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NEW TRENDS IN MONITORING STORED WHEAT WITH CO2 SENSING

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TOXI-SCRUB®

Toxi-Scrub is the trade mark for detoxificating **Mycotoxins** like Aflatoxin and Fumonisin

iGRAIN is the trade covering all Silo Monitoring Products

CROP-PROTECTOR is trade mark for OZONATION and CHILLING Machines

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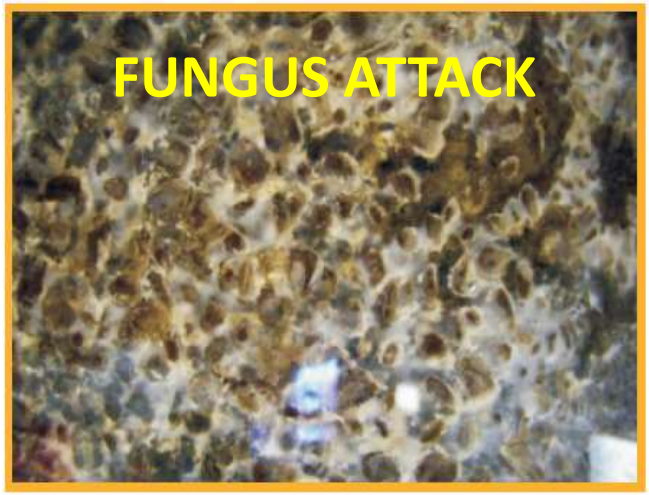
STATE OF THE ART - GRAIN MONITORING

Scope of this presentation

- **What is NEW and IMPORTANT in Grain Monitoring?**
- **HOW can commodity assets be preserved best possible?**
  … and secure less losses for increased profitability
- **Experiences from storage sites and flour mills**
- **Portable iGRAIN CO_2 Sniffer**

WHY GRAIN MONITORING?

Grain is obviously a food resource for many organisms
Stored commodities will be attacked if they are not protected



BIOLOGIC ACTIVITY IN THE GRAIN

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

Many scientists recommend monitoring total metabolism = CO_2 in the grain mass

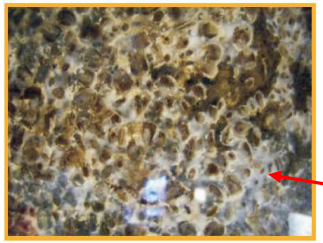
Organism + O_2 + Feed (Grain C) $\longrightarrow$ Heat + H_2O + CO_2

Traditional Temperature Monitoring

New Advanced Monitoring CO2 SNIFFER

Insects

Time … with increased moisture generated by insects



Fungus

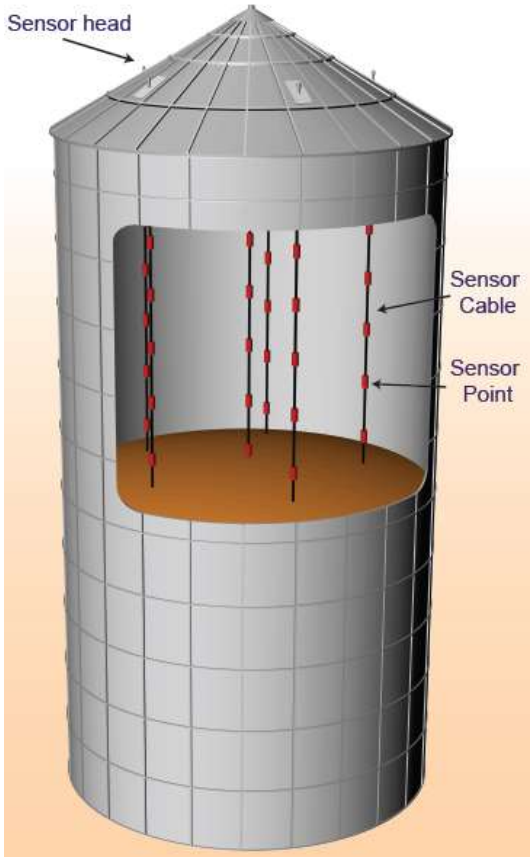
Mycotoxin as result of fungus

THEREFORE….

