



# Maize Process and Fortification

Walter von Reding  
Leader Grain Milling Flour Services

Innovations for a **better world.**

**BUHLER**

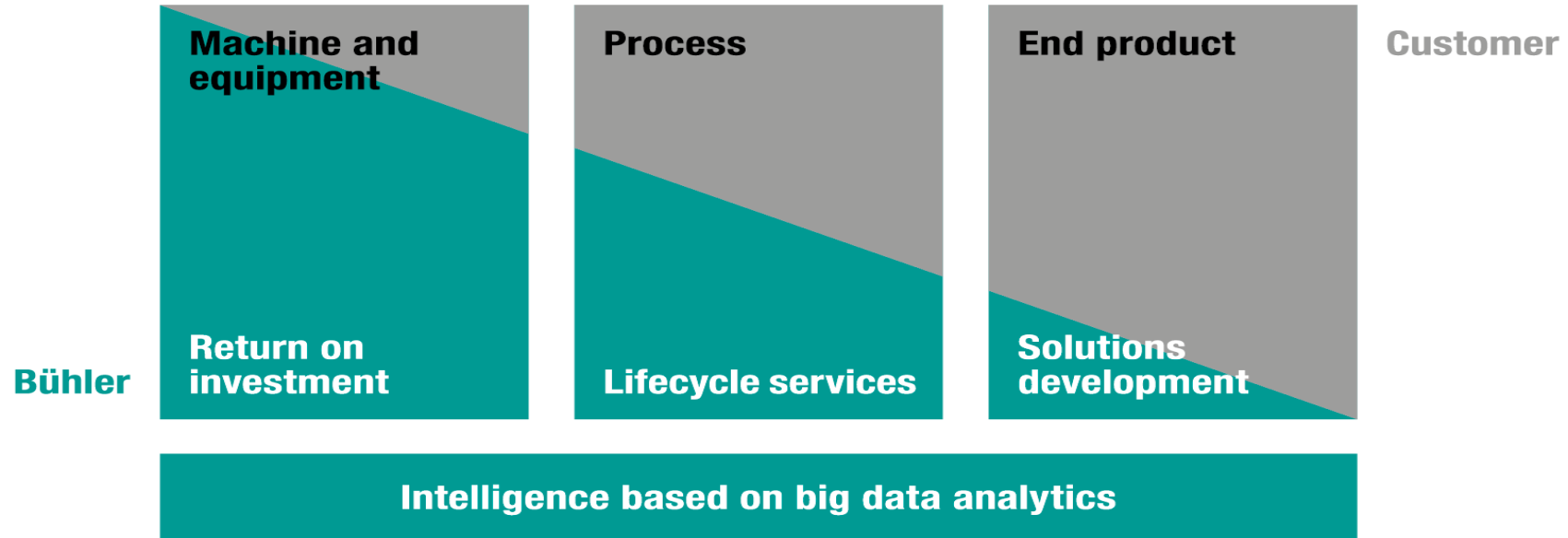
# Integrated Solutions in Maize Fortification.

## Outline

- Maize Market Relevance
- Maize Milling Process
- Key Machines
- Dosing Units
- Mixing
- Conclusions

# The Bühler Core.

Processing of foods, feeds and advanced materials.



