



Investigation of Air Flow Resistance for Maize Cobs Bulk Using an Automatic Test Rig

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Introduction

- Air flow resistance during drying is an important contributing factor to energy consumption.
- Estimation of fan energy requirements involves knowledge of the air flow resistance of dried product.
- In this study, air flow resistance of maize cobs was assessed during drying of maize cobs to investigate the impact of cob shrinkage on the static pressure.

Material and Methods

- The developed test ring had dimensions of $0.8 \times 0.6 \times 1.115$ m with a holding volume of 0.53 m^3 .
- Three batches of 200 kg maize cobs of variety Amadeo were dried at a set temperature of $40 \text{ }^\circ\text{C}$.
- Pressure was measured at 0.00 to 1.115 m of the bulk height and air velocity varying from 0.0 to 1.0 m s^{-1} .
- Moisture content of maize was analysed using oven method.

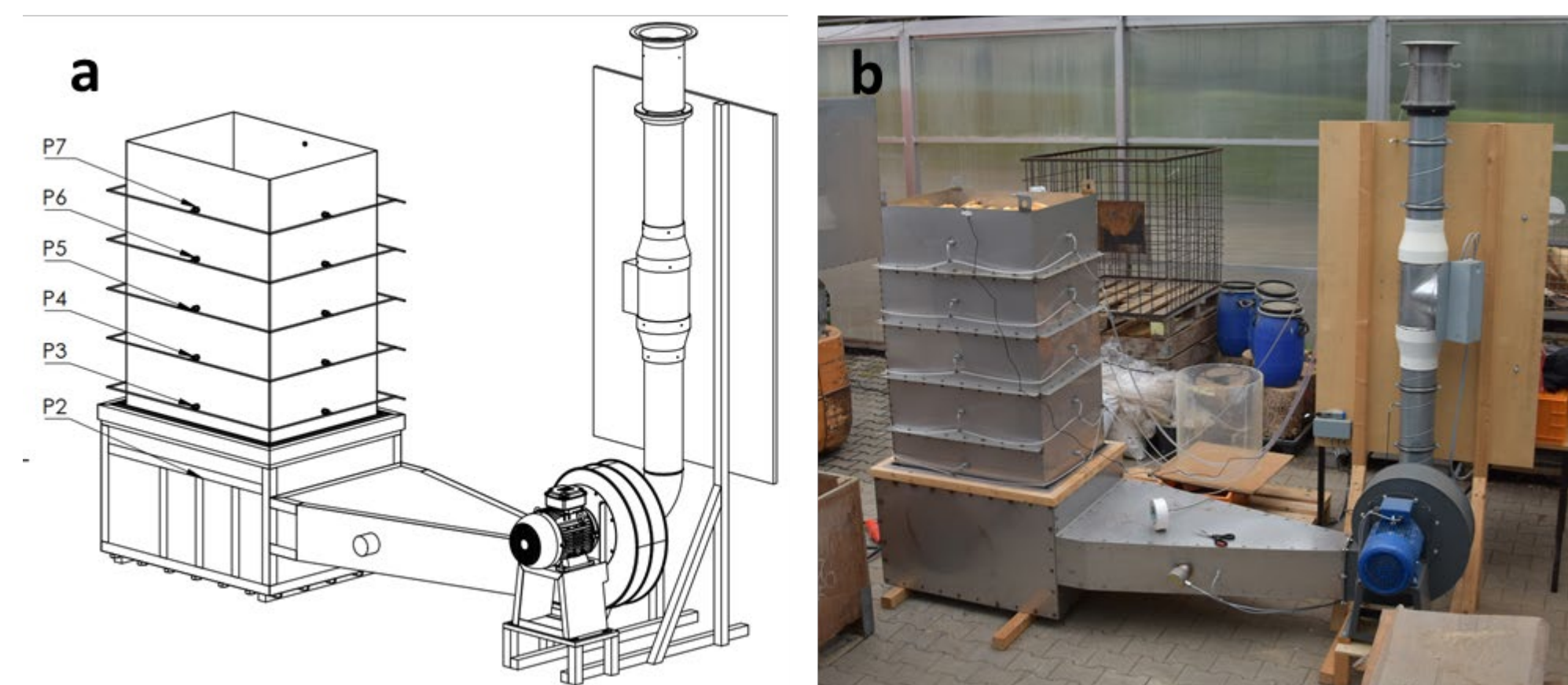


Fig. 1. the automatic test ring.

Results

- The maize bulk shrank from 1.115 m to 0.9 m through out the drying process.
- Shrinkage of cobs resulted in density reduction from 409.43 to 354.80 kg m^{-3} .

