

RICOWAS

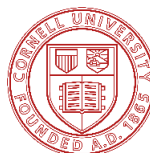
“Scaling up Climate-Resilient Rice Production in West Africa”

(Benin, Burkina Faso, Cote d'Ivoire, Gambia, Ghana, Guinea Conakry, Liberia, Mali, Niger, Nigeria, Senegal, Sierra Leone and Togo).

TRAINING MANUAL

TRAINING OF FARMERS AND FABRICATORS ON USE AND MAINTENANCE OF SRI EQUIPMENT

.....Building climate resilient rice production system



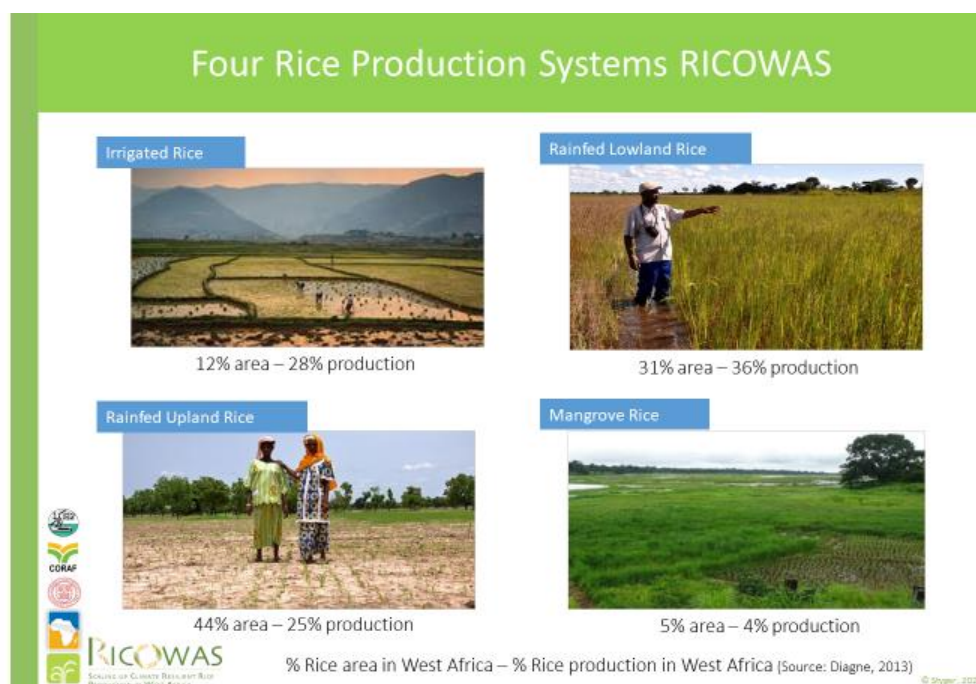
OCTOBER 2024

About RICOWAS Project

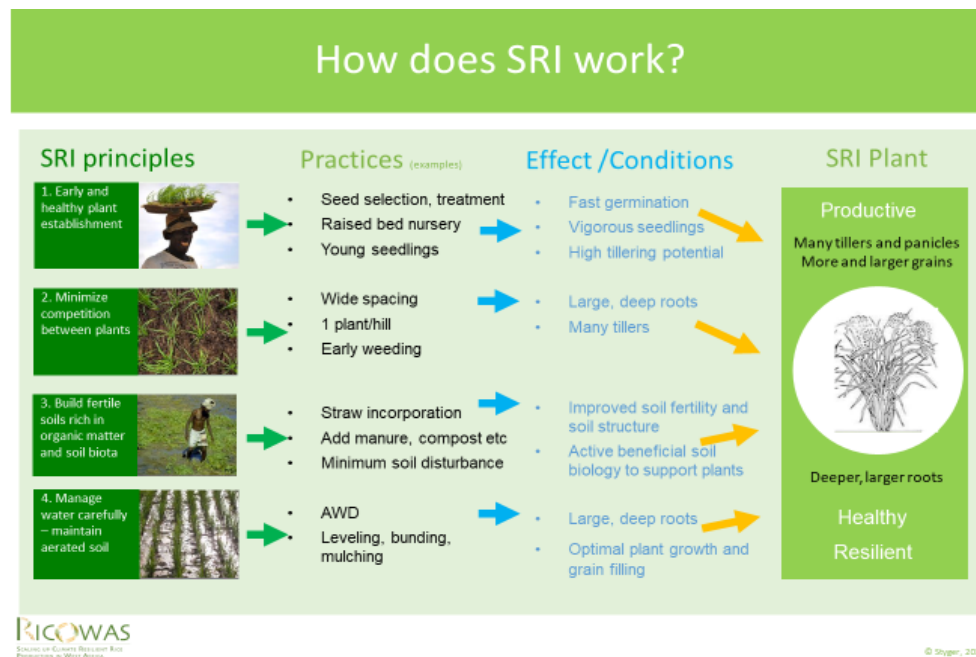
RICOWAS project was developed to improve the climate change resilience and increase rice systems productivity of smallholder farmers across West Africa. The project aims at improving and scaling up the System of Rice Intensification (SRI) and Sustainable Land and Water Management (SLWM) in West Africa building on the SRI-WAAPP regional project results. The project is implemented at regional level by the Sahara and Sahel Observatory (OSS), financed by the Adaptation Fund (AF) and implemented in 13 ECOWAS countries.