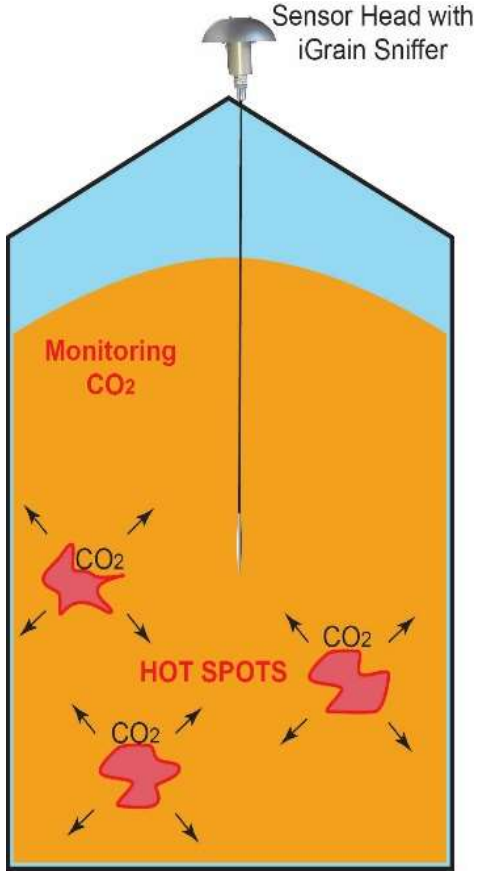
BEST MONITORING … MUST BE

- The ***earliest*** possible detection of spoilage and shrinkage - *That* is essential for optimization of resource management and profit optimization
- ***CO_2 sensing*** has proven most effective according to the industry leading scientists
- ***CO_2 sensing*** is the ONLY way to prevent Mycotoxin contamination efficiently

WHY IS TEMPERATURE MONITORING NOT EFFICIENT?



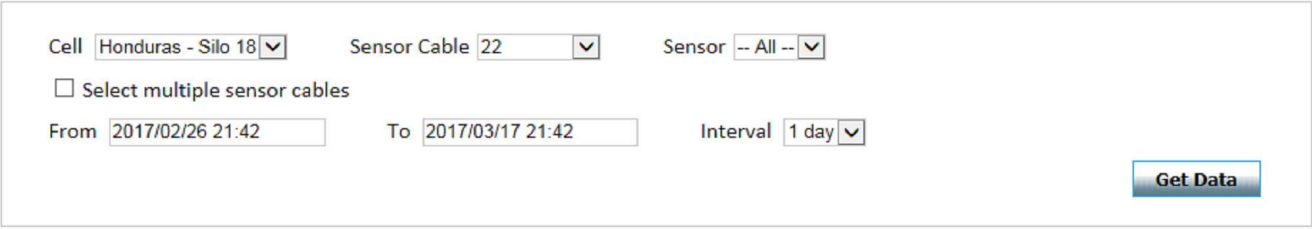
- The grain is very insulating and HOT-SPOTS are discovered too late
- Temperature monitoring stems from 25 – 50 years ago … when no other technology was available
- ONLY CO_2 Monitoring responds as soon as HOT-SPOTS start

