Post-Harvest Loss of Cereal Grains, Fruits and Vegetables in Bangladesh

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Research Interests:
• Precision Farming,
• Agricultural Machinery Robotics,
• Image Processing of Agricultural Products
• Post-Harvest Technology of Agricultural Products
Total: 147,570 km²
Land: 130,170 km²
Water: 18,290 km²

Source: World Bank Development Indicators
Area Under Cultivation of Different Crops in Bangladesh, 2020-2021

(Source: Yearbook of Agricultural Statistics – 2022)
Reasons of Grain, Vegetables and Fruits Loss in Bangladesh

- Inadequate postharvest activities
- Lack of modern technologies and machineries
- Inefficient marketing systems
- Government supports not sufficient in research and extension sector
- Lack of Processing and preservation facilities
- Poor handling during loading and unloading at market point

(Source: Latiful Bari, 2015)
Types of losses/Waste

- **Production**: Losses due to mechanical damage/spillage during harvesting operation.
- **Post-harvest handling and storage**: Losses due to spillage and degradation during handling, storage and transportation between farm and distribution.
- **Processing**: Losses due to spillage and degradation during industrial or domestic processing. Loss may occur during washing, peeling, slicing and boiling or during process interruptions and accidental spillage.
- **Distribution**: Losses and waste in the market system i.e. wholesale markets, supermarket, retailers and wet markets.
- **Consumption**: Losses and waste during consumption at the household level.

(Source: Latiful Bari, 2015)
Post-harvest Loss of Cereal Grains
Area Under Cultivation of Major and Minor Cereals, 2020-21

Production

Aus = 3.0 Million Tonnes (1.2 Million ha)
Rice (Boro) = 20.2 Million Tonnes (4.8 Million ha)
Aman = 14.9 Million Tonnes (5.7 Million ha)
Wheat = 1.08 Million Tonnes (0.314 Million ha)
Maize = 4.3 Million Tonnes (0.48 Million ha)

(Source: Yearbook of Agricultural Statistics – 2022)
Potential Losses in Postharvest Operation of Cereal Grains in Bangladesh

- **Harvesting**: Lodging, Shattering, Delay Harvesting, Fissuring
- **Field Stacking**: Yellowing, Discoloration
- **Threshing**: Spillage, Mechanical Damage
- **Sun Drying**: Over drying, Non-uniform drying, Fissuring
- **Storage**: Pest Infestation, Moisture Migration, Discoloration, Rotting
- **Milling**: Over milling, Mechanical damage

(Source: Latiful Bari, 2015)
Table: Post harvest losses of rice in the different stages of supply chain

<table>
<thead>
<tr>
<th>Season</th>
<th>Harvesting loss, %</th>
<th>Transporting loss, %</th>
<th>Threshing loss, %</th>
<th>Parboiling loss, %</th>
<th>Drying loss, %</th>
<th>Storage loss, %</th>
<th>Total loss, %</th>
<th>Processor Total loss, %</th>
<th>Wholesaler Total loss, %</th>
<th>Retailer Total loss, %</th>
<th>Grand Total loss, %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aman</td>
<td>1.60</td>
<td>0.87</td>
<td>1.10</td>
<td>0.03</td>
<td>2.19</td>
<td>3.70</td>
<td>9.16</td>
<td>1.30</td>
<td>0.17</td>
<td>0.27</td>
<td>10.74</td>
</tr>
<tr>
<td>Boro</td>
<td>1.62</td>
<td>1.13</td>
<td>1.22</td>
<td>0.03</td>
<td>2.37</td>
<td>4.14</td>
<td>10.10</td>
<td>1.30</td>
<td>0.18</td>
<td>0.31</td>
<td>11.71</td>
</tr>
<tr>
<td>Aus</td>
<td>1.91</td>
<td>1.07</td>
<td>1.79</td>
<td>0.02</td>
<td>2.35</td>
<td>3.45</td>
<td>10.17</td>
<td>1.13</td>
<td>0.19</td>
<td>0.28</td>
<td>11.59</td>
</tr>
</tbody>
</table>

