

A photograph of various maize products. In the foreground, a large white bowl is divided into three sections by semi-transparent colored overlays (teal, orange, and pink), containing yellow maize meal, orange maize meal, and pink maize meal respectively. To the left, a smaller white bowl is filled with yellow maize meal. In the background, two ears of yellow corn are visible. The entire scene is set on a light-colored, weathered wooden surface with scattered yellow maize kernels. A semi-transparent white text box is positioned in the upper right quadrant.

Whitepaper

Measuring maize products  
with speed and precision.



# Measuring maize and finish products with speed and precision.

**Maize – or corn as it is known in North America – is the world’s most important cereal grain in terms of production quantities. It is processed into a wide range of valuable products, including premium-quality grits and flour. Essential metrics for millers are the granulation and the fat content of the ground maize, as their customer – the companies that use the flour and grits, have a very precise requirements in this respect. Bühler’s online measurement systems and analyzers provide millers like Lifeline Foods LLC in the United States high levels of quality control, which also provides a solution with huge financial benefits.**

In 1996 a group of innovative corn producers from Iowa, Kansas, Nebraska and Missouri – the United States Corn Belt – founded AgraMarke, an identity preserved production cooperative. Five years later in 2001, the cooperative purchased a 750,000 square foot manufacturing facility in Saint Joseph, Missouri. In 2006, LifeLine Foods, LLC leveraged its corn based food ingredient knowledge with that of ICM, Inc. Combining the vision, mission and talent of the 650 owners from AgraMarke Quality Grains with the expertise of Kansas-based ethanol facility designer and builder ICM Inc., the plant was able to leverage both owners skill set to build a process that enhanced its high-quality food ingredients.

Today LifeLine Foods is a leader in the corn milling industry, with more than 150+ employees, and its Level-2 SQF certified plant has been extended to 780,000 square foot. The co-op’s corn-based products are used as ingredients for corn flakes, snacks,

soups, tortillas and taco shells, brewing and distilling ingredients, corn meal and flour, as well as industrial lubricants and ethanol. The cooperative specializes in the processing and packaging of identity-preserved grain, ensuring product segregation which keeps each grower’s produce unblended with grain from other fields. The company is proud of its zero-waste approach.

Bühler has been at LifeLine Foods side from an early stage. The specialty mill produces a range of corn ingredients including corn grits, corn meals, pre-gelatinized corn flour that meet Non-GMO Project Verified, USDA-Certified Organic and Certified Whole Grain standards. The dry corn mill produces various granulations ranging from coarse grits to fine flours that are used in a variety of food applications which we indicate in the newsletter below. Bühler has been able to provide LifeLine Foods with the latest technology and dedicated support with quality measurements.

Region	Corn Flour					Corn Grits		
	Corn Meal	Arepas	Tortillas	Polenta	Regional Foods	Corn Flakes	Extruded Snacks	Beer
<b>Africa &amp; Middle East</b> (Egypt, Ethiopia, Kenya, Nigeria, South Africa)	●	○	○	○	Corn pudding (Nigeria) Famix (Ethiopia) Ugali (Kenya) Baladi (Egypt)	●	●	●
<b>North America</b> (Canada, Mexico, USA)	●	○	○	○	Tamales and Nachos (Mexico)	●	●	●
<b>Latin America</b> (Brazil, Colombia, Venezuela)	●	●	●	○	Cuscuz (Brazil) Empanadas and Almojabana (Colombia)	●	○	○
<b>Asia Pacific</b> (China, India, Indonesia, Japan, Pakistan, South Korea)	●	○	○	○	—	●	●	●
<b>Europe</b> (France, Germany, Ukraine)	●	○	○	○	Nachos (Germany) Nachynkyia (Ukraine)	●	●	●

○ No presence    ● Low    ● Moderate    ● High

## Corn based products<sup>1</sup>

Corn flour is largely used to prepare corn meal with each region having its own traditional corn-flour based recipes.