The RICOWAS project is being implemented in five States namely, Jigawa (Auyo, Miga and Jahun Local Government Areas), Niger (Lavun, Wushishi, Katcha Local Government Areas), Nasarawa (Doma, Obi, Awe Local Government Areas), Gombe (Yamaltu-Deba, Balanga and Kaltungo Local Government Areas), and Ebonyi (Ikwo, Afikpo-North, Ohaukwu Local Government Areas).

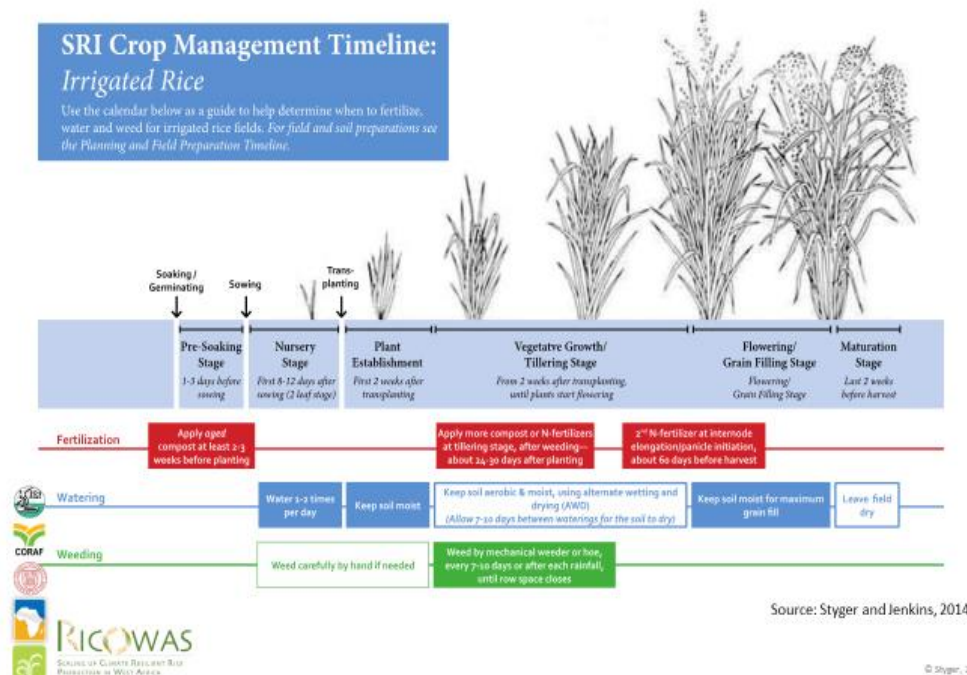
Introduction to Rice Production Systems



Introduction of SRI Principles and how SRI works?



SRI Crop Management Timeline



INTRODUCTION TO FARM EQUIPMENT

Introduction to farm Equipment

- Farm equipment and machines have various role in agriculture
 - Provide power to areas of labour shortage
 - Reduce labour cost
 - Increase farm profitability
 - Help farmers improve productivity
 - Allow for commercial production of crops in large area
 - Improve quality and uniformity of agricultural production processes
 - Such machineries include tractor, power tiller, combine harvester, field cultivator, planters/seeder, plough, baler, subsoiler, rotary tiller, thresher etc.

