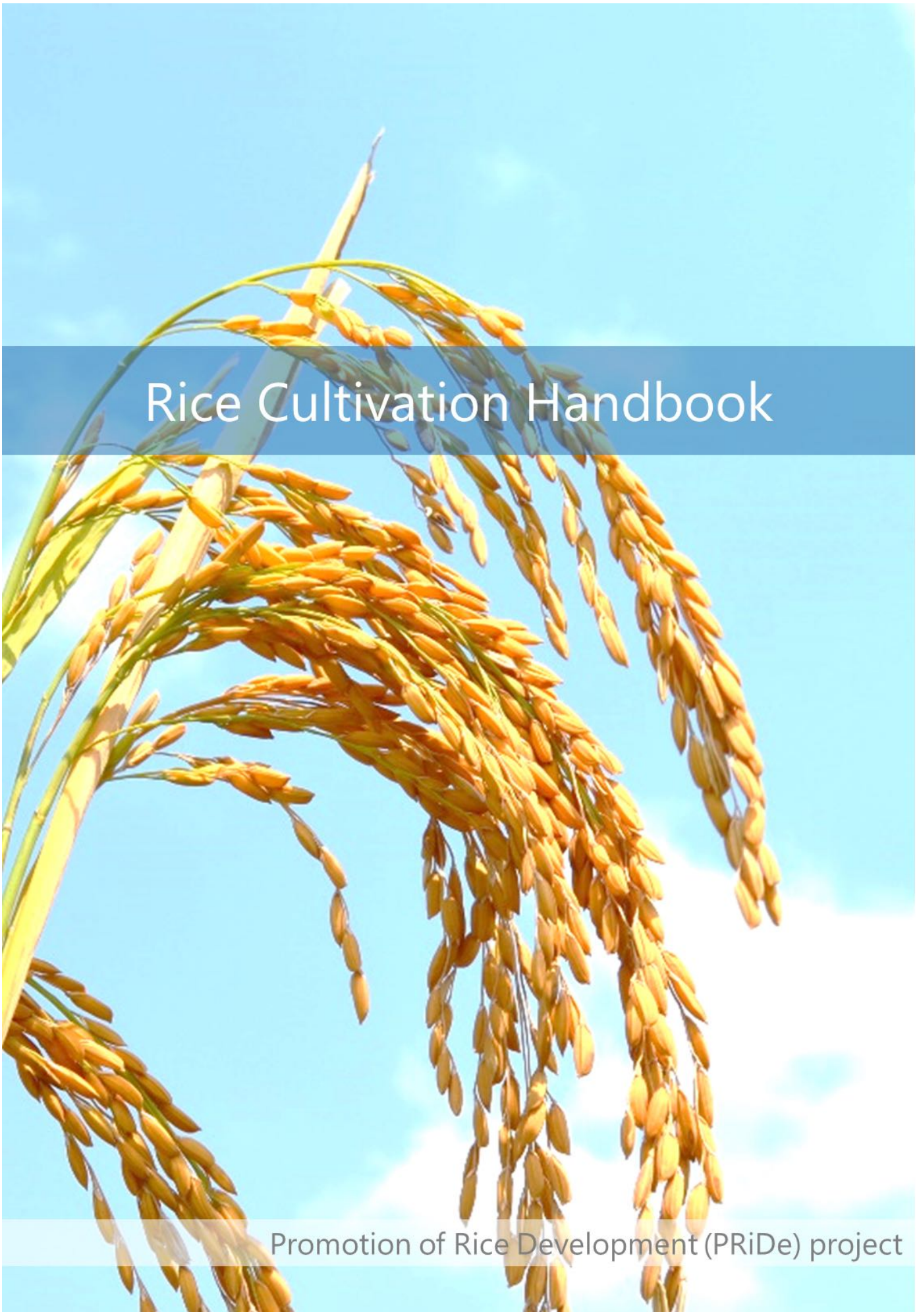


Rice Cultivation Handbook

Promotion of Rice Development (PRiDe) project

Preface

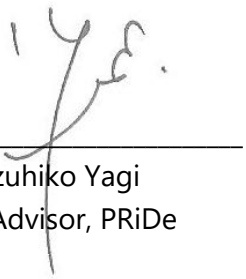
The Government of Uganda, through Ministry of Agriculture, Animal Industry and Fisheries (MAAIF) has been implementing agricultural sector development and strategy investment plan that prioritized rice as important strategic crop to address food security and household income. The National Agricultural Research Organization (NARO and National Agricultural Advisory Services (NAADS) have been implementing Promotion of Rice Development (PRiDe) Project with support from Japan International Cooperation Agency (JICA) as cooperation area with Government of Japan to enhance rice production and improved quality and competitiveness of local rice for a span of 5 years from November 2011.

