CO_2 Production As Early Indicator Of Pest And Fungal Infestation: Effective Tool For Post-harvest Decision Support System In Stored Cereals

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Introduction

At present, temperature (T) and sometimes relative humidity (RH) sensors are used in stored grain silos to monitor quality and detect changes that may be related to initiation of mould growth or pest infestation. Spoilage can cause significant quality deterioration and nutritional losses. However, because grain is a good insulator, changes in temperature occur slowly. Most stored commodities respire naturally and produce CO_2 which permeates the intergranular air spaces significantly more rapidly than changes in temperature in a grain bulk.

Aim

Evaluate the increase of T and CO_2 of naturally stored grain in real time under different environmental conditions.

Experimental Design and Results

Lab Scale (1.5kg wheat)

- Wheat conditioned to different moisture contents (15.6, 20, 24, 31% m.c.) placed in 5L thermos flasks.
- Stored at 15 and 20°C.
- CO_2 and T were monitored in real time with integrated sensors every 30 min for 1 month.

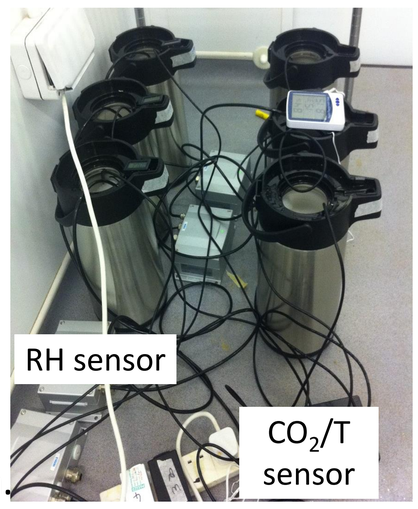


Fig. 1 Sensors in thermos flasks with wheat grain

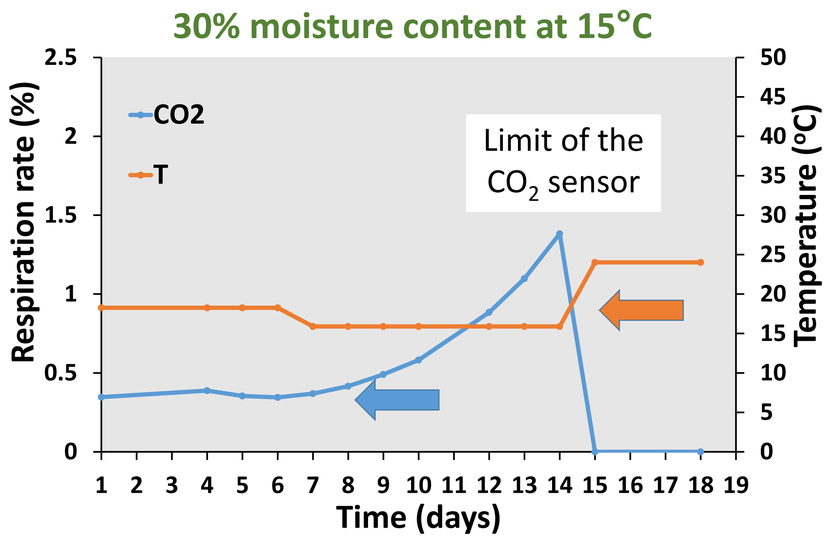
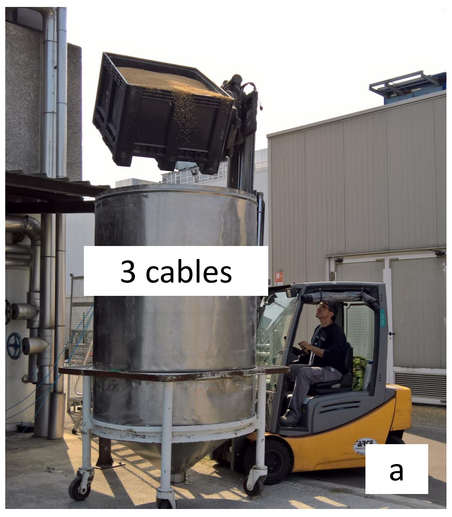
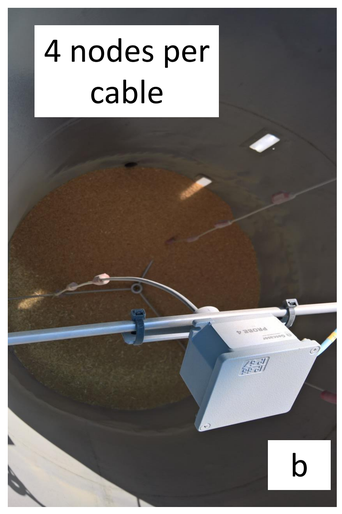


Fig. 3 T and CO_2 temporary changes on natural wheat grain

- In wet grain 30% m.c. at 15°C CO_2 increase after 7-8 days while T increase after 14 days.

