FARM AFRICA

October 2025

Rice production training manual

Uganda

AGRA
Sustainably Growing Africa's Food Systems

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Preface

The Government of Uganda, through the Ministry of Agriculture, Animal Industry and Fisheries (MAAIF), has been implementing an agricultural sector development and strategy investment plan that prioritised rice as an important strategic crop to address food security and household income in Uganda.

Farm Africa, the Alliance for a Green Revolution in Africa (AGRA), and other collaborating partners including District Local Governments, Japan International Cooperation Agency (JICA), etc., are strengthening market-preferred, nutrient-dense, and climate-smart varieties in Eastern Uganda as well as enhancing rice production, quality, and competitiveness of rice.

A key component of the project involves capacity building of the Village Based Advisors (VBAs) in the rice value chain, including farmers and millers. The AGRA project will train 100 VBAs who will reach 12,000 smallholder farmers in Eastern Uganda.

The smallholder farmers are great assets in enhancing rice production and productivity since they dominate the sector, and this will be achieved in line with Uganda's rice sub-sector development as outlined in the National Rice Development Strategy 2015–2018.

This is a revised "Rice Cultivation Handbook" for both upland and lowland rice cultivation techniques that will be used by Farm Africa Village Based Advisors to help improve rice crop management. This version contains more photos to help our farmers comprehend better rice cultivation techniques. The revised version also contains additions such as "Farm record keeping" to assist farmers in managing their production costs and enhancing their income.

It is our wish that farmers and Village Based Advisors best utilise this handbook and use practical experiences to provide feedback to better revise the book for future versions. We thank all the readers and users of this handbook as we work together to improve rice production and productivity in this country.

October 2025

Introduction

Rice is one of Uganda's fastest-growing staple crops and an increasingly important source of income for smallholder farmers. Production has expanded in lowland marshes, along perennial river valleys and irrigation schemes, and on newly developed upland varieties. Rice contributes to food security, household incomes, local employment (processing, milling, transport and marketing), and regional trade. For development projects, rice is attractive because it allows relatively fast scaling of production and market linkages when combined with good seed, mechanisation, agronomy and post-harvest handling.

Importance of rice growing in Uganda

- **Income generation:**
  Rice is a major source of **income generation**, driven by high demand in urban and regional markets — and when yields are improved and post-harvest losses reduced, farmers can earn significantly higher returns.

- **Food security and nutrition:**
  Rice provides energy and can complement other staples to improve dietary diversity when combined with legumes, vegetables and animal-source foods.

- **Employment and enterprise:**
  The rice value chain creates **employment and entrepreneurship opportunities** — from seed production and mechanized land preparation to milling, packaging, and transport — particularly benefiting youth and women.

- **Climate resilience options:**
  Certain rice systems such as the System of Rice Intensification, improved water management, and use of drought-tolerant varieties can increase productivity per unit of water and land.

- **Resource intensification:**
  Rice can make marginal wetlands productive if managed sustainably, generating higher returns from small plots.

- **Value-addition potential:**
  Rice has strong value addition potential, with opportunities in milling, grading, packaging, and branding (e.g., local, organic, or premium parboiled rice), which increase profitability and open doors to formal markets.

Agro-ecological and production zones in Uganda

- **Lowland marshes and valley bottoms:** These are major traditional rice zones that are good for irrigated or rainfed lowland rice.

- **Irrigated schemes and perimeters of large wetlands:** They offer potential for multiple crops per year.

- **Upland/rainfed areas:** These regions cultivate upland rice varieties that require less water. Although these varieties typically have lower yield potential, they are well-suited to specific districts.

- **Considerations:** The soil type should ideally be loam or clay, as these are most suitable for paddy rice production. The land should preferably be flat to allow for proper water retention and management. It is also important to assess how deep the water table is, as this affects water availability for the crop.

  The risk of flooding needs to be evaluated to ensure it is manageable. Although salinity is not a common issue in most local areas, it should still be checked. Finally, the site should be close to markets and processing facilities to reduce transport costs and post-harvest losses.

Key requirements for successful rice production

A. Land and water

- Flat or gently sloping land— Lowlands/valley bottoms are ideal for paddy systems.
- Reliable water source or the ability to construct simple water control structures such as bunds, inlets, and outlets for rainfed or irrigated systems.
- Land tenure clarity — Stable access encourages investment.

B. Good seed and varieties

- Use certified, high-yielding and improved varieties suited to local conditions. These include varieties that are early maturing, drought tolerant, flood tolerant or pest resistant as required.
- Maintain seed quality through proper storage and timely replacement.

C. Soil fertility and inputs

- Soil testing and targeted fertiliser application should be conducted, ensuring balanced supply of Nitrogen, Phosphorus and Potassium (NPK) and essential micronutrients.
- Organic matter addition such as compost/manure is needed to maintain structure and fertility.
- Access to quality agrochemicals for pest and disease control when needed is important. The agrochemicals should be used responsibly.

D. Labour, tools and mechanisation

- Labour for land preparation, transplanting, weeding and harvesting — Consider labour-saving options such as mechanised land preparation, transplanters, combine harvesters or hired services.
- Basic tools — These include hand hoes, sickles, tarpaulins, moisture meters, and weighing scales. For groups, rice threshers and de-huskers are required.

E. Knowledge and extension

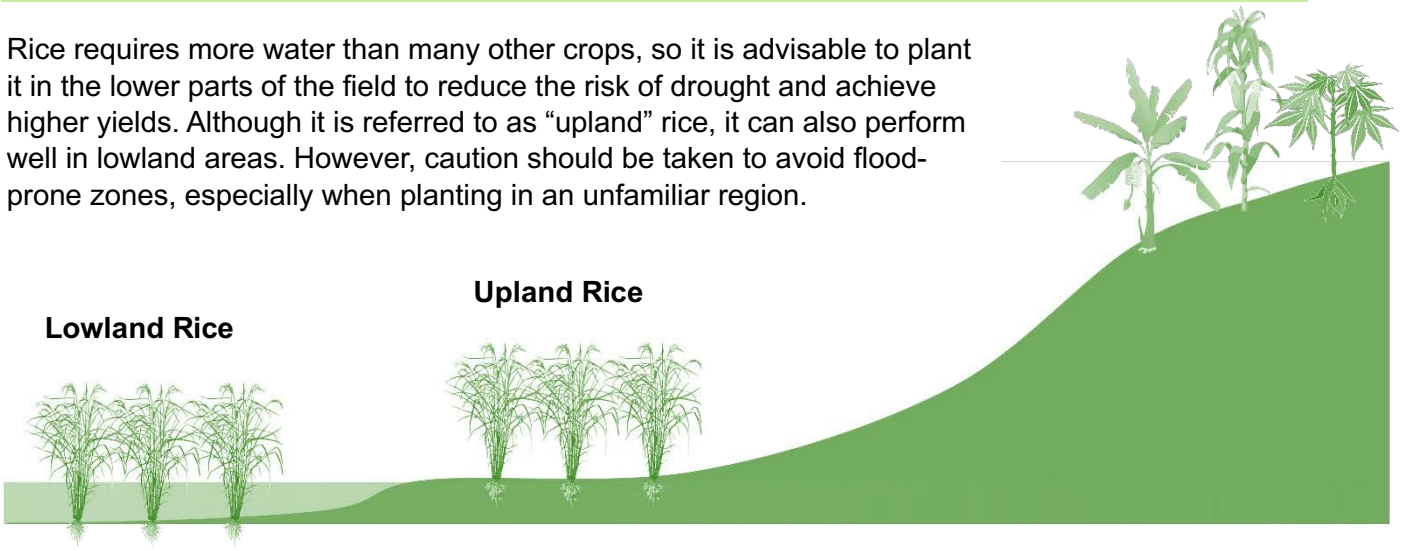
- Farmer training is required in good agronomic practices, such as System of Rice Intensification (SRI) where appropriate, integrated pest management (IPM), water management and post-harvest handling.
- Demonstration plots and farmer-to-farmer learning accelerate adoption of good agronomic practices.

