Postharvest Management Through IRRI Rice Postharvest Technologies

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Presentation Outline

• Background on IRRI and Postharvest Unit
• Why is Postharvest Important?
• Leveling
• Harvesting
• Drying
• Storage
• Rice Quality
• Learning Alliance
• IRRI Rice Postharvest Activities in Myanmar
International Rice Research Institute
Los Baños, Philippines

Mission
Reduce poverty and hunger,
Improve the health of rice farmers and consumers,
Ensure environmental sustainability
Through research partnerships

Home of the Green Revolution
Established in 1960 by the Ford and Rockefeller Foundations

www.irri.org
IRRI’s Postharvest Projects Framework
“Preventing losses and ensuring quality harvest for a better quality of life”

Goals
– Contribute to food security
– Poverty reduction through value adding

Objectives
– Reduction of postharvest losses.
– Increasing farmers’ incomes.
– Strengthening public and private extension systems.
– Policy dialogue for sustainable PH sector development
Why is Postharvest (PH) important?

**Losses during PH operations**
- Physical losses: 15—20% in SE Asia
- Quality losses (20-30%)

**Rice is a living product**
- Rice quality is best at harvest,
- Quality deteriorates over time if not properly handled

**Losses due to labour shortage**
- High cost of PH operations
- Delays in PH operations

**Best PH management practice**
- Minimized losses
- Maintained quality
- Reduced cost
Postharvest Chain

To minimize losses along the PH chain rice must be...

- Harvested at the right time
- Threshed in the correct manner
  - Dried properly
  - Cleaned properly
- Stored and maintained properly
  - Milled efficiently
Benefits of leveling

- Increase crop yields - 15%
- Water saving - 10%
- Reduction in weeds - 40% in rainfed rice
- Improved timeliness of plowing, planting and harvesting
- Improved uniformity of crop
4-wheel Tractor With a Laser Controlled Bucket

- The use of laser controlled equipment results in a much more level field
- 50% better than leveling using other techniques
- Demonstrated with PPDG in Myanmar in 2006, more trainings planned
- Usage: as a leveling service
Harvesting

Issues

• Harvesting losses
• Delays in operations
• Labour cost
When to harvest

Harvest rice when:
• 20-25% grain moisture
• 80-85% straw colored and
• the grains in the lower part of the panicle are in the hard dough stage
• 30 days after flowering
Mechanical reaping

**Capacity:** 2-4 ha/d

**Advantages**
- Fast cutting

**Problems**
- Places crop in windrow back in the field
- Problem with lodged crop
- Complex cutter bar and conveying mechanism
Combine harvesting

Features
- Capacity: 1, 4-8 ha/day
- Combines cutting, threshing, cleaning and hauling
- Tracks for mobility in wet fields

Advantages
- High capacity
- Low total harvest losses

Disadvantages
- Requires relatively large field sizes
- Problem in terraced fields
Threshing

**Issues**

- Threshing losses
- Delays in operations
- Labour cost
Axial-flow thresher

Capacity: 0.3-3t/h
- Threshing through impact
- Large range of sizes available
- With or without cleaner
- Truck mounted units

Advantages
- Can thresh wet crop
- Compact

Produced in 9 different countries used by several 100,000’s of rice farmers across Asia
Cleaning and Grading

Issues

- Storage pests
- Energy needed
- Price/value addition
Oscillating Cleaner

Combination of fan and oscillating sieves
Air delivered by fan removes lighter materials
Top sieves with large holes remove larger straw particles
Bottom sieves with smaller holes remove small seeds (e.g. weed seeds)
Drying

Rice is harvested at 20% - 25% MC

Quality deterioration starts immediately after harvest

The wetter the grain the faster the loss of quality

Different MC for different purposes
Tips for better sundrying

Management
- Layer depth of 4 cm
- Mixing every 30 minutes
- Monitor moisture content
- Monitor temperature

Protection
- Cover the grain when temperature rise above 50-60ºC
- Cover during rain.
- Prevent contamination
- keep animals off the grain

