportion of straw and feed concentrate. At the same time, it has been possible to increase the per-hectare yields of both energy and dry matter. This is ideal for the current situation in the US, where the growing herd sizes mean that it is now more important than ever to use farmland as efficiently as possible.
Based on best practice to deliver practical benefits.

The founders of the Shredlage company and, so to speak, the inventors of the process are Ross Dale and Roger Olsen. Both work as dairy nutritionists for dairy farms in the US. In the course of their work, they recognised the benefits of maize silage with longer chop lengths and shredded plants.

Before this, the livestock nutritionists had for many years supported the trend for short chop lengths in the knowledge that these did not provide an optimal response to the physiological requirements of the rumen. This is because formation of the rumen mat is impeded and this, in turn, depresses rumination. This makes it necessary to restrict the maize silage component of the feed ration accordingly.

In 2008, Loren Olsen (father of Roger Olsen) and the two founders of the company developed the first prototype of a new SHREDLAGE corncracker. This system met the requirement for intensive plant and kernel processing in combination with very long chop lengths. A working prototype was quickly built and followed by five different models for field trials. In the end, Dale and Olsen chose the top-performing corncracker and fitted it in 25 CLAAS JAGUAR forage harvesters.

At the same time, scientific studies conducted at the top US universities specialising in livestock nutrition validated the effectiveness of the SHREDLAGE technology.

Better compression.

Compression in the clamp is another area in which the experience with the SHREDLAGE process is a positive one. As a result of the greater proportion of shredded plant components and the more intensive grinding of the kernels, this silage is even easier to compress than silage with short chop lengths.
NEW: MCC SHREDLAGE.
Three different conditioning effects.

The cracker for the SHREDLAGE process.

In order to allow chopped material with chop lengths in excess of 25 mm to be conditioned even more intensively, CLAAS has made SHREDLAGE technology from the US available since 2015. This cracker, which is available ex factory in a MULTI CROP CRACKER housing, is manufactured under licence at CLAAS Industrietechnik (CIT) in Paderborn.

The key feature of the MCC size L (250 mm diameter) rollers is the design of the roller sleeves which have a special sawtooth profile into which a circumferential, spiral groove has also been cut.

Whereas one roller has 110 rows of teeth, the other has 145. This roller design results in three different conditioning effects.

First, the chopped material is crushed to a greater or lesser degree depending on the gap setting which can be adjusted in the same way as in conventional systems. Second, there is a particularly intensive grinding effect which results from the differing numbers of rows of teeth and the 50% speed differential.
Third effect: as it passes through the rollers, the stalk material is twisted by the circumferential spiral groove of the front roller and the opposing groove of the rear roller. In this way, the maize stalks are effectively "peeled" with the relatively hard bark or skin of the maize stalks being separated from the soft core of the plant.

MCC SHREDLAGE equipment.

<table>
<thead>
<tr>
<th>Cylinder</th>
<th>V20</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cracker</td>
<td>MCC SHREDLAGE with 50% speed differential</td>
</tr>
<tr>
<td>ORBIS front attachment speed</td>
<td>Fast</td>
</tr>
<tr>
<td>Assessment</td>
<td>Very high quality long-chopped forage &gt; 25 mm</td>
</tr>
<tr>
<td></td>
<td>Very high degree of kernel processing, multiple fragmentation of cob sections</td>
</tr>
<tr>
<td></td>
<td>Shredded pieces of stalks and leaves</td>
</tr>
<tr>
<td></td>
<td>Forage structure has high physical effectiveness</td>
</tr>
<tr>
<td></td>
<td>&quot;Frictional effect&quot;: stalk rind is rubbed off the core, kernels undergo extreme cracking</td>
</tr>
</tbody>
</table>
MCC SHREDLAGE in practical use: success that speaks for itself.

Demand for SHREDLAGE is growing.

The Western United States is home to large dairy farms with more than 2000 cows. Although the feed rations are calculated tightly, the milk yields are huge, achieving as much as 54 litres per cow per day. Maize silage plays a central role here.

US farmers have always used long-chopped silage, but the last four to five years have seen growing demand for the SHREDLAGE process. As a result, some 70% of dairy farms are already using this new feed concept – and its success speaks for itself.

Farmers Aaron Kutz and Paul Trierweiler talk about their experiences with SHREDLAGE.

Trierweiler Dairy, Westphalia, Michigan, USA.

Trierweiler Dairy, Westphalia, is a well-known dairy farm in Michigan. Owners Frank and Paul Trierweiler have some 1500 cows.

Today, three years after the two farmers switched over to SHREDLAGE forage processing with a chop length of 26 mm, their verdict is a very positive one: "Out in the field, the new SHREDLAGE corncracker has proved a great success with its excellent kernel cracking and optimal overall processing performance."