Table: Post harvest losses of wheat and maize in producer stage

<table>
<thead>
<tr>
<th>Crop</th>
<th>Harvesting loss, %</th>
<th>Transporting loss, %</th>
<th>Threshing loss, %</th>
<th>Drying loss, %</th>
<th>Storage loss, %</th>
<th>Total loss, %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wheat</td>
<td>0.77</td>
<td>0.09</td>
<td>0.65</td>
<td>0.62</td>
<td>1.54</td>
<td>3.62</td>
</tr>
<tr>
<td>Maize</td>
<td>0.33</td>
<td>0.12</td>
<td>0.55</td>
<td>0.62</td>
<td>2.50</td>
<td>4.07</td>
</tr>
</tbody>
</table>

(Source: Bala et al., 2010)
Figure: Manual and Mechanical harvesting and transportation of rice and wheat in Bangladesh
Postharvest Operations for Cereal Grains

Figure: Manual and Mechanical harvesting threshing, Sun drying, and storing of rice in Bangladesh
Introducing Modern Postharvest Operations for Cereal Grains in Bangladesh

BAU STR drying of Rice

Hermatic Bag for Rice Storing

Agri-Storage in Jamalpur District (Source: BRAC)

Godowns
Post-harvest Loss of Vegetables
➢ Farmers grow 100 types of vegetables. According to (FAO), Bangladesh ranked third as a vegetable producer in the world. China secured first position and India is second.

➢ In FY2021-22, **32.6 million tonnes** of vegetables (winter + summer) were produced on 1.42 million hectares of land. This is a significant jump from the production in FY2015-16 when **19.9 million tonnes** of vegetables were produced on 1.06 million hectares in the country.

(Source: DAE database)
Winter and Summer Vegetables Available in Bangladesh

Winter Vegetables
- Others 17%
- Carrot 1%
- Beans 10%
- Radish 12%
- Tomato 14%
- Robi Pumpkin 8%
- Water Guard 9%
- Cauliflower 10%
- Robi Brinjal 9%

Area Under Cultivation of Winter Vegetables
(Source: Yearbook of Agricultural Statistics – 2022)

Summer Vegetables
- Kharif Pumpkin 5%
- Kharif Brinjal 9%
- Patal 5%
- Lady’s Finger 5%
- Jhinga 4%
- Karala 5%
- Chalkumra 5%
- Cucumber 5%
- Green Banana 5%
- Sajna 3%
- Green Papaya 5%
- Kakrot 2%
- Barbat 3%

Area Under Cultivation of Summer Vegetables
(Source: Yearbook of Agricultural Statistics – 2022)
In FY2015-16: 19.9 million tons on 1.06 million ha  
In FY2021-22: 32.6 million tons on 1.42 million ha

<table>
<thead>
<tr>
<th>Fiscal Year</th>
<th>Production (MT)</th>
<th>Area (ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015-16</td>
<td>19.9</td>
<td>1.06</td>
</tr>
<tr>
<td>2016-17</td>
<td>21.2</td>
<td>1.08</td>
</tr>
<tr>
<td>2017-18</td>
<td>22.5</td>
<td>1.10</td>
</tr>
<tr>
<td>2018-19</td>
<td>23.8</td>
<td>1.20</td>
</tr>
<tr>
<td>2019-20</td>
<td>25.1</td>
<td>1.30</td>
</tr>
<tr>
<td>2020-21</td>
<td>26.4</td>
<td>1.40</td>
</tr>
<tr>
<td>2021-22</td>
<td>32.6</td>
<td>1.42</td>
</tr>
</tbody>
</table>

Production (MT) and Area (ha) of vegetables in Bangladesh by the Fiscal Years  
(Source: DAE database)
Principal Causes of Post-harvest Loss of Vegetables and Fruits in Bangladesh

Causes of Losses in Bangladesh

- Mechanical Damage
  - Overpacking/Poor Harvesting Practices/Careless Handling
- Physiological Deterioration
  - High Temperature Injury/Low Temperature Injury
- Pest and Disease
  - Parasite and Fungi

