

# Land preparation for lowland irrigated rice production in West Africa

## Introduction

Land preparation is crucial for rice productivity. Rice is mainly produced in the lowland ecology. Although upland rice cultivation is common across Africa, significant production comes from the lowland environment. Rice is typically grown in banded fields that are flooded until about 14-21 days before harvest. The effectiveness of irrigation water application start with good land preparation. Land preparation may result in better water use, fertility distribution and yield.

## Key facts

- Land preparation should be based on the duration of rice variety you intend to cultivate: Short duration 100-120 days; Medium duration 120-140 days; Long duration 160 days or more.
- Most varieties take 50-55 days from panicle initiation to harvest. This should be considered in field planning.
- It is even more critical when the cultivation is rainfed.

## Forms of land preparation

### Wet preparation (WP)

- WP is the common way of preparing land for rice farming.
- The soil is tilled and the soil structure is broken under saturated water conditions.
- WP requires a lot of water: It is only possible where irrigation water is abundant.
- WP also includes puddling.
- This increases the gross water requirement for rice production, but it also has the advantages of reducing weed infestation and incorporating nutrients into the soil.



Photo: Adebayo Oke

## Dry preparation (DP)

- DP is used for upland soils or areas with limited irrigation water supply.
- DP requires machinery for tillage: When the soil is coarse with a hardpan, tillage sub-soiler machinery may be used to break the soil.

Such soil should, however, be suitable for rice cultivation: It should be fertile and have high water holding capacity. It is even more crucial when cultivation is rainfed.

## Other essential land preparation requirements

**Land leveling** is an essential component of land preparation.

**Land leveling:** Leveling helps to distribute water more uniformly, leading to 20-30% water savings. It also prevents waterlogging and improves crop irrigation uniformly.

## Key facts of land leveling

- Ensuring the land is levelled and has virtually no slope is critical.
- A gradient of between 0.05-0.1 (5 m/100 m-1 m/10 m) will facilitate water drainage at critical times in rice production.
- Essential tools (hoes, planks and lines) and, where available, efficient and modern technology like the laser-guided leveller technology ensure leveling in lowland rice production.
- Leveling the basins will improve water coverage, crop establishment, and weed control.
- It allows the maintenance of uniform water spread within the basin during irrigation periods.
- It also facilitates management practices such as nutrients (fertilizer management), weed control, and water control in the basin.
- An engineering plan for land leveling is developed when a new scheme is designed, or an old field is being improved, showing all the features of the new field.

## Essential steps in land preparation

**Ploughing:** Tractors, other small tillage equipment, or manual tilling could be used immediately after harvesting when the soil is still moist. Clayey soil is not easy to plough when dry and has cracks.

- There may be a need for first and second ploughings.
- A disc or mouldboard plough is recommended for use: It turns the soil, and subverts and kills the weeds.

**First ploughing:** should incorporate residue 6-8 weeks before planting to a depth of about 10-15 cm. A good soil surface improves water distribution and infiltration.

**Second ploughing:** Plough twice across the field with the disc or tine harrow. It should be done 2-3 weeks before planting, and the last harrowing should be done one week before planting with a maximum depth of 5-7.5 cm.

**Harrowing:** Land preparation process in which the soil clods are broken to achieve a fine soil texture.

- Necessary in heavy clay soils when the second ploughing

does not accomplish a fine bed.

- Harrowing should be done before puddling, which further aids the puddling process.
- Poor land preparation can increase the problem of depression in the fields, leading to ponding.
- Also, uniform infiltration across the field may be difficult to accomplish.

This is a process during which soil in a rice field is mixed continuously to break the clods and create a fine bed for rice planting.