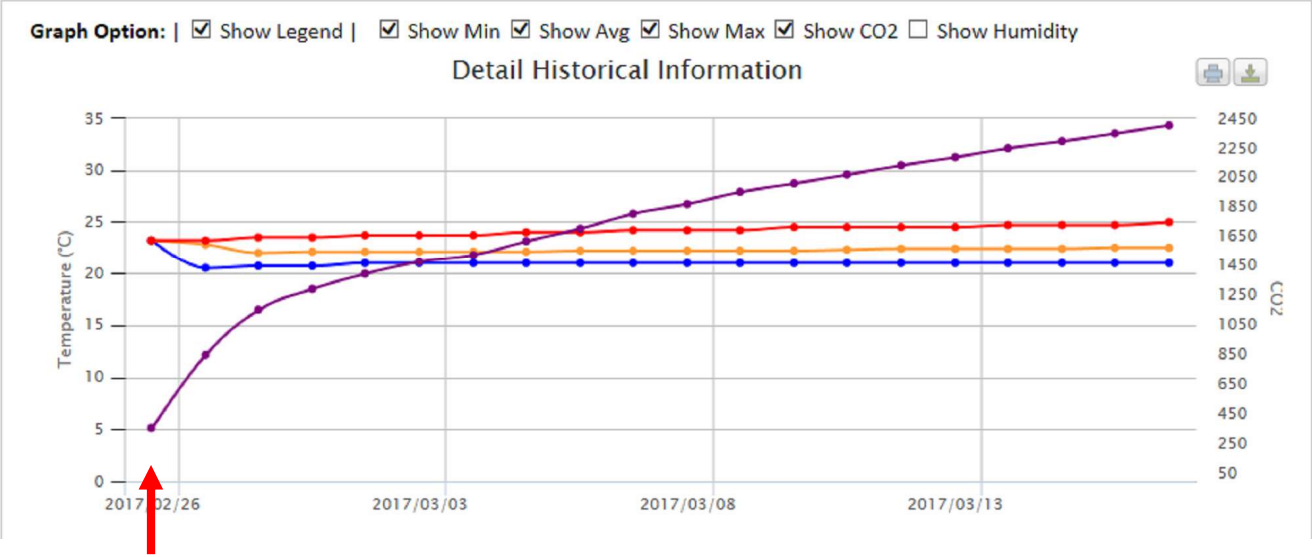


How is Practice?

Observe:

- HIGH (RED) Temp sensor is almost stable
- CO_2 moving up from day one of loading the bin
- CO_2 concentration reaches 2400 ppm within 18 days
- For sure UNWANTED BIOLOGIC ACTIVITY is progressing in the bin
- A HOT SPOT is only vaguely indicated by the temperature curve

