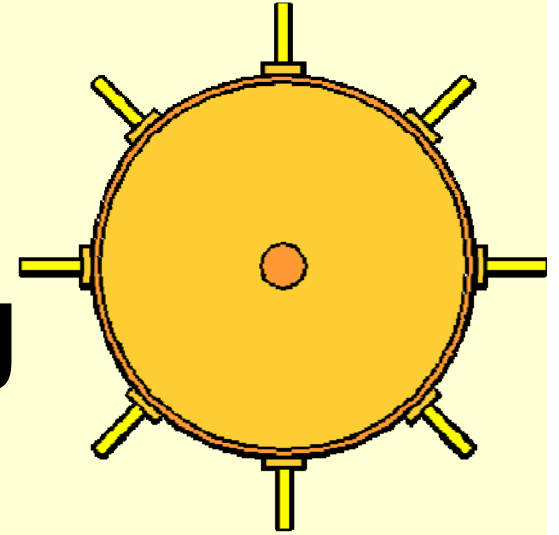


IRRI



Research  
Program on  
Rice  
Global Rice  
Science  
Partnership

# Harvesting



M.Gummert

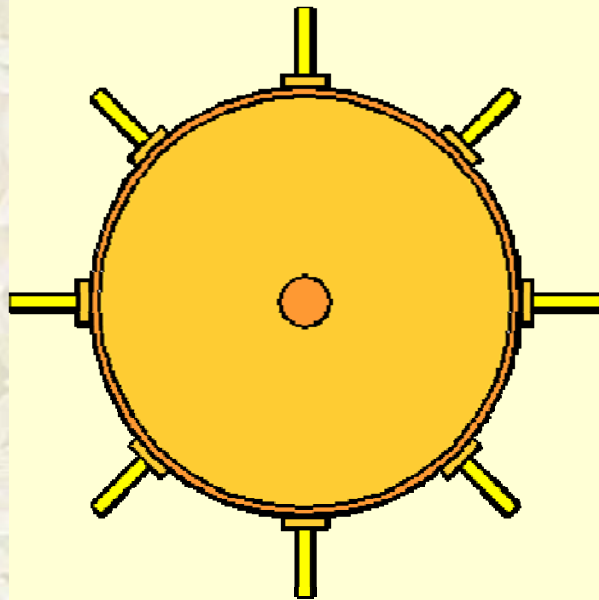
Postharvest Unit, CESD

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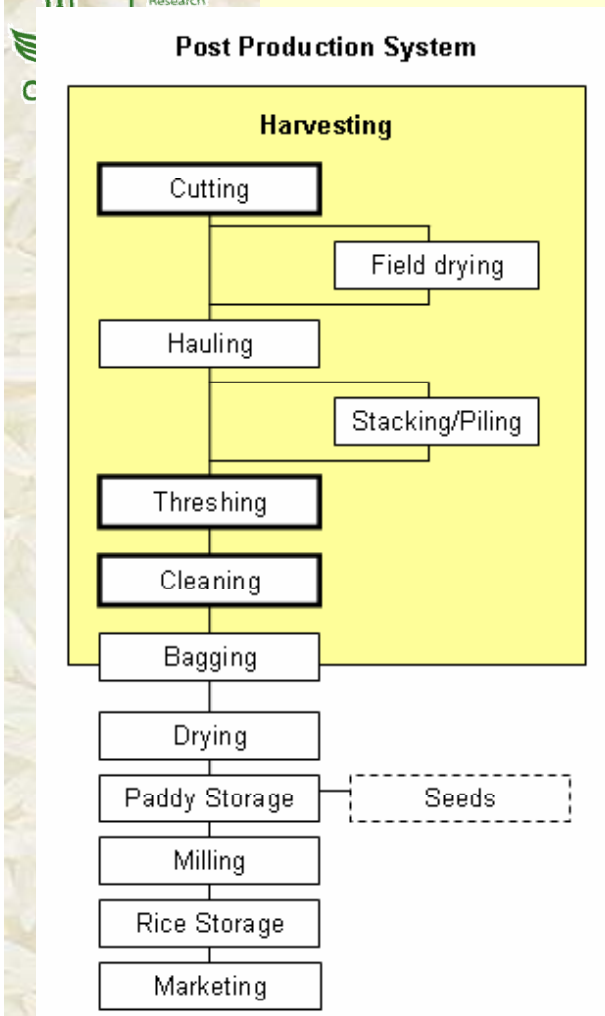
Rice  
Science  
for a Better  
World