LAND PREPARATION EQUIPMENT

Land Preparation Equipment

- Major land preparation equipment are those equipment use to cultivate the soil before planting. These equipment consist of both manual and mechanical.
 - **Manual**
 - Hoe
 - Animal drawn cultivators by Cattle or horse
 - **Mechanical**
 - Hand on simple equipment
 - Power tiller and its accessories
 - Tractor and its accessories
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Land Preparation Equipment

- Power Tiller

- Power tiller is a working tractor that is commonly used for soil cultivation.
- It is the best for small and medium scale farmers
- It helps reduce animal and man power
- It is a machine compiled with a powerful engine and design to push forward and backward



LAND PREPARATION EQUIPMENT

Land Preparation Equipment

- Power Tiller

- Power tiller is capable of performing various operations such as ploughing, harrowing, puddling, leveling, weed control etc.



LAND PREPARATION EQUIPMENT

TRACTOR

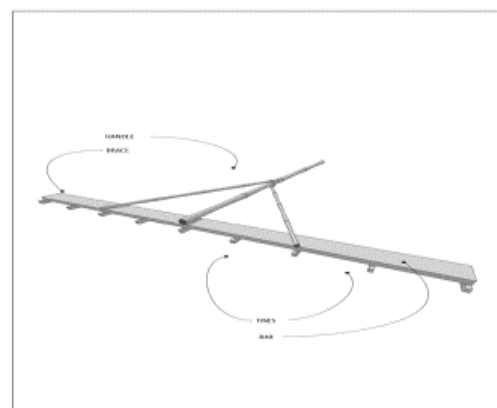


FIELD MARKERS IN SRI SYSTEM

Field Markers SRI System

- **Malaysian Wooden Marker**

- The Malaysian Wooden Marker is an efficient tool for marking planting grids in agricultural fields.
- This tool features a simple yet sturdy construction consisting of a handle, brace, bar, and tines.
- The handle and braces can be made from locally sourced materials such as tree branches or bamboo canes, which are then tied together using wire or rope wraps.
- The bar, measuring 100x25mm, supports the tines, which are equally spaced at 25cm intervals to create consistent planting rows.
- Each tine is angled at 45 degrees towards the tool handle for optimal marking.
- For enhanced functionality, the marker includes an optional ballast weight, which can be a brick, stone, or timber strapped to the bar to provide additional force when marking the planting grids.
- This design ensures the tool is adaptable, sustainable, and user-friendly, making it ideal for various farming conditions.



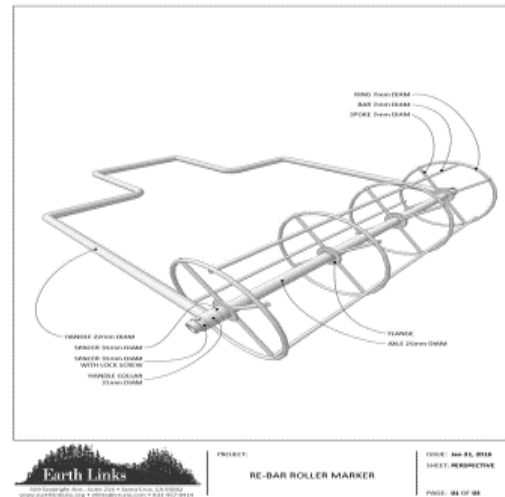
PROJECT: MALAYSIAN MARKER 02

DATE: 24.08.2018
SHEET: PERSPECTIVE
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Field Markers SRI System

• Re-bar Roller Marker

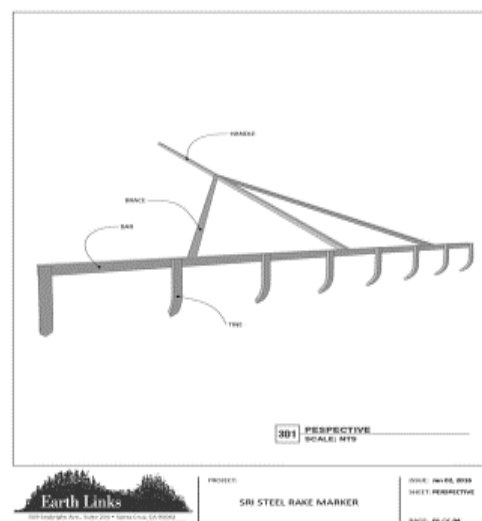
- The Re-bar Roller Marker is an innovative tool for marking planting grids with precision and efficiency.
- This marker features a robust design constructed primarily from steel components, ensuring durability and long-term use.
- The main parts include a handle with a diameter of 22mm, an axle of 25mm, and spokes, bars, and rings all measuring 7mm in diameter.
- The handle collar and spacers are 31mm in diameter, with one spacer equipped with a lock screw for secure assembly.
- The tool is engineered to create 25cm grid lines along the path of travel with every ring rotation, facilitating accurate planting spacing.
- This design ensures consistent and precise marking, making the Re-bar Roller Marker an essential tool for efficient agricultural planning and planting



