

## **Abstract**

This paper presents a comparison of optimized mixed-mode and indirect-mode natural convection solar dryers for maize. The mixed-mode and indirect-mode solar drying simulation models were validated against results from a laboratory solar dryer with experiments carried out under a solar simulator at the University of Newcastle upon Tyne, UK. The models are now run under variable solar conditions in order to optimize the dryers and compare their performance. The inputs to the simulation models were Zambian weather conditions and materials. The solar drying simulations are combined with the cost of the dryer materials and a search technique that finds the dryer dimensions at the minimum drying cost. Optimization gave a shorter collector length for the mixed-mode solar dryer (1.8 m) than for the indirect-mode dryer (3.34 m) of the same grain capacity (90 kg). The drying cost, annual cost and initial cost of the mixed-mode dryer are lower than those of the indirect-mode although the quantity of dry grain obtained from the mixed-mode for the whole year is less than for the indirect-mode; the drying costs are 12.76 and 16.05 US\$/ton for mixed-mode and indirect-mode dryers, respectively.