Table 1. maize volume and bulk density during the drying experiments.

Stage of drying	Volume (m^3)	Bulk density (kg m^{-3})
Beginning	0.53	409.43
End	0.48	354.76

- The temperature and relative humidity varied between 30 to $40 \text{ }^\circ\text{C}$ and 20 to 40% , respectively.
- The drying of maize cobs was slow as equilibrium moisture content was reached after 2 days.

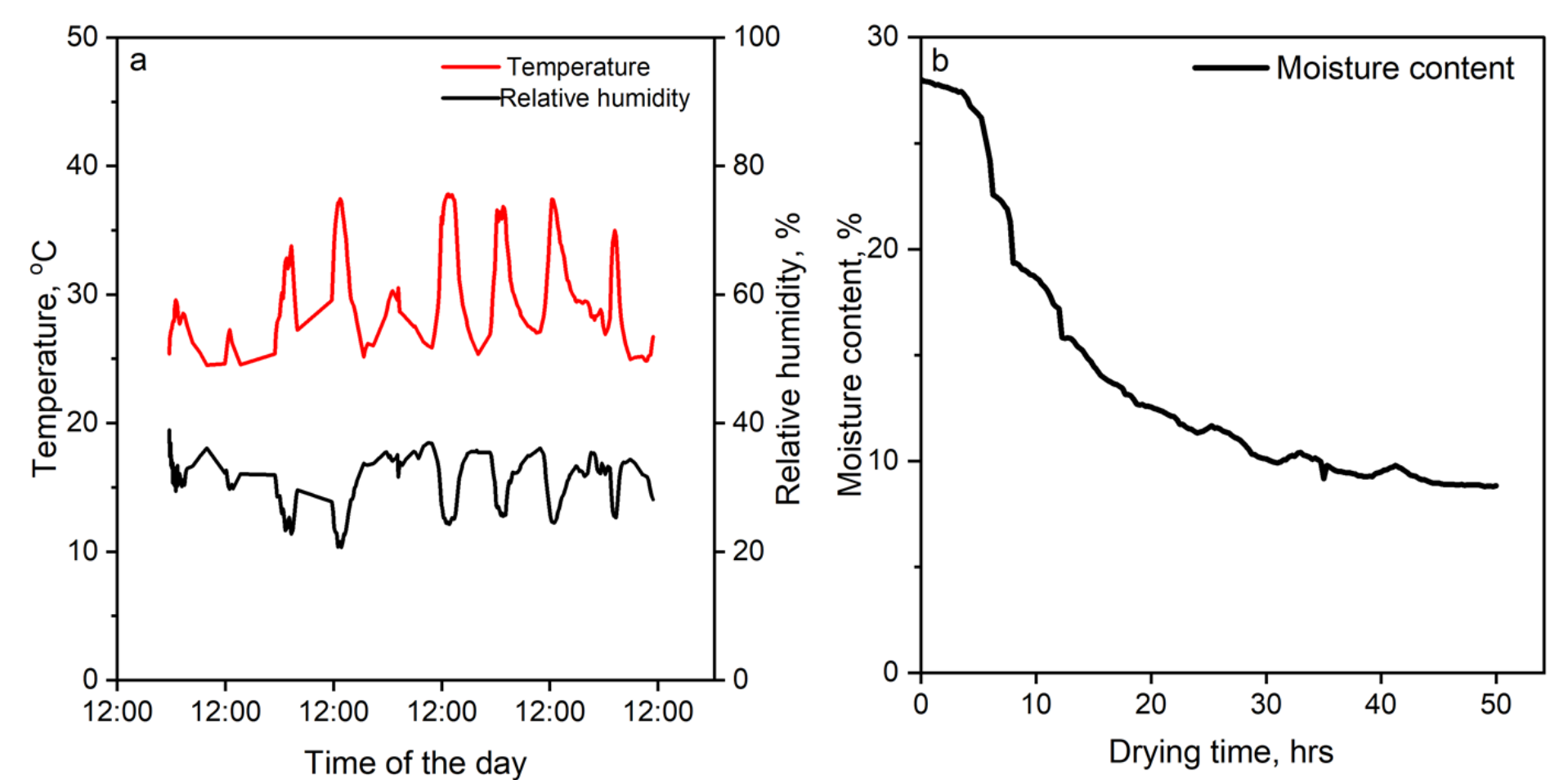


Fig. 3. temperature and humidity (a) and drying curve (b), $n=3$.