(Source: Samar Biswas, 2018)
Post-harvest Handling of vegetables in Bangladesh

(Source: Hassan et al., 2010; Online Images)
Post-harvest losses of vegetables at different stages of supply chain in Bangladesh

(Source: Hassan et al., 2010 and DAE 2022)

**Tomato (32.9%)**
- Growers: 6.9%
- Bepari: 9.1%
- Wholesalers: 8%
- Retailers: 8.9%

**Cauliflower (34.4%)**
- Growers: 4.2%
- Bepari: 9.2%
- Wholesalers: 10.3%
- Retailers: 10.7%

**Lady’s Finger (32.3%)**
- Growers: 9.4%
- Bepari: 9.8%
- Wholesalers: 4.9%
- Retailers: 8.3%

1.8 million tonnes for 60669 ha
1.7 million tonnes for 65633 ha
0.32 million tonnes for 27080 ha
Brinjal (29.4%)

- Retailers: 6.6%
- Wholesalers: 8.4%
- Bepari: 7.4%
- Growers: 6.9%

Cucumber (27.1%)

- Retailers: 4.7%
- Wholesalers: 10.7%
- Bepari: 4.5%
- Growers: 7.2%

(Source: Hassan et al., 2010 and DAE, 2022)

2.9 million tonnes for 0.1 million ha

0.66 million tonnes for 35495 ha
### Post-harvest Loss of Potato

#### REASONS OF POTATO LOSS

<table>
<thead>
<tr>
<th>Reason</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lack of Storage Facility</td>
<td>48.94%</td>
</tr>
<tr>
<td>Poor Packaging System</td>
<td>32.73%</td>
</tr>
<tr>
<td>Rain at Harvesting Time</td>
<td>17.63%</td>
</tr>
<tr>
<td>Loading and Unloading Problem</td>
<td>0.51%</td>
</tr>
<tr>
<td>Poor Transportation</td>
<td>0.2%</td>
</tr>
</tbody>
</table>

(Source: Akter et al., 2022)

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(Source: Bhuiyan et al. 2012)
Potato Storing System in Bangladesh

Potato storing in Farmers Level

Potato storing in Commercial Cold Storage

Potato rotting due to faulty operation in Cold Storage
Post-harvest Loss of Fruits
Bangladesh now lists among the top 10 countries of the world for producing seasonal fruits.

Mango and jackfruit were the only major fruit produced in the country 20 years ago and produced only 56 types of fruits. Now, Bangladesh produces 72 types of fruits.

Bangladesh secured 2nd place for jackfruit production in the world, was 7th in mango production, 8th in guava production and 14th in papaya production.

According to the DAE, in FY2013-14, fruits were cultivated on 0.69 million hectares of land and the yield was 10.6 million tonnes. In FY2020-21, agricultural land for fruit farming has jumped to 0.729 million hectares and fruit production to 12.2 million tonnes.

(Source: Online News Portal and DAE Database)
Area Under Cultivation of Fruits in Bangladesh, 2020-2021

Source: Yearbook of Agricultural Statistics-2022
FY2013-14: 10.6 million tons on 0.69 million ha
FY2020-21: 12.2 million tons on 0.729 million ha
### Post-harvest losses of fruits at different stages of supply chain in Bangladesh

<table>
<thead>
<tr>
<th>Fruit</th>
<th>Growers</th>
<th>Bepari</th>
<th>Wholesalers</th>
<th>Retailers</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mango (27%)</strong></td>
<td>6.6%</td>
<td>1.1%</td>
<td>5.3%</td>
<td>2.1%</td>
</tr>
<tr>
<td><strong>Banana (24.6%)</strong></td>
<td>6.6%</td>
<td>1.1%</td>
<td>5.3%</td>
<td>2.1%</td>
</tr>
<tr>
<td><strong>Jackfruits (43.5%)</strong></td>
<td>6.6%</td>
<td>1.1%</td>
<td>5.3%</td>
<td>2.1%</td>
</tr>
</tbody>
</table>

