LOW-COST SEED DRYER

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Introduction

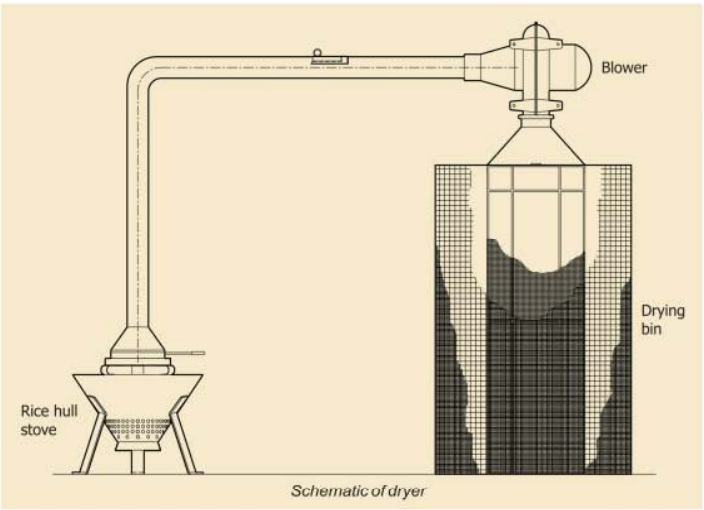
Rice farmers in Asia often rely on their own seed reserves for rice production. Farmers frequently report on the low quality of their seed because of problems in cleaning, drying and storage. Low-cost options for seed drying and storage are needed to improve seed quality at the farm level, and to improve plant establishment rates in rice production.

Farm-level seed storage

Germination levels of seed following storage are strongly related to the moisture content of the seed. Farmers often dry their seed on drying mats, concrete slabs or roadways. This works well during good weather if seed is turned frequently, however during extended periods of inclement weather some artificial form of drying is often necessary to prevent seed spoilage.

A low-cost seed dryer that uses a small blower and external heat source was developed out of locally available materials. The design is based on the simple Vietnamese low-cost dryer for paddy. Two tests were conducted to evaluate the technical performance and cost of drying.

Materials and Methods



Schematic of dryer

Grain Dryer Specifications

- Lo Trau Vietnamese Rice Hull stove; consumption = 1 to 1.5 kg hull per hr.
- 3 inch electric blower (260 W; 3200 rpm; 0.11 m^3/s)
- Drying duct diameter = 25 cm; Air duct diameter = 6 cm
- Grain holding bin: plastic mesh (2 mm opening) reinforced by welded steel mesh
- Grain: Harvested at IRRI Experimental Station on June 4, 2001 (MC=~22% w.b.)
- Grain bed thickness = 31 cm (Test A), 23 cm (Test B)
- Grain drying temperature = 43 deg. C max.

Results

Test A: Drying 250 kg from harvest moisture content down to safe level for seed storage.

Test B: Drying of 150 kg pre-dried* paddy to safe level for seed storage
(*Grain was pre-dried in a flatbed dryer).

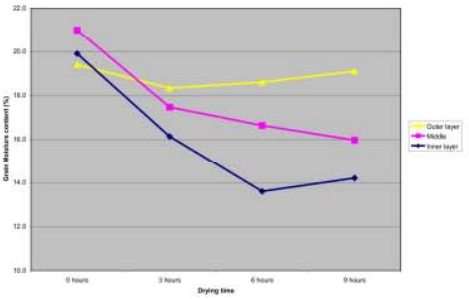
View on seed dryer during performance test

Overview of Test Results

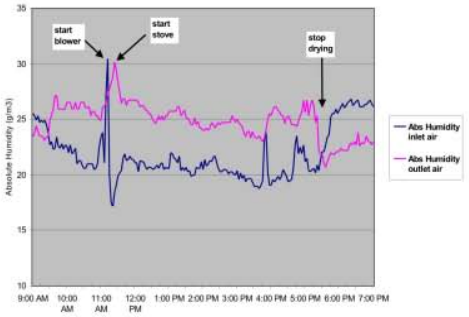
	Test A	Test B
Sample Size	250 kg, wb	150 kg, wb
Initial MC (%)	20.6 %	15.3 %
Final MC (%)	13.3 %	12.2 %
Total Drying Time (hr:mm)	12:30	5:00
Average Drying Rate (% h^{-1})	0.6 % h^{-1}	0.6 % h^{-1}
Average Grain Temp	32.5 ºC	32.5 ºC
Average Drying Air Temp	42.7 ºC	41.6 ºC
Average Dryer Outlet Temp	31.7 ºC	32.1 ºC
Average RH Drying Air	36.9 %	36.6 %
Average RH Outlet Dryer	78.6 %	65.2 %

Drying Rate

The average drying rate is 0.6 % per hour, for both tests. During the 250 kg test there is a differential in MC within the grainbed, as indicated by the figure below. The grain located close to the drying duct dries faster than the grain located at the outside of the drying bin. This is a common feature of round-bin grain drying systems.



Based on the absolute humidity (g/m^3) of the dryer inlet air and outlet air (see figure), the average moisture removal rate for test A was 5.0 gram per m^3 of air, equivalent to 0.5 gram per second. For test B, average moisture removal rate was 0.28 gram per second.



Cost of Drying

Cost for drying amount to $ 0.22 (11 peso) per 50 kg bag for drying from harvesting MC down to storage MC, and $ 0.11 (5 peso) per 50 kg bag for drying of pre-dried grain. These costs do not include costs of labor for loading the dryer, attending to the stove, and unloading. Labor requirements for operating the dryer are comparable to that of pavement drying.

Cost of drying*

	Test A	Test B
Sample size	250 kg, wb	150 kg, wb
Electric power for blower (W)	226	241
Total electricity (kWhr)	2.8	1.2
Total cost of electricity	$ 0.28	$ 0.12
Rice hull used (kg)	15.9	4.5
Cost of rice hull	$ 0.80	$ 0.23
Total operating cost excl labor	$ 1.08	$ 0.34
Total operating cost per hour	$ 0.09	$ 0.07
Total operating cost per bag (50 kg)	$ 0.22	$ 0.11

* cost of electricity = 0.1 $/Kwhr; cost of rice hull = 0.05 $/kg)

Conclusions

A. Seed dryer performs well, with drying rate of 0.6% per hour regardless of bed size
b. When operating with the larger grainbed (250 kg), drying time could be improved by unloading, stirring and reloading the grain halfway the operation
c. Operating costs for the dryer amount to $ 1.1 to $ 2.2 per ton of grain, depending on initial moisture content and loading capacity
d. Following design improvements were made after completing the tests:
- simple heat exchanger to improve temperature control
- installing of smaller electric blower (2.5 inch) with comparable performance but lower electric power requirement

On-going Research and Technology Transfer Activities:

- Dryer manufacturing and demonstration in three villages in Bangladesh in collaboration with Bangladesh Rice Research Institute and Rural Development Academy
- Dryer evaluation in Indonesia in collaboration with Padi Research Institute, Karawang
- Dryer evaluation in Nepal in collaboration with NARC, Kathmandu
- Dryer demonstration in the Philippines in collaboration with the Philippine Rural Reconstruction Movement, a rural NGO.

Acknowledgement

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