## 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

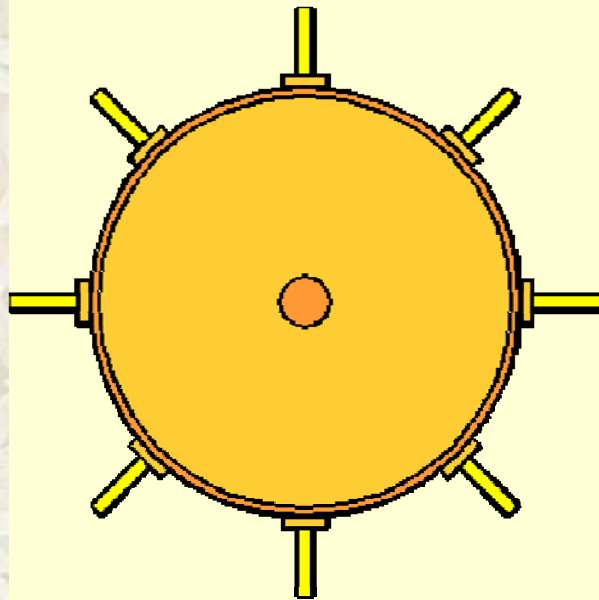
- Heat build up from mold and insect development
- Discoloration/Yellowing from heat build-up
- Cracking from re-wetting of dried grains
- Loss of vigor
- Reduced head rice yield
- Shattering losses



## Goals of good harvesting:

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

## In this module



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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



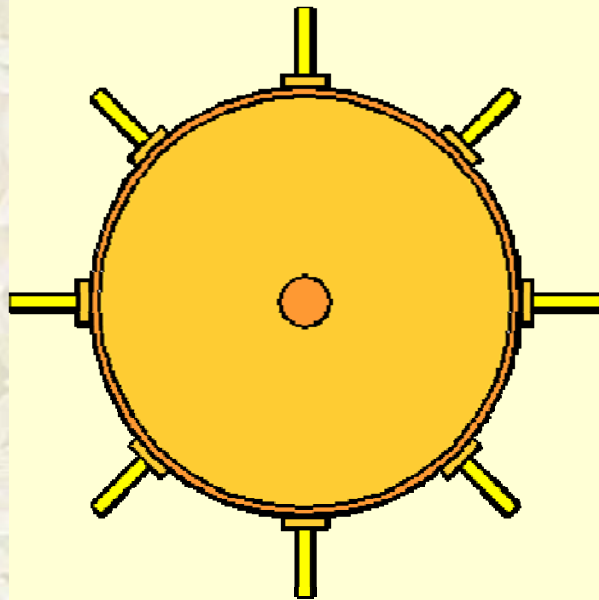
# Harvesting systems

## 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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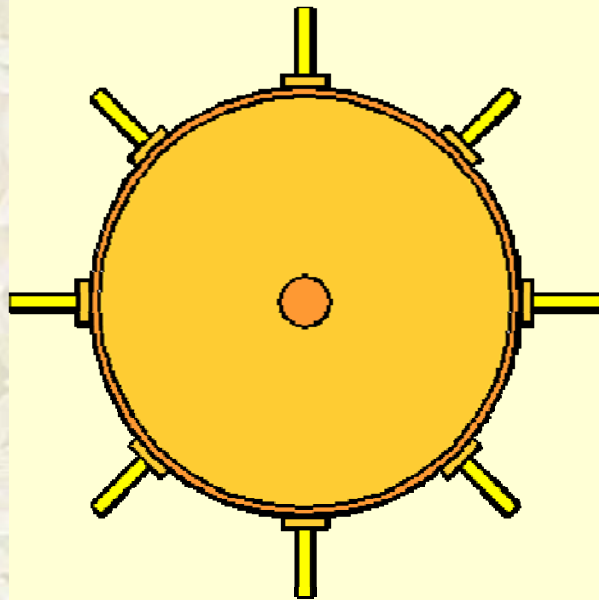
# When to harvest