<sup>1</sup>Source: Aranca Market analysis 2015, paid by Bühler



- 1 Measurement head  
Installed at the scale hopper wall
- 2 Sampling box with sampling button for automatic  
sample registration in the sensors database
- 3 Sampling position for validation

**Picture 1**  
Installation of NIR Multi Online Analyzer MYRG

## Quality measurement in corn processing

A quality assurance program tests a variety of specific product attributes with regards to their intended application. Routine laboratory tests analyze granulation, moisture, fat, protein, fiber, ash, Color b\* value (yellowness) & Color L\* value (brightness), viscosity and test for microbiological contamination and mycotoxins. In corn milling, these parameters play a decisive role in the consistent quality of the various end products such as corn flour, corn semolina and corn grits.

The precise granulation of ground corn is an essential metric in milling. Customers' tolerances for processing flour and grits are set up for a very narrow range of particle size. It is paramount for a milling plant to gauge and control product quality to avoid the risk of finish product being rejected. A rejected batch of produce can quickly result in a loss of US\$10,000.

Determination of ingredients is also key. Fat and moisture contents have a decisive influence on the quality and shelf life of the product as well as the overall yield of a corn mill.

## Bühler online measurement supports quality assurance

Continuous real-time online analysis of quality parameters of raw material, intermediate and final products during the corn processing allows immediate adjustments of processes and optimization of quality and yield. Even marginal changes to ingredient parameters can significantly optimize yields. Based on case data, Bühler's systems have the capability of optimizing yield of corn grits by 0.3% resulting in additional annual earnings of US\$200,000.

Online measurement also reduces the need for lab testing. The costs of lab testing can be significant. Samples all over the facility have to be taken every two hours and brought to the lab for testing. This can take around 20 minutes each time depending on the layout. In an 8-hour day, that amounts to 80 minutes spent just on sampling. The labor costs for sampling and manual analytics over a year could add up to as much as US\$25,000 – a saving that can be made by using Bühler's two online measurements – the NIR multi online analyzer MYRG and the online particle size analyzer MYTA.

The strength of the NIR Multi Online Analyzer MYRG lies in the ability to analyze raw material and finished product across variable measuring points in real-time during the production processes. A single spectrometer of the latest NIR generation can evaluate the data from up to six different measuring points. The MYRG is durable and reliable and includes Bühler pre-calibrated applications. The sensors are positioned after pre-cleaning to measure moisture and the contents of crude fat and fiber, polar starch and protein from the raw material. At the other end of the process, the sensors measure the parameters of the finished product – whether it is flaking grits or corn flour – as it arrives in the hopper scale. Bühler can also provide NIR calibrations to measure protein, crude fiber and starch content in the final corn product.

Bühler's online particle size analyzer MYTA optically measures granulation. A camera with a strobed LED in conjunction with laser diffraction measures the shape and size of both coarse and fine particles in a size distribution between 10 µm and 5,000 µm – a range that covers most grain processing products. The compact design of the measuring probe is suited for retrofitting in existing production plants.

## Supporting LifeLine Foods

At LifeLine Foods' facility, an online NIR sensor has been installed to measure and monitor primarily the fat and moisture content in snack grits. The sensor is located after the degerminator and milling section at the batch hopper scale. Fat content is an important indicator that gauges the performance of the degermination process. The process is set to the quality specifications set by their customers, according to which only a minimal germ/bran content is tolerated in snack meal. Traditionally, a product sample is taken to the reference lab every two hours to measure moisture and fat contents. If the specification limits are exceeded, operators need to adjust the process accordingly.

Using Bühler's online NIR system to measure fat content in real time, minimizes human effort and reduces the time it takes from measuring product characteristics to taking action from two hours to minutes. The automatic process adjustments guarantee consistent and efficient production within the set quality specifications and reduce the probability of false decisions based on erroneous representative measurements.

How does the NIR multi online analyzer MYRG compare to lab results for accuracy? To find out LifeLine Foods validated fat and moisture contents against laboratory standards. Measurement accuracy, calculated as standard error of prediction (SEP) based on 20 distinct samples taken over a period of one month showed a high level of precision, with an SEP of 0.1% for both the fat and the moisture content.