**GRAIN  
LOGISTICS**



**GRAIN MILLING**



**SORTEX & RICE**



**VALUE  
NUTRITION**



**CONSUMER  
FOODS**



**DIE CASTING**



**GRINDING &  
DISPERSION**



**LEYBOLD  
OPTICS**

# Bühler at a glance.

Global market leader with a strong presence in local markets



**CHF 2,4 bn**

Turnover



**140**

Countries



**90**

Service stations



**27**

Manufacturing sites



**10,800**

Employees



**100%**

Family-owned company



**up to 5%**

of turnover are invested in Research & Development



Particularly committed to sustainability



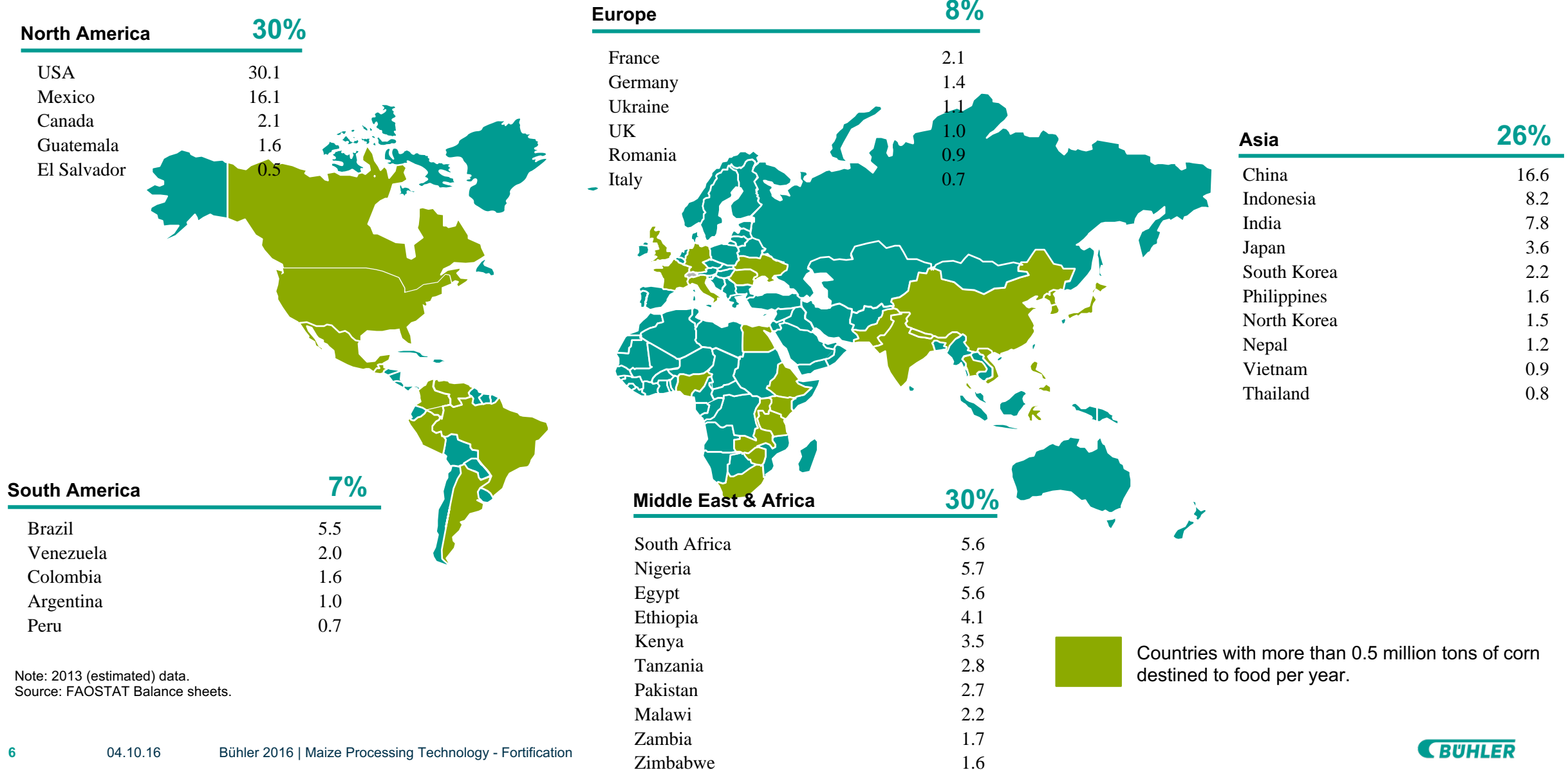
**About 175 million tons of maize  
are destined yearly to food  
applications.**

**2/3 of this consumption is  
realized in 13 countries.**

Note: 2013 (estimated) data.  
Source: FAOSTAT Balance sheets.

# Maize Market Relevance.

About 175 million tons of Maize destined to Food Worldwide



Note: 2013 (estimated) data.  
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# Maize Market Relevance.

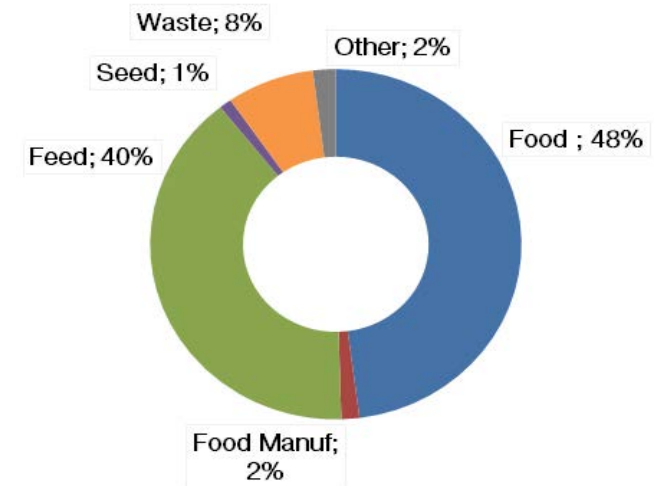
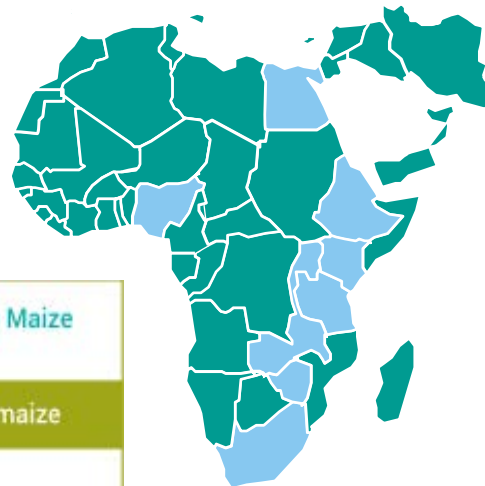
MEA about 32 kg of maize consumed per capita per

about 104 million metric tons domestic supply of maize per year.

## Top Maize Food Consumer (million tons)

South Africa	5.6
Nigeria	5.7
Egypt	5.6
Ethiopia	4.1
Kenya	3.5
Tanzania	2.8
Pakistan	2.7
Malawi	2.2
Zambia	1.7
Zimbabwe	1.6

