Final Report

Improvement of Small-Scale Longan Drying to Increase the Livelihood of Local Producers in Northern Thailand

Submitted to the Eiselen Foundation, Ulm

Juan Carlos González Azcárraga

Universität Hohenheim

Institute of Agricultural Engineering

Tropics and Subtropics Group

November 2007

1. Introduction

Dimocarpus longan Lour. (Sapindaceae), commonly known as longan, is a fruit notable for its nutritional and medicinal value most commonly grown in Asia. Thailand is currently the leading producer of longan in the world, with about a third of the harvest is dried annually (Anupunt and Sukhvibul, 2005). In Chiang Mai, longan has a substantial influence on local income, livelihood and food security. Unfortunately, increased production and competition from producers like China have forced fresh longan prices to decrease. In order to remain competitive and sustainable, drying is an easy, value-adding process for local farmers.

Drying the longan reduces the weight by approximately 66% and makes the fruit available year-round food source. However, for proper storability and optimal market value, dried longan must be free of damage and contaminants and have optimum color and uniform equilibrium moisture content (Mahayothee et al., 2006). Overall, an adequate, consistent drying process is critical in achieving these required standards.

The focus of a recent M.Sc. thesis (made possible by the Eiselen Foundation), was to conduct a performance evaluation of a longan dryer (Gonzalez-Azcarraga, 2006). The drying process was documented and evaluated for the Taiwan-type dryer, the most common longan dryer in Thailand, using different shifting procedures. Experiments monitored drying conditions and product quality. Results showed that air velocity and temperature distributions were heterogeneous for all experiments. Difference in drying conditions influenced the drying rate for samples at various positions in the dryer. As a result, product quality was affected. Only samples in certain positions of the dryer did not show significant differences when compared to a standard sample. It was also observed that one shifting scheme was more optimal in terms of end product quality.

Non-uniform drying is a problem that affects quality, storability and market value of dried longan and small-scale drying industries currently operating in northern Thailand are largely affected by inconsistent product quality. Furthermore, the dryers being used have low energy efficiency, while the price of fossil fuel is increasing. This contributes significantly to increased costs, decreased profitability and questions the sustainability of longan drying operations. Several ideas have been suggested to remediate this problem, but so far none have been investigated on site in drying facilities. The present solution to improve drying uniformity is to shift and rotate the longan bulk during drying, but for some facilities, especially the smaller ones, this is time consuming, labor intensive and damages the fruit.

A second problem is heat losses through the floor of the plenum and walls of the dryer that decrease the efficiency of the dryers. This may be restrained by using insulation materials, a solution that so far has not been investigated. Insulation has been proposed and installed in some drying facilities, but no scientific evaluation has been made. Analysis of temperature distribution in the previous study showed values consistently decreased towards the sides of the dryer. At this particular drying facility, the dryer walls were insulated with plywood and rice husk. However, this approach is believed to be insufficient for effectively insulating the dryer and optimizing energy consumption based on the results (Gonzalez-Azcarraga, 2006).

An attempt to improve air distribution using deflectors was studied in laboratory experiments with a reportedly high degree of success (Janjai et al., 2006). The study designed an intricate series of air deflectors based on airflow simulations. Laboratory test showed greatly improve air velocity distribution in a modified dryer with 30 cm bulk height. However, the evaluation of field implementation of such technology has not been undertaken to date.

The objective of this research is to test on the field several modification on the Taiwan-type dryer in terms of airflow and temperature distributions, which are essential to obtain a uniformly dried product of high quality throughout the bulk. Also, a precise, scientific attempt to evaluate energy consumption and measure efficiency of the dryer is required. This research will complete the information gaps that currently exist, test new technologies to improve longan drying and transfer knowledge to local people.

More efficient dryers with simple and low-cost modifications could be easily adopted by many drying facilities, increasing sustainability of drying operations. This will contribute to the livelihood of the farmers by generating income, decreasing operation costs and increasing product value. Based on the thesis results, the main improvements to obtain a more consistent high quality product in the Taiwan-type dryer are to increase the uniformity of air velocity and temperature distribution in the bulk.

3.5 Knowledge Transfer

The results of the experiments were presented to the local farmers by conducting technology transfer interviews. Descriptions of the modifications were explained to different operators of drying facilities who gave their opinion about the results and modifications made to the dryers. During the interviews, the owners of drying facilities showed interest for the solutions presented to what seemed to be a common problem for all of them. Some others showed their own solutions to the problem and all the ideas were gathered and presented to other drying facilities (Fig. 14). Most of the farmers were willing to test different ideas, but the determining factor to adopt one idea over the others was the costs of the modifications. Future research should test all existing ideas to find a balance between ease of modification, costs and effectiveness.

4. Conclusions

The air deflector modifications in the plenum had a noticeable impact on airflow distribution in empty dryers, but influence was less noticeable in full dryers. However, drying consistency of the bulk was not improved and efficiency was not increased. The best results in terms of bulk dryness were obtained using insulation. This was also the experiment that showed a better calculated efficiency in the modified dryer.

All interviewed farmers were familiar with the problem of non-uniformity in longan drying and were willing and interested to test modifications resulting from our work and from other farmers in order to solve the problem. However, cost would the determining factor to adaptation of new technologies Thermal photography will be a useful tool to obtain data for modeling and will be used more extensively in future research.