

# PROTECTING STORED GRAIN

## DETOXIFYING STORED GRAIN

**iGRAIN<sup>®</sup>**



PEER HANSEN

BIOCHEMIST, FOUNDER

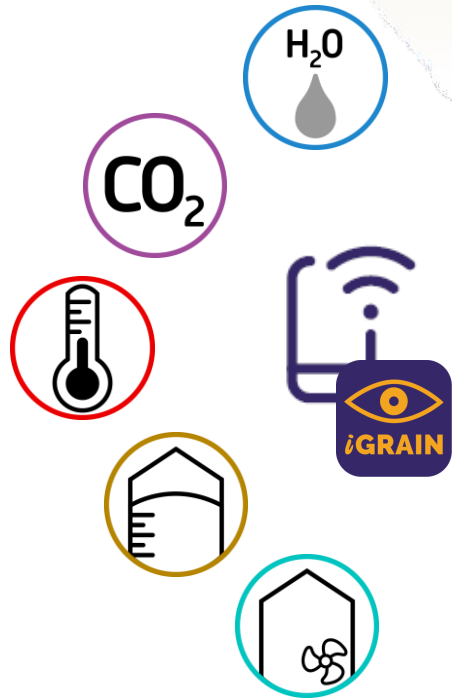
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**TOXI-SCRUB<sup>®</sup>**

**CROP-PROTECTOR<sup>®</sup>**

**GRAIN CHILLING MACHINES – COOL STORAGE**  
**NITROGEN GENERATORS – GREEN FUMIGATION**  
**NO USE OF PESTICIDES**

TOXI-SCRUB ApS, Denmark  
EYE-GRAIN ApS, Denmark  
iGRAIN LLC, USA  
GRAIN-TOXIN LLC, Uganda  
iGRAIN, Thailand



**AFRICAN**  
GRAIN TRADE SUMMIT

# THE FOUNDATION OF OUR CIVILIZATION

Innovative individuals developed agriculture over millennia and created the foundation for our current civilization.

We have the responsibility to

- Secure stored crop quality
- Prevent contamination
- Enhance food safety
- Avoid losses



5000 year old milling stones

***Together for Safe Crop for the World!***

# QUALITY GRAIN MANAGEMENT – EAST AFRICA



Requirements for professional **stored grain quality management in tropical climate** has many steps both in terms of best preservation and best detoxification. The most important steps are:

## ■ **PRESERVATION MONITORING**

- store the cleaned grain in sanitized silos
- monitor the grain condition: CO<sub>2</sub> (infestation) most important, grain temperature and grain moisture
- have an automatic system – stay updated in an APP – you are too busy for anything else 😊

## ■ **PRESERVATION CONTROL**

- Controlling the aeration fans, based on EMC (Equilibrium Moisture Content) to reach your TARGET: Moisture and temperature

## ■ **DETOXIFICATION with TOXI-SCRUB or other Ozonation technology**

TOXI-SCRUB strongly recommend detoxification with OZONE to avoid especially 3 general health problems in East Africa

- Liver Cancer - due to especially Aflatoxin in Maize
- Stunned growth in Children - due to DON in Wheat and Maize
- Cancer in general – Most mycotoxins are very carcinogenic



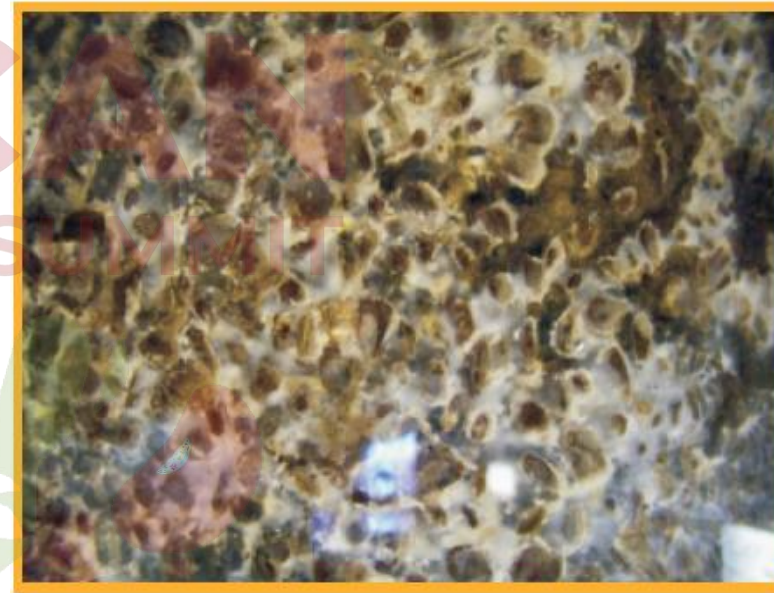
# INFESTATION CAUSES THE PROBLEMS



Grain is an abundant food resource for many organisms when stored in silos  
Stored grain will be “attacked” if not protected – especially in warm and humid climate