F. Finance and markets

- Access to short-term finance is needed for inputs and small equipment. This required linkages to microfinance institutions (MFIs), Village Savings and Loans Associations (VSLAs), and input suppliers.
- Clear market channels and contracts with millers, aggregators, and buyers are crucial to secure offtake and fair prices.

Site Selection

Rice requires more water than many other crops, so it is advisable to plant it in the lower parts of the field to reduce the risk of drought and achieve higher yields. Although it is referred to as “upland” rice, it can also perform well in lowland areas. However, caution should be taken to avoid flood-prone zones, especially when planting in an unfamiliar region.



Variety Selection

There are several rice varieties available in Uganda, including:

NERICA 4 (U)	Maturity: 110-120 days	Yield: 4.0-5.0 t/ha	High yield in upland rice)
NERICA 1 (U)	Maturity: 105-115 days	Yield: 3.0-4.0 t/ha	Aromatic
NERICA 10 (U)	Maturity: 100-105 days	Yield: 3.0-4.0 t/ha	Short maturity period
NERICA 6 (U/L)	Maturity: 130-140 days	Yield: 3.0-5.0 t/ha	Very tolerant against Rice Yellow Mottle Virus (RYMV)
WITA 9 (L)	Maturity: 140-160 days	Yield: 5.0-6.0 t/ha	Tolerant against RYMV


NERICA 4


NERICA 1

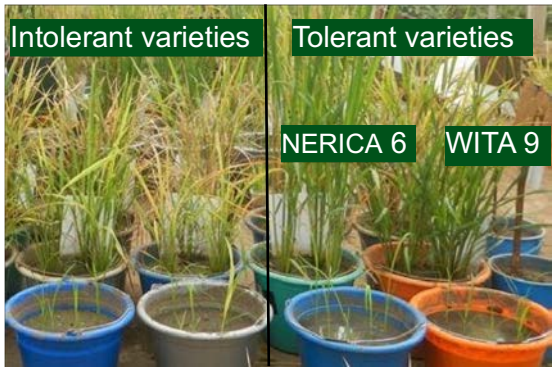

NERICA 10


NERICA 6


WITA 9

If your field is infected by Rice Yellow Mottle Virus (RYMV), planting tolerant varieties is recommended.


WITA 9 has a purple colour on its stems



NERICA 6 & WITA 9 have high tolerance against RYMV

NARIC1, NARIC2, NAMCHE1-6, OKILE, AGORO, and KOMBOGA are also available in Uganda.

Land Preparation

Land preparation is one of the most critical steps in rice production because it influences crop establishment, water management, nutrient availability, and weed control. A seedbed refers to the condition of the soil surface where rice seeds are sown, or seedlings are transplanted. The physical quality of the seedbed — whether rough (cloddy and uneven) or fine (well-leveled and friable) — directly affects rice germination, growth, and yield. Rice can be established either through direct seeding or transplanting. In both cases, achieving an appropriate seedbed texture is vital for uniform crop establishment and efficient water use.

Effect of Seedbed preparation		
Aspect	**Rough seed bed**	**Fine seed bed**
Seed germination	Poor germination and patchy emergence due to uneven soil-seed contact.	Uniform and high germination rate due to good soil-seed contact.
Transplanting	Difficult planting — seedlings may not root well or stand upright.	Easier planting, better root establishment, and less transplanting shock.
Weed control	Higher weed pressure as clod protects weed seeds and reduces puddling effectiveness.	Fewer weeds because puddling buries weed seeds and creates anaerobic conditions.
Water management	Uneven distribution as some areas may flood while others remain dry.	Even water distribution thus minimizing waterlogging and dry spots.

Nutrient availability	Non-uniform fertilizer distribution and uptake.	Improved decomposition of organic matter and nutrient uniformity in the root zone.
Crop growth	Uneven plant height and tillering, and weak stands in dry spots.	Uniform tiller development and stronger plant stand.
Yield	Reduced yields due to non-uniform crop establishment and competition from weeds.	Higher yields due to uniform establishment and better management efficiency.

Upland Rice: Planting on rough soil results to poor germination. Fine soil is recommended for proper germination of rice.

Lowland Rice:

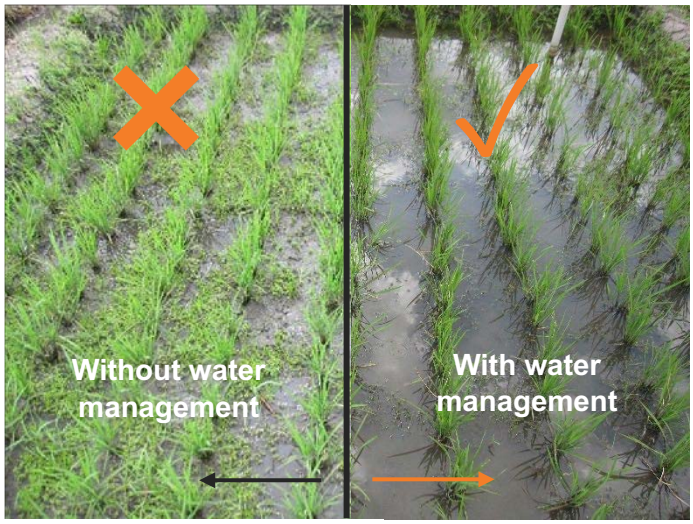
Bunds are small earthen embankments or ridges constructed around rice fields to retain and control water. They are an essential component of paddy rice production systems — especially in lowland and irrigated areas — because they help regulate water levels, reduce soil erosion, and limit weed growth.

Properly designed and maintained bunds are critical for achieving efficient water use, effective weed control, and high yields in rice farming.

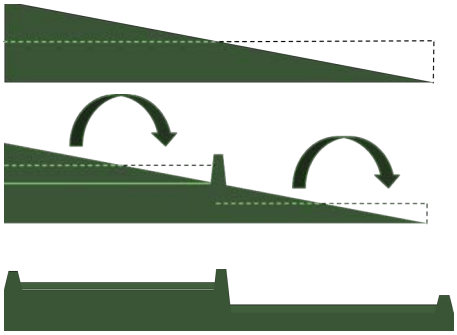
Role of Bunds in Water Management

Function	Explanation
Water retention	Bunds keep water within the field, ensuring the soil remains saturated or flooded — which is essential for paddy rice growth.
Water level control	By allowing controlled inflow and outflow, bunds help maintain optimal water depth (2–5 cm after transplanting and 5–10 cm during tillering).
Prevention of runoff and erosion	Bunds reduce water runoff during heavy rains, protecting topsoil and preventing nutrient loss.
Efficient irrigation	They allow even water distribution and reduce wastage in irrigated systems.
Drought management	Stored water within bunded fields can sustain rice plants during short dry spells.

Bunding with 30 to 60 cm and leveling is recommended for higher yield as shown below.



Bunds help control water levels and also make weed management more effective.



If the field is too large, it can be separated into small pieces.

Levelling contributes to uniform plant growth

Seed Preparation

a) Seed Selection

High-quality seed is the foundation of a good rice crop. While selecting seed, ensure purity, viability, vigor, and resistance to pests and diseases.

Steps:

- Choose the right variety: Select a variety suitable for your region, soil type, and production goal (upland or lowland, irrigated or rainfed).
- Select pure seed: Obtain certified or quality-declared seed from a reliable source to maintain genetic purity.
- Discard inferior seed: Remove discoloured, shrivelled, broken, or insect-damaged seeds.

b) Seed Purification (Cleaning and Sorting)

Before soaking or treatment, clean the seed to remove unwanted materials.

Methods of cleaning:

- Manual cleaning: Remove stones, chaff, weed seeds, and other impurities.
- Winnowing: Use wind or air to separate light or empty grains.