>51 million tons

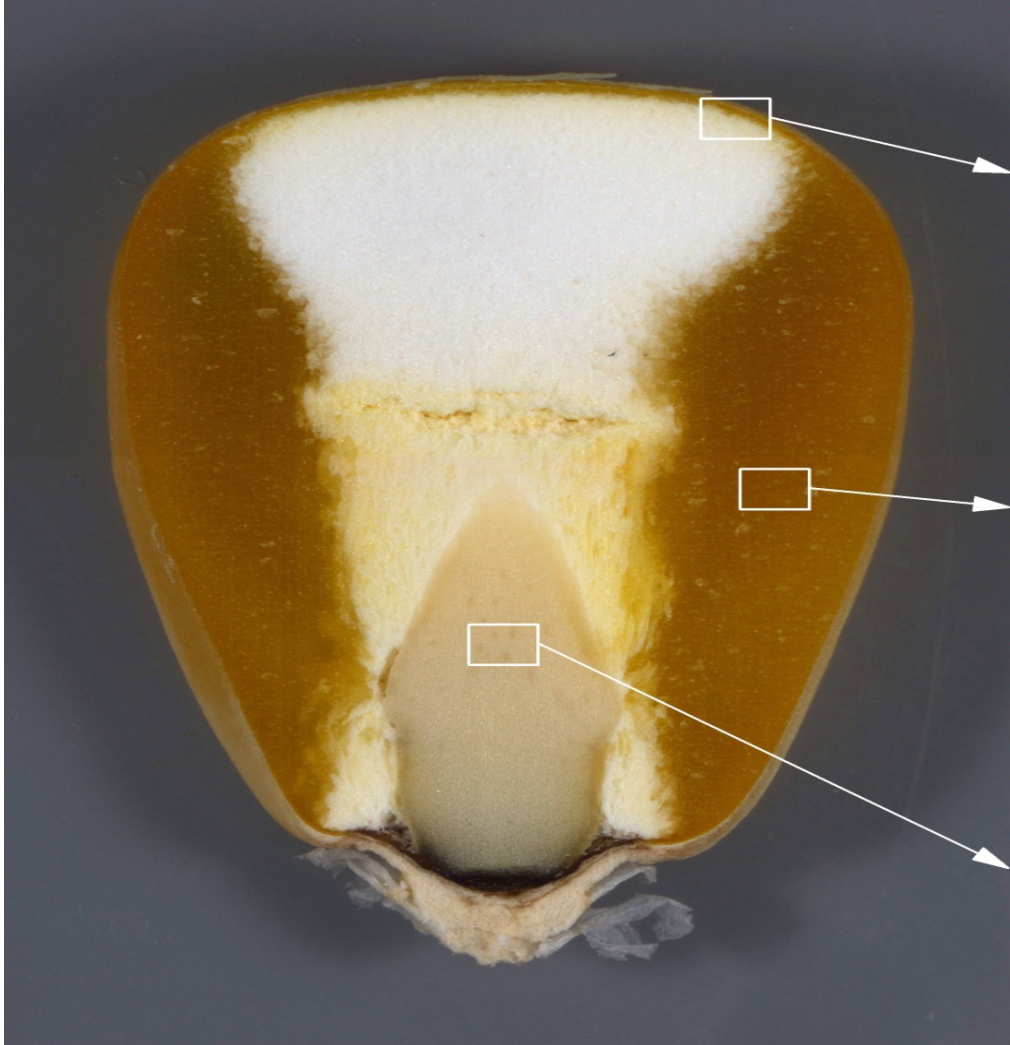


## Per Capita Maize Consumption and Percentage Daily Energy Intake from Maize in Selected Countries

Country (2011)	Consumption (gms/day)	% energy intake of maize
Kenya	192	31%
Uganda	161	15%
Tanzania	204	23%
Zambia	386	51%
Malawi	482	49%

# Maize Kernel.

## Constituents



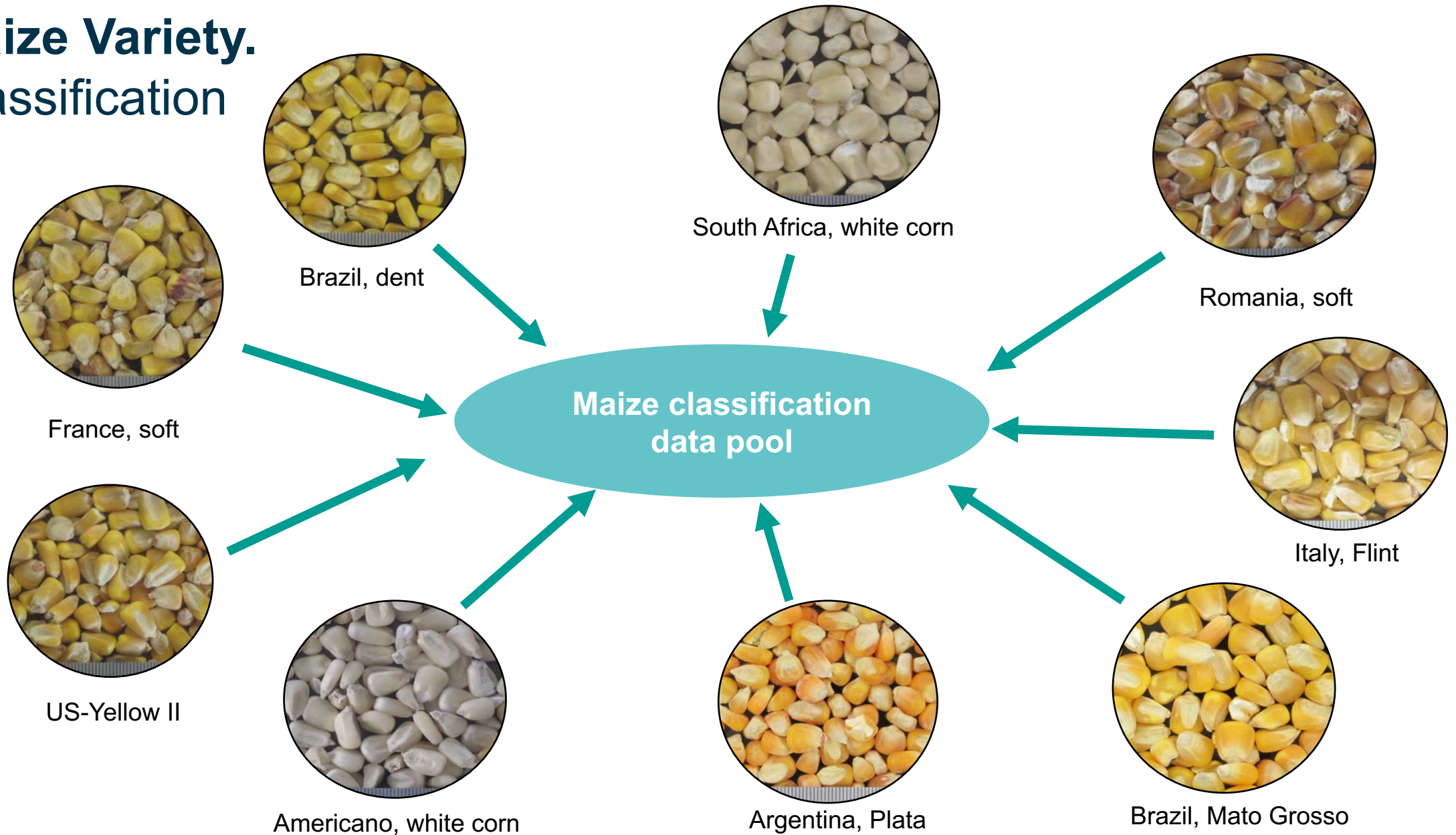
Pericarp / Testa	6.0%	0.89%
Aleurone	7.0%	7.0%
Glassy Endosperm	51.0%	0.24%
Floury Endosperm	23.0%	0.24%
Germ	11.5%	34.8%
Cap	1.5%	1.5%
<b>Amount</b>	<b>Fat</b>	