**GRAIN WEEVIL ATTACK**



**FUNGUS ATTACK**

# INFESTATION EVOLVES IN MOST CASES IN THIS SEQUENCE:

INSECT GROWTH → FUNGUS GROWTH → MYCOTOXINS

iGRAIN®

Traditionally, infestation has been detected with **temperature** sensors

The challenge with this technology is that grain is very insulating, so many sensors are required, and it may take a long time to detect a **Hot-Spot**

Most scientists recommend monitoring the total metabolism = CO<sub>2</sub> in the grain mass

Grain (feed) + Organisms + O<sub>2</sub> → Heat + H<sub>2</sub>O + CO<sub>2</sub> (Biology Respiration)

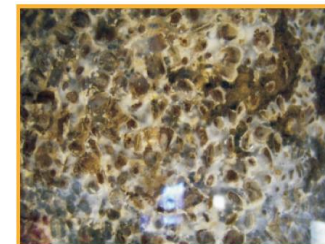
Traditional temperature monitoring

Advanced monitoring



Insects (start)

Time with increased moisture

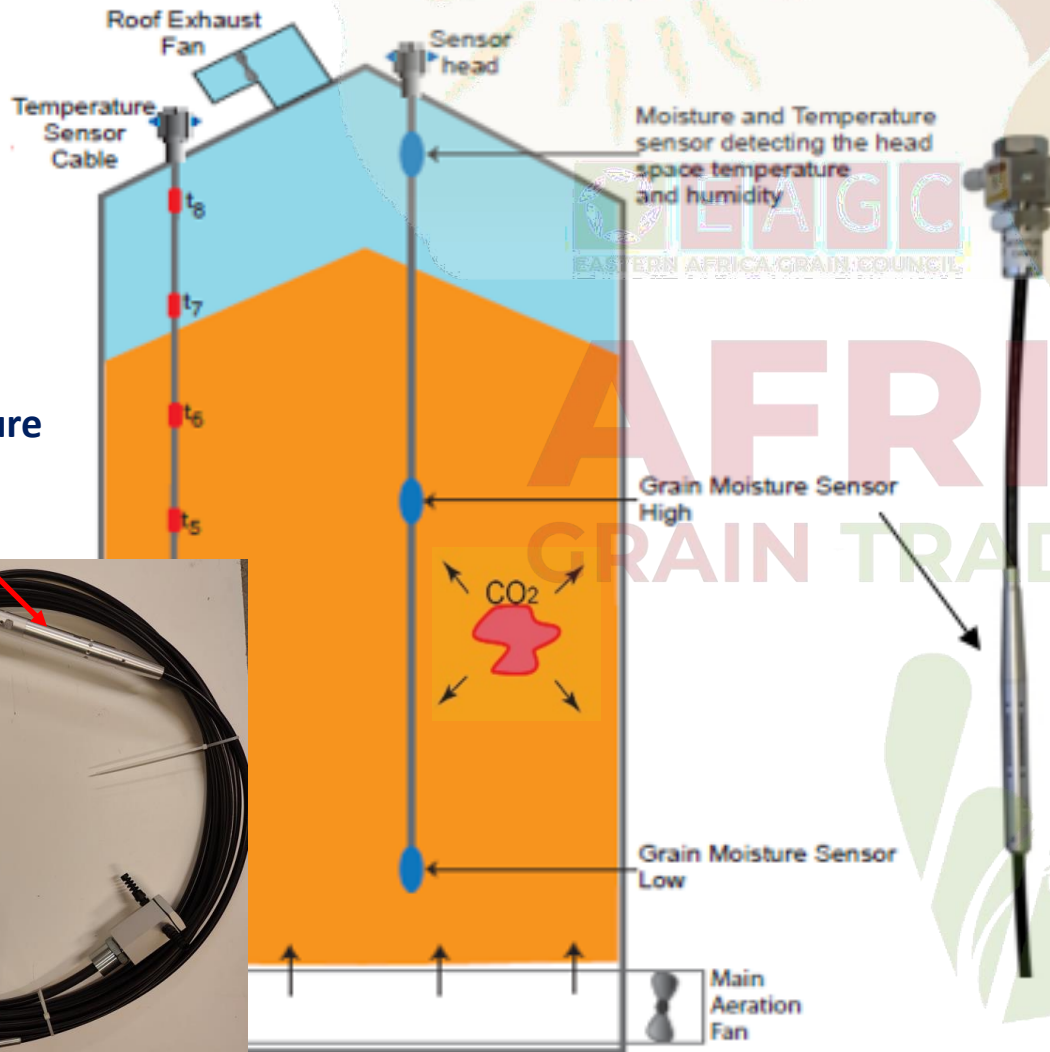


Fungus & Aflatoxin

# ALL-IN-ONE SENSOR CABLE

iGRAIN®

All-In-One  
Sensor:  
CO2  
Moisture  
Temperature  
VOC



- ONLY ONE SENSOR CABLE
- CO2 concentration = Infestation detection
- Grain Moisture
- Head space Humidity
- Temperature every 1 or 2 m
- Simple level measurement based on T-sensors
- Fire or Smoldering detection (*early*) in oil seed
- Complete monitoring with iGRAIN Smart APP in cloud-based set-up
- Simple – Efficient - affordable

