Effect of airflow rates on moisture content and drying air profiles during cross-flow drying

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Cross-flow drying

On-farm cross-flow dryer

Cross-flow drying

Research gap

Limited research on moisture content (MC) and drying air profiles within a cross-flow rice drying column, and the impact of airflow rate on these profiles

Goal

Improve the rice drying process

Milling yield

Dryer performance

Energy-use efficiency

Dryer throughput

Overall goal

1. Generate data to validate a mathematical model describing cross-flow dryer operation
2. Recommend optimum airflow rates for cross-flow dryers

Objectives

1. Experimentally simulate a cross-flow drying column so as to measure MC and drying-air profiles throughout the column
2. Quantify the impact of airflow rate on these profiles
Experimental design (full factorial)

FACTORS
1. Initial moisture content (IMC) [20.5% and 16.3%(wb)]
2. Drying-air conditions
   i. Temperature (T) and relative humidity (RH) at inlet [60°C/12% RH]
   ii. Airflow rate of the drying air [0.36, 0.46, or 0.56 (m³/min)/ft²]
   iii. Drying duration [30, 60, or 90 min]

RESPONSES
1. MC of rice after the drying duration
2. T/RH of the drying air throughout the drying column

From “basket number” to “distance from the HAP”

MCs after 30 min of drying

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<th>Cultivar Roy J</th>
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<th>RESPONSES</th>
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From “basket number” to “distance from the HAP”

MCs after 30 min of drying

20.5% Initial MC
May 23, 2017

**Table:**

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<th>Temperature (°C)</th>
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<td>Medium</td>
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<td>High</td>
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**Graph:**

- **Drying air profile after 30 min of drying: 16.3% Initial MC**
- **Drying air profile after 30 min of drying: 20.5% Initial MC**
- **Drying air profile after 30 min of drying: 16.3% Initial MC**

**T/RH responses throughout the 90-min drying duration**

- **Temperature profile throughout drying duration: 20.5% Initial MC**
- **RH profile throughout drying duration: 20.5% Initial MC**

**Notes:**
- Different drying durations
- **Dependent variable**
- **Exhaust**
- **Inlet**

**Legend:**
- B1, B5, B7, B10
**Summary**

1. The MC and drying air profiles will enable us model cross-flow drying operation.
2. Airflow rate has a significant effect on MC and drying air profiles.
3. These results will have implications on water use efficiency and dryer throughput.

**Milling yields?**

Poster presentation:

“Effect of tempering approaches after cross-flow drying on head rice yield reduction”

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**Thank you**