DRYING CHARACTERISTICS OF PADDY IN A HOT-AIR BATCH DRYER

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Optimum drying parameters provide high paddy drying throughput, maintain uniform and high-quality paddy, use minimal energy input, and operate reliably with minimal downtime. The drying performance of an electric-powered hot-air batch dryer at the Faculty of Agriculture, Rajarata University of Sri Lanka, was evaluated. Freshly harvested paddy (Bg300) samples at different moisture contents were dried in three paddy bed thicknesses, 0.10 m, 0.25 m, and 0.40 m to evaluate the drying rate, and quality parameters: germination rate, yellowness, cracked grain percentage, and the head rice yield. The influences of paddy bed thickness and initial moisture content and their interactions on drying rate were analysed using a response surface method, and the tri-dimensional response surface was plotted. The experimental data of moisture changes during hot-air drying were modelled with eleven thin-layer drying models. The paddy bed temperature during the experimental time was 35.50 ± 2.67^{0}C. The drying rates of paddy at 0.10 m, 0.25 m, and 0.40 m bed thicknesses were 0.072 $kgkg^{-1}$ of dry solid per hour, 0.054 $kgkg^{-1}$ of dry solid per hour, and 0.029 $kgkg^{-1}$ of dry solid per hour, respectively. The highest germination rate was 62.67% at the bed height of 0.40 m. According to 0.10 m, 0.25 m, and 0.40 m bed thicknesses, cracked grain percentage was 9.0%, 10.9%, and 16.0%, head rice yield was, 21.00%, 28.17%, and 10.18%, and yellowness value was 13.36 ± 0.30, 13.5 ± 0.20, and 13.03 ± 0.20 respectively. The optimum drying rate and quality were achieved by 0.10 m and 0.40 m, respectively. Increasing the drying bed thickness increased the quality of dried paddy but decreased the drying rate. Further, The Henderson & Pabis model showed the best fit to all experimental data with maximum modelling efficiency of 0.997, a minimum RMSE of 0.016.

Keywords: Drying rate, Hot-air drying, Moisture content, Paddy