On-Farm Postharvest Operations Management to Reduce Food Losses in Bangladesh


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Bangladesh Agricultural University: At a Glance

Established: 18 August 1961
Total Area: 500 ha
Total students: 7000
No. of Faculty: 6

- Veterinary Science
- Agriculture
- Animal Husbandry
- Agricultural Economics
- **Agricultural Engineering**
- Fisheries

Institute: 5
Degree: 9 (Bachelor Degrees)
Website: [https://www.bau.edu.bd/](https://www.bau.edu.bd/)
Department of Farm Power and Machinery: At a Glance

Major department of the Faculty of Ag. Engg.
No. of Faculties : 17
No. of Lab : 8
Research area :
- Agricultural Machinery
- Agricultural Mechanization
- Renewable Energy System
- Precision Agriculture
- Drying & Storage Technology
Website : http://fpm.bau.edu.bd/
On-Farm Postharvest Operations Management to Reduce Paddy Losses in Bangladesh
Agricultural Production in Bangladesh

Rice is the staple food of Bangladesh

Population: 170 million
Area: 14.5 million km²
Context of Bangladesh Agriculture

Successes
- Bangladesh is the 3rd largest rice producer, 3rd largest vegetable and inland water fish producer and 5th largest aquaculture fish producer in the world.
- Since the independence of Bangladesh, the production of paddy has increased over three folds (55.4 million tonnes in 2019; GIEWS-FAO, 2020) compared to double the population growth and attains self-sufficiency in paddy production.

Challenges
- Agricultural land is decreasing by 0.5% per year (FAO, 2014).
- On-farm labor employment was about 43% of rural labor force in 2017 and reduced to about 36% by 2020 and predicted to be 20% by 2030 (FAOSTAT, 2017).
- Mentionable mechanization has been achieved in tilling, irrigation and threshing, however, planting, harvesting and drying & storage activities are lagging far behind.
- Postharvest loss of paddy at the field level is about 14% amounting to around Tk 3,442 crore (ASMIH-Bangladesh, 2018; PHLIL-Bangladesh, 2021; The Daily Observer, 2020).

Potential Solutions
- Appropriate scale mechanization in field crops production and reduction of postharvest losses would have been the potential solutions of the challenges.
Area Focused

Traditional to Modern

- **6.20% losses** • Harvesting
- **3.0% losses** • Drying
- **6.0% losses** • Storage
Paddy Harvesting

- About 85% paddy field harvested
- Labor intensive and costly
- High harvesting loss (6.20%)
- Time consuming

- Low capacity
- Need threshing and cleaning
- Cannot harvest shattered crop

Best Solution

- Combine can harvest 100% shattered paddy
- Operate in wet and 15 - 20 cm standing water
- It saves time, labor, cost and harvesting loss
- Detect clogging using six sensors
- Easy operation, adjustment and maintenance
Paddy Harvesting

Reaper
❖ Capacity: 0.22 ha/hr
❖ Field efficiency: 58%
❖ Cost saved: 36% over manual harvesting
❖ Market Price: USD 2000
❖ Payback period: less than a year

Mini-Combine
❖ Capacity: 0.10 ha/hr
❖ Field efficiency: 55%
❖ Cost saved: 51% over manual harvesting
❖ Market Price: USD 8529
❖ Payback period: 2 years

YANMAR Combine
❖ Capacity: 0.45 ha/hr
❖ Cost saved over manual harvesting:
  ➢ Cost saved: 61%
  ➢ Loss saved: 4.74%
  ➢ Labor saved: 70%
❖ Market Price: USD 30000
❖ Payback period: less than 3 years

More than 8500 combine harvesters are being used in field of Bangladesh
Paddy Drying

The 12 ton capacity BAU Recirculating Paddy Dryer has been developed locally as an alternative of traditional sun drying at farmers’ level.

The 500 kg capacity BAU-STR Dryer has been developed locally as an alternative of traditional sun drying at farmers’ level.