## 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

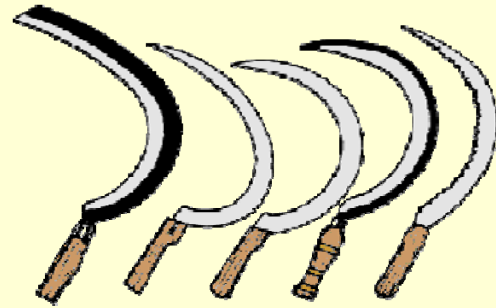


## In this module



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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

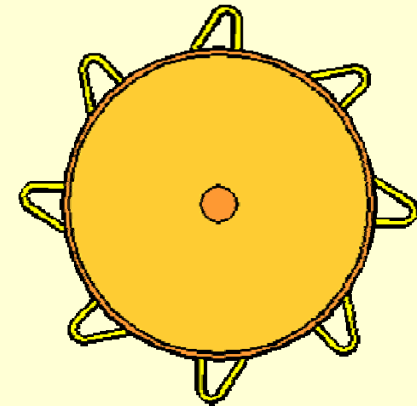


- **Capacity:** approximately 15 person days/ha
- Threshing by impact
- High shattering losses
- Pre-drying might be needed



# 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

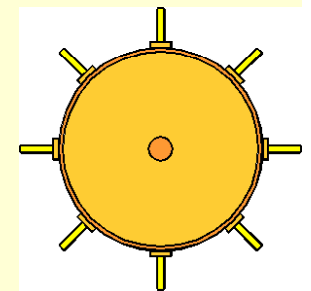
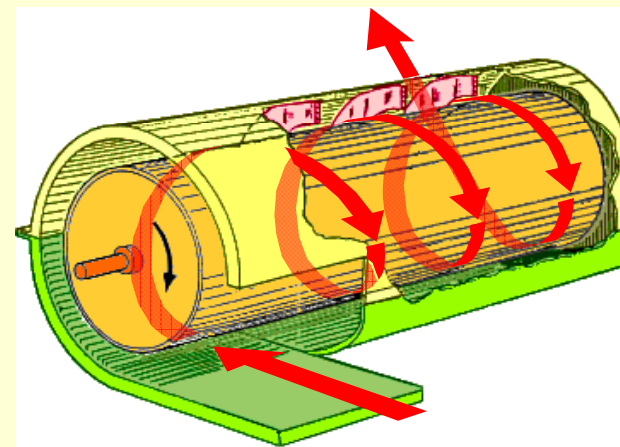


Wire loop threshing drum



# 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



Peg tooth threshing drum

produced in 9 different countries  
 used by several 100,000's of rice farmers across Asia