Field Markers SRI System

• Steel Rake Marker

- The SRI Steel Rake Marker is a robust and versatile agricultural tool engineered for marking planting grids in various soil conditions.
- This tool features a sturdy construction with a handle and brace made from 20x20mm steel, ensuring durability and ease of use.
- The bar, measuring 25x25mm, supports multiple tines made from 10x20mm steel, each precisely spaced at 250mm intervals to create consistent planting rows.
- The tines are designed with a unique folding mechanism that allows them to turn at a 75mm radius, enhancing their effectiveness in marking the soil.
- The handle and brace are ergonomically designed for optimal user comfort, with a total length of 2000mm to provide ample leverage.
- The tool's top, front, and side views demonstrate its comprehensive design, making it a reliable and essential implement for efficient field marking and planting preparation



Rice Seeders and Transplanters

- A transplanter is an agricultural machine use for transplanting seedling in the field
- In the early days, people use to plant seedling with their hands. Trthey often use rope to plant the seedling.
- This is very important as it reduces the time taken to transplant seedling when compared with manual transplanting
- In the 20th centuary transplanter invented to transplant seedlings into the field which replace human efforts and consumed less time.
- Transplanters consist of trays, forks, handles and skids.

Rice Seeders and Transplanters

- How transplanter work?
 - Paddy seedlings are kept in the tray and allow to flow down under gravity .
 - The fork which attached to the shaft pick up the seedling from the try and keep it in horizontal position on the skid
 - The motion of the shaft is given by hand using chain and sprocket arrangement.
 - A simple four bar mechanism is used to plant the paddy seedling into the field.
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Paddy Rice Seeders and Transplanters

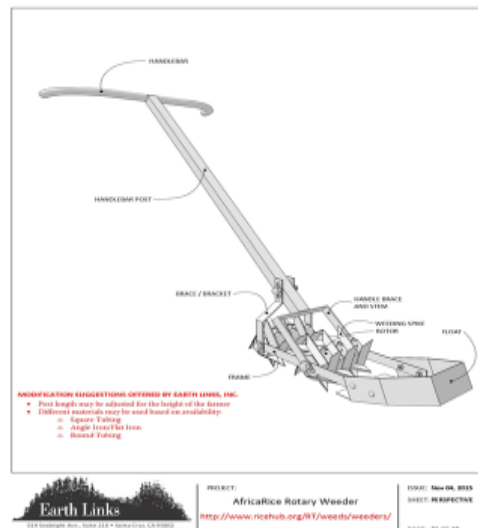
- Advantages of transplanters
- Reduce human effort to a maximum extent
- Simple design
- Easy to repair by farmers themselves
- Maintenance is less frequent
- Pulling force is greatly reduced by decreasing the weight of the model.
- Relatively low cost of purchase



Weed Control Equipment

• **Rotary Weeder**

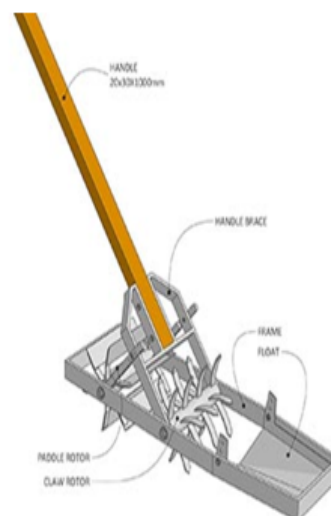
- The rotary weeder drastically changed the lives of many smallholder rice farmers.
- Instead of walking almost 10km to weed 1 Hectare by hand, in a bent position, they are able to weed in an upright position.
- This is a tool that has been tested and is used by many famers.
- You can build this locally with our Open-Source Plans.