(Information: Hopkins, Smith + East)

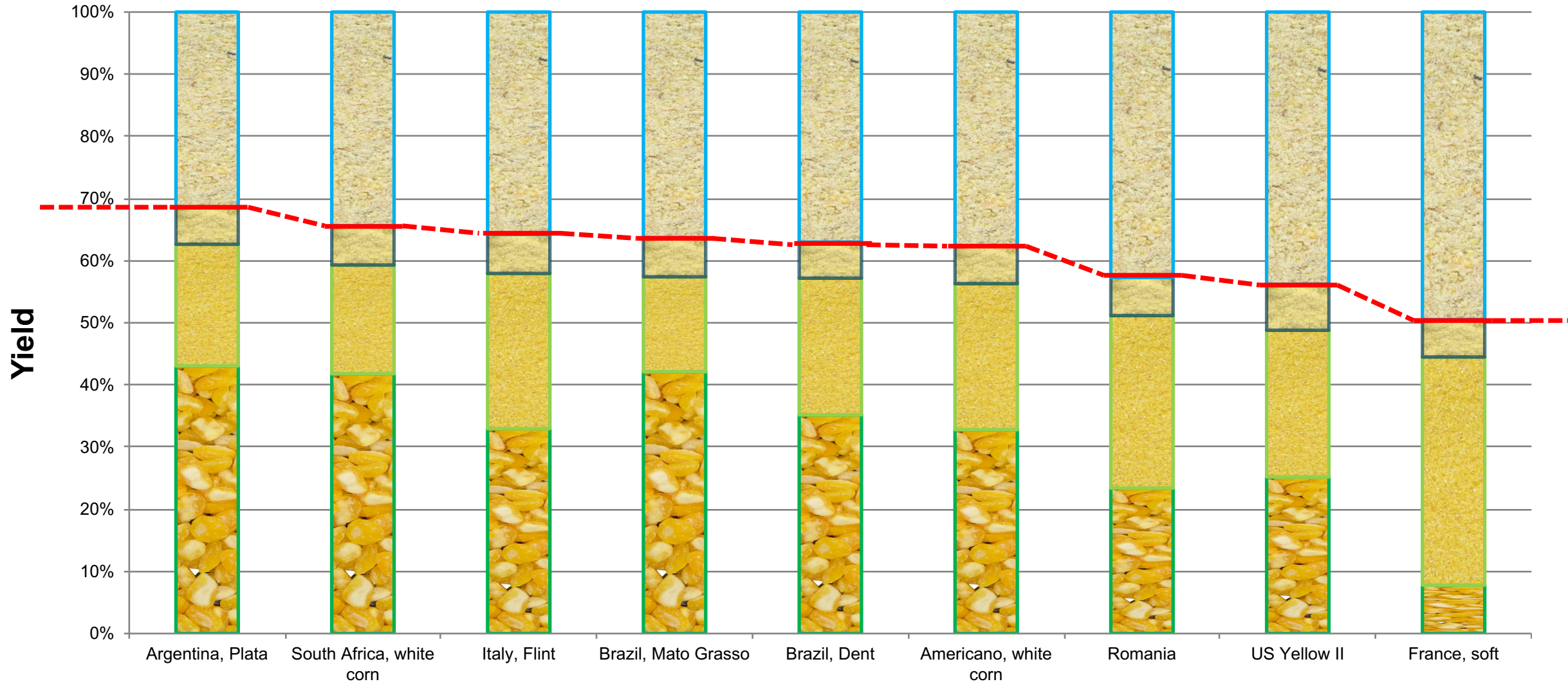


# Maize Variety. Classification



# Maize Variety.