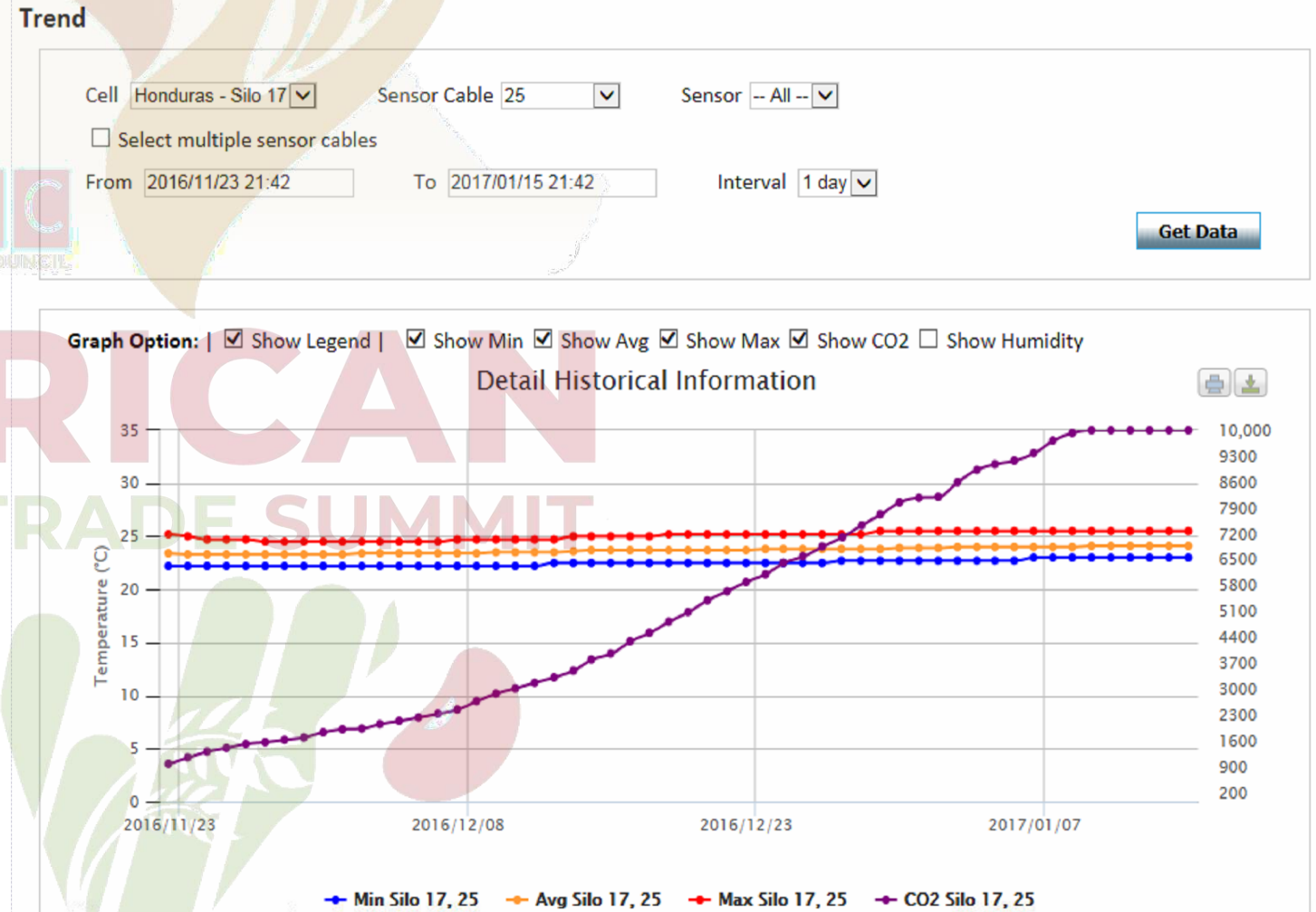


# EXAMPLE - FLOUR MILL DATE – EFFICIENCY OF CO<sub>2</sub> SENSING

iGRAIN<sup>®</sup>

## Observe

- **High** temperature sensor is very stable
- No increasing gap between **high** and **average**
- Yet the **CO<sub>2</sub>** level is increasing steadily!
- Reaching 10.000 ppm = 1% in 40 days! **HEAVY INFESTATION**
- This is real spoilage, approx. 0,1% per day!
- This shows the efficiency of CO<sub>2</sub> Monitoring



# Big Loss due to Mycotoxins

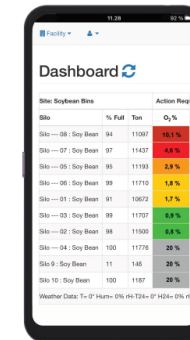
- Silo -15.000 ton Soy Bean storage
- iGRAIN Online Center discovers the problem and recommends to unload to another silo immediately
- Product reaches Temperature of 98°
- 3 Days later unloading is only 30% possible = PROBLEM:
- Difficult digging ... Very bad conditions
- Beans heavily contaminated with Mycotoxins
- \$ 2 mio. lost
- CO2 monitoring and an APP would easily have saved this loss