- In rice fields with sufficient water, puddling is done to a soil depth of 5-10 cm after initial ploughing or harrowing.
- It breaks up the clods and churns the soil.
- Soil puddling should be done at least 1-2 days before seeding to allow the water to clear when direct seeding.
- Soil puddling is done when the basin bunds have been well established.
- It is the last of the land preparation activities before transplanting seedlings or direct seeding.
- Soil puddling creates an anaerobic environment for rice and hinders weed growth.

## How is puddling done?

- Manually using hand held tools
- Animal-drawn cultivator
- Mechanical cultivator (either small machine or standard tractors)



Land preparation with different equipment (photo: Adebayo Oke).



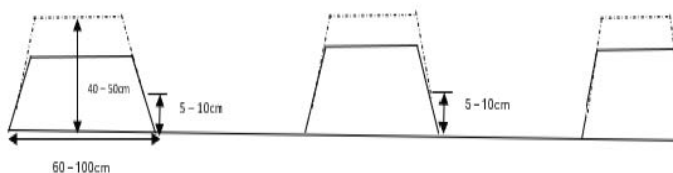
Photo: Isaac Eldridge



Photo: Adebayo Oke

## Basin bunds: Construction and repair

- The bunds define the basin/check basins or borders for water and nutrient management.
- Construction or repair of existing bunds is important in cultivating lowland irrigated rice.
- Bunds are typically made from clay materials in the field.
- Suitable bunds are a prerequisite to limit water and nutrient losses.
- Bunds could be at least 40-50 cm high and 1 m wide at the base, smaller when there is no threat of flooding.
- Bunds should be high enough to avoid overflowing during heavy rainfall.
- Lower sides of 5-10 cm height in the bunds is the irrigation water level.
- Bunds should be compacted to retain water in the basin.
- Cracks and rat holes are often bored through the bunds, which increases water loss during irrigation.
- Compacting bund sides could also limit water losses from cracks and holes.



## Irrigation scheme canals: Maintenance and repair

In the formal irrigation schemes, irrigation water conveyance is based on a network of canals.

- The canals could be lined (concrete) or unlined (earthen).
- Lined canals reduce the permeability of the canal bank and seepage loss.

- Water loss could be high in the unlined tertiary and field canals.
- The situation becomes more worrisome when such canals are not well-kept.

The irrigation canal system operates optimally when kept clean and without leakages.

Maintenance may be required on all categories of canals:

- **Primary canals** (usually the central canals) that convey irrigation water from the dam intake to the major sectors of the scheme).
- **Secondary** (feeder), tertiary and field canals.

The significant issues that affect the performance of irrigation canals are:

- Plant growth in the canals
- Sedimentation
- Cracks

Canal maintenance is best implemented between irrigation seasons when there is low irrigation water demand or when cutting flow in the canal system is possible.

The maintenance practice should include the following:

- Removal of weeds, bushes, and shrubs that may have grown in the canal.
- Removal of sediments or debris from the canal.
- Blocking or mending of breaches and rat holes in the canals, bunds, and embankments.
- Fill in weak sections of the canals and bunds with compacted soil to restore the structure.
- Reconstruction of the eroded sections to restore the original shape.

## What happens when a canal is not properly maintained?

- The canal capacity is reduced (due to sedimentation or growth of weeds, bushes, and shrubs).
- The distribution capacity is reduced (due to a reduction of the cross-sectional area).
- Irrigation water supplied to the field is thus reduced.

## Summary checklist for a well-prepared field

Ask the following Yes/No questions

1. Are the soil lumps well broken to give good seed-soil contact and proper seedbed?
2. Is the land levelled with a very gentle slope?
3. Is the soil surface well-leveled and smooth across the field and basins?
4. Are the cracks and holes on the bunds blocked?
5. Are your canals clean?
6. Have you removed grasses from the field channels?
7. Are the bunds in good shape and are the breaks repaired?
8. Have you blocked all holes and eroded sides of the bunds?
9. Have you cleared your intake point if you are lifting water from a river/stream?
10. Are you generally satisfied with the state of your entire field?



Photo: Adebayo Oke

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