Weed Control Equipment

• **Claw-Paddle Weeder**

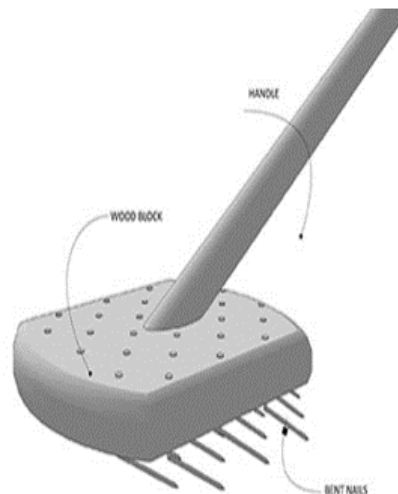
- The Claw & Paddle Flat Frame Weeder is a versatile agricultural tool designed to facilitate efficient weeding in various soil conditions.
- This tool integrates multiple rotor types, including the claw, paddle, blade, and stirrup rotors, each with specific functionalities to optimize soil and weed management.
- The tool's design allows for easy adjustments to match different user ergonomics and field conditions



Weed Control Equipment

- **Wooden and Tire Nail Weeders**

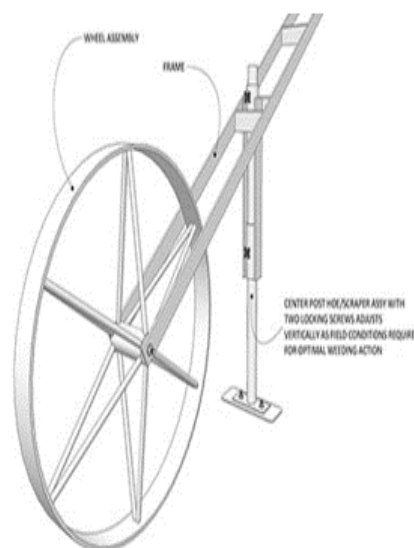
- Simple Rice Weeding Hand Tool. Fabricated from available wood pieces, or organic, unfinished timber scraps. Ultimate shape follows “artisan” (artistic sculptural) craftsmanship established by local craftsmen.
- Simple Rice Weeding Hand Tool. Fabricated from available wood pieces, or organic, unfinished timber scraps.
- Ultimate shape follows “artisan” (artistic sculptural) craftsmanship established by local craftsmen.
- User may select available materials and experiment with the weeder width, length or depth of the side wall.
- Nails or screws should project 2.5cm outside of the Tire but sizes can be changed for best results as User sees fit.



Weed Control Equipment

- **Single Wheeled Blade Weeder**

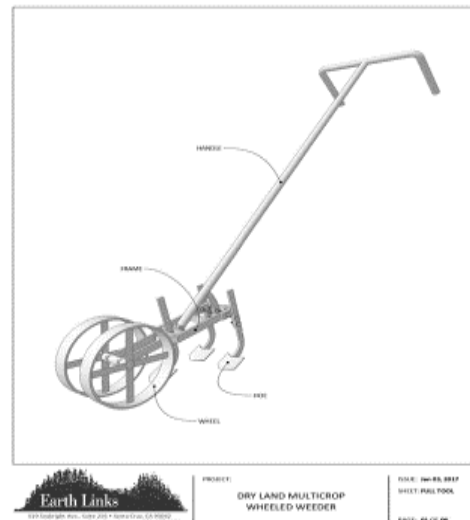
- The Single Wheeled Weeder, is a specialized tool designed for efficient weeding in dry land farming conditions.
- Featuring a robust steel frame made from 30mm x 5mm material and a 30mm diameter handle, this weeder ensures durability and ease of use.
- Its key component is the center post hoe/scrapper assembly, which adjusts vertically with two locking screws to accommodate varying field conditions and ensure optimal weeding action.
- The hoe blade, measuring 200mm x 70mm, is welded to maintain a parallel orientation to the ground, enhancing its weeding efficiency. The wheel assembly supports the frame, making it easy to maneuver.
- Additionally, the handle angle is custom-fitted to the user's waist height, providing ergonomic comfort.
- The vertical braces and gusset plates, welded to the frame and sleeves, add structural stability. This design includes an adjustable post detail that allows the hoe/scrapper to slide vertically inside sleeves, ensuring precise ground level adjustment.
- The tool also features screw holes on the hoe support and scraper plates for easy fastening, removal, re-sharpening, or replacement of the hoe/scrapper plate.
- This single-wheeled blade weeder is a practical and adaptable solution for farmers looking to maintain weed-free fields with minimal effort.