- The measured static pressure was 329 Pa at the bottom of the bulk and 55 Pa at 1.115 m of the bulk height.
- Pressure dropped at the end of the drying to 275 Pa and 32 Pa at bottom of the bulk and 1.115 m , respectively.

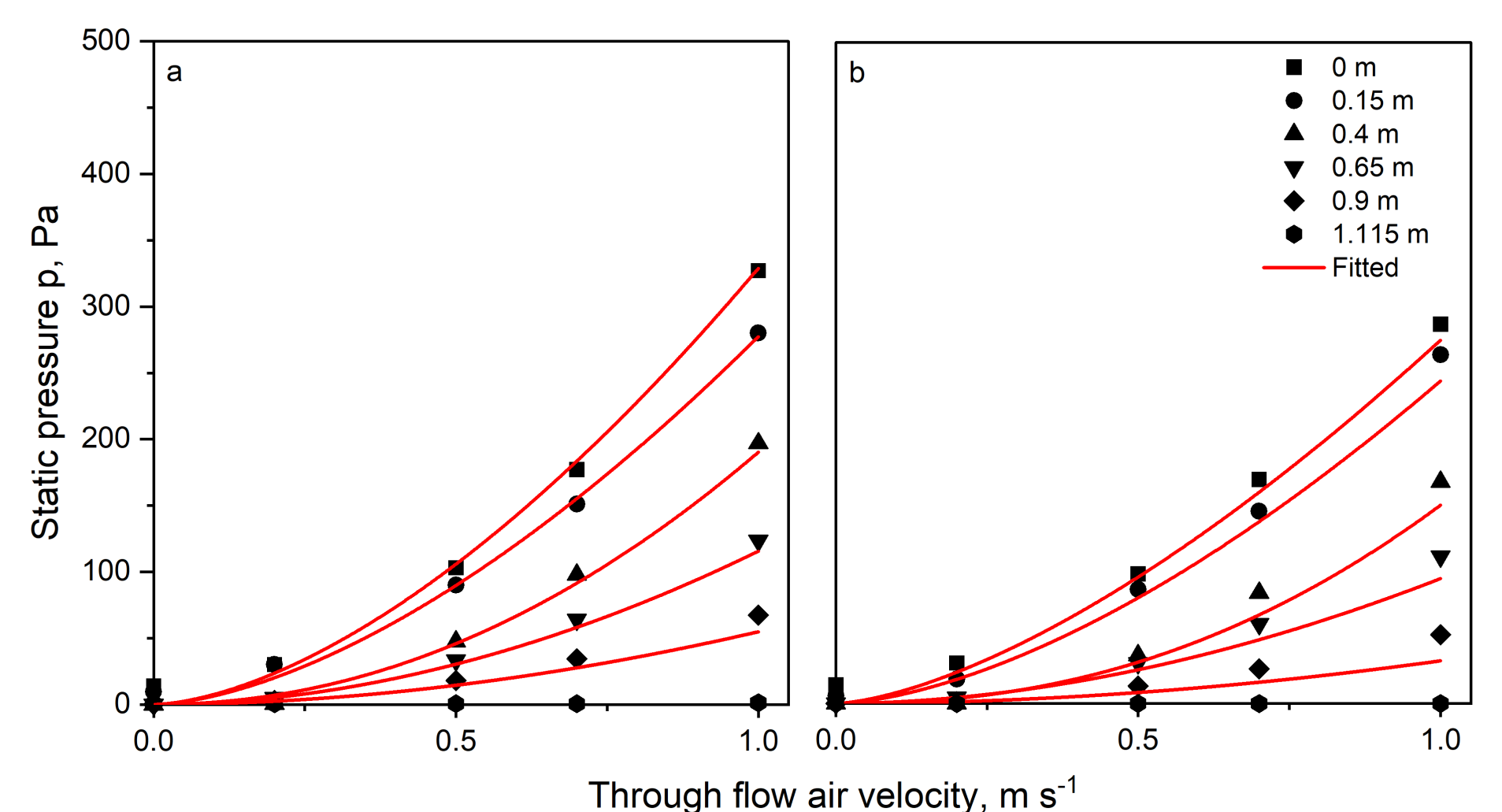


Fig. 4. static pressure at the beginning (1) and end of drying (2), $n=3$.

Conclusions

- The static pressure of maize cobs bulk was relatively low.
- There was a significant drop in static pressure due to reduction in maize bulk as a result of cobs shrinkage.
- Although maize cobs dry slower compared to grains, it is possible to use a PV powered fan for maize cobs drying as a strategy to save energy.

