

Development and Evaluation of Solar-assisted Dryers for Round Rice Straw

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Project: Scalable straw management options for improved livelihoods, sustainability, and low environmental footprint in rice-based production systems



Introduction

- With the production of over 20 million tons paddy per year, the Mekong Delta (MD) region of Vietnam produced > 20 mn. tons rice straw annually, however most are burnt in the field, this status is causing a considerable waste of energy and contributing to cause the environmental pollution.
- Service of gathering rice straw by balers is booming and developing quickly, but practically operates only in the winter-spring harvest season → **dry the wet straw bales in the summer-autumn harvest season!!??**



Objectives of the conduct of the research:

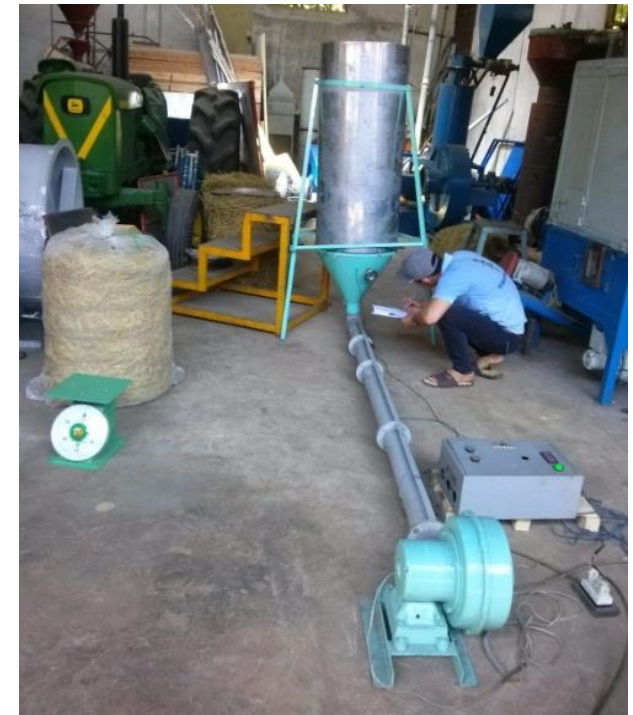
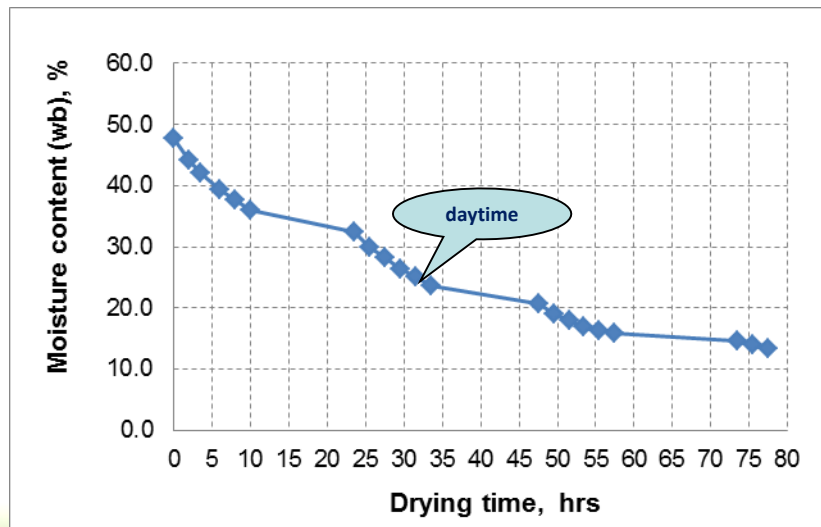
- To improve the effectiveness for the activities of processing and trading of rice straw and its products by applying solar-assisted dryers for wet round straw bales.
- Thence, to contribute to resolve the needs of dry rice straw products in the rainy season at rice straw trading and processing establishments in MD.