"We have seen a distinct increase in our herd’s milk yield", says a clearly impressed Frank Trierweiler. What’s more, thanks to SHREDLAGE, we have been able to reduce the proportion of roughage or straw in the overall ration mix”, explains Paul Trierweiler. It was also found that it was possible to improve management of the silage clamp. Today, the compression figures are 24 to 40 kg/m³ greater than those obtained with conventionally chopped maize.

"It really is an excellent result", agree Frank and Paul Trierweiler. In order to use SHREDLAGE on a professional basis, they even changed over their farm’s forage harvester from a competitor brand to a CLAAS JAGUAR – a decision fully justified by the success they have enjoyed.
Kutz Dairy, Jefferson, Wisconsin, USA.

Established in 1973, the Kutz family business is one of the most successful dairy farms in Wisconsin. With 1800 cows and a total head of livestock of 2100, the dairy farm is today run by Aaron Kutz with his brother, Allen, and their father, Roy.

Aaron Kutz began using SHREDLAGE five years ago. The maize silage with chop lengths of 17 to 21 mm which had been used in the past was replaced by SHREDLAGE with lengths of up to 30 mm. "Before we integrated SHREDLAGE in the feed ration, we used to have to add chopped straw or hay to increase the crude fibre content. After changing over the feed ration to include SHREDLAGE, we found that the daily milk yield per cow increased. At the same time, we were able to reduce the feed cost by € 0.11 to € 0.14 per animal per day", says the farmer.

He explains that this reduction is due to the smaller proportion of supplements in the ration. "With SHREDLAGE, we have also been able to improve the packing density of the silage clamp. We worked out that we managed to get some 56 kg more fresh mass in the clamp, so that was another factor that told us that this was the right feed strategy."

In summary, it can be stated that through improved livestock health, greater silage clamp density and, ultimately, an increased milk yield, the Kutz farm is able to operate more profitably per hectare. Aaron Kutz therefore regards the decision to change over the feed process as the right one: for him, SHREDLAGE is the only way to go when it comes to producing maize silage for feed.
Overview of SHREDLAGE benefits.

One extra litre of milk per animal per day.

The University of Wisconsin conducted comprehensive feed studies to establish the effect of SHREDLAGE on milk yield. A direct feed comparison was conducted between two groups comprising 56 cows each. After eight weeks of feeding with conventionally chopped silage (19 mm) and SHREDLAGE (30 mm) respectively, a 0.6 kg higher dry matter intake per cow and per day was identified in the SHREDLAGE group. This resulted in an average increase in daily milk yield of 1 litre per cow per day. In the course of the trial, additional milk yields as high as 2 litres per cow and per day were measured.

Another study by the University of Wisconsin investigated kernel processing and the quantity of starch available for digestion in the rumen. The study involved the comparison of the SHREDLAGE cracker (26 mm chop length, CC gap of 2 mm, 32% speed differential) and a standard cracker (19 mm chop length, CC gap of 2 mm, 50% speed differential).

SHREDLAGE material attained a CSPS ("corn [maize] silage processing score" which serves as an indicator of the percentage of available starch) average of 72% (occasionally as high as 80%). The corresponding comparative average for conventionally chopped maize silage, however, was only 68% (see page 27 for details of the CSPS measurement method).

A process that pays.

SHREDLAGE, the result of subjecting long-chopped silage to a high degree of processing, thus leads to a number of beneficial effects which pay for dairy and beef farmers:

1 Silage has a more physically beneficial structure
   – Improved rumen health and rumen activity
   – Falling forage costs: low-energy structural feed is replaced by high-quality maize silage with high structural content
2 Increased proportion of digestible crude fibre
   - Increased microorganism activity in the rumen and during ensiling

3 Greater kernel processing, more starch available to the rumen
   - Starch availability increased from previous figure of less than 60% to well over 70%
   - Benefit of faster fermentation

Source: Dairy Science Department, UW Madison
The MULTI CROP CRACKER: comparison of all versions.

A perfect match for practical requirements.

Now available with three different roller profiles, the new MULTI CROP CRACKER concept is able to respond to changing practical requirements. As a rule, the fuel consumption and throughput associated with the three different processes vary depending on the degree of processing. The chop length scale in the diagram on the next page shows the boundaries between the key application areas of these processes.

Short chop lengths from 3.5 mm are the principal domain of the MCC CLASSIC. This cracker with 125 / 125 teeth (250 or 196 mm diameter) and a 30% speed differential is therefore primarily designed for conditioning maize silage for biogas facilities. At the same time, the MCC CLASSIC remains a well-established and proven solution for chop lengths up to 12 mm which are used in the preparation of maize silage as feed for dairy and beef cattle. Over many years, the sawtooth profile of the MCC CLASSIC has proved itself to be a robust and uncompromising solution.

An exchange roller with only 100 teeth, which can be ordered through the parts system, for example, allows the application spectrum of this cracker to be extended into the chop length range above 12 mm.