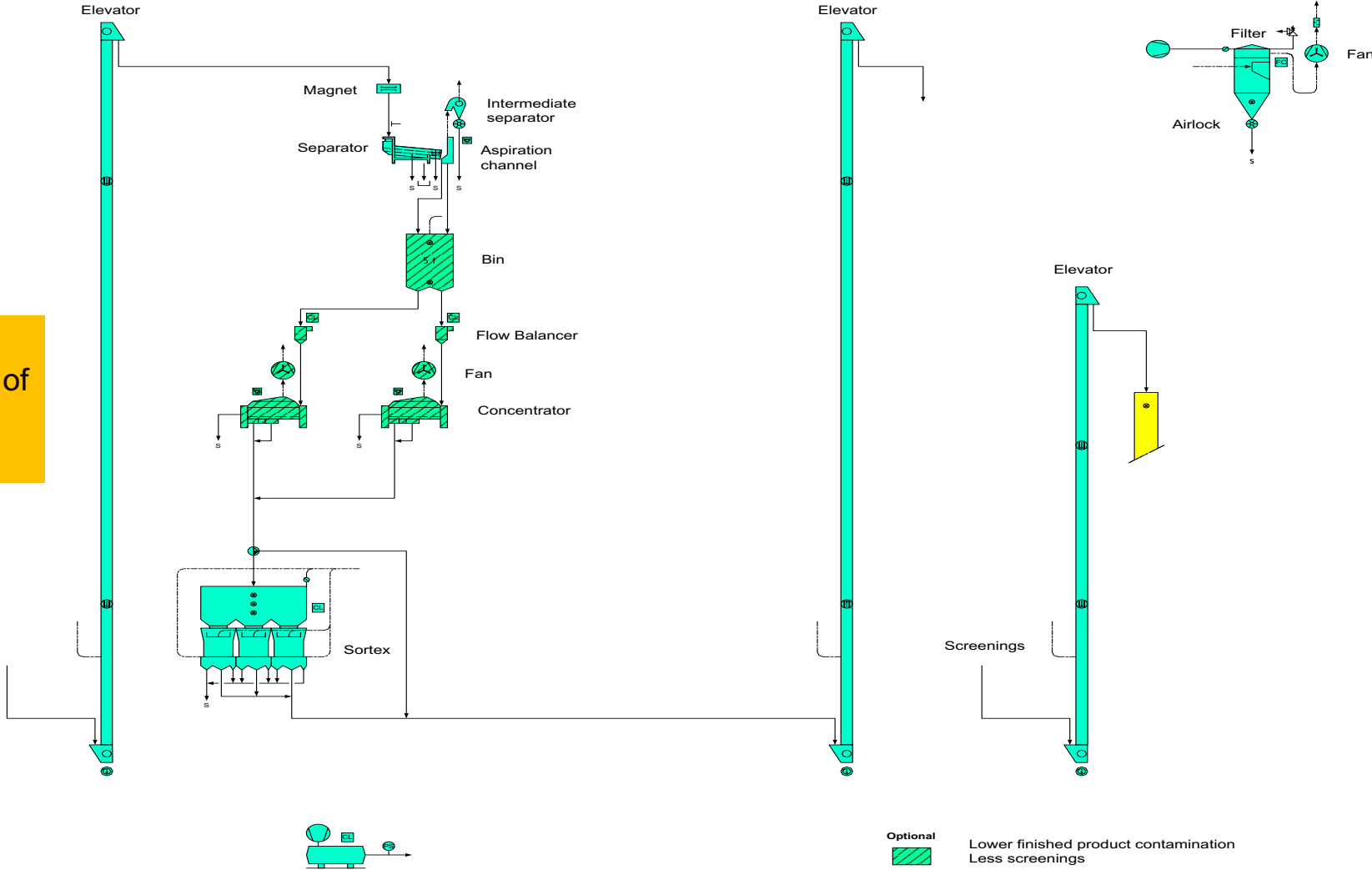
## Yield



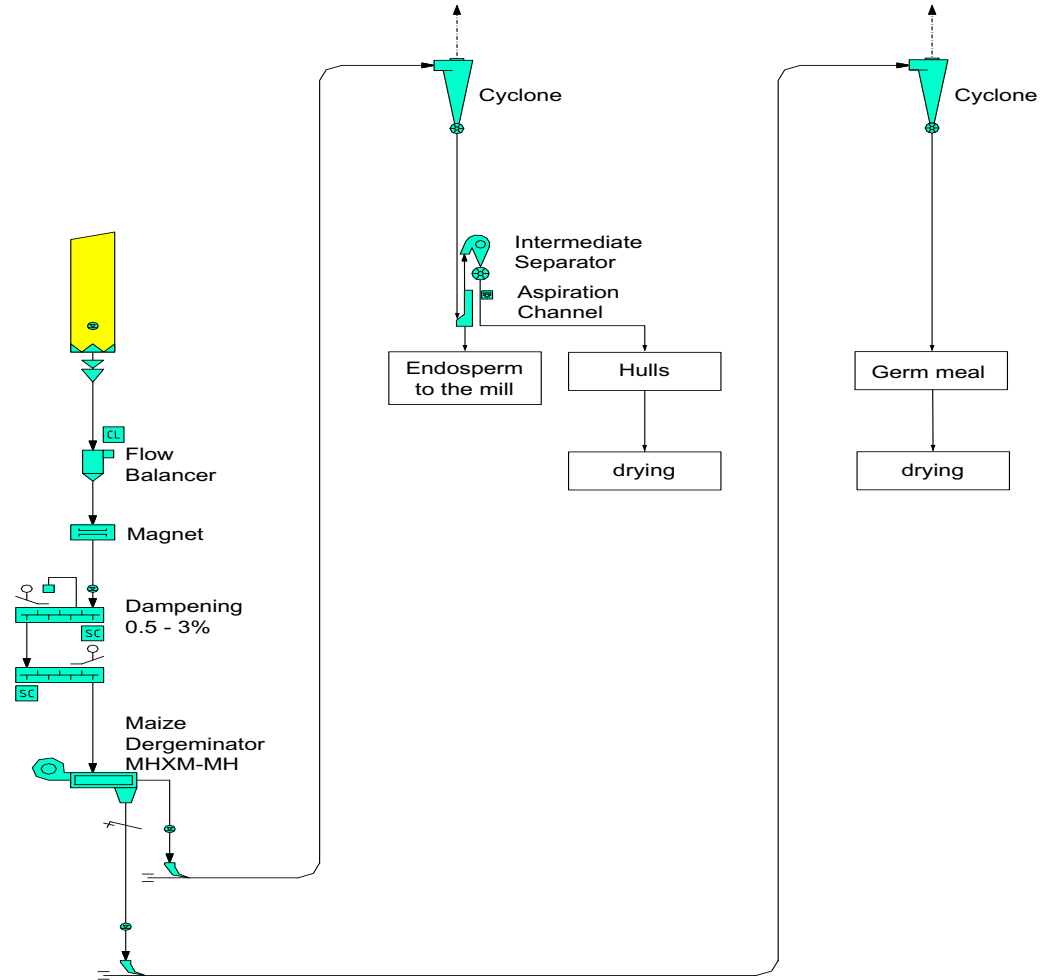
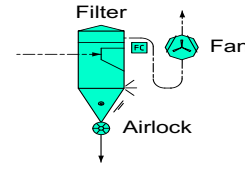
# Maize Milling Core Process.