Results

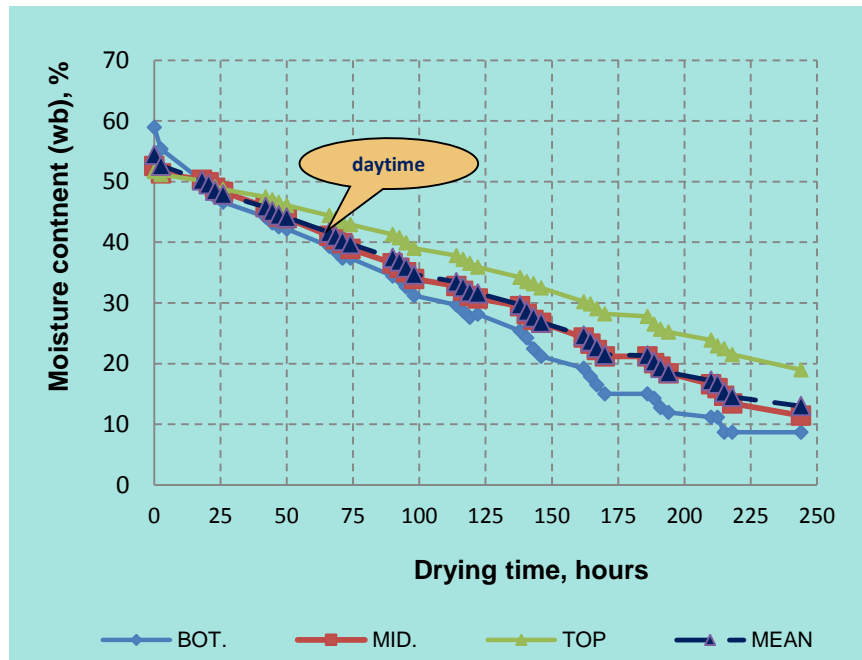
Drying of straw bale sample at the lab dryer

Particulars	Batch 1	Batch 2	Batch 3
Initial weight of sample, kg	21.5	23.4	20.9
Mean initial MC, %	43.1	48.2	41.8
Drying temperature, °C			
- At daytime	35-40	35-40	35-40
- At night	30-35	30-35	30-35
Final weight of sample, kg	14.2	14.0	14.1
Mean final MC of sample, %	13.8	13.4	13.7
Air volume, m ³ /s	0.025	0.025	0.025
Total drying time, hours	76.25	77.5	73.5



Results

Drying of straw bale samples at the pilot dryer



Results

Drying of straw bale sample at the solar bubble dryer (SBD)

Particulars	Sample 1 (*)	Sample 2 (**)
Initial weight of sample, kg	28.3	26.6
Mean initial MC, %	47.3	49.1
Drying temperature range, °C	35-45	35-45
Final weight of sample, kg	16.6	15.4
Final MC of sample, %	10.1	12.0
Total time to finalize the drying batch, hours	224	224
Total actual drying time, hours	80	80

(*) & (**): Samples placed at two ends of the drying bin



Results

Calculations for the cost of drying

Dryer type	The 500-kg pilot dryer		The 30-ton reversible dryer		The 100-ton reversible dryer	
Particulars	Drying cost, VND/kg	Percentage, %	Drying cost, VND/kg	Percentage, (%)	Drying cost, VND/kg	Percentage, %
Depreciation and Repair	3,397.3	55.0	294.0	44.0	240.0	45.0
Interest	1,097.6	18.0	82.5	12.0	67.1	13.0
Power	896.0	14.0	52.9	8.0	54.0	10.0
Fuel	0	0	96.0	14.0	97.9	18.0
Labor	692.3	11.0	130.0	20.0	67.0	13.0
Land space	149.3	2.0	9.8	2.0	7.5	1.0
TOTAL	6,232.5	100	665.2	100	533.5	100



Lessons learned

- The drying product meets requirements, the drying time was too long → a low drying capacity obtained.
- Solar energy as auxiliary heat source for drying of rice straw is an appropriate option.
- In-store drying tech. could be applied for rice straw bale, however, samples with very high MC, the drying time lasts too long → low drying capacity and high drying cost, so drying of high MC straw bales is un-benefited.
- Shortening the drying time shall help improve the drying volume; in this case, reversible airflow dryers might be fit for drying of rice straw bales.
- High drying cost would be a real barrier for promoting dryers for wet rice straw.