## Products from LifeLine Foods

### Specialty mill:

Corn ingredients including corn grits, corn meals, that meet Non-GMO Project Verified, USDA Certified Organic, certified Whole Grain standards.

[Facilities provided by Bühler](#)

### Dry corn mill:

Various granulations ranging from coarse grits to fine flours that are used in a variety of food applications.

[Facilities provided by Bühler](#)

### Masa mill:

Masa flours for tortilla, chip, and taco production.

### Specials corn flour products:

Pre-gelatinized corn flour

### Extruded pre-gel food:

Pre-Gel Binder that is versatile and is used in the food industry in flavor bites, meat mixtures, batter mixes, and breakfast cereals.

### Extruded binder:

Used in many industrial settings, including the production of plywood, fertilizer and oil drilling.

### Ethanol:

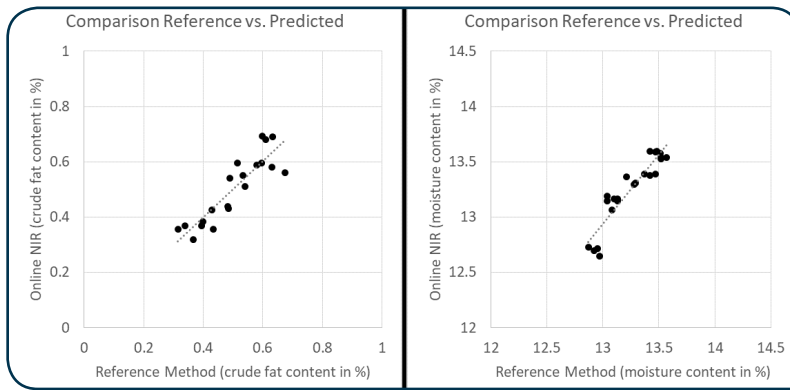
Approx. 190 million liters on Ethanol fuel



## Website

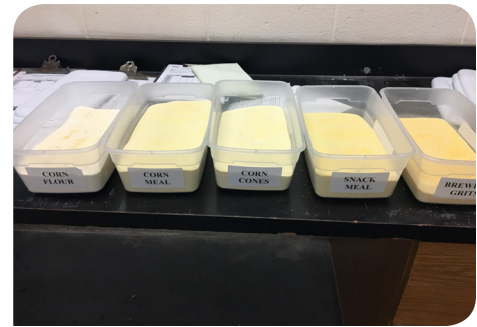
Find out more about LifeLine Foods:





**Picture 2**

Validation MYRG online results with laboratory methods at LifeLine Foods



**Picture 3**

Corn grits products from LifeLine Foods prepared for validation

## A reliable helping hand

Trenton Jacobs, Mill Manager at LifeLine Foods is impressed with the findings. After a six-month test period, the results provided by the online system in comparison to laboratory tests convinced him of the system's benefits. "The online monitoring systems enable our millers to focus on their craft, while also educating them to the impacts directly tied to processing or input changes," he says.

The LifeLine Foods example demonstrates how online process analysis can reliably supplement or even replace many of the measuring processes performed in laboratories. Switching from traditional methods to online measuring processes eliminates the need for manual sampling and analysis and the associated laboratory costs. Providing real-time quality data

automated online systems allow for continuous adjustments optimizing quality and increasing throughput. They also allow for greater consistency, save resources and ensure a level of traceability.

Bühler's online process analyzers for measuring particle size and ingredient determination can be retrofitted in existing production plants. LifeLine Foods uses both sensor systems at their plant. "Ease of use paired with accurate and immediate results has provided the exact value we were looking for," says Trenton.



**Website**

Find out more about  
Bühler's maize offering:



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**Picture 4**

LifeLine Foods corn mill features the latest milling technology with a strong focus on food safety. The 750,000 square foot manufacturing facility is located in St. Joseph, Missouri

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