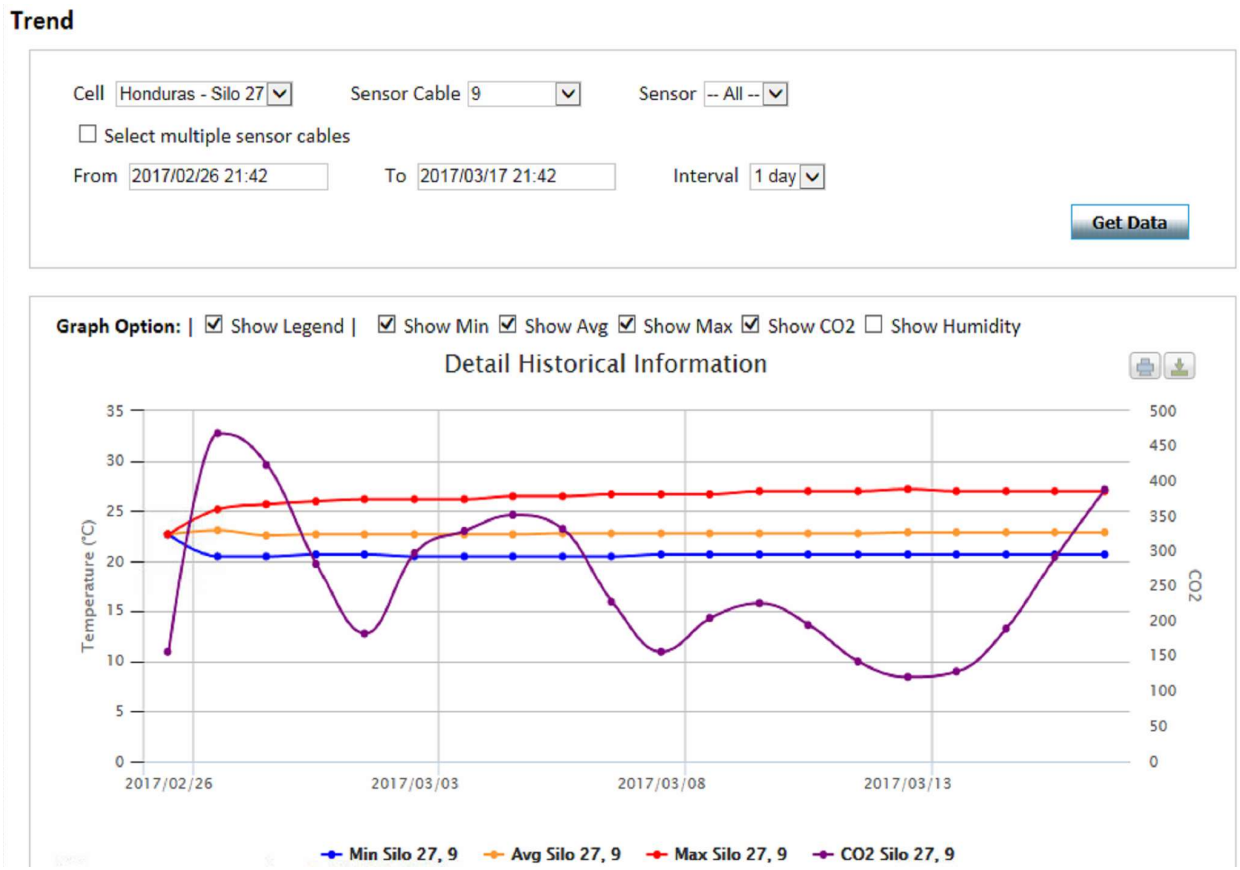




EXAMPLE - NO INFESTATION

Observe:

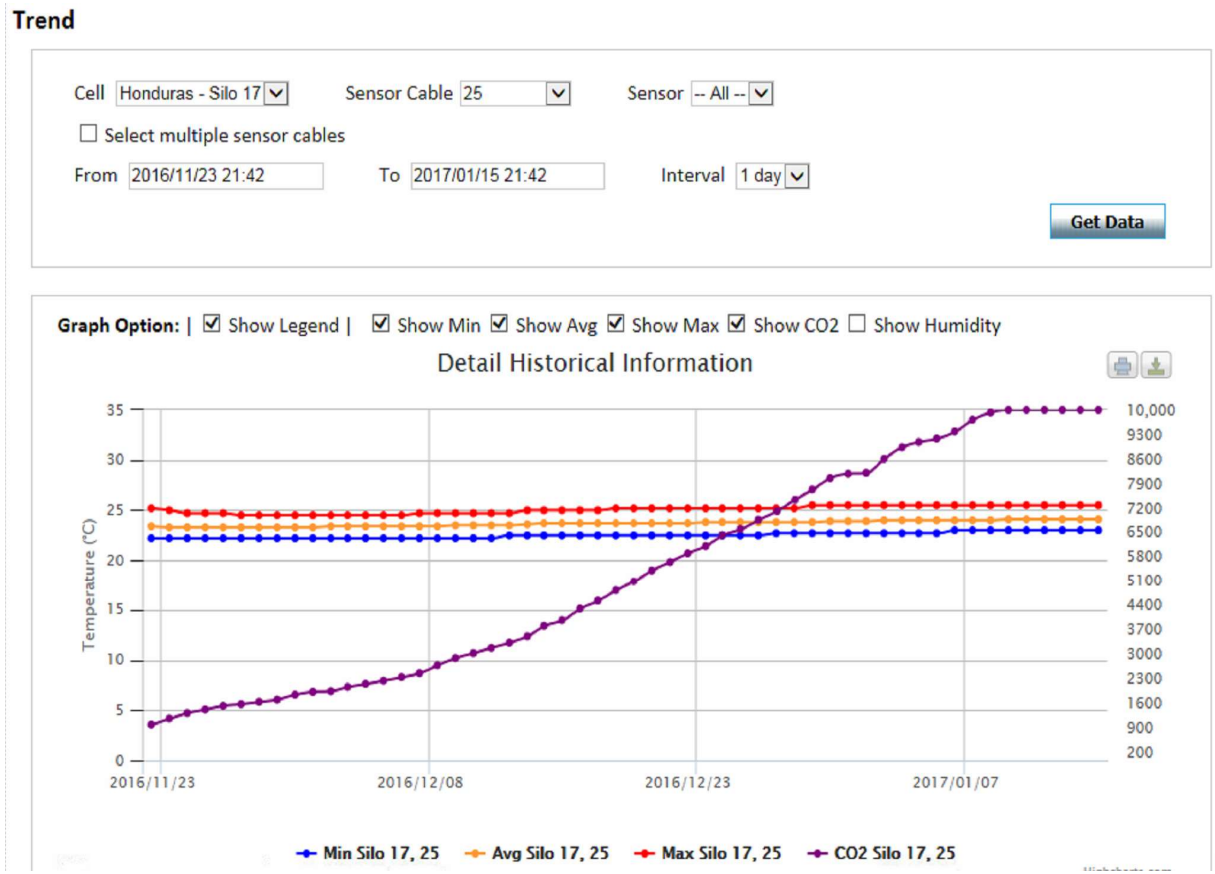
- HIGH (RED) Temp sensor is stable
- No increasing gap between HIGH (RED) and AVERAGE (ORANGE)
- CO_2 level moving close to the ambient level - and NO steady increase
- Fluctuations caused by windy conditions
- **NO** infestation in this bin!