# SMART APP – RISK FACTOR – SAFE STORAGE



The iGRAIN Smart App makes monitoring data simple and decision-making easy; and always in your hand. Based on the sensory input, the App shows:

- the silos according to **risk** (listed worst to best)
- Predicts of the **maximum storage time**

Site: Jensen Feed Mill			Action Required: YES	Time Stamp: 28.08.2019 7:01			
Silo	% Full	Metric Ton	Risk Factor (Infestation)	Max storage	CO2	Temp (avg)	DeltaTemp
HACCP Control Points			CCP 1	CCP 2	CCP 3	CCP 4	CCP 5
Silo 4	88	1854	5.1	0 weeks	2943	28.1	3.1
Silo 1	92	1044	4.1	4 weeks	1904	31.0	1.3
Silo 6	73	2698	3.4	4 weeks	2101	25.6	0.9
Silo 3	30	2288	2.7	20 weeks	360	26.8	0.1
Silo 2	11	4682	1.8	22 weeks	411	25.6	0.2
Silo 5	98	3086	0.9	42 weeks	317	26.8	0.3
Weather Data: T= 17,8° Hum= 71% rH - T <sub>24</sub> = 23,8° H <sub>24</sub> = 54% rH				Climatic Zone: Temperate			





**iGRAIN<sup>®</sup>**

# CROP-PROTECTOR<sup>®</sup> PRODUCTS

## GRAIN CHILLERS



## NITROGEN GENERATORS



**TOXI-SCRUB<sup>®</sup>**

**Detoxification**



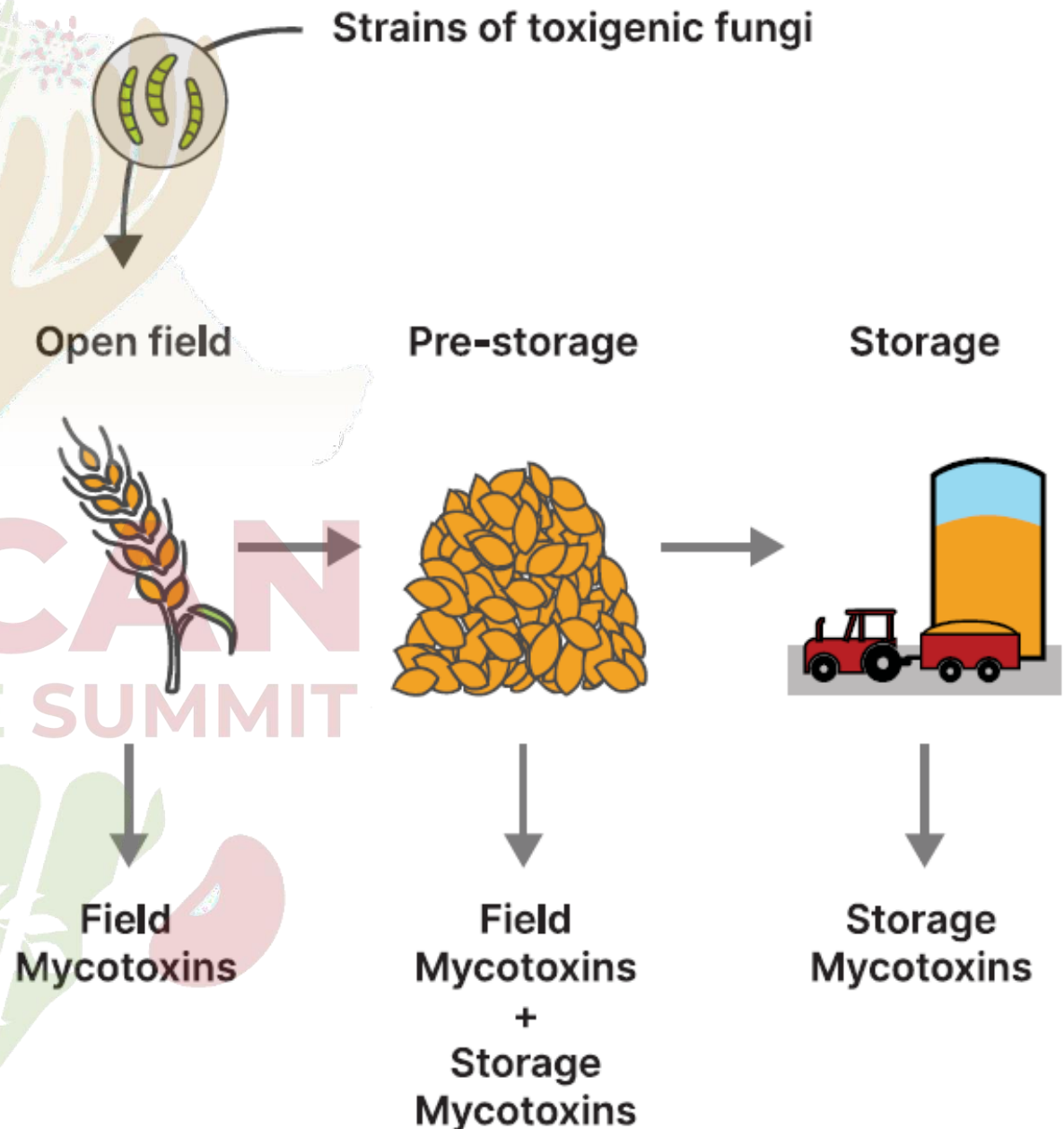