- **Mango**: 2.35 million tonnes for 0.20 million ha
- **Banana**: 2.9 million tonnes for 88938 ha
- **Jackfruits**: 1.89 million tonnes for 62273 ha

(Source: Hassan et al., 2010 and DAE 2022)
<table>
<thead>
<tr>
<th>Fruit</th>
<th>Percentage</th>
<th>Retailers</th>
<th>Wholesalers</th>
<th>Bepari</th>
<th>Growers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Papaya (39.9%)</td>
<td></td>
<td>2.1%</td>
<td>5.3%</td>
<td>1.1%</td>
<td>6.6%</td>
</tr>
<tr>
<td>Litchi (24.86%)</td>
<td></td>
<td>2.1%</td>
<td>5.3%</td>
<td>1.1%</td>
<td>6.6%</td>
</tr>
<tr>
<td>Pineapple (42.62%)</td>
<td></td>
<td>2.1%</td>
<td>5.3%</td>
<td>1.1%</td>
<td>6.6%</td>
</tr>
</tbody>
</table>

(Source: Hassan et al., 2010 and DAE, 2022)

- Papaya: 0.713 million tonnes for 27944 ha
- Litchi: 0.225 million tonnes for 30565 ha
- Pineapple: 0.536 million tonnes for 18654 ha
Post-harvest Handling of Fruits in Bangladesh

Mango Packing with Plastic Crates and Bamboo Baskets

Litchi Fruits Packing with Bamboo Baskets and Huge Litchi Leaves

Mango Transported with Van and Trucks

Pineapple Transported with Bi-cycle, Van and Trucks

(Source: Hassan et al., 2010)
Jackfruits Marketing and Loading in Truck

Banana Marketing and Loading in Truck
Pictures for Post-harvest losses of Fruits in Bangladesh

- Over matured
- Chilling Injury
- Abrasion Injury
- Cutting Damage
- Impact Bruising

Diseases of mango: anthracnose, stem end rot and fruit rot
(Source: FAO, 2018)

Rough handling leads to damaged portion with white starchy areas and failure to turn yellow

(Source: Saha et al., 2021)
Damage by A) Fungal pathogen, B) by Rain water, and C) by Transportation

Damage Litchi due to Skin Cracking

(Source: Hassan et al., 2010)
Management for Reducing Post-harvest Losses  (Source: Samar Biswas, 2018)

Post-harvest Management

Temperature
- Refrigeration
- Rapid Cooling After Harvest
- Shade in Sunny Place
- Low Temperature Room

Relative Humidity
- Wetting Floor
- Supply Moisture by Humidifier

Harvesting
- Sorting and Grading
- Packaging
- Storage
- Transportation
- Processing Plant
What about GO/NGO working for Post-harvest Loss Management in BD?

➢ Govt takes Tk31.98 billion farm mechanization project to support farmers as well as post-harvest loss of rice.

➢ PKSF has granted finance to install two pilot plants/storage (6-8 tons capacity) to ensure development of income generating activities among farmers and middlemen suppliers of safe food.

➢ A capacity of 1,000 tonnes Privately-owned special cold storage at Tejgaon in Dhaka only for imported fruits.

➢ A capacity of 120 tonnes Specialised cold storage for vegetables and fruits near Hazrat Shahjalal International Airport, which is only used by exporters.

➢ More than 400 cold storages with a combined capacity of 0.60 million tonnes have been operating across Bangladesh to store potatoes.

➢ 25 Specialised cold storages across the country (Capacity of 300 tonnes and 500 tonnes) with a combined capacity of storing 3,000 tonnes of vegetables or fruits. The project is expected to be implemented by December 2024 at a cost of Tk 2.70 billion with the Govt. funding.

➢ Govt. is building 196 new silos in 53 districts for storing rice, wheat and maize.

(Source: Online News Portal in Bangladesh)
Thank you!

STOP FOOD LOSS AND WASTE. FOR THE PEOPLE. FOR THE PLANET.