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Influence of Surface Reflection (Albedo) in Simulating the Sun Drying of Paddy Rice

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Abstract: The sun drying of agricultural products is a complicated process involving heat transfer, mass transfer, and variable weather conditions. Surface reflection (albedo), a crop's radiative property, plays an essential role in energy balance, and understanding its contribution can improve the thermal analysis. In this study, field experiments were conducted in the Philippines to explore the influence of surface albedo on the sun drying of paddy rice. First, we implemented energy and mass balance equations in a transient model with the surroundings using a graphical programming language in Matlab/Simulink®. Second, we identified the influence of albedo on the sun drying model by using a sensitivity analysis. Third, we investigated the relationship of paddy rice albedo and the solar zenith angle. Lastly, we integrated the albedo function into the sun drying model. The simulation outputs were validated with field experiments. A better estimation of the measured exit temperature and instantaneous mass were obtained when a variable albedo was applied. This study makes clear that introducing a variable albedo has a positive impact on model improvement. This information is important for application in solar drying technologies, so that the drying process can be better assessed.

Keywords: solar energy; thermal analysis; sun drying; paddy rice; albedo; dynamic modeling