Weed Control Equipment

- **Multi-Crop Wheeled Weeder**

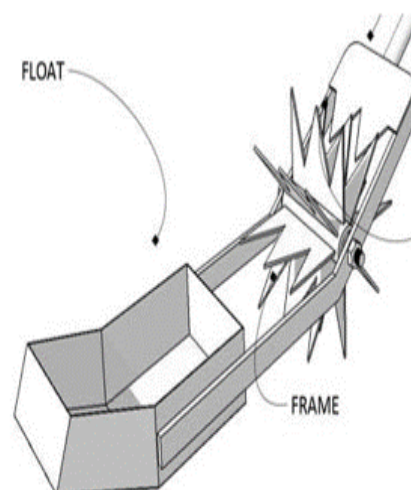
- The Multi-crop Wheeled Weeder is a versatile agricultural tool designed for efficient weeding across various crop types in dry land conditions.
- This weeder features a sturdy frame constructed from 5x20mm steel bars, ensuring durability and longevity.
- The central component is a hoe blade, supported by a 20mm diameter handle and adjustable brackets, allowing for precise depth and angle control to match specific field requirements.
- The handle is ergonomically designed for user comfort, with a radius adjustment stem welded to it, ensuring optimal leverage and ease of use.
- The wheel assembly, incorporating an axle and grommet system, provides smooth maneuverability across the field. This tool's design facilitates efficient weed removal with minimal soil disturbance, making it an essential implement for sustainable agricultural practices..



Weed Control Equipment

- **Mandava Weeder**

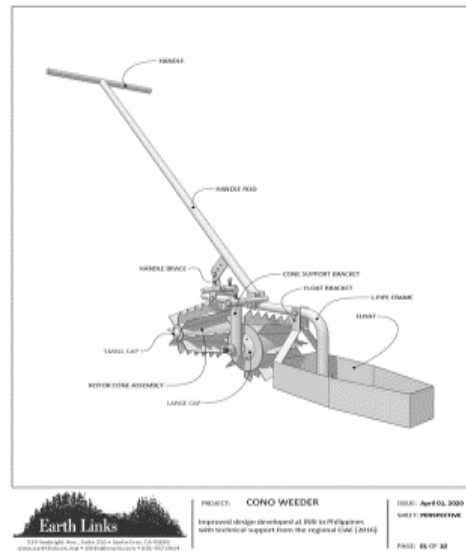
- The Mandava Weeder was designed with women farmers in mind.
- It weighs less than 2-rotor weeders.
- Many farmers have said that it is easy to push.
- It has been tested and is used by thousands of rice farmers.
- You can build this locally with our Open-Source Plans.



Weed Control Equipment

- **Cono Weeder**

- Two rollers, one behind the other, are fitted at the bottom of a long handle.
- The cone-shaped rollers have serrated blades on the outside. A float provided in the front portion prevents the unit from sinking into the soil.
- The cono weeder can also be used for trampling green manure crop in addition to weeding operation. It disturbs the topsoil and increases soil aeration.
- The equipment is operated in a standing posture thus avoiding the bent posture involved during uprooting of weeds by hand..



HARVEST AND POST HARVEST EQUIPMENT

Harvest and Post Harvest Equipment

- Harvesting rice consists of the basic operations which can be done in individual steps or in combination using a combine harvester. These include:
 - **Reaping** - cutting the mature panicles and straw above ground
 - **Threshing** - separating the paddy grain from the rest of cut crop
 - **Cleaning** - removing immature, unfilled, non-grain materials
 - **Hauling** - moving the cut crop to the threshing location
 - **Field drying** - leaving the cut crop in the field and exposing it to the sun for drying (*optional*)
 - **Stacking/piling** - temporarily storing the harvested crop in stacks or piles (*optional*)
 - **Bagging** - putting the threshed grain in bags for transport and storage
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MANUAL HARVESTING

- Manual system is the most common means of rice harvesting.
- The rice crop is cut by using simple hand tools like *sickle* (best for cutting 15–25 cm above ground level), and simple *hand-held knives* (best for cutting just below the panicle, e.g. *ani ani* in Indonesia).
- When cutting crop with a sickle, always hold the stems with thumb pointing upwards, away from the blade.
- **Advantages:** Very effective in lodged crop conditions
- **Disadvantages:** Labor-intensive; Manual harvesting requires 5–10 person days per hectare. It will take additional labor to manually collect and haul the harvested crop.