Axial flow principle

# 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)

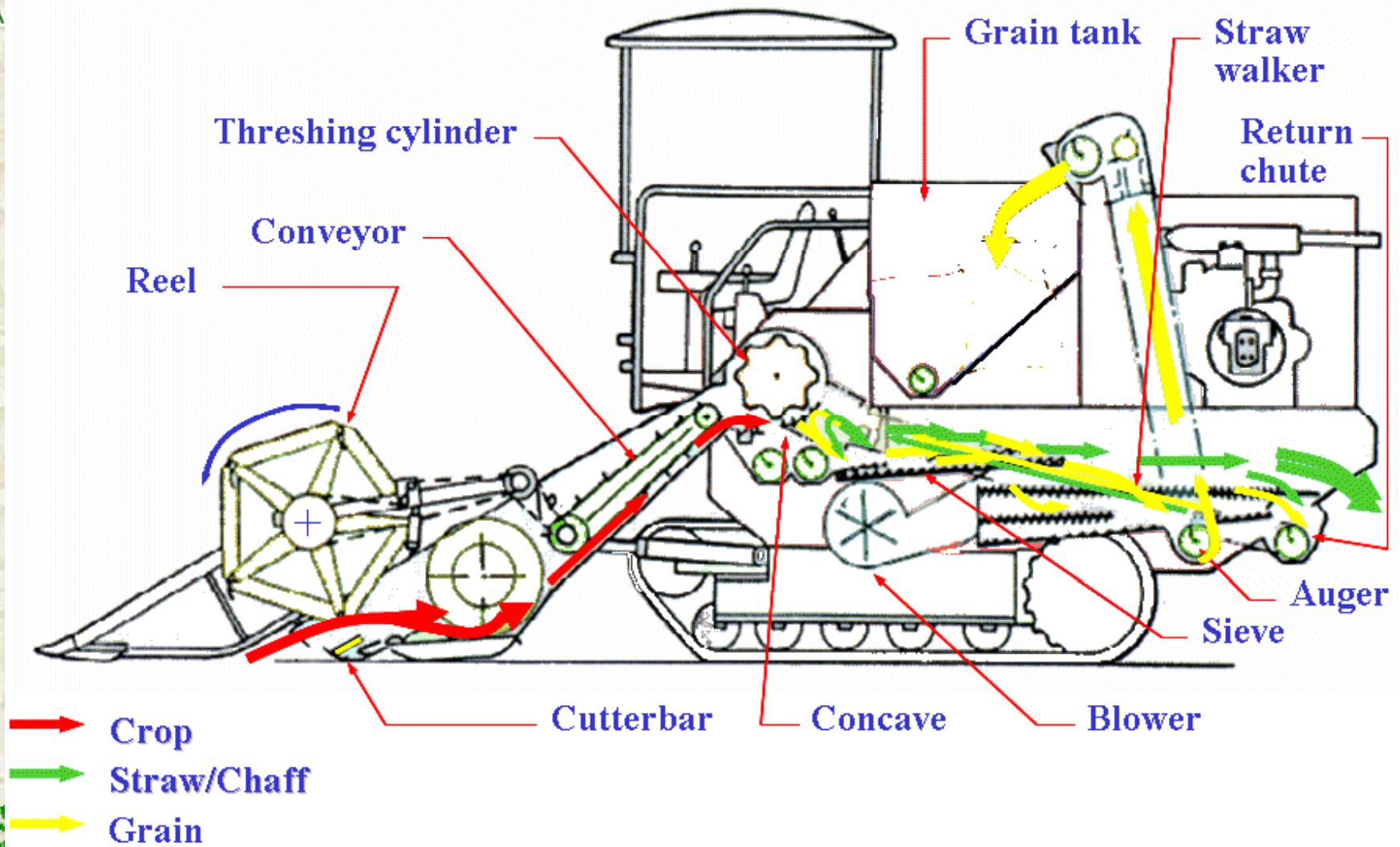


# Combine harvesting

- 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



# Stripper harvesting

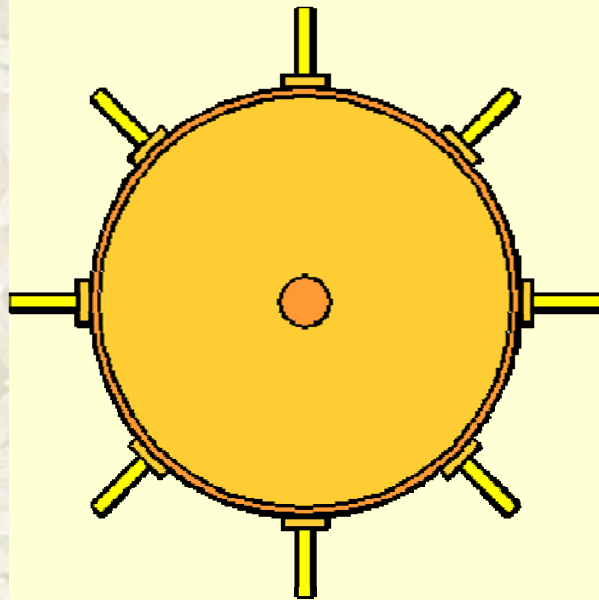
- **Capacity:** 1ha/day
- **Advantages**
  - strips and collects grains only
  - less material to handle
- **Problems**
  - problems in wet soils and lodged crop
  - straw treatment
  - does not work well with long straw
  - complex machine
  - skills required



