

**SHORT COMMUNICATION**

**Development of simple small dryer suitable to  
Small farms in remote area**

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**ABSTRACT**

*In the Mekong Delta, paddy drying is mostly due to solar energy from sunshine. This traditional method is simple, low cost, but many problems have been created due to erratic rainfall and sunshine. According to On-Farm Trial Proposal by JIRCAS Project 2, two dryer prototypes have been set up to meet the demand of small holders at remote areas as: (1) drying in tent house combined with fans, bowers and white pure nylon covering wood frame; (2) small standing cylinder dryer with capacity 1-2T/batch. These dryers were tested and applied at Tan Phu Thanh village, a target site of the project. They indicate their efficiency, low investment, low drying cost, suitability to small holders and shortening of drying time.*

**INTRODUCTION**

In the Mekong Delta, paddy drying is mostly due to solar energy from sunshine. This traditional method is simple, low cost, but many problems have been created due to erratic rainfall and sunshine. In the other hand, drying temperature cannot be controlled especially in summer- autumn crop, rain can suddenly come, this possibly impairs grain or seed quality. It is also difficult to prevent from grain cracking, discoloration. Paddy drying on high way has inhibited transportation and created traffic problems. Almost farmers know that mechanical dryers will be the most efficient approach for their post-harvest. But mechanical dryers have been used from 8 to 10% of total paddy products in the delta so far. By the way using mechanical drying, farmers actually have tried: (1) drying paddy in tent house combined with fans, bowers and white pure nylon covering wood frame like housing-roof so-called "tent house", (2) Simple small dryers (SRR) suitable to small-holders (1 to 2 tons/batch), (3) medium mechanical dryers (4 –8 tons/batch) suitable to cooperation farms, collaborated farmer

groups, or milling machine combined with rice drying.

In JICAS Project 2, the Agricultural Engineering Department (AED) of Cuu Long Delta Rice Research Institute (CLRRI) dealt with studying and setting up dryer prototypes to improve drying tent house combined with fans and modify simple small dryer (SRR) suitable to low-income small holders living at remote areas

**MATERIALS AND METHODS**

Development of simple small dryers involved:

1. Surveying rice grain drying ways in small size farms at Tan Phu Thanh village, Chau Thanh District, Can Tho Province.
2. Designing and setting up small dryer prototypes.
3. Testing, assessing and transferring to farmers.

**RESULTS**

1. Survey data on rice grain drying ways in small size farms at Tan Phu Thanh village, Chau Thanh district, Can Tho province are presented in table 1, 2, 3 and 4

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Table 1: Hold farm and agricultural production

Total household (A)	Hold farm (B)	B/A (%)	Cultivation (ha)		
			Orchard	Rice field	Home garden
5287.0	4046.0	76.52	944.5	974.0	100.0

Table 2: Rice production area

Natural area (ha)	Rice production area (ha)			Total rice production (1999)	Average yield (t/ha)	Average rice farm size (ha/farm)
	Winter- Spring	Spring- Summer	Autumn- Winter			
2,018.5	927.4	516.4	780.0	10,484	4.5	0.24

Table 3: Drying rice methods

Trade rice (%)	Self consumption (%)	Traditional drying due to sunshine (%)	Mechanical drying (%)
90.0	10.0	88.6	11.4

Table 4: Dryers at Tan Phu Thanh Village

Total (unit)	Flat Bed Dryer (unit)		Tent house	Small Dryer (SRR)
	4 T/batch	8 T/batch		
4.0	1.0	3.0	0.0	0.0

Agricultural house hold accounts for 76.2% at Tan phu Thanh actually (table 1). Average rice yield obtained 4.5t/ha, but average rice farm size is very low (0.24 ha/farm). One house hold gained 1-2 t of rice / season only. So small dryers with low capacity and low investment should be needed. Four dryers actually meet about 11.4% of rice drying demand at Tan phu Thanh (table 4), they are available for hire on rice food drying only, not suitable to rice seed. Using dryers with high capacity (4-8T/bach), mixed rice varieties have been created problem on seed purification and grain quality for export.

There fore, small dryers at Tan phu Thanh are preferred to fit the small farm size.

2. Designing and setting up small dryer prototypes.

2-1. Tent house:

White pure nylon (PE sheet) has been used to cover on wood frame like housing-roof, farmers call it "drying tent". It takes opportunity of sunny time to dry paddy, and it can prevent paddy from sudden rain. This drying approach is very simple, although sunny or rainy conditions, the temperature inside tent is always higher than out side from 3 to 5°C. But the evaporated air moisture come from wet paddy pile inside the tent

during drying can extend duration of the proceed (about 2-3 days/batch). Fans combined with the tent can be considered to solve the problem with structure including 4 parts:

- **Tent house:** with iron frame, or wood or bamboo, then tent house roof covered by pure nylon plate (PE).
- **Blower:** 400 mm diameter, vane-axial type, 10 wings, airflow: 0.2 m<sup>3</sup>/s, a static pressure up to 25 mm water column, and drying air conduct system.
- **Engine:** 4-6HP or 1kW electric motor.
- **Burner:** coal (3kg / hrs)

#### Features:

- Low cost, easy to fabricate.
- Compact and portable
- Little maintenance and easy to operate
- Low drying temperature due to ventilation.