EXAMPLE - TOTAL SPOILAGE

Observe:

- HIGH (RED) Temp sensor is VERY stable
- No increasing gap between HIGH (RED) and AVERAGE (ORANGE)
- YET CO_2 level increasing steadily!
- Reaching 10.000ppm = 1% in 40 days! HEAVY INFESTATION.
- This is REAL SPOILAGE!
- This shows the POWER of CO_2 Monitoring



iGRAIN MONITORING SOLUTION

Priority hierarchy

- iGRAIN SNIFFER to ***quantify*** the problems
- Also check temperature (with MUCH reduced sensor cable number)
- Moisture is also helpful in many cases

Operational issues

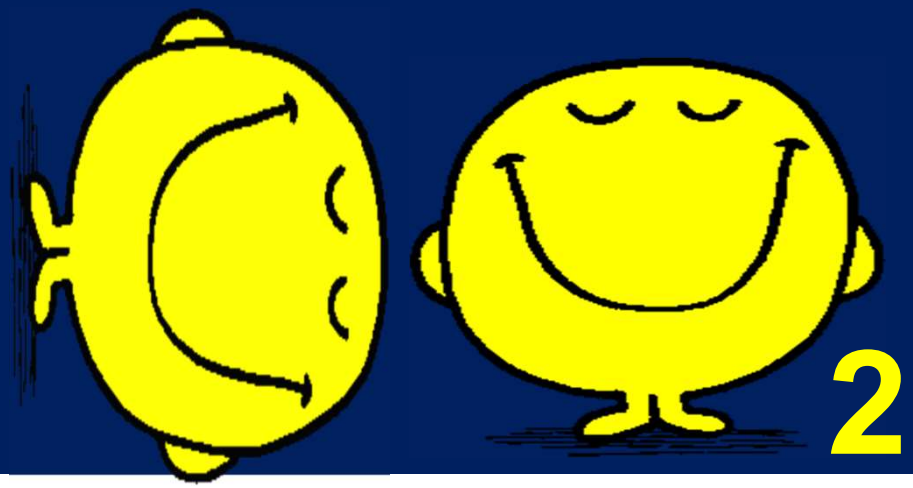
- It is difficult for staff to get a good and complete overview
- iGRAIN has created ASSISTED MANAGEMENT
- with HACCP report – generated automatically every day primarily based on CO_2 Sensing

DAILY HACCP REPORT – BASED ON CO2 MONITORING

CCP points and overview – silo with 6 cells : *WORST to BEST*

Silo	% Full	Ton	Grain Quality*	Relative Rating	T(max)	T(avg)	T(min)	CO2
HACCP			CCP 1			CCP 3		CCP 2
Silo 4 WORST	88	854	5,1	1 / 6	29.5	28.1	19.7	2943
Silo 1	92	1044	3,6	2 / 6	32.3	31	22.2	1904
Silo 6	73	698	3,4	3 / 6	29	25.6	16.2	2101
Silo 3	30	288	2,7	4 / 6	28	26.8	25.2	360
Silo 2	11	120	2,3	5 / 6	29.4	25.6	16.2	411
Silo 5 BEST	98	1086	1,4	6 / 6	26.7	26.8	25.2	317

CO_2 SNIFFING - THE FUTURE OF GRAIN MONITORING



Thank you for listening

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CROP-PROTECTOR - Ozonation and Chilling

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