Use tools to improve sundrying
# Low-cost seed dryer

<table>
<thead>
<tr>
<th>Feature</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Capacity</strong></td>
<td>100-250 kg</td>
</tr>
<tr>
<td><strong>Price</strong></td>
<td>US$ 150-200</td>
</tr>
<tr>
<td><strong>Drying time</strong></td>
<td>6-9h (initial MC of 22%)</td>
</tr>
<tr>
<td><strong>Grain Quality</strong></td>
<td>Good seed quality</td>
</tr>
<tr>
<td><strong>Heater</strong></td>
<td>Drying air temperature: 43°C</td>
</tr>
<tr>
<td></td>
<td>Rice hull stove, 1-1.5 kg rice hull/h</td>
</tr>
<tr>
<td><strong>Fan</strong></td>
<td>Centrifugal fan, 3200 rpm</td>
</tr>
<tr>
<td></td>
<td>0.11 m³/s</td>
</tr>
<tr>
<td></td>
<td>Electric motor, 220W</td>
</tr>
<tr>
<td><strong>Advantage</strong></td>
<td>Simple design, can be locally made, affordable,</td>
</tr>
<tr>
<td></td>
<td>mobile</td>
</tr>
<tr>
<td><strong>Disadvantage</strong></td>
<td>Moisture gradient</td>
</tr>
</tbody>
</table>
Rice dryers in Myanmar

Features
- Low cost (< US$ 3,000 for dryer, blower, furnace)
- Increase head rice by 12–40% over sun-dried rice
- Minimizes physical loss (0.1%)

Results
- 133 flat bed dryers installed, another 200 copies also built

Plans
- New rice husk furnace with automatic feeding & ash removal
- Clean burning, low emissions (CO$_2$ neutral), no fly ash
Vietnamese type Flat Bed Dryer transferred to Myanmar, Lao, Cambodia
GRiSP Milestone 4.1.1.1. Dryers adapted to local conditions and produced in three countries.....

Myanmar

Partnerships for scaling out:
- Myanmar Rice and Paddy Traders Association - Extension
- Private manufacturer - Production
- Pioneer Postharvest Development Group (NGO) - Extension
- Myanmar Agricultural Services - Training

Outcomes:
- 133 Vietnam type dryers
- 200 copies (poorer performance)
- ~13,700 farmers used drying service
- ~5% higher income in dry season
- ~50% higher income in wet season
- 10,000 people trained on postharvest

Need for follow-up:
- Introduce 2nd generation dryer
- Introduce improved rice husk furnace
- Capacity building in blower testing

Source: R. Flor, for publication

Technology Champion: Dr. Myo Aung Kyaw
Rice Storage

**Issues**

- Physical losses
  - Insects, birds, rodents
- Quality loss
  - Moisture adsorption
  - Discoloration, etc,
Storage Hygiene

• Keep storage areas clean.
• Clean storage rooms after they are emptied
• Placing rat-traps and barriers in drying and storage areas. Cats deter and help control rats and mice
• Inspect storage room regularly to keep it vermin proof.
• Inspect the stored seeds once a week for signs of insect infestation.
Granary improvements

- Lifted floor to exclude ground moisture and provide the grain with ventilation
- Insulation material for protection against heat and condensation
- Rat barrier
- Long eaves for enough shade and protection against rain.
- Tarpaulin as outer wall for protection against rain, especially when walls are made from bamboo or wire mesh.
- Wire mesh for ventilation and protection against birds and rats
Hermetic sealed storage systems

5 t Cocoon

**Principle**

- Special plastic - low oxygen permeability
- Biological activity reduces oxygen level quickly
- Insects die at low oxygen level
- Plastic prevents moisture adsorption

50 kg “Super bag”
Benefits of Hermetic Storage

### Insect control

- **No pesticides / fumigation**
  - (farmers often store inside the house to avoid theft)

### High germination rates

- Farmers in SE Asia use around 80% own seeds and use high seed rates to compensate for low germination -> more grains to sell

### Higher milling returns

- More grain to sell
- Also controls moisture content -> protection from mycotoxins

Source: IRRI - Bac Lieu Seed Center, Vietnam collaboration

Eight months of storage, 4 varieties, comparing IRRI Super bag with farmers practice
Rice quality is a combination of physical and chemical characteristics based on user preference.