REAPING

- Mechanical cutting uses reapers (machine that cuts and gathers).
- Reapers are either hand-driven or mounted on the front of a tractor. While the use of reapers has not been widespread,
- it is gaining popularity where labor shortages have occurred.
- Most reapers lay the crop in a windrow, which allows easy pick-up of the harvested crop. A reaper with a cutting-width of 1.5 m can operate at a rate of 2–4 ha per day.
- To efficiently use reapers, fields need to be leveled and water drained at least 10–20 days before harvest.
- **Advantages:** Low labor requirements
- **Disadvantages:** Difficult to reap lodged crop; Availability of machine may be an issue



Harvest and Post Harvest Equipment

- **For manual threshing**

- For hand threshed crops, partial drying in the field for a couple of days may be necessary to lower the moisture content and make threshing easier.
- The highest milling yield will be attained for hand threshed, sun dried rice at grain moisture content between 18–20%.
- Care must be taken not to overdry the crop if it is to be transported any distance before threshing as excessive shattering will occur.
- While the crop may be dried before threshing, dried crop should not be subjected to rewetting. Rewetting causes grain fissures which lead to high broken grain when milled.

Harvest and Post Harvest Equipment

- **For machine threshing**

- Harvest the grain at optimum maturity to maximize yield and minimize losses. Axial-flow threshers that are particularly designed for rice can handle very wet crop.

- *Timing of threshing*

Ideally, machine threshing should begin immediately after cutting and often these crops can be threshed in the field.

Immediate threshing reduces the exposure of crop to insects, birds and rodents, disease, and molds. Crop that is piled over a period of time generates heat that will serve as an ideal medium for growth of molds, disease and pests. Piling for several days will lead to grain discoloration, germinated grains, and spoilage.

- *Machine adjustments*

Always make sure that threshing drum speed and the cleaner settings are done properly according to the crop conditions. Wrongly adjusted threshers create higher threshing loss and grain damage.

Manual Threshing

- **Pedal thresher (recommended best practice)**
- The pedal or treadle thresher consists of threshing drum, base, transmission unit and a foot crank.
- When pedaled, the threshing drum rotates and rice can be threshed when panicles are applied against the threshing drum.
- Because small straws, chaff, and foreign matter drop along with the threshed grain, whole grains must be separated using a flail, sieve or by winnowing (see section on cleaning).



Manual Threshing

- **Trampling**
- This involves the use of bare feet or animals to thresh the crop.
- The crop is spread over a mat or canvass and workers trample with their own feet or use their animals.
- Animal treading or trampling is normally carried out at a designated location near the field or in the village.
- In some regions, animals have been replaced by tractors.
- After animal treading, the straw is separated from the grains and cleaning of the grain is done by winnowing, with or without the aid of an electric fan.
- Losses are high from broken and damaged grains



Manual Threshing

- **Threshing rack**
- The crop is held by the sheaves and beats it against a slatted bamboo, wooden platform, or any other hard object such as a steel oil drum. This is very labor intensive.



Mechanical Threshing

- The use of small stationary machine threshers commonly replaces manual threshing given the high labor requirements of manual threshing.
- Stationary threshing is generally done in the field, or near the field.
- Many stationary threshers for paddy have peg-toothed threshing drums, however threshers fitted with wire-loop or rasp-bars are used as well.
- Most threshers are of the feed-in type (e.g. entire crop is fed through the thresher) which ensure high throughput



Introduction to tools use for fabrication

- Some tools and materials used to fabricate agricultural equipment include:
- **Steel**
- A common metal for agricultural tools and parts, such as rakes, shovels, and hoes. Steel prevents soil from sticking and makes cleanup faster.
- **Stainless steel**
- A version of steel that's combined with chromium to create a smooth texture and sheen. Stainless steel is strong, environmentally friendly, and easy to fabricate.
- **Conveyor systems**
- Mechanical equipment used to move a variety of products, including in agriculture.
- **Telescopic loaders**
- Can be used for both agricultural and construction purposes.

Some tools for fabrication of agricultural equipment

1. Bandsaw
 2. Die Grinder
 3. Press Brake
 4. Bending Tools
 5. Metal Nibbler
 6. Fasteners
 7. Wire Cutter
 8. Flange And Punch Tool
 9. Marking Tools
 10. Beam Lines
 11. Throatless Shear
 12. Planishing Hammer
 13. Stretchers
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Introduction to tools use for fabrication