# Contamination with Mycotoxins

## TOXI-SCRUB®

### What creates Mycotoxins like Aflatoxin?

- Starts in the field
- Grows after harvest if grain not dried properly
- Continue to grow in silos therefore aeration control important
- Aeration and Moisture control is the keys to SAFE grain storage ... and MUST be automatic



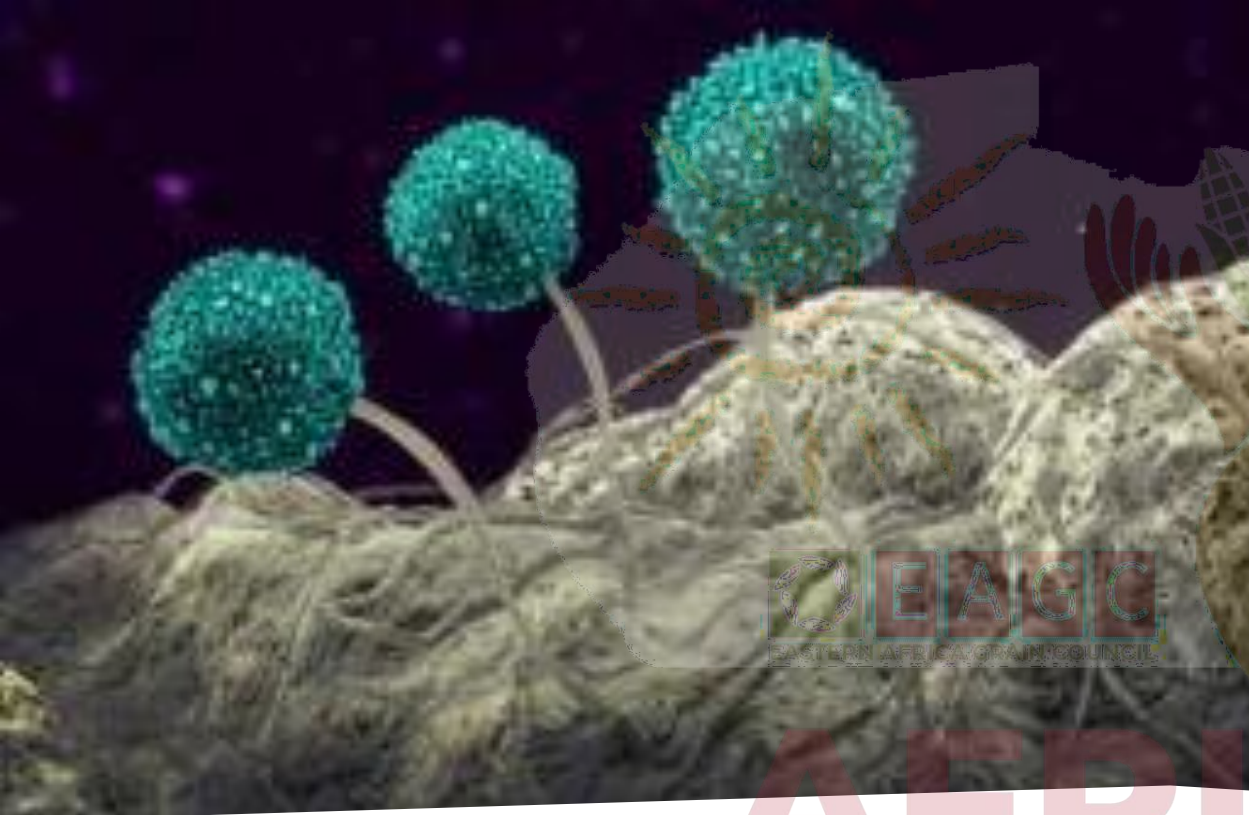




## CONTAMINATION OF CORN / MAIZE

Contamination starts already in the field by air-borne fungus spores. Climate change are partially responsibly for contamination. Once the fungus has started to thrive ... they will never go away ... trillions of spores will spread





## CREATION OF MYCOTOXINS: FIRST YOU HAVE FUNGUS

Nature is incredible! Some funguses are very aesthetic. They multiply abundantly via the spores, that's why grains are already “contaminated” with spores on the surface in the field. More than 1000 on each seed !