- Density sorting (Salt solution method):
    - Prepare a salt solution by dissolving 1 kg of common salt in 10 litres of water.
    - Pour in the seeds and stir well.
    - Good seeds sink to the bottom while light/bad seeds float.
    - Collect the good seeds, wash them with clean water to remove salt, and dry before use.

c) Seed Treatment

Seed treatment helps protect against fungal and bacterial diseases, insects, and soil-borne pathogens. There are three types of seed treatment which include:

i) Fungicidal Treatment
Use recommended fungicides such as:

- Thiram or Carbendazim (Bavistin) at 2–3 g per kg of seed.
- Mix the seed and chemical thoroughly in a clean container.

ii) Biological Treatment (Alternative)
If available, treat with Trichoderma spp. at 10 g per kg of seed to control seed-borne pathogens naturally.

iii) Insecticidal Treatment (if needed)
Use appropriate insecticides to prevent early pest attack, e.g., ants or stem borers.

d) Pre-germination or Seed Soaking

Pre-germination ensures quick and uniform field emergence.

Steps:

1. Soak the seeds in clean water for 24 hours (for most varieties).
2. Drain the water and incubate (keep in a warm, moist place covered with a sack or banana leaves) for 24–36 hours until small sprouts of 1–2 mm appear.
3. Avoid over-germination — excessively long sprouts can break during sowing.

For direct seeded rice, some farmers may skip full germination but soaking for 12–24 hours will still enhance uniform emergence.

e) Germination Test

A germination test helps determine the viability and vigor of rice seed — that is, the percentage of seeds capable of sprouting under favorable conditions.

This test helps farmers to:

- Know whether the seed is suitable for planting.
- Adjust the seed rate if germination is low.
- Ensure uniform crop establishment and better yields.

Materials Needed

- Sample of rice seed (about 400–500 grains)
- Two clean plastic trays, basins, or plates
- Clean water
- Paper towels, cloth, or muslin fabric (can also use sand or soil)
- Labels to record variety and date
- Notebook and pen/pencil

Sampling the Seed

- Take a representative sample from the seed lot or bag (mix well before sampling).
- Avoid taking from only the top or bottom of the bag — mix seed thoroughly for accurate results.

Number of Seeds for Testing

- Use 400 seeds divided into 4 sets of 100 seeds each**.** This gives more accurate results and allows for averaging.

Germination Methods

Method A: Paper Towel or Cloth Method

1. Moisten two layers of paper towel or cloth with clean water (not dripping wet).
2. Spread 100 seeds evenly on the surface.
3. Cover them with another moist layer.
4. Place the setup in a warm place (25–35°C) — avoid direct sunlight.
5. Keep the towels moist throughout (sprinkle water when necessary).
6. After 5–7 days, observe and count the number of seeds that have germinated.

Method B: Sand or Soil Method

1. Fill a small tray or basin with fine, moist sand or soil (well levelled).
2. Place 100 seeds evenly on the surface and cover lightly (about 1 cm).
3. Keep the soil moist daily with light watering.
4. After 5–7 days, count the number of seeds that have produced normal seedlings.

Counting Germinated Seeds

After 5–7 days:

- Count normal seedlings — those with a well-developed shoot and root system.
- Abnormal seedlings (e.g., weak, deformed, or partially sprouted) are not counted as germinated.
- Dead or hard seeds that did not sprout are recorded as non-germinated.

Calculation of Germination Percentage

Formula:

$$\text{Germination (\%)} = \frac{\text{Number of germinated seeds}}{\text{Total number of seeds tested}} \times 100$$

Example:
If 92 seeds out of 100 germinate:

$$\text{Germination (\%)} = \frac{92}{100} \times 100 = 92\%$$

If four sets of 100 seeds were used, calculate the average as follows:

$$\text{Average Germination (\%)} = \frac{(92 + 88 + 95 + 90)}{4} = 91.25\%$$

Therefore, the average germination rate = 91.25%.

Interpretation of Results

Germination Rate	Seed Quality	Recommendation
Above 85%	Excellent	Suitable for planting
70–85%	Good	Can be used; consider slightly increasing seed rate
50–69%	Poor	Not recommended; may need re-selection
Below 50%	Very poor	Reject and use a new seed lot

f) Seed Selection

It is difficult to determine seed viability with naked eyes. It is advisable to carry out seed selection using flotation method. Separate sunken seeds (filled grain) of higher germination and better growth from those floating seeds (empty grain) that are of poor viability.

Sowing upland rice

Line planting (drilling) or spot planting (dibbling) methods are recommended to ensure optimum seeding depth, plant population and easier weed control.

Line planting (drilling) involves dropping seeds continuously in a furrow, creating rows for uniform spacing.

Spot planting (drilling) involves placing several seeds together in a specific spot or 'hill'.

A planting fork can be made with metal or wood.

Using a planting fork can reduce the planting time and ensure proper distance between the lines.

Spacing and Seeding Rate

- Spacing between lines/rows should be maintained at 1 foot (30 cm).
- Within each line/row, place 20 seeds per foot (20 seeds per 1 foot or per 30 cm).
- The optimal seeding rate is 20 kg per acre.
- It is recommended that upland rice be planted at a depth of 2 to 4 cm.

- Planting too deep leads to low germination and delayed maturity.
- Shallow planting increases the risk of drought stress and bird damage.

Refilling of missing hills

Missing hills lead to low yields. It is therefore advisable to establish a small nursery bed beside the main garden to raise seedlings for refilling gaps and missing hills. Gap filling should be done 15–20 days after sowing. It is important to water the seedlings after transplanting.

Spacing and seed rate

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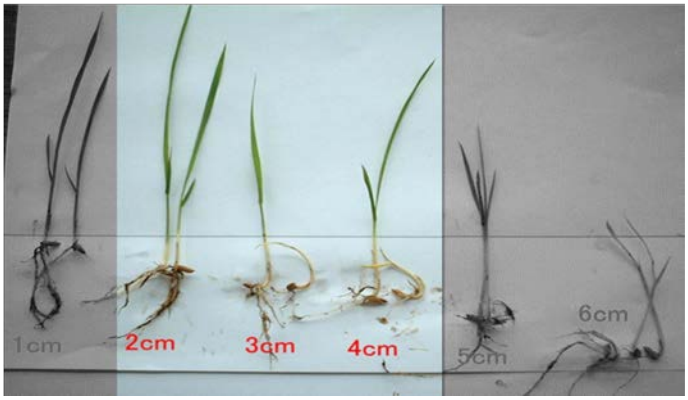


Planting depth

Upland rice be planted at a depth of 2 to 4 cm.

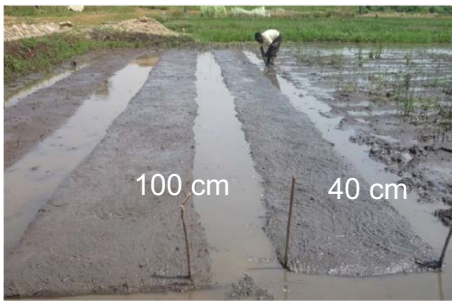
Nursery bed preparation

Pre-germination

After selecting seeds by removing empty grains through floating, it is recommended to incubate the seeds before preparing the nursery bed using the following procedure:

1. Soak the seeds in clean water for 24 hours.
2. Incubate the seeds for 36–48 hours by keeping them in a wet sack.

Bed making



The recommended width of a nursery bed should be 100 cm (1 m) and the width between the beds should be 40 to 50 cm.