## Cleaning concept for Aflatoxin Reduction

Use of Concentrator:  
Mostly for separation of  
cobs for prod. of  
**flaking grits.**



# Maize Milling Core Process Roller Mill. De-germination for hard maize (corn)

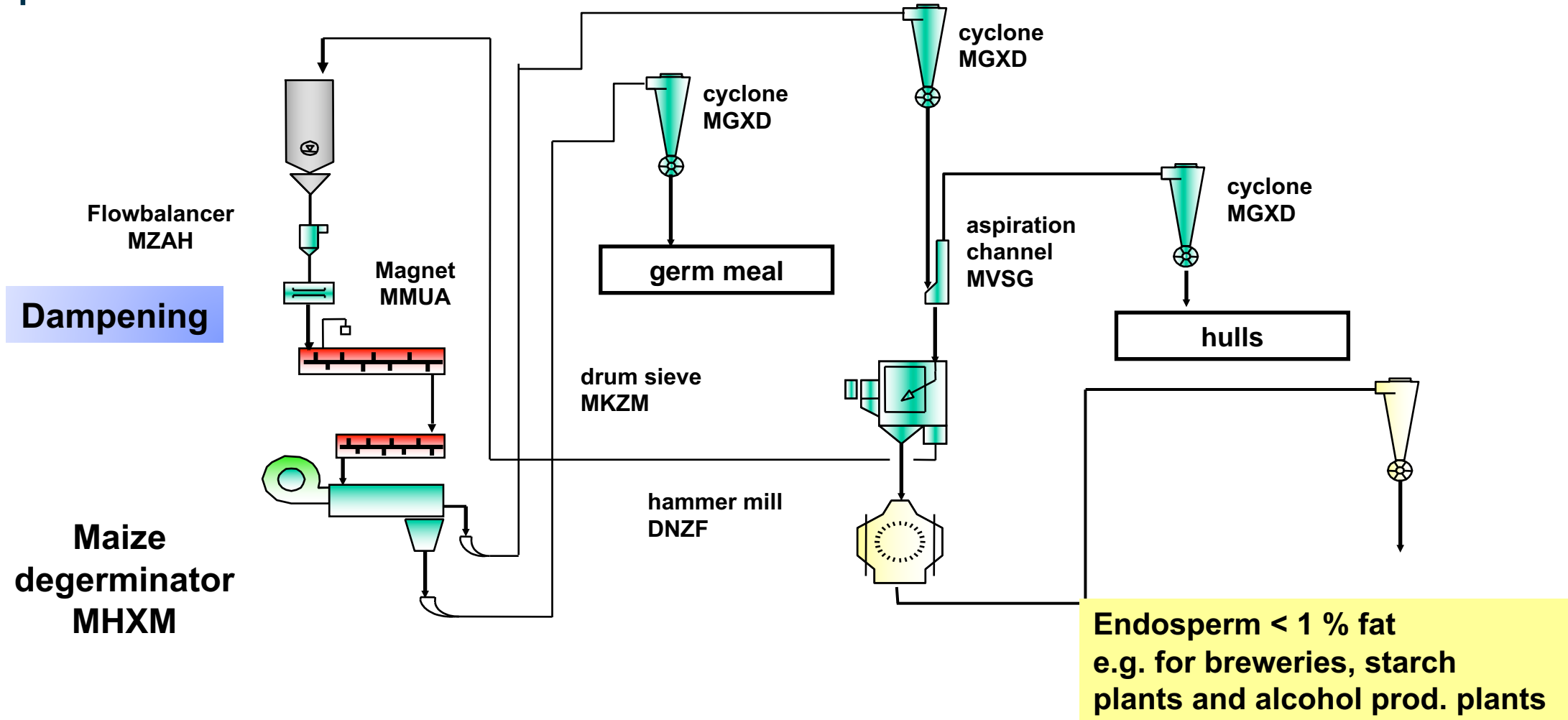


Flaking, brewery, snack grits  
corn flour and germ meal

MHXM-MH, slotted sieve, square sieve jacket for hard corn

# Maize Milling Core Process.

## Compact Mill - Hammer Mill



# Integrated Solutions in Maize Fortification.

## Micro-feeder with conveyer

Location of feeder on flour collection conveyer. Adequate Mixing - at the front half of collection conveyer above the blades of the mixing screw. At least 3 meters of conveyer length is normally needed to ensure adequate blending.

Another option for feeder location: If it would be difficult to install the feeder at the beginning of a conveyer, the feeder can be connected to the flour discharge spout of a plan sifter.



Micro-feeder fitted above mixing conveyer.

