Harvesting

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In this module

- What is harvesting
- Harvesting systems
- When to harvest
- How to harvest (technology options)
- Harvest losses
- Recommendations
What is harvesting?

Harvesting is the process of collecting the mature rice crop from the field.

- **Cutting**: cutting the panicles and straw.
- **Hauling**: moving the cut crop to the threshing location.
- **Threshing**: separating the paddy grain from the rest of the cut crop.
- **Cleaning**: removing immature, unfilled and non-grain materials.
- **Field drying**: (optional) leaving the cut crop in the field and exposing it to the sun for drying.
- **Stacking / Piling**: (optional) temporarily storing the harvested crop in stacks or piles.
Good harvesting practices

At harvest the quality of rice is best. From then on it can deteriorate quickly

- Heat build up from mold and insect development
- Discoloration/Yellowing from heat build-up
- Cracking from re-wetting of dried grains
- Loss of vigor
- Reduced head rice yield
- Shattering losses

**Goals of good harvesting:**

- maximize grain yield (minimize losses)
- minimize grain damage
- Minimize quality deterioration
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Harvesting systems

1. Manual system

- Manual operation sometimes using tools
- Labor requirement: 48 person days / ha
Harvesting systems

2. Manual cutting / machine threshing

Optional: winnowing or cleaning

- Labor requirement: 28 person days/ha
- Capital cost appr.: US$ 1000
Harvesting systems

2. Machine cutting / machine threshing

Optional: Winnowing or cleaning

- Capacity reaper: 2-4 ha/day
- Capacity thresher: 0.5-2 t/h
- Capital cost approx.: US$ 2,500
Harvesting systems

4. Combine harvesting

- Cutting, hauling, threshing, cleaning in one combined operation
- Capacity: > 1-6 ha/day
- Labor requirement: 1-3 operators
- Capital cost: $ 4 - 250k
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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
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Manual cutting and hauling

- **Capacity:** 0.07 ha/person day
- **Advantages**
  - effective in lodged crop
  - less weather dependent
- **Problems**
  - high labor cost
  - labor dependent, competes with other operations in peak season
  - winnowing/cleaning necessary
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
Manual threshing

- **Capacity:** approximately 15 person days/ha
- Threshing by impact
- High shattering losses
- Pre-drying might be needed
Pedal thresher

- **Capacity:**
- **Principle**
  - Wire loop threshing drum
  - Mainly combing the grains off the straw, some threshing by impact
- **Advantages**
  - Maintains the straw
- **Disadvantage**
  - Needs winnowing after threshing

Wire loop threshing drum
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
Winnowing

- Principle: lighter materials are blown away by air
- Removes chaff, straw and empty grains
- Hand or mechanical winnowing
- Does not work for materials heavier than grain (dirt, stones)
Cleaning

- 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)
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
Combine harvester

- Threshing cylinder
- Conveyor
- Reel
- Grain tank
- Straw walker
- Return chute
- Auger
- Sieve
- Cutterbar
- Concave
- Blower

- Crop
- Straw/Chaff
- Grain
Stripper harvesting

- **Capacity:** 1ha/day
- **Advantages**
  - strips and collects grains only
  - less material to handle
- **Problems**
  - problems in wet soils and lodged crop
  - straw treatment
  - does not work well with long straw
  - complex machine
  - skills required

Despite strong promotion in SE-Asia the stripper harvester has not gained wide popularity because of its problems in less favorable harvesting conditions.

Only in South Sulawesi, Indonesia, stripper harvesters are used.
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Losses during cutting

- **Shattering loss** = premature shedding of mature grains from the panicle caused by birds, wind, rats, and handling operations. Certain rice varieties shatter more easily than others.

- **Lodging loss** = plants with mature grains in the panicles fall on the ground making the grains difficult to recover.

- **Standing crop loss** = standing plants with mature grains are left standing in the field after harvesting operations as a result of oversight, carelessness or haste.
Losses during threshing

- **Threshing loss** = mature grains that remain attached to the panicle in the straw after completion of the threshing operation.

- **Separation loss** or “blower loss” = mature grains that are mixed with straw or chaff during the cleaning operation.

- **Scatter loss** = mature grains that are scattered on the ground during the threshing and cleaning operation.
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Tips for optimizing quality

• Harvest at the right time and moisture content
• Avoid stacking the cut crop in the field
• Avoid delays in threshing after harvesting
• Use the proper machine settings when using a threshing machine
• Clean the grain properly after threshing
• Avoid delay in drying after threshing
Tips for manual threshing

• Thresh as soon as possible after cutting
• Hand thresh at lower moisture
• Place a large canvas under the threshing frame to minimize shatter loss
Tips for machine threshing

- Thresh as soon as possible after cutting
- Level the thresher
- Set machine correctly
  - drum speeds in IRRI thresher (600rpm)
  - air flow in the cleaner
  - angle in the cleaner sieves
Axial flow thresher
Setting threshing drum speed

Always adjust the thresher correctly.

- For peg-tooth drums the drum tip speed should be about 12-16 m/sec (see Table for correct RPM).

```
RPM | Tip speed (m/s) for drum diameters of
    | 30 cm | 40 cm | 50 cm
400  | 6.3 | 8.4 | 10.42
450  | 7.07 | 9.4 | 11.78
500  | 7.85 | 10.5 | 13.09
550  | 8.64 | 11.5 | 14.4
600  | 9.42 | 12.6 | 15.7
650  | 10.21 | 13.6 | 17.02
700  | 11 | 14.7 | 18.3
750  | 11.8 | 15.7 | 19.64
800  | 12.6 | 16.8 | 21
850  | 13.4 | 17.8 | 22.25
900  | 14.14 | 18.85 | 23.6
```

- Too high speed:
  - higher grain damage and de-hulled grains.
- Too low speeds:
  - increased threshing loss. Decreased capacity.
Setting concave clearance

- For most threshers clearances between peg-teeth and concave should be about 25mm.
- Smaller clearance - increases grain damage and might lead to clogging of straw.
- Larger clearance - reduce threshing efficiency.
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