Sowing

Step 1

Sow pre-germinated seeds on the nursery bed

Step 2

Cover seeds with soil by pushing down gently

Step 3

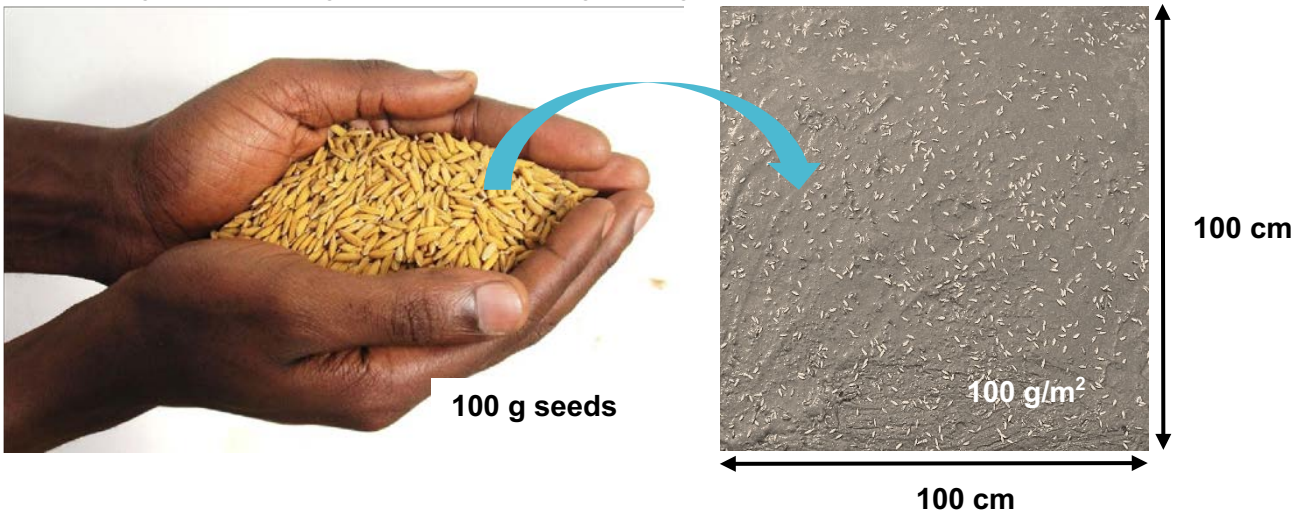
Cover beds with banana leaves or rice straws (can be removed after 3-5 days)

Step 4

Keep shallow water level and the seedling will be ready 18-21 days after sowing

Seeding Rate

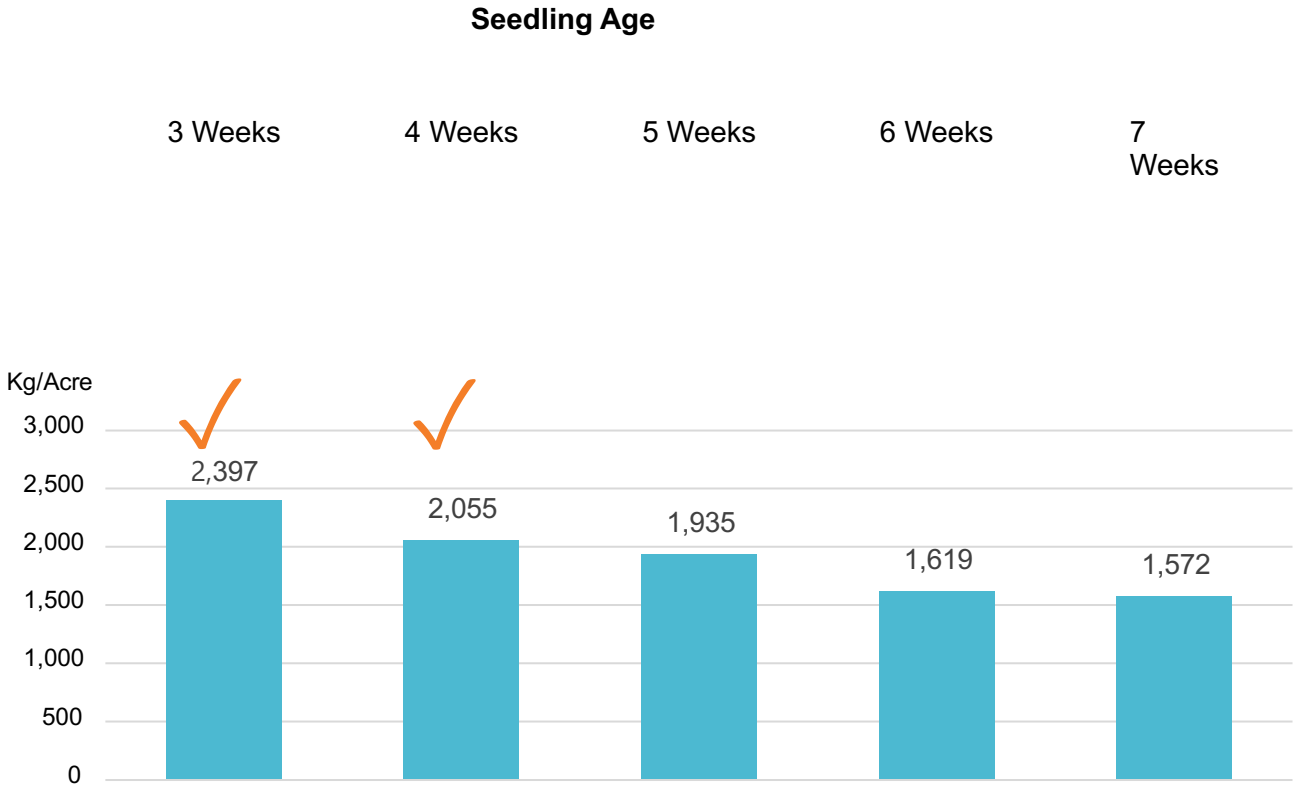
For healthy seedling growth, seeding rate on the nursery bed should be 100 – 200 g/m^2. If the seeding rate is too high, late transplanting damage will be increased.



Transplanting

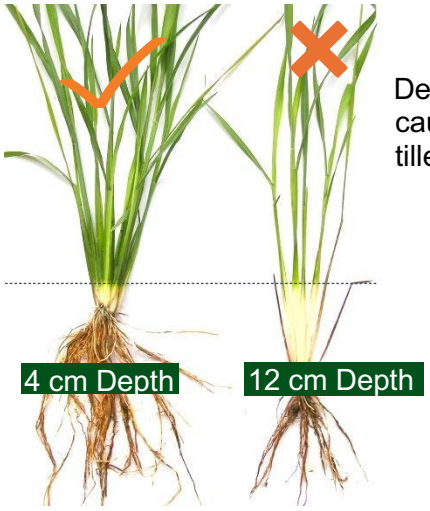
Seedling Age

It is recommended to begin transplanting about three weeks after sowing. At this stage, rice starts tillering (the vegetative stage when the main stem produces new stems called tillers from its leaf axils), and if the seedlings remain in the nursery bed, they may not receive enough nutrients and will lose valuable time for tillering. However, if young seedlings are affected by snail damage, transplanting at four weeks after sowing is also acceptable.



Planting depth

The recommended transplanting depth is **3 to 4 cm**.



Deep planting will cause poor tillering

Damage caused by deep planting

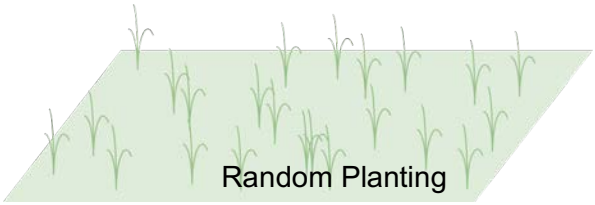
If the seedlings are too tall to stand, you can cut off the tip of the seedlings to avoid deep planting.

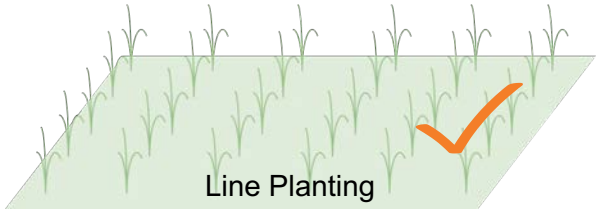
Cannot stand

Easy to stand

Transplanting: Method and Spacing

Line planting is recommended because it promotes uniform plant growth, makes weeding easier, and improves disease and pest control. The recommended spacing is 30 cm × 15 cm or 20 cm × 20 cm, but 30 cm × 15 cm is preferred as it reduces transplanting labor and allows for better weed management.