# Integrated Solutions in Maize Fortification.

## Sizing of micro-feeders to the capacity of the mill

Mills generally need one feeder per flour or meal line to be fortified. Larger Milling units with multiple products may require additional feeders including spares.

Feeders used for flour fortification need to deliver only relatively small amounts of material.

Hopper size on the feeder is also an important consideration, since you do not want to fill it constantly.

# Integrated Solutions in Maize Fortification.

## Procurement and Installation Micro-feeder system

This is done after technical evaluation of the production/milling systems and capacity of the streams.

Feeders should be set up with an electrical interlock system that prevents the flow of premix when flour flow is stopped.

An interlock causes the feeder to stop if the flour collection conveyor stops.

This will prevent the inadvertent over-Food Fortification of the flour, if there is a mechanical breakdown in the Mill.

An alternative approach is to have an automatic shut off switch on the feeder that is hooked up to a flour flow indicator or a pressure indicator in a pneumatic system.



# Integrated Solutions in Maize Fortification.

## Micro-feeder Versions and Applications



Type	S/1-Typ (Performance Line) MSDC / MZMC	S-Typ (Top Line) MSDF / MZMO	R-Typ (Top Line) MSDF / MZMO	A-Typ (Top Line) MSDF
Capacity	0.75 – 127 l/h	0.75 – 500 l/h	0.75 - 2'000 l/h	0.75 - 9'000 l/h
Screw-ø	20/32		20/32/65	
Double screw	No	Yes		
Gravimetric	Yes			
Volumetric	Yes			No
Non-free flowing bulk materials	No		Yes	
Accuracy	perfect			excellent
Servo drive	No			Yes
Variability proportioning range	1 to 20			1 to 100
Refilling manually	Yes			
Refilling with screw	Yes			
Cleaning door	No		Yes	
Price	50%	100%	150%	200%

# Integrated Solutions in Maize Fortification.

## Micro-feeder mechanical principles

### Gravimetric feeding

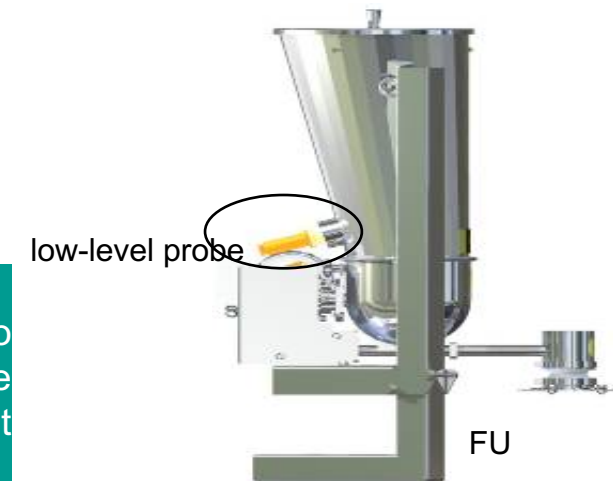
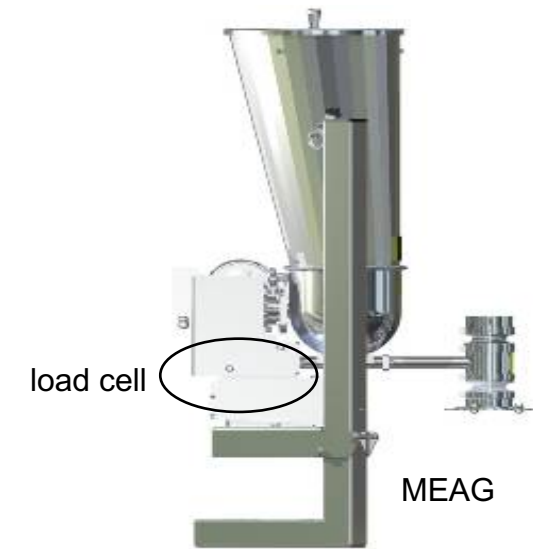
- Accurate gravimetric feeding of continuous product stream or small batch.
- very precise, accurate dosage.
- Traceability for food safety.

**Gravimetric Addition:**  
Gravimetric addition involves measuring the weight of material to be added on a continuous basis. All feeders can be made into “loss in weight” feeders. The rate at which this weight drops with time indicates the true addition rate.

### Volumetric feeding

- for constant volumetric feeding of micro components.
- very easy to use.
- cost-effective alternative.

**Volumetric Addition:**  
Volumetric addition is similar to using a cup or spoon to measure out ingredients. This is based on the principle that the volume of the material being added has a set weight when handled in a uniform manner.



# Integrated Solutions in Maize Fortification.

## Micro-feeder Versions S-Typ (Standard)

- For free flowing bulk materials



**MSDC-S/1**  
**MZMC-S/1**  
**(S/1 = SINGLE SCREW)**  
**Performance Line**

Typical Products:

- Malt flour
- Gluten
- Grits
- Maize meal

- Single Screw
- Screw-Ø 20/32 mm
- 0.75 – 127 Liter/h
- limited number of options



**MSDF-S**  
**MZMO-S**  
**(S=STANDARD)**  
**Top Line**





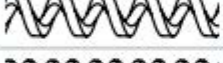
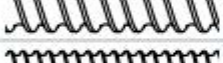
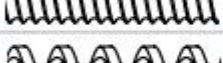
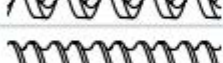
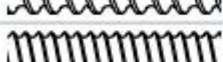

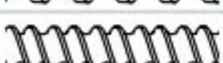
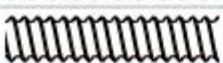
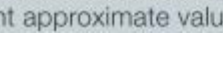
Typical Products:

