#### INTERNATIONAL WORKSHOP ON FOOD LOSS AND WASTE PREVENTION IN SOUTH ASIAN REGION

# 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 : <u>https://www.bau.edu.bd/</u>

# **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





### Successes

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

### Challenges

- $_{\odot}\,$  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**





# **Paddy Harvesting**







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

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

- Low capacity
- Low power & less robust
- High repair & maintenance cost
- Cannot harvest shattered crop



Combine can harvest 100% shattered paddy

- $\circ$  Operate in wet and 15 20 cm standing water
- $\circ$  It saves time, labor, cost and harvesting loss
- Detect clogging using six sensors
- Easy operation, adjustment and maintenance

# **Paddy Harvesting**





✤ Capacity: 0.22 ha/hr

Reaper

- ✤ 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**





# **Adaptation of Technologies**



### **Sun-drying to Mechanical drying**



## **Impact of Improved Drying**





# **Existing Storage Technologies**





# Storage Loss of Existing Technologies: Boro Paddy





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 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 (%)**





# Paddy Seed Storage



### Paddy Seed Storage











#### Efficacy of Metal bin at on-farm



Efficacy of Metal bin at Laboratory



#### Storage technologies



### **Adoption of Technologies**





#### **30-ton capacity**







#### 5-ton capacity

#### Hermetic Cocoon

### Impact of Improved Storage



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

# **Scaling Strategy**





# **Capacity Building Strategy**





# **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









#### **ASMIH-Bangladesh Project**









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