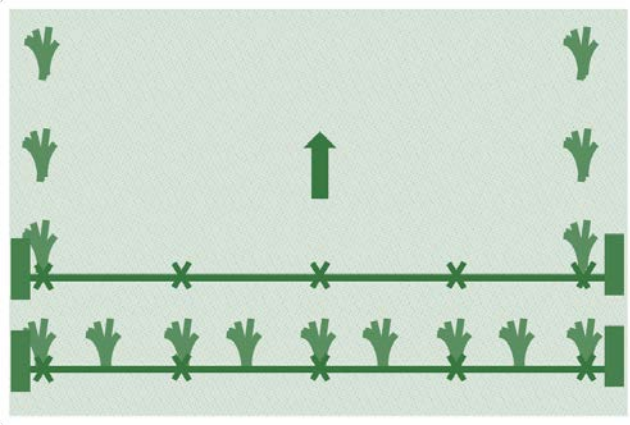




Transplanting method with several farmers (Prepare a rope which has mark (or knot) each 30cm)

Step 1: Transplant seedlings at a spacing of 30cm between rows on both sides of the field by using a marked rope.

Step 2: Stretch the ropes between the seedlings planted on both sides and transplant where there is a mark and between the marks on the ropes.



A transplanting tool for an individual farmer

Fertiliser application in rice is critical for achieving high yields, strong plant growth, and good grain quality. However, timing is just as important as the type and amount of fertiliser applied. Applying fertiliser at the right growth stage ensures nutrients are used efficiently by the crop.

Major Nutrients Required by Rice

Nutrient	Function	Common Fertiliser Sources
Nitrogen (N)	Promotes vigorous growth, tillering, and leaf colour	Urea, Ammonium Sulphate
Phosphorus (P)	Strengthens root development, early growth, and flowering	DAP, SSP, TSP
Potassium (K)	Improves stem strength, disease resistance, and grain filling	Muriate of Potash (MOP), SOP
Sulphur, Zinc, and other Micronutrients	Support enzyme activity and grain formation	Zinc Sulphate, gypsum, micronutrient blends

Basal Application (Before or at Planting/Transplanting)

The purpose of application before or art the time of transplanting is to provide essential nutrients for early seedling establishment and root growth.

Timing

- Apply before final land leveling or during transplanting.
- For directly-seeded rice, apply and mix well into the soil before sowing.

Fertilisers and Amounts (Typical Rate per Acre):

- DAP or TSP: 25–30 kg/acre (for Phosphorus)
- MOP: 10–15 kg/acre (for Potassium)
- Urea: 10–15 kg/acre (apply part of total N at this stage)

Method

- Broadcast evenly and incorporate into the soil during final harrowing or puddling.
- For transplanted rice, apply to the nursery before transplanting or to the main field at planting.

Tillering Stage (Active Growth Stage)

The purpose of application at tillering stage is to promote tiller (shoot) formation and lush growth.

Timing

- Around 20–25 days after transplanting or 3–4 weeks after direct seeding.

Fertiliser

- Urea (Nitrogen): Apply 1/3 to 1/2 of total Nitrogen requirement.

Method

- Apply when the field has moist soil (not waterlogged).
- Drain excess water before application and re-flood lightly after 1–2 days.

Apply when you see new tillers forming and leaves starting to turn light green.

Panicle Initiation Stage (Before Flowering)

The purpose of application before flowering is to support panicle (head) formation, grain filling, and increase yield.

Timing

- 45–50 days after transplanting (or when the uppermost leaf sheath begins to swell).

Fertiliser

- Apply the remaining Nitrogen (urea) and Potassium (MOP).
- Typical rate: Urea (10–15 kg/acre) + MOP (10 kg/acre).

Method

- Apply to a moist field; avoid applying in standing water.
- Maintain shallow flooding after application.

Nutrient Management by Rice System

Rice System	Key Fertiliser Timing	Notes
Transplanted Lowland Rice	Basal, Tillering, Panicle initiation	Maintain shallow flooding after each application
Direct-Seeded Rice	Basal, 3–4 weeks after sowing, 6–7 weeks after sowing	Avoid applying fertiliser to waterlogged soil
Upland Rice	Basal, 3–4 weeks after emergence	Use split Nitrogen application; rainfall determines timing

Fertiliser Recommendations

Recommendation

Upland Rice	3 weeks after germination:	Urea (20 kg/Acre) DAP (20 kg/Acre)
	8 weeks after germination:	Urea (20 kg/Acre)

Lowland Rice	At transplanting:	Urea (25 kg/Acre) DAP (25 kg/Acre)
	8–10 weeks after transplanting	Urea (25 kg/Acre)

Please be careful while applying fertiliser to upland rice. The rice plant usually becomes taller and requires more water when fertiliser is used. If there is inadequate rain after rice plants become big, drought damage tends to be more serious.

Urea contains 46% of Nitrogen. DAP contains 18% of Nitrogen and 46% of Phosphorus.

Weed Control

Weeds are unwanted plants that compete with rice for nutrients, sunlight, water, and space, leading to reduced yields, poor grain quality, and difficulty during harvesting. Effective weed management is essential for high rice productivity and cost-efficient farming.

Importance of Weed Control

- Reduces competition for nutrients, water, and light.
- Enhances crop growth and yield potential.
- Prevents pests and diseases that hide in weeds.
- Reduces labour costs during harvesting.
- Improves fertiliser and water-use efficiency.

Major Weed Types in Rice Fields

1. Grassy weeds – resemble rice plants (e.g., *Echinochloa crus-galli* and *Leptochloa chinensis*).
2. Broad-leaved weeds – have wide leaves (e.g., *Monochoria vaginalis*, *Eclipta alba*).
3. Sedges – grass-like weeds with triangular stems (e.g., *Cyperus difformis*, *Fimbristylis miliacea*).

Methods of Weed Control

Weed control in rice can be achieved through integrated weed management, combining cultural, mechanical, biological, and chemical methods.

Cultural Methods

These are preventive and non-chemical practices that create unfavourable conditions for weed growth.

1. **Use of Clean and Pure Seed**
    a. Avoid planting contaminated seed with weed seeds.
    b. Use certified seed or clean seed thoroughly before planting.
2. **Land Preparation**
    a. Plow and harrow thoroughly to bury weed seeds and rhizomes.
    b. Prepare a fine, level seedbed for uniform rice growth and easy weeding.
    c. In lowland systems, puddling (wet tillage) reduces germination of many weed species.
3. **Proper Water Management**
    a. Maintain continuous shallow flooding (2–5 cm) after crop establishment in lowland rice to suppress weeds.
    b. Avoid exposing soil frequently as it encourages weed growth.

4. **Optimum Plant Density and Spacing**

- Use recommended spacing (e.g., 20 × 20 cm for transplanted rice) to ensure quick canopy closure and shade weeds.

5. **Crop Rotation**

- Rotate rice with legumes, maize, or upland crops to break weed cycles.

6. **Use of Mulching**

- Organic mulch suppresses weeds and conserves moisture in upland rice.

Mechanical / Manual Methods

This is the physical removal of weeds using labour or tools.

1. **Hand Weeding**
    a. Most common in Uganda.
    b. Carried out 2–3 times during the growing period:
        i. 1st weeding: 15–20 days after planting/transplanting.
        ii. 2nd weeding: 35–40 days after planting.
        iii. 3rd weeding (if needed): before flowering.
    c. Weeds should be removed before flowering to prevent seed spread.

2. **Use of Mechanical Weeders**
    a. Rotary or cono weeders for lowland transplanted rice.
    b. Operated between rows when soil is moist or under shallow water.
    c. Reduces labour and improves soil aeration.

Chemical Methods (Herbicides)

Herbicides are used to kill or suppress weeds economically, especially in large fields.

1. Pre-plant or Pre-emergence Herbicides

Applied before or soon after planting but before weeds emerge.

