Tropentag, September 17-19, 2013, Stuttgart-Hohenheim

"Agricultural development within the rural-urban continuum"

Optimisation of Solar Drying for Paddy Rice in the Philippines

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Abstract

Paddy drying remains a main problem in postharvest production of rice. In the Philippines "highway dryers" are used, where wet paddy (rough rice) is spread out in sufficiently thick layers to dry alongside roads and highways. The paddy is raked during drying to continuously mix it to prevent the grain from prolonged exposure to the sun, which causes lower head rice yields and reduced product quality. Automation of rice drying is more difficult than mechanisation of production, because the use of mechanical dryers often requires adaptation of technology into existing postharvest systems. Furthermore, drying is a complicated procedure involving air and crop properties, which require in-depth knowledge of the process. As a response, the present study developed a low-cost solar dryer to reduce drying time during the rainy season and ensure a secure drying process. Field experiments were conducted in the Philippines during the peak harvest period during both wet and dry seasons. The work involved primary data collection and calculation of drying rates, which were then used to evaluate thermal performance of the solar dryer based on solar intensity, temperature and humidity.

Furthermore, there is high correlation between the dryer performance and the homogeneity of airflow distribution, as unfavourable designs often cause uneven drying. Then the arrangement of the inlet ventilators and the geometric design of the solar dryer influence the uniformity of airflow distribution. To achieve an optimised flow distribution, several simulations of the design was perform using FLUENT a Computational Fluid Dynamic software, where fluid flow was optimised without costly experimental repetitions. Results of the field experiments as well as the optimised solar dryer design are presented and discussed.

Keywords: Computational fluid dynamics, grain quality, paddy, rice, solar drying

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