- Easy to mix to have uniform moisture at the end of procedure
- High milling quality (head rice percentage increased)

#### Specifications

- Power requires: 4-6HP or 1kW electric motor
- Tent house size: 24 m<sup>2</sup> (6m x 4m)
- Tent house with iron frame, or wood, or bamboo, etc.... covered by pure nylon plate (PE).
- Drying capacity: 1.0 –2.0 tons/batch.
- Drying time: decrease 10% w.b. moisture content within 8-10 hours
- Blower: 400 mm diameter, vane-axial type, 10 wings, airflow: 0.2 m<sup>3</sup>/s, a static pressure up to 25 mm water column.
- Low drying air temperature at the sunny days, maintaining air temperature inside 30-38<sup>o</sup>C. At night or rainy days, air temperature up down 30<sup>o</sup>C, drying air needed adding heat from burner, but drying air still less than 40<sup>o</sup>C suitable to rice seed drying
- Operating labor: 1 person
- Drying cost: 30 VND/kg

2-2. Development small dryer suitable to small farm size in remote area (standing cylinder dryer) with capacity 1-2T/batch.

This dryer has simple structure with 4 parts included

- **Drying bin:** Standing cylinder shape, iron frame, or wood, or bamboo, etc....

Two standing cylinders: one big at out side and one small at in side to create drying bin,

Drying bin bottom with funnel added an outlet at middle to take out dried rice to mix or to package when drying batch finished.

Drying bin with three-legged support to make easy rice grain taken out.

- **Blower:** 400 mm diameter, vane-axial type, 10 wings, airflow: 0.2 m<sup>3</sup>/s, a static pressure up to 25 mm water column, and drying air conduct system.
- **Engine:** 4-6HP or 1.5-2kW electric motor.
- **Burner:** by coal (3kg/h).

#### Features

- Low cost, easy to fabricate; compact and semi-portable;
- Using diesel engine or electric motor to operate blower;;
- Easy maintenance and easy operation
- Drying 1 batch (1-2 tons) to decrease 10% w.b. moisture content within 8 -10 hours;
- Easy to mix to have uniform moisture at the end of procedure
- Using this dryer as a paddy basket when drying finishing
- High milling quality, head rice percentage increased

#### Specifications

- Power: 4-6 HP diesel engine or 0.5 kW electric motor;
- Drying bin size

	1 ton per batch type	2 tons per batch type
Outside diameter:	150 cm	180 cm
Inside diameter:	40 cm	40 cm
Height:	110 cm	180 cm

- Drying bin fram by iron or wood
- Blower: 40 cm diameter vane-axial type, 10 wings, airflow = 0.2 m<sup>3</sup>/h, static pressure up to 25 mm water column.
- Low drying air temperature always up down 40<sup>o</sup>C
- Drying cost: 40 VND/kg
- Operating labor: 1-2 persons

## 2-3. Testing, demonstration and transferring to farmers

Table 5: Drying parameters of tested dryers

Parameters	Unit	Dryer type			Remark
		SRR 0.5	Standing Cylinder	Tent house combined with fan	
Wet Paddy	kg	560	1091	1410	Before drying
Dried Paddy	kg	443	853	1088	After drying
Initial M.C.	%	30.2	30.2	30.2	Before drying
Final M.C.	%	15.0	15.7	15.3	After drying
Air temp.	°C	29.5 – 32.1	29.5 – 32.1	29.5 – 32.1	Ambiance air
Air humidity	%	77.6 – 65.7	77.6 – 65.7	77.6 – 65.7	Ambiance air
Drying time	hour	12.4	18.4	17.6	non sunshine combine
Drying rate	%/hour	1.26	0.81	0.87	
Drying capacity	kg/hr	45.16	59.29	80.11	

Demonstration was implemented at Tan phu Thanh with 40 participated farmers (table 6)

Table 6: Initial conditions before drying

Wet paddy (kg)	Dried paddy	Initial M.C (%)	Final M.C.(%)	Air temp. (°C)	Humidity (%)
1,200	1032.0	28.0	14.0	28 - 32	76 - 70

Table 7: Drying parameters

Drying time (hour)	Drying rate (%MC/hr)	Drying temperature (°C)	Fuel consumption		Drying cost VND/kg	Drying capacity (kg/hr)
			Diesel (litter)	Coal (kg)		
9.5	1.47	38 - 40	5.0	24.0	35.0	126.31

**PROSPECTS**

- To continue improving these dryers with the emphasis on eco-technical parameters and their structures suitable to farmers in the target areas.
- To transfer these dryers to farmers with the cooperation by agricultural extension centres in terms of demonstrations, training on operating, repairing, maintaining

**SUMMARY IN VIETNAMESE**

### Phát triển máy sấy lúa gián đơn phục vụ cho nông dân có qui mô sản xuất nhỏ

Trong dự án hợp tác với JIRCAS giai đoạn 2, hai mô hình về qui trình sấy lúa gián đơn đã được nghiên cứu và phát triển: (1) Lều sấy được cải tiến với hệ thống quạt thông gió, (2) máy sấy rất rẻ (SRR) cải tiến. Mô hình này được thử nghiệm tại Tân phú Thạnh, Cần Thơ nhằm xem xét tính hữu dụng của chúng trong trường hợp nông dân có qui mô diện tích nhỏ, ở vùng xa