- Common examples:
    - Butachlor (1.5–2 L/Ha)
    - Pretilachlor (1–1.5 L/Ha)
    - Pendimethalin (1–1.5 L/Ha)
- Apply on moist soil and maintain light irrigation after spraying.

2. Post-emergence Herbicides

Applied after weeds have emerged (usually 15–25 days after planting).

Examples:

- 2,4-D Amine (0.75–1.0 L/Ha) – controls broad-leaved weeds.
- Bispyribac-sodium (20–30 g a.i./Ha) – controls grasses and sedges.
- Penoxsulam (25–35 g a.i./Ha) – for mixed weed flora.

Precautions:

- Use the correct dose and spray at the recommended growth stage.
- Avoid drift to rice leaves to prevent crop injury.
- Use clean water and calibrated sprayers.
- Wear protective gear during application.

Biological Methods

This is the use of living organisms to control weeds.

- Fish in paddy fields: Some fish species feed on young weeds.
- Ducks in paddy fields: Ducks eat weed seedlings and insect pests while stirring the water, suppressing weed growth.
- Cover crops: Planting fast-growing legumes in rotation suppresses weed seed germination.

No Weeding

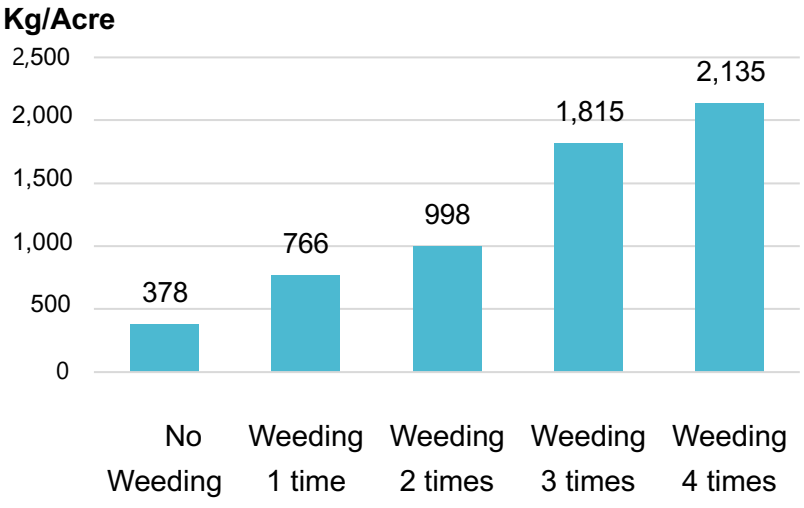
Weeding 1 time (3 WAG)

- 

Weeding 2 times (3 & 6 WAG)

Weeding 3 times (3,6 & 9 WAG)

* **WAG** = Week after germination



The more you weed, the more you harvest

Line planting is highly recommended to reduce the time for weeding

Common Pests

Stalked-eyed flies: The larvae bore and feed on plant tissues and cause dead heart to rice stems.


Stalk-eyed fly (adult)


Stalk-eyed fly (larva)


Stalk-eyed fly (damage)

Stem borers : The larvae bore through the stem and eat up plant tissue, resulting in dead heart or white head.


Stem borer (Adult)


Stem borer (larva)


Stem borer (damage)

Sting bug & Rice bug: The bugs stay on the panicles and suck the milky juice of young panicles and cause staining grains hence lowering grain quality.


Rice bug

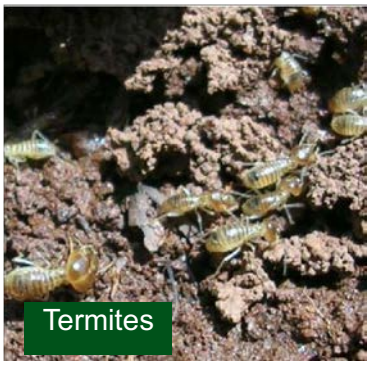

Stink bug


Damaged Rice

Termites: Termites eat and cut the stem of rice plants. Severe damage is experienced in dry soils. *Usually, insect damage does NOT require chemical control since it does not reduce yields significantly.

Snails: Snails attack the transplanted seedlings in lowlands. Remove by hands and try to keep a saturated condition 1 week after transplanting. In case the damage is serious, a farmer can try to use 4 weeks old seedlings.

Birds: Chasing by human labour is the best solution. Bird chasing is needed during the one-month period leading to harvest.


Termites


Snail


Bird Damage

Common Rice Diseases

A. Rice Blast: It is one of the most destructive fungal diseases affecting rice. The fungus produces spots or lesions on leaves, nodes, panicles and grains. The spots are usually elongated and pointed at each end. Damage is often characterised by 50% of yield reduction. Control can be done by planting resistant varieties like NERICAs and avoiding excessive Nitrogen application.

B. Rice Yellow mottle Virus (RYMV): It can be found in lowland rice fields and shows the symptoms of stunting, yellowish leaves. There is no chemical that can kill this virus, and the only solution is to plant tolerant or resistant varieties like WITA9 or NERICA6. Direct sowing also can reduce the damage.

   RYMV is one of the most serious viral diseases affecting rice in sub-Saharan Africa, including Uganda. It causes significant yield losses, especially in lowland and irrigated rice systems. The disease can reduce yields by **20–100%**, depending on the crop stage at infection, rice variety, and environmental conditions.

   RYMV was first reported in Kenya in 1966 and is now widespread across East, West, and Central Africa. In Uganda, it is particularly common in major rice-growing regions such as Eastern, Northern, and Central Uganda — where rice is cultivated under both irrigated and rainfed lowland conditions.

   Causal Agent

   The disease is caused by the Rice Yellow Mottle Virus (RYMV), which belongs to the genus *Sobemovirus*.
   It infects only rice and a few wild grass species related to rice (such as *Oryza longistaminata*), which act as reservoirs for the virus between cropping seasons.

   Mode of Transmission

   RYMV is not transmitted through seeds, but spreads in several ways:

   - Insect vectors: Mainly by chrysomelid beetles (such as *Sesselia pusilla*, *Trichispa sericea*) and leaf-feeding beetles that move from infected to healthy plants.

- Mechanical contact: Through tools, animals, or people moving between infected and healthy fields.
- Water movement: In irrigated systems, contaminated water can carry plant debris containing the virus.
- Volunteer plants and wild grasses: These serve as virus reservoirs and infect new rice plants when cropping resumes.

Symptoms of RYMV

Symptoms vary with the rice variety, growth stage, and environmental conditions but generally include:

Stage	Symptoms
Early stage	Pale yellow streaks on young leaves, often beginning at the leaf tip.
Middle stage	Yellow mottling, stunted growth, and fewer tillers.
Advanced stage	Leaf rolling, severe yellowing, and drying of leaves. Plants appear dwarfed and weak.
Grain filling	Poor panicle development, empty grains, and significant yield loss.

Conditions Favoring Disease Development

- Continuous rice cultivation (no rotation).
- The presence of wild rice or grasses around fields.
- Poor sanitation and volunteer rice plants between seasons.
- High population of leaf beetles and other vectors.
- Overlapping cropping cycles in irrigated schemes.
- Warm and humid conditions favor vector activity.

Yield Losses

- Mild infections can cause 10–30% yield loss.
- Moderate infections can cause 40–60**%** loss.
- Severe early infections may cause complete crop failure (up to 100%).

Management and Control Measures

i. Cultural Practices

- Use resistant or tolerant varieties: Plant RYMV-tolerant varieties such as NERICA 4, NERICA 1, WITA 9, WAB 56-104, NamChe 5, and NamChe 2 (depending on availability and agroecological zone).
- Field sanitation: Remove volunteer rice and wild grasses (*Oryza longistaminata*) around the field before planting.
- Crop rotation: Alternate rice with non-host crops such as maize, beans, or vegetables to break the virus cycle.
- Synchronised planting: Plant all rice in an area at the same time to reduce continuous host availability for vectors.
- Clean tools and equipment: Disinfect tools used in multiple fields to avoid mechanical spread.