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

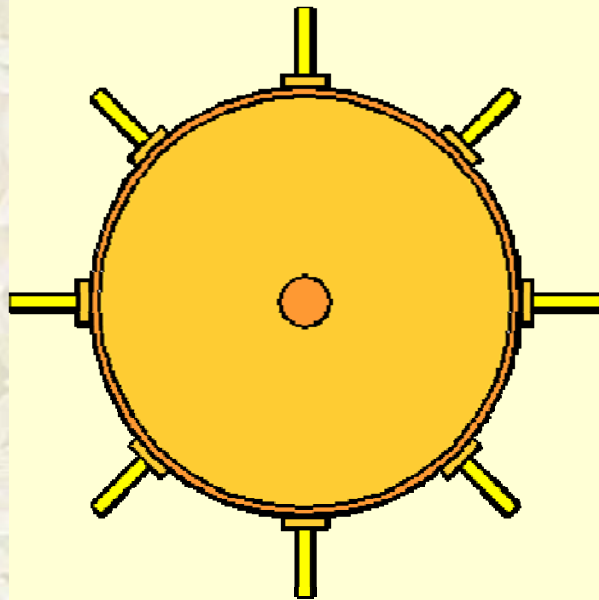
- **Shattering loss** = premature shedding of mature grains from the panicle caused by birds, wind, rats, and handling operations. Certain rice varieties shatter more easily than others.
- **Lodging loss** = plants with mature grains in the panicles fall on the ground making the grains difficult to recover.
- **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.



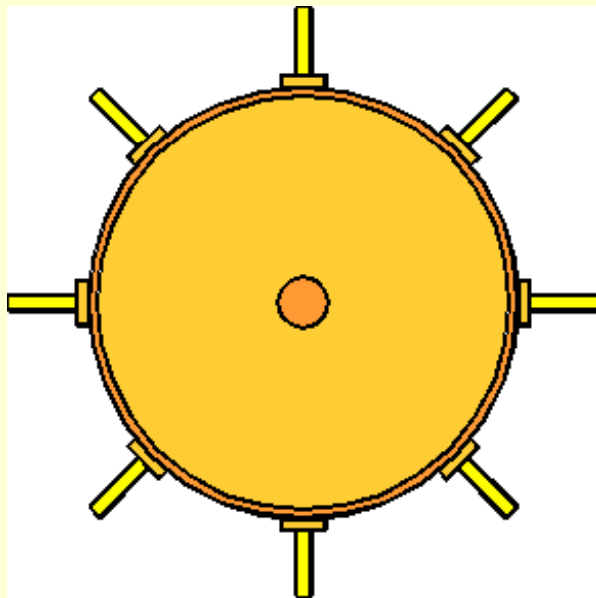
# Losses during threshing

- **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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## Content

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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