- **Seed quality**
- **Paddy quality**
- **Milled rice quality**
Rice Postharvest Quality Kit

Grain shape and size
Color
Chalkiness
Bulk density
Moisture content
Grain purity
Damaged & Immature grains
Learning Alliance

Philippines
- Agusan del Norte
- Agusan del Sur
- Bohol
- Camarines Sur
- Activities in other sites (e.g. Rice husk furnace)
- Major focus: Hermetic storage verification, reversible flow dryer piloting

Cambodia
- 6 Provinces: Battambang, Kampong Thom, Kampot, Prey Veng, Pursat and Takeo
- 10 villages each province
- Major focus: Business models for dryer, combine, hermetic storage

Vietnam
- 5 regions, several sites in each region
- Major focus: Documenting business models identified in previous phase
Cambodia Learning Alliance

• Conducted widespread PH training and village inception meetings in 44 villages in 6 provinces.

• Over 10,000 Super bags given out for farmers to trial.

• Identified support needs for contract combine harvesting as a business model.

• Piloted mechanical dryers with farmers, millers, seed companies.
Vietnam - Learning Alliance

5 regions:

- Region 1 (north): **hermetic storage services** w/ food processor partner
- Region 2 (north-central): **flatbed dryer** with farmer/seed grower
- Region 3 (central): Contract services for **laser leveling**
- Region 4 & 5 (Mekong) investigating proposed **joint-stock company** for integrated processing
Philippines
Postharvest Learning Alliance

- Piloting *hermetic storage* amongst seed growers and seed sellers.

- **4 Provinces**: Bohol, Camarines Sur, Agusan del Norte, Agusan del Sur

- Trainings on Postharvest Management

- *Hermetic storage trials* initiated (so actors learn about constraints, needs, and next steps).
Future Activities

• Assessment of and support to local thresher manufacturing industry, 2013
• Postharvest value chain assessments in project villages, 2013
• Establishment and facilitation of PH Learning Alliance
IRRI Rice Postharvest Management Activities in Myanmar

Improving livelihoods of rice-based rural households in the lower region of the Ayeyarwady delta
1. Training on Postharvest Management for Improved Quality of Rice Grain and Seeds

• Conducted in Bogale in November 5-7, 2012
• 42 participants (NGO, DoA, technicians, farmers, traders and millers)
Dr. Myo discusses the importance of measuring MC
Rice quality evaluation using the Postharvest Quality Kit
Flatbed dryer demonstration
Setting-up of 5-ton capacity hermetic storage cocoon
Visit to local rice mill
Awarding of Certificates
2. Set-up of Storage Trials Comparing Ordinary Bag, Pioneer Bag and IRRI Super Bag

• Conducted in two sites in Bogale on November 22-23, 2012

• Parameters tested were the following – weight, moisture content, insect count, discoloration and germination rate
How to use the IRRI Moisture Meter
GRET agronomist explains the digital weighing scale
Discussion on advantages of hermetic storage
Setting-up of the storage trials
Farmer U Han Aye poses with one of his storage trial bags
3. Set-up of storage trials and 1-ton capacity hermetic cocoon for pilot testing

- Conducted in Labutta on November 27, 2012
- Parameters tested were the following – weight, moisture content, insect count, discoloration and germination rate
How to use the Postharvest Quality Kit
Setting-up of the storage trials
Setting-up of the 1-ton capacity hermetic cocoon
Mercy Corps technician records weight of grains going into the cocoon
Sealing of the cocoon
Installation of rodent guards
Farmer U Tun Myint with IRRI staff and Mercy Corps field technicians
4. Future Activities

• Set-up 1-ton capacity hermetic cocoons in 3 townships by 2013
• Establish PH trials in 3 townships by 2014
• Establish supply chains for postharvest technologies in 2 townships by 2014
Acknowledgments

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