- Rogue infected plants: Remove and bury severely affected plants early to prevent further spread.

ii. Vector Management

- Avoid early beetle infestations: Use insecticide-treated seedbeds or early pest scouting.
- Minimise the use of broad-spectrum insecticides: Instead, focus on integrated pest management (IPM) to conserve beneficial insects.
- Encourage natural enemies: Promote vegetation diversity around rice fields that supports beetle predators.

iii. Water and Field Management

- Control field water flow to prevent movement of infected plant debris.
- Maintain good bunds and drainage channels to reduce water movement from infected plots.

iv. Use of Certified Seed

- Always plant certified, virus-free seed obtained from approved suppliers.
- Avoid using seed saved from infected fields.

C. Brown Spot: It is common in soils that are poorly drained or deficient in nutrients. The symptoms include brown spots on the leaf and grain. The most effective way of controlling brown spots is to grow plants in good and healthy soil and apply adequate fertiliser.

D. False smut: The fungus changes single grains of the panicle into velvety balls, which may grow to a diameter of 1 cm. The occurrence of the disease is believed to indicate a good yield because the same weather that supports the development of false smut also favors good crop production. Usually, damage of this disease is minimal, and no control measures are necessary.

Chemical Use

Herbicides

Common herbicides available in Uganda are shown below.

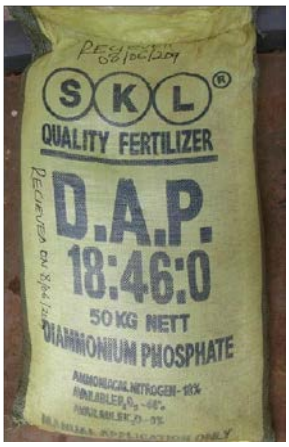
- Glyphosate: Non-Selective, Pre-plant, Foliar applied (Round Up, Weed Master etc.) *
- Butachlor: Selective, Pre-emergence, Soil applied (Butanil-70, Butanil-S)
- Benthiocarb: Selective, Pre- & Post-emergence, Soil applied (Hasunil, Satunil)
- 2,4-D: Selective, Post-emergence, Foliar applied (2,4-D) **

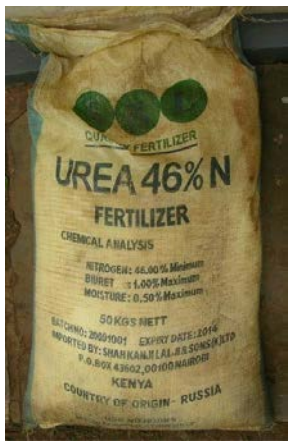
- Propanil: Selective, Post-emergence. Foliar applied (Butanil-70, Hasunil, Satunil)

If the water is not clean, glyphosate will not be very effective.

2,4-D can prevent tillering of rice. It is recommended to use when the rice is at late stage (2 months after planting).

- Pre-plant herbicides are applied before the crop is planted.
- Pre-emergence herbicides are applied after the crop has been planted but before weeds emerge.
- Post-emergence herbicides are applied after weeds have emerged.
- Selective herbicides kill or stunt some plant species with little or no injury to others, especially the crop. Non-selective herbicides will kill all plants in a field, including rice.
- Foliar applied herbicides are applied to the portion of the plant above the ground and absorbed by exposed tissues.
- Soil applied herbicides are applied to the soil, usually taken up by the root or shoot of the emerging seedlings and used as pre-plant or pre-emergence treatment.

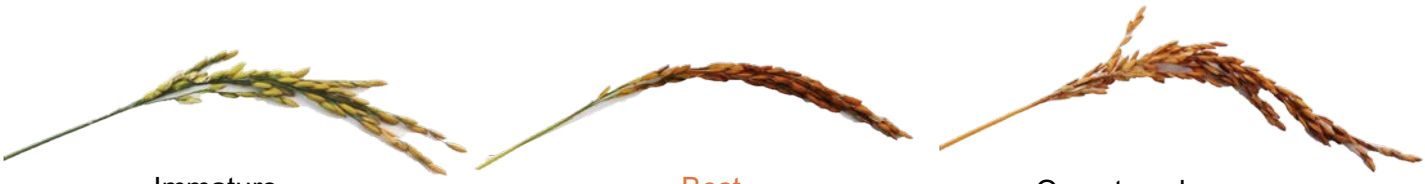




Common Herbicides in Uganda

Harvesting and Post-harvest Management

The stems of the rice crop are cut close to the ground using serrated sickles. This method of harvesting is faster than harvesting panicles using a knife. Harvesting should be done when **80 - 85 %** of the grains are yellow-colored and the grains of the lower part of the panicle are in the hard dough stage.



Immature | Best | Overstayed

Threshing

Threshing can be done by beating to logs, with sticks or using a thresher. Threshing by beating increases the chances of broken grains at milling. It is recommended to use a thresher where possible.

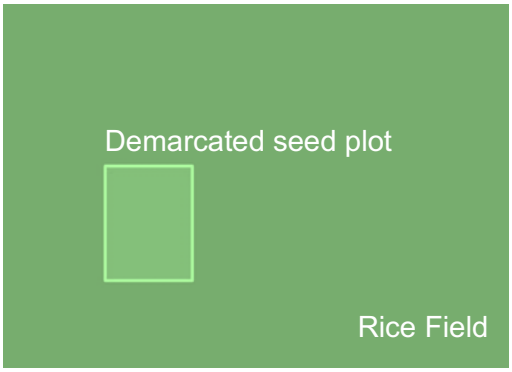
Drying

Open air drying under the hot sun heat is widely practiced in the tropics. Preferably, drying should be done on a tarpaulin or a clean drying floor free of stones. The rice should be dried slowly with 4-5cm thickness and needs to be turned over every 30 – 60 minutes to allow equal exposure to the sun. If you dry too quickly, you will get more broken grains at milling.

4 to 5 cm thickness is recommended

Frequent turn-over for better milling recovery rate

Seed Maintenance



Rice is a self-pollinated crop, and harvested seed can be used for the next season and yield is NOT going to be decreased if the seed is maintained. Seed purity can be maintained by farmers.

It is recommended that a farmer separates the seed multiplication plot from other areas and removes off the varieties they do not want in the plot.

100m^2 seed multiplication plot is enough to get seed for 1 acre for the next season.

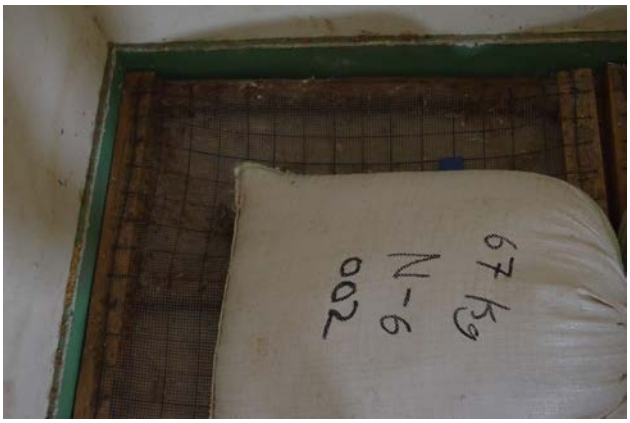
Off types can be detected by the difference in maturity period, plant height, plant shape, grain colour, grain shape, etc.