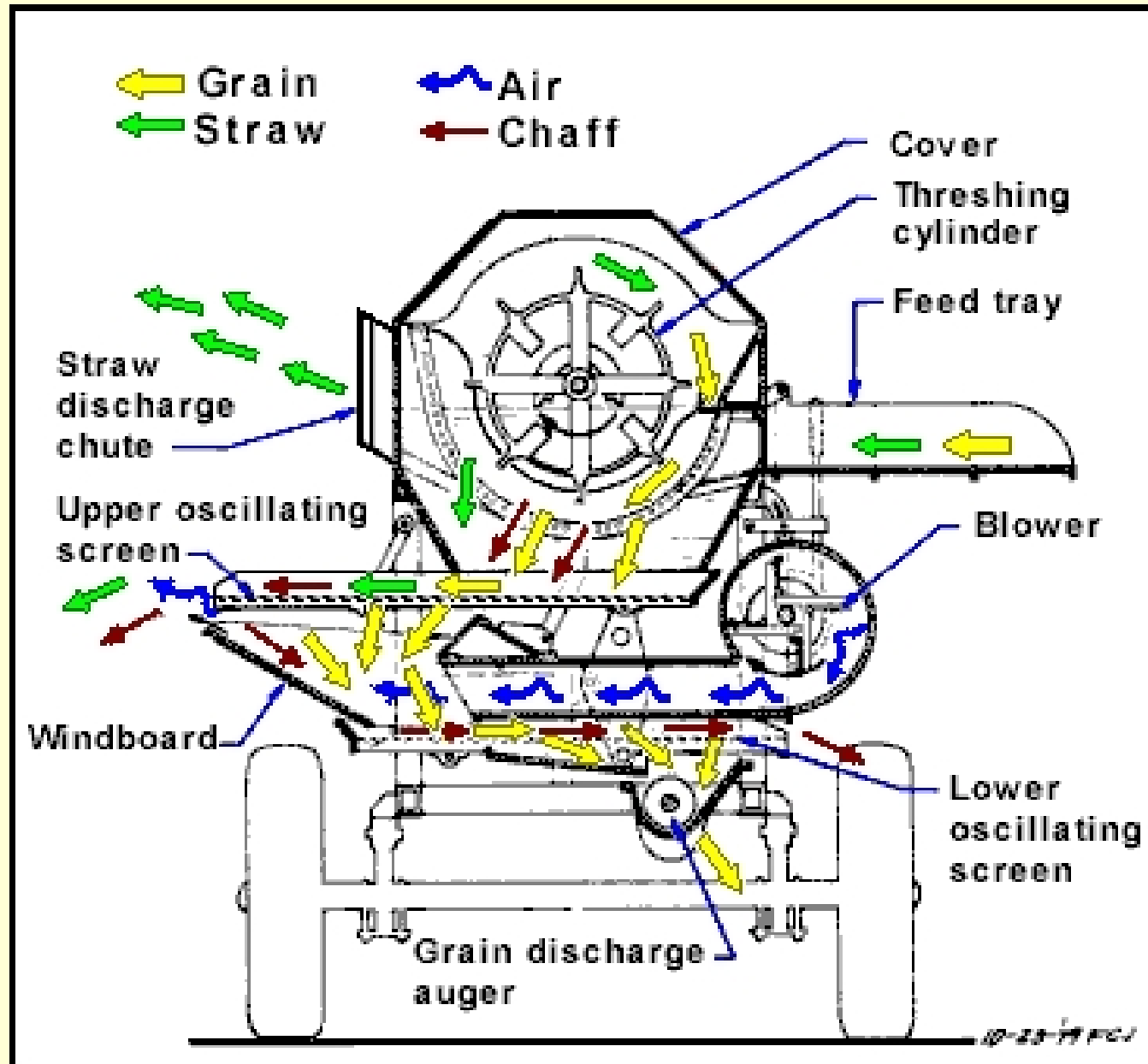


# Tips for machine threshing

- 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



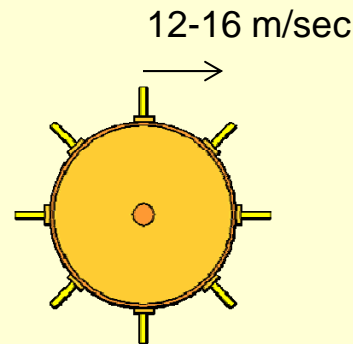
# Axial flow thresher



# 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).



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

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



# 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.



# IRRI



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