# TOXI-SCRUB® IN SOROTI, UGANDA

# TOXI-SCRUB®

Contaminated  
Buffer Silo

Reactor  
Ozonation

Ozone generator  
in 40' container





# CROSS-SECTION VIEW OF THE TOXI-SCRUB® PROCESSING LINE AND THE ASSOCIATED MATERIAL HANDLING

Process flow:

Cleaning

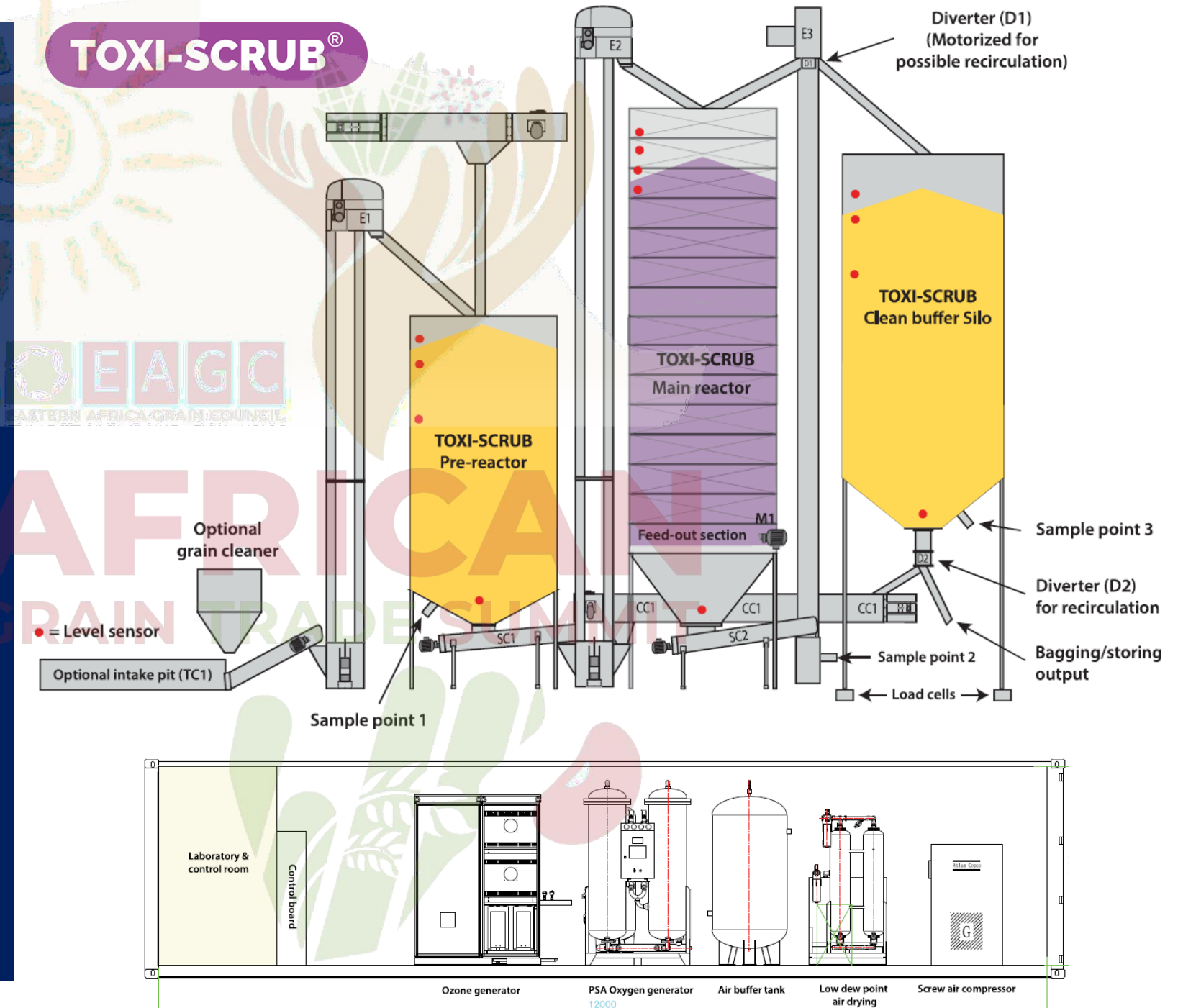
2 step reactor

Possibility to Recycle

Ongoing sampling

Ongoing testing

## PROCES CONTROL IN CONTAINER WITH OZONE GENERATOR



# TOP VIEW OF THE TOXI-SCRUB® PROCESSING LINE

**TOXI-SCRUB®**



Molecular Oxygen sieve



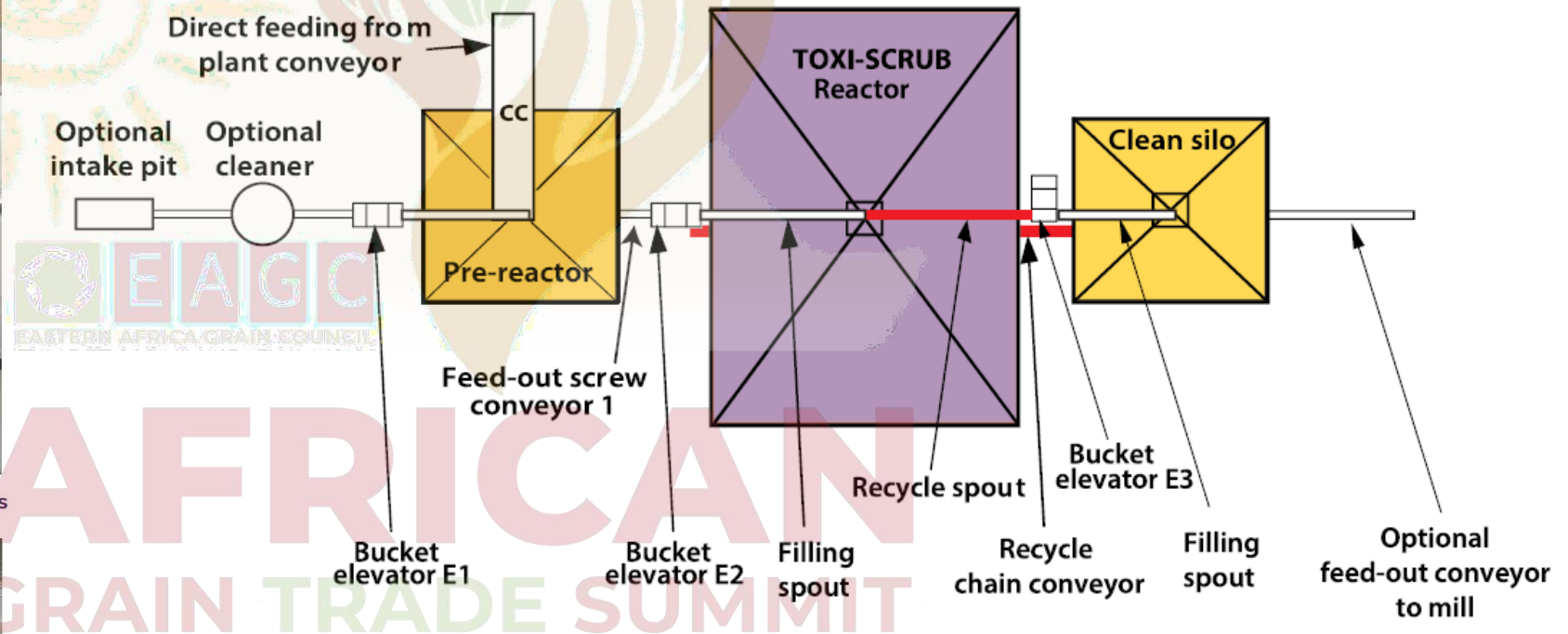
Freeze dryer and drying columns



Container section with Ozone generator board and control panel



Compressor



**TOXI-SCRUB® control container**  
One or two, depending on capacity  
40' HQ

Control board

Laboratory  
&  
control room

# TOXI-SCRUB®

## The distinct advantages of TOXI-SCRUB®

- Reduces greatly AFLATOXIN and other MYCOTOXINS
- *Kills ALL* insects + Mites + Fungus + Bacteria
- Makes GOOD GRAIN out of CONTAMINATED GRAIN