The new MCC MAX, on the other hand, is the optimal solution for meeting requirements which are constantly changing – from short chop lengths for biogas facilities all the way up to long-chopped 22 mm lengths; this adaptation is possible without even having to change the rollers.

The newly developed friction segments with combined friction and cutting surfaces as well as the 30% speed differential lead to more intensive processing by friction with additional cutting and shearing effects which were impossible in the past. The key benefits of the MCC MAX therefore lie not only in its ability to operate flexibly across a huge chop length range, but also in the more intensive conditioning and the more pronounced effects on the silage structure. This type of chopped material, measuring 7 to 8 mm, scores more highly than conventional maize silage with a 4 mm chop length.

The MCC SHREDLAGE meets the requirements of the feed strategy that shares its name. It is based on a redefined approach to the chopped material used for silage production which is increasingly gaining ground, especially in the US. Roller elements with a sawtooth profile and a spiral groove, 110 / 145 teeth as well as a speed differential of 50% condition the silage in such a way that milk and meat yields are increased. Depending on the DM content, the system can deliver chop lengths of 26 to 30 mm. At higher DM levels, chop lengths as short as 21 mm are possible. SHREDLAGE is long-chopped maize silage which also undergoes special conditioning. This can only be achieved with the genuine SHREDLAGE corncracker rollers. The benefits of high milk and meat yields as well as improved animal health make themselves felt in particular in the case of feed rations with high maize content.
Energy and quality can be measured.

Counting the fractured kernels.

There are various measuring methods, with which the quality parameters of maize silage can be assessed objectively. One commonly used and straightforward method for assessing processing quality involves counting the kernels that have been fractured: a measuring cup (1 litre) may not contain more than two kernels which have not been fractured. Kernels which are only nicked do not count as being adequately fractured. Furthermore, it is possible to count very obvious overlengths. This simple method provides a very good overview of the intensity of the processing by the corncracker. The forage harvester settings can be optimised quickly once a measurement has been performed. Advisers recommend repeating the test every two hours.

Checking chop lengths.

Proven in practical use, the shaker box is used for checking the proportion of different chop lengths. The various sieve fractions of the different chop lengths are weighed to estimate their respective proportions. The four fractions have been kept relatively simple with two sieve hole sizes of 19 mm for long content as well as 10 and 9 mm for the chop length ranges concerned. This means that the content which reaches the lower fraction comprises everything with a chop length of less than 4 mm along with the fine fraction.

Depending on the set chop length, the target is a fraction of at least 45% in the lower container or at least 45% in the middle sieve.

<table>
<thead>
<tr>
<th>Class 1</th>
<th>Class 2</th>
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<tbody>
<tr>
<td>Whole kernels must be cracked open, regardless of their size.</td>
<td>Kernel only slightly nicked by meshing of rollers</td>
</tr>
<tr>
<td>Kernel pulled out of cob only with tip attached</td>
<td>Kernel only burst, but not properly fractured</td>
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<tr>
<td>Kernel component &gt; ¼ of the total kernel</td>
<td></td>
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Optimal solutions for every requirement.

The search for new solutions to further improve the quality of maize silage for use as feed is a never-ending process. For biogas plant operators, it is all about obtaining energy more quickly from better processed substrate. At the same time, dairy and beef farmers need to optimise their feed rations to promote livestock health as well as to optimise the milk or beef yield. Although their end objectives are different, both groups are pursuing a common goal: to obtain as much available starch per hectare in order to reduce the cost of production.

It is above all in the area of chop processing that drastic differences in the practical requirements of each farm are to be found. The spectrum begins with fine chopped material with chop lengths of 3.5 to 12 mm and extends all the way up to long-chopped, intensively shredded material with chop lengths of up to 30 mm.

With the new, flexible MULTI CROP CRACKER (MCC) concept for the JAGUAR, CLAAS is in a position to satisfy these differing requirements. The three versions which make up the MCC concept provide optimal solutions for implementing short chop lengths, long chop lengths and the new SHREDLAGE process. This brochure provides details of these versions and how the new concept satisfies the current practical requirements not only of biogas plant operators, but also of dairy and beef farmers.

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Measuring method

Checking starch availability.

The CSPS (corn silage processing score) is a recognised measuring method used in the US to assess the starch available to the rumen on the basis of the degree of processing of the kernels. To start with, the starch content of the initial sample is determined in the laboratory by means of wet chemical analysis. The sample is then shaken on a special sieve with a 4.75 mm screen. Particles that are small enough to pass through are available to the rumen while larger ones are not. Wet chemical analysis is used again to determine the percentage of starch in the particles (< 4.75 mm) that pass through. If the figure is less than 50%, the kernel processing is inadequate. 50 to 70% represents adequate processing. A CSPS figure greater than 70% signifies optimal kernel processing. Whereas the CSPS figure for conventional silage is often around 55%, SHREDLAGE with a high degree of grain processing can increase this to as much as 80%.