Pilot Scale (2 tonnes)





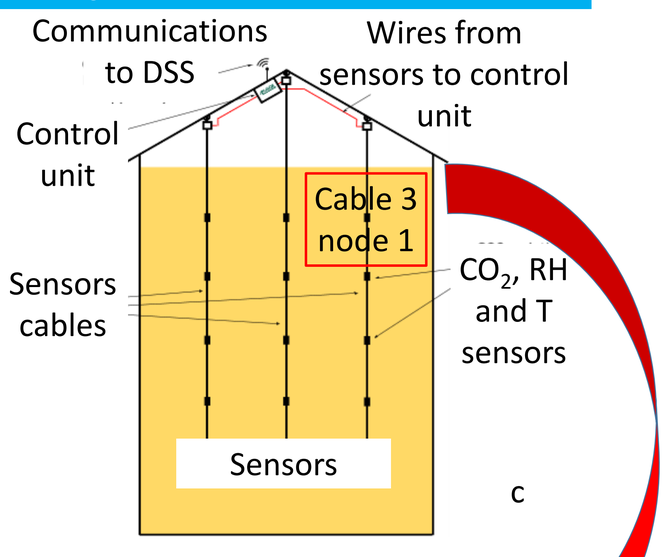


Fig. 2 a) Pilot silo, b) Cable detail and c) Graphical representation of nodes inside the silo

- Wheat placed in 2 pilot silos in Parma, Italy from 08/2017 until the present time (06/2018).
- CO_2 T and RH were monitored in real time with integrated sensors every 30 min.
- On 4th of May dry wheat (12.5% m.c.) of sensor 1 of the cable 3 was removed and substitute for wet wheat grain (18% m.c.).

Table 1 Changes on T, CO_2, and RH

Data	03/05	04/05	10/05
T C°	21.4	24.1	24.6
CO_2 ppm	950	830	8260
RH %	40.4	75.5	88.4

- Earlier changes in CO_2 were detected for the sensors when the mc of the wheat was increased prior to temperature or RH changes.

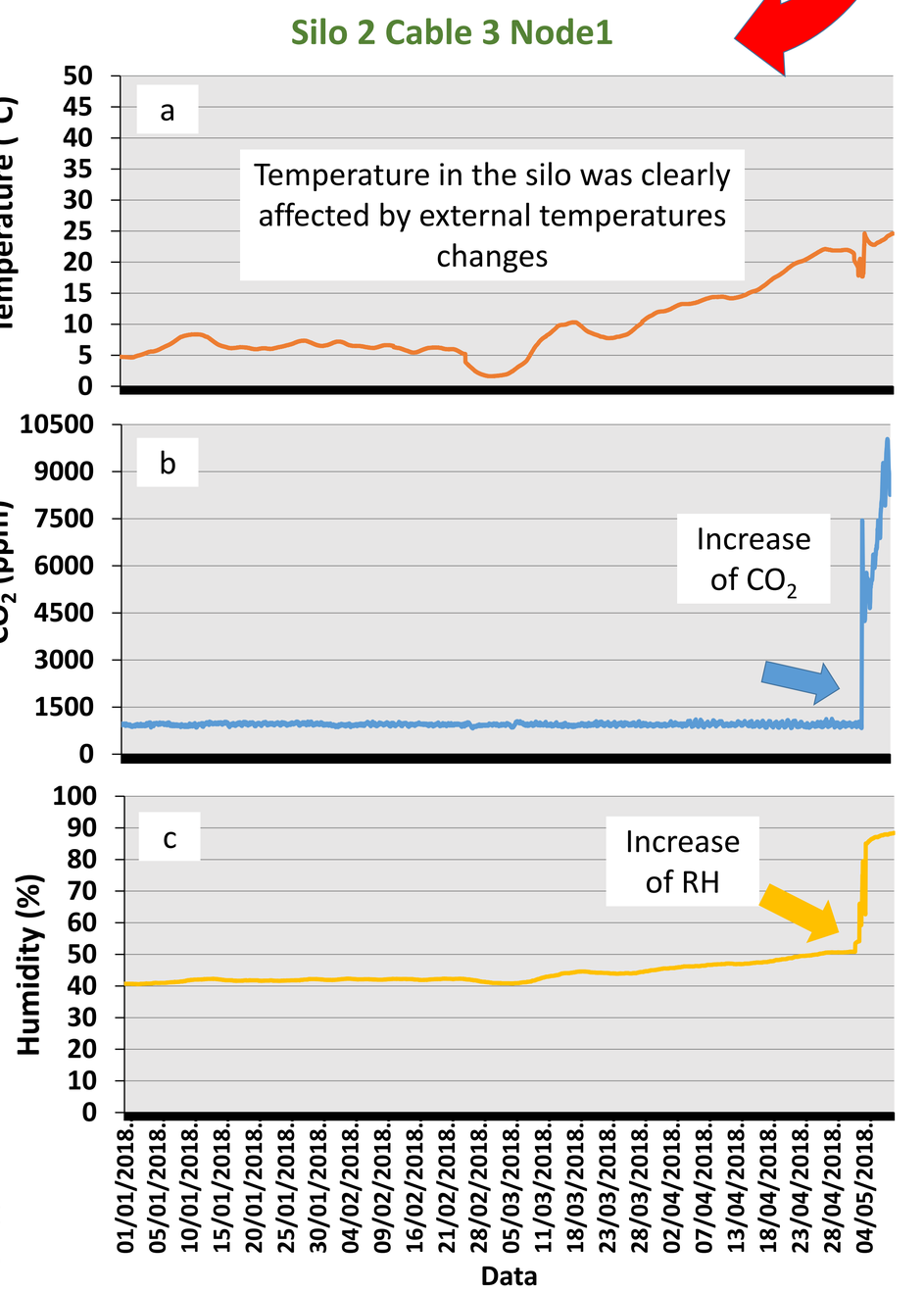


Fig. 4 (a) Temperature, (b) CO_2 and (c) RH temporal changes on natural wheat grain after increase in the m.c. from 12.5% to 18%

Conclusions

Results suggests that better management of stored commodities may be possible by real time monitoring of CO_2 to facilitate rapid remedial options to avoid spoilage initiation and the risk of mycotoxin contamination.

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Applied Mycology Group
Deciphering mycological complexity

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