Potential Beneficiaries

- Paddy Seed Producer
- Local Service Provider
- Farmers’ Group
- Individual Farmer
- Major Rice Mill
- Automatic and Semi-automatic Rice Mill
- Public and Private Sector Paddy Seed Processing Centers
- Rice Husking Mill

Sun drying at commercial level

Intervention of PHLIL-Bangladesh

Sun drying at farmers’ level

BAU Recirculating Paddy Dryer

BAU-STR Dryer
Adaptation of Technologies

Sun-drying to Mechanical drying

BAU-STR Dryer
Capacity: 500 kg/batch
❖ Drying time: 4-5 hours/batch
❖ Heating options: LPG and Briquette
❖ Production Price: USD 850
❖ Operating cost
  ➢ 0.93 BDT/kg (LPG based)
  ➢ 0.78 BDT/kg (Briquette based)
  ➢ 2 BDT/kg (Sun drying)
❖ Payback period: < 1 year
❖ Loss save: about 2.5% over sun-drying

Source: PHLIL-BD, 2019
Impact of Improved Drying

- **Reduces loss**
  2.5% over sun drying

- **Reduces labor**
  Single woman can operate

- **Maintains germination**
  Germination rate is above 95%

- **Saves time**
  Drying time: 4-5 hr

- **Easy to manufacture**
  Can be manufactured locally
Existing Storage Technologies

- Dole
- Gunny Bag
- Motka
- Gola
- Steel drum
- Plastic bag
- Plastic drum
- Auri
Storage Loss was found in stored paddy in Motka (6.05%) followed by Dole, Plastic Bag, Plastic Drum and PICS Bag (0.05%)
Storage Loss of Existing Technologies: *Aman* Paddy

- **Storage Loss (%)**
  - Dole
  - Motka
  - Plastic Drum
  - Plastic Bag
  - GrainPro Bag
  - PICS Bag

- **Storage loss was found in stored paddy in Motka (5.49%) followed by Dole, Plastic Bag, Plastic Drum and PICS Bag (0.04%)**
Possible Storage Loss Reduction (%)

<table>
<thead>
<tr>
<th>Storage Technology</th>
<th>Possible Storage Loss Reduction (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dole Motka Plastic Bag</td>
<td>0.3</td>
</tr>
<tr>
<td>Plastic Drum</td>
<td>1.72</td>
</tr>
<tr>
<td>GrainPro Bag</td>
<td>4.92</td>
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<tr>
<td>PICS Bag</td>
<td>5.92</td>
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<td></td>
<td>6</td>
</tr>
</tbody>
</table>
The 30 ton capacity hermetic cocoon has been identified as an alternative of traditional paddy seed storage at commercial level.

The 50 kg capacity GrainPro Bag has been identified as an alternative of traditional storage at farmers’ level.

Potential Beneficiaries

- Individual Farmer
- Farmers’ Group
- BADC Seed Processing Centers
- Rice Millers and Traders
Paddy Seed Storage

Storage technologies

Efficacy of Metal bin at Laboratory

Efficacy of Metal bin at on-farm
Adoption of Technologies

Public Sector
BADC

Private Sector
Rice Mill

30-ton capacity

5-ton capacity

Hermetic Cocoon

PHLIL-Bangladesh, 2021; IFPRI-BAU, 2019
Impact of Improved Storage

- No health hazard
- No insects
- No insecticides
- No chemical
- Loss saved: >5%
- Germination above 90%
- No fumigation

**Moisture content of stored paddy seed remains constant over storage period.**
Scaling Strategy

Scaling:

DAE: 184 + 5000 (ongoing)
FAO: 8 (Farmers group)
Farmers & Seed traders: 20

Stakeholders:

Activity Adoption level

Potential: Major rice mills (15,500)
Potential: Public & Private sector seed storage
DAE: > 3400 (1 ton cocoon)
Farmers’ Level: 3007
Capacity Building Strategy

Men

PH Training

2947

Workshops

389

Women

PH Training

1356

Workshops

57
Conclusion and Recommendations

❖ Hermetic storage is found effective storage technology for paddy seed at farmers and commercial level, however there are some policy issues that need to be addressed for making them available in Bangladesh in cheaper price and adopted in a wider scale.

❖ BAU-STR dryer is proven to be appropriate drying technology for smallholder farmers and paddy seed traders.

❖ A 12-ton capacity BAU Recirculating paddy dryer, suitable for both parboiled and aromatic paddy, has been developed through Public Private Partnership (PPP) approach to mitigate drying issues of major rice mills and large-scale seed producers, and ready to scale to a larger extent.

❖ Capacity and awareness building are necessary for appropriate drying and storage practices at farmers and commercial level to reduce post-harvest losses.

❖ Appropriate scale machines and technologies to be made available through innovation and adaptation.
Acknowledgement

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