- Malt flour
- Gluten
- Grits
- Maize meal

- Double Screw
- Screw-Ø 20/32 mm
- 0.75 – 500 Liter/h
- extensive number of options

# Integrated Solutions in Maize Fortification.

## Micro-feeder Screw Configuration (Capacity range)

Type		Capacity range (dm <sup>3</sup> /h) <sup>1)</sup>		
		36:36	Belt set <sup>2)</sup> 36:18	54:18
MZMC - 20/1		0.75 – 12.7	0.94 – 25.3	1.40 – 37.3
		0.75 – 6.8	0.75 – 13.1	0.80 – 19.8
		0.75 – 3.1	0.75 – 6.2	0.75 – 8.9
MSDC - 20/1		0.75 – 12.4	0.94 – 24.6	1.40 – 36.2
		0.75 – 6.5	0.75 – 12.7	0.80 – 19.0
		0.75 – 3.0	0.75 – 5.9	0.75 – 8.5
MZMC - 32/1		3.3 – 84.2	6.6 – 164	9.5 – 239
		1.7 – 39.8	3.0 – 76.9	4.7 – 114
		0.75 – 18.0	1.4 – 35.0	2.1 – 50
MSDC - 32/1		3.6 – 80.7	6.6 – 155	9.3 – 228
		1.7 – 38.3	3.4 – 73.9	5.1 – 108
		0.75 – 17.0	1.6 – 33.0	2.3 – 48

<sup>1)</sup> Product-dependent approximate values      <sup>2)</sup> Belt pulley of reel and twin screw can be exchanged

# Conclusions.

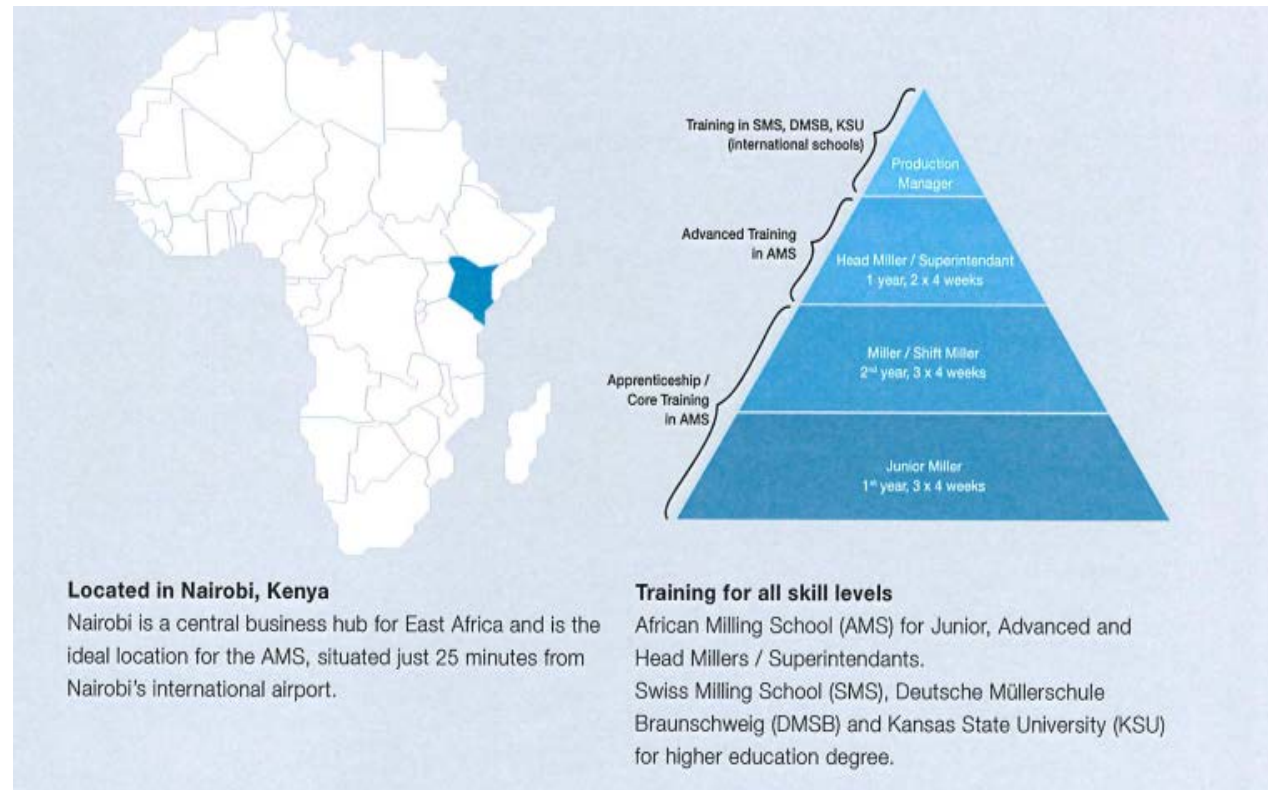
## To get I right – meet nutritional requirements

- Proper Assessment at the mill in terms of capacity of the streams and flow.
- Evaluation of the micro-feeders.
- Choosing the right screw configuration.
- Design and layout of the conveyers.
- Commissioning - installation of the feeders.
- Quality Check.
- Training and Education.



# Training at African Milling School. To get I right

- In Milling Processes
- Grain and Flour Quality Assessment.
- Flour Quality Improvement.
- Fortifications Solutions (DEMO).
- Baking Training.





Sustainability.

# Bühler Isigayo.

Compact Maize Mill with lower capacity (intake 2 tons per hour)



**Isigayo Compact Maize Mill** – Compact maize mill requiring minimum investment.

- Pre-assembled maize mill
- High quality maize flour
- Reliable processing
- High yield