- SAFE storage for up to 1 year after treatment

### Treatment Cost:

- Costs about \$ 3 - 5 per ton – depending on commodity and other factors
- This is only 0,005 Cent/Kg = UGX 20/Kg = KES 0,75/Kg





**TOXI-SCRUB®**

# HOW TO MOVE FORWARD IN EAST-AFRICA?

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**SAFE GRAIN IS THE RESPONSIBILITY OF EVERYBODY ... AND *MUST* BE ACHIEVED**

**CASE EXAMPLE**

**OGWAL'S UPCOMING MICRO MILL**  
**IN COOPERATION WITH TOXI-SCRUB® DENMARK**



**AGRO SUPPLY**

**NEW CONCEPT FOR SMALL SCALE MILLING**

**PROVIDING A *SAFE GRAIN* APPROACH TO  
ENDING POVERTY FOR FARMERS**

**BEJA ANDREW**

**HEAD OF SALES & MARKETING**

**JOSEPH OGWAL**

**FOUNDER AND INSPIRATOR**





# AGRO SUPPLY MILL PROJECT



- Farmers first
- Fair Trade
- Agro Supply trades with 20.000+ farmers in Uganda
- Sustainable production and growth
- NO compromise on grain and food quality
- TOXIN free products
- Supporting sustainable farming