Off type identified by plant height

Different grain colour

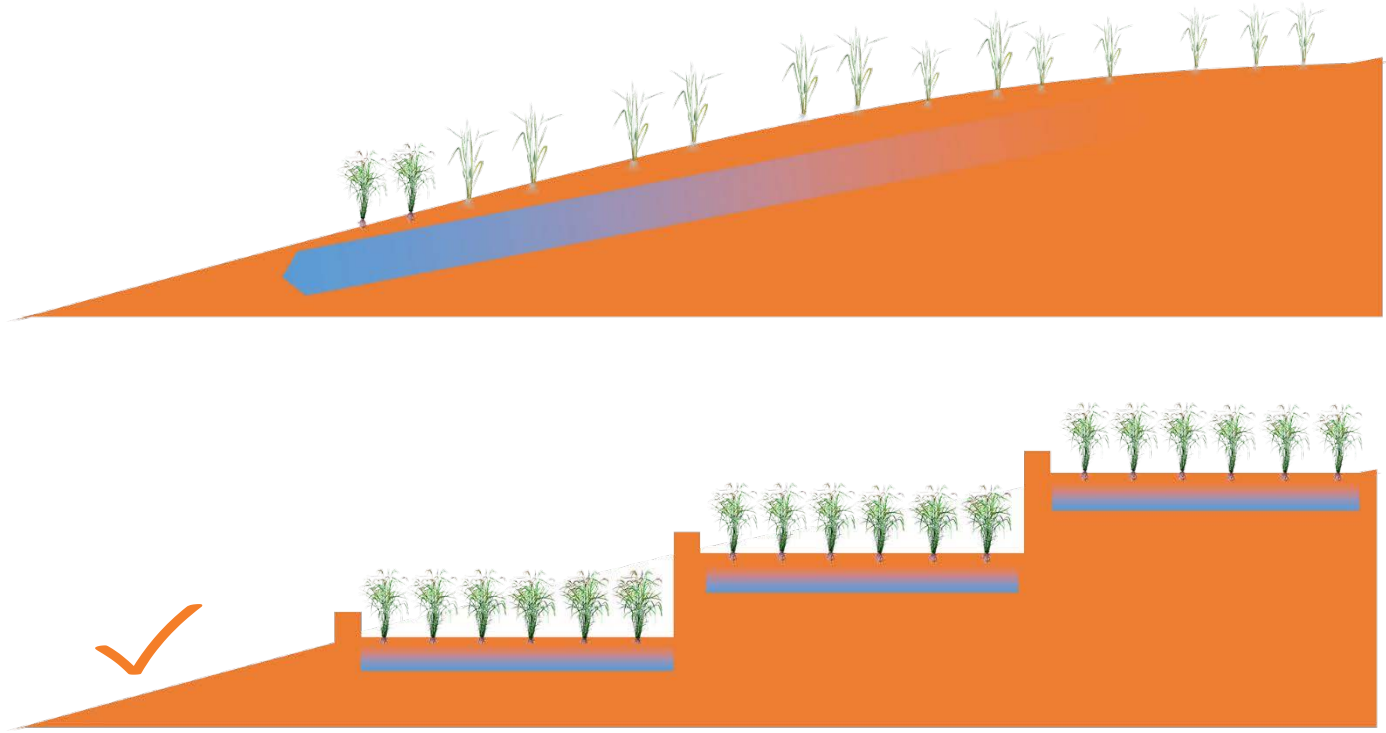
Seed Storage

Harvested seed should be stored in a dark and cool place. Putting seed directly on the ground should be avoided and instead pallets should be used.



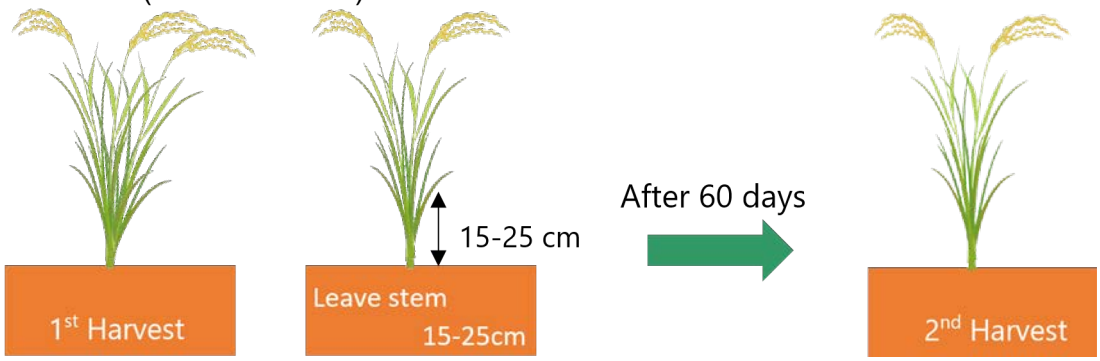
Advanced Techniques

Terracing: This helps to keep rainfall water in the farm longer leading to higher yield.



Ratoon Crop: After harvest, rice plants produce new shoots and panicles if they receive enough water.

About 0.4 – 1.0 t / Acre can be harvested within 60 days after harvest. The height of harvested rice plants (stubble) should be 15-25 cm. This technique is recommended in areas which have longer rainy seasons (about 6 months).



Intercropping

Upland rice can be intercropped with maize, soybeans, banana and coffee. The density of the intercropped plants should not be too high to avoid competition with rice.

Annex: Rice Record

Rice Record

Year		Season		Variety		Area	

Sowing Date	
*Transplanting Date	
1st Weeding Date	
2nd Weeding Date	
3rd Weeding Date	
Harvesting Date	

*Only for lowland rice farmer

Harvest	kg/Bags	Sold Price	Ush/kg

Year		Season		Variety		Area	

Sowing Date	
*Transplanting Date	
1st Weeding Date	
2nd Weeding Date	
3rd Weeding Date	
Harvesting Date	

*Only for lowland rice farmer

Harvest	kg/Bags	Sold Price	Ush/kg

Year			Season			Variety			Area	

Sowing Date	
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Year			Season			Variety			Area	

Sowing Date	
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1st Weeding Date	
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Harvest	kg/Bags		Sold Price	Ush/kg

Year			Season			Variety			Area	

Sowing Date	
*Transplanting Date	
1st Weeding Date	
2nd Weeding Date	
3rd Weeding Date	
Harvesting Date	

*Only for lowland rice farmer

Harvest	kg/Bags		Sold Price	Ush/kg

Year		Season		Variety		Area	

Sowing Date	
*Transplanting Date	
1st Weeding Date	
2nd Weeding Date	
3rd Weeding Date	
Harvesting Date	

*Only for lowland rice farmer

Harvest	Kg/Bags

Sold Price	Ush/kg

Cost Benefit Analysis for One Acre of Upland Rice Cultivation Cultivation

(Assuming the yield is 1,500 kg / acre)

Expenditure		Ush
Seeds	20 Kg x 1500	30,000
Fertiliser DAP (18-46-0)	25 Kg x 2,000	50,000
Urea (46-0-0)	50 Kg x 2,000	100,000
Sacks	15 Bags x 1,000	15,000
Slashing		60,000
Digging		80,000
2nd digging		80,000
Planting		30,000
Hand weeding	50,000 x 2	100,000
Bird scaring	2,000 x 30 days	60,000
Harvesting and threshing		40,000
Transport		30,000
Milling cost (If one gains 67% of milled rice out of paddy)	1,000 x 100	100,000
	Total	775,000
Income		Ush
15 Bags x 100 Kg	1,500 Kg x 67%	
Milled rice 1,000 Kg	1,800 x1,005 Kg	1,809,000
Income- Expenditure	1,809,000- 775,000	**1,034,000**

Cost Benefit Analysis for One Acre of Lowland Rice

(Assuming the yield is 2,000 Kg / acre)

Expenditure		Ush
Seeds	15 Kg x 1,500	22,500
Fertilizer DAP (18-46-0)	25 Kg x 2,000	50,000
Urea (46-0-0)	50 Kg x 2,000	100,000
Sacks	20 bags x1,000	20,000
Slashing		60,000
Digging		80,000
Paddling and levelling		80,000
Transplanting		60,000
Hand weeding	50,000 x 2 times	100,000
Bird scaring	2,000 x 30 days	60,000
Harvesting and threshing		60,000
Transport		40,000
Milling cost (If one gains 67% of milled rice out of paddy)	1,300 x 100	130,000
	Total	862.500
Income		Ush
20 Bags x100 Kg	2,000 Kg x 67%	
Milled rice 1,300 Kg	1,300 Kg x 1,800	2,340,000
Income- Expenditure	2,340,000- 862,500	**1,477,500**