# INTRODUCING THE CLEAN MICRO MILLING CONCEPT



Cooperation Partner and  
Designer of the Micro Mill

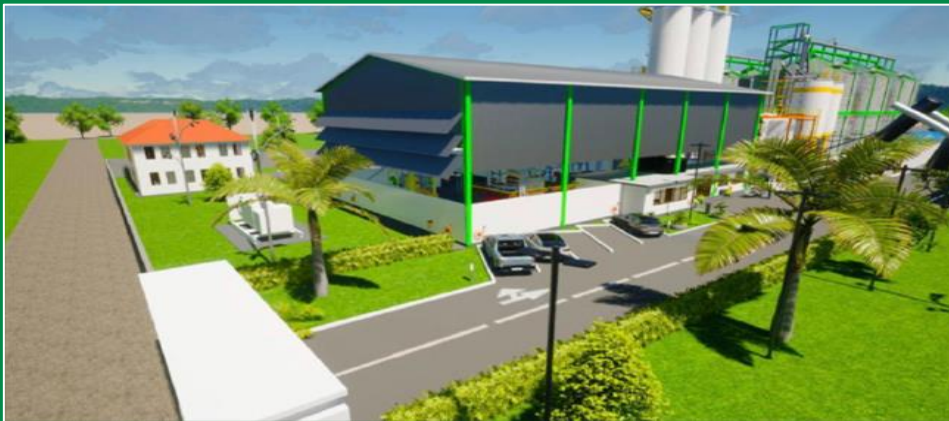
**TOXI-SCRUB®**

- Intake from farmers and supply partners
- Cleaning of grain to keep it safe
  - Magnet – Aspiration – drum cleaning – vibrating table cleaning –
  - RGB color sorting – UV Color sorting (first Mycotoxin removal step) – possible re-bagging
- Drying when required
- TOXI-SCRUB® treatment for detoxification
- Storage – 6 silos with 50 ton capacity – later more
- MILLING - Up to 4 Ton Corn Per Day
- MILLING STEPS
  - Intake – Degerming or whole grain milling - Tempering – Hammer milling – Roller Milling – Sifting
  - Milling adjustment options: Uganda Style or Kenya Style flour as required
- PACKAGING
  - Line 1: 1 Kg or 2,5 Kg paper bags
  - Line 2: 25 – 50 Kg bags

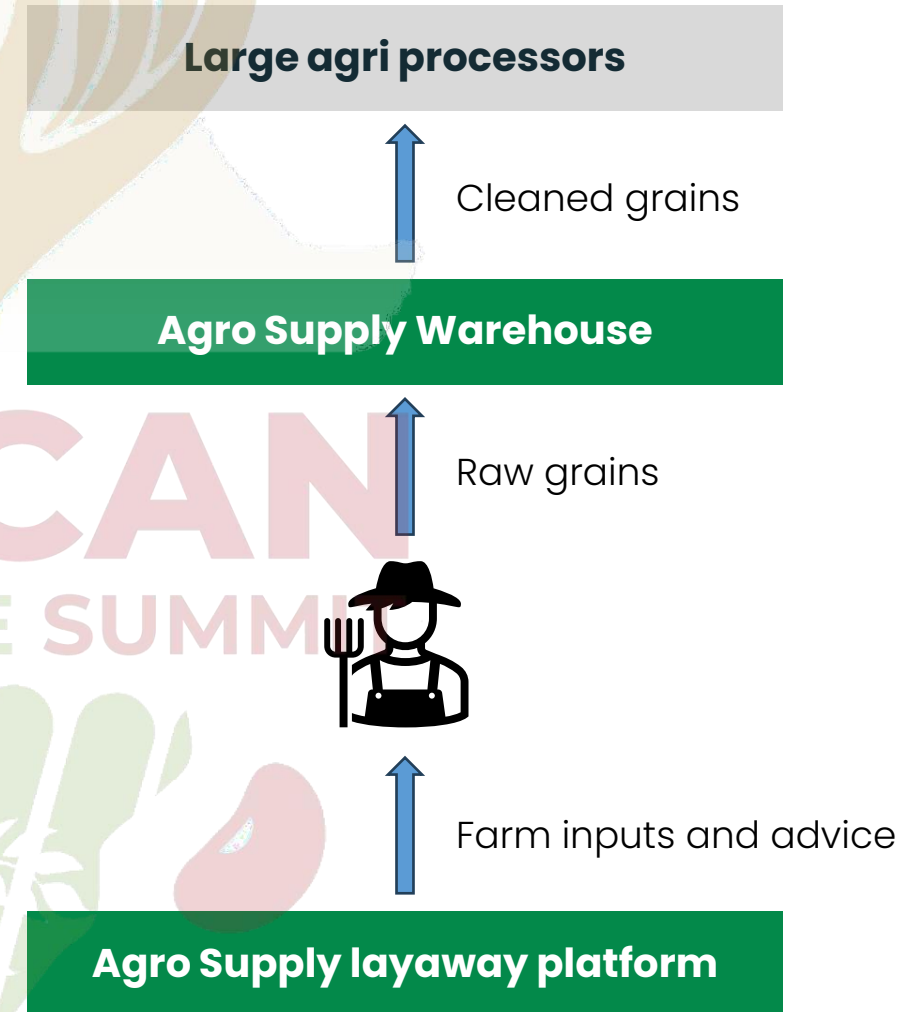
# The planned facility

The mobile layaway and inputs supply is now successfully operational. Now, we are planning to set up an agro-processing factory to offtake the fresh grains from our farmers, guaranteeing a stable and beneficial sales market. The factory comprises of:

- Warehouses to stock the sourced grains
- Aflatoxin removal equipment (ozonation technology from Denmark)
- Grain mill
- Laboratory
- Infrastructure



# Our holistic intervention





**TOXI-SCRUB®** Detoxification



**Agro Supply**

together we farm for the future

**Thank you for  
listening!**