A key component of the project involves capacity building of the actors in the rice value chain including farmers and millers. PRiDe project has trained so far more than 34,000 farmers as direct beneficiaries as of September 2015, and is expected to surpass the target of 40,000. Our beneficiary farmers are great assets for further increase rice production and productivity 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 to help improve rice crop management. This version contains more photos to help our farmers comprehend more about better rice cultivation techniques. The revised version also contains editions such as "Farm record keeping" to assist farmers manage their production costs and enhance their income.
It is our wish that farmers and extension service providers best utilize this handbook, and use practical experiences to provide feedback to better revise the book for future version. We thank all the readers and users of this handbook as we work together to improve rice production and productivity in this country.

October 2015

Dr. Godfrey Asea
Director, NaCRRI

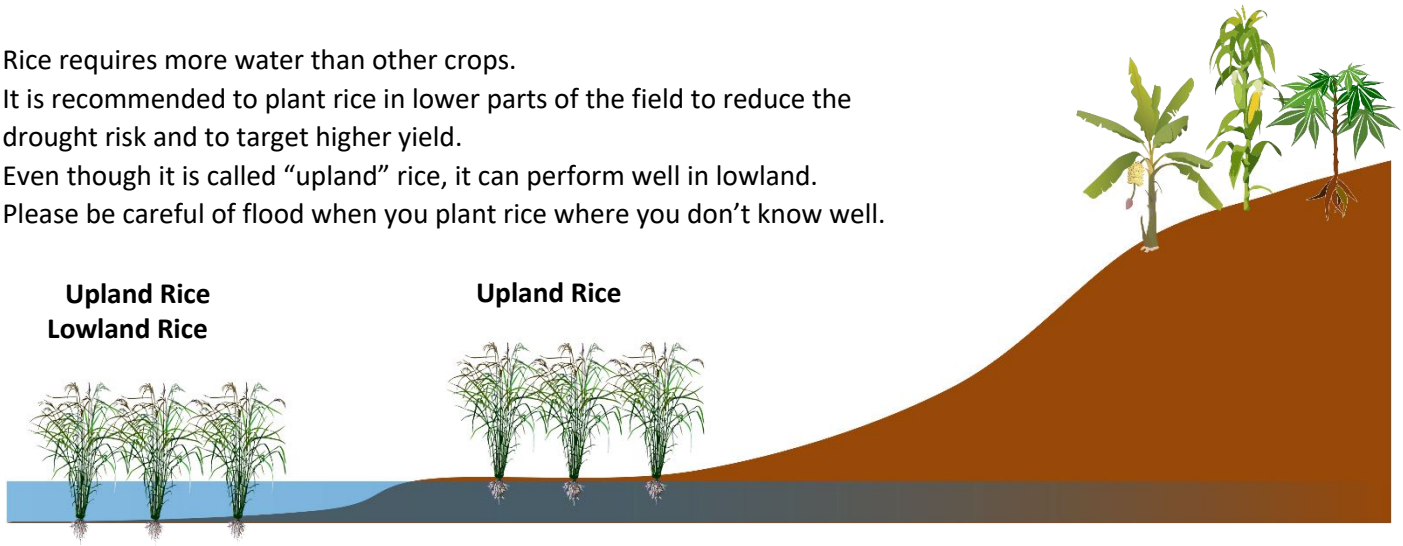


Dr. Kazuhiko Yagi
Chief Advisor, PRiDe

Contents

Site Selection

Rice requires more water than other crops.
It is recommended to plant rice in lower parts of the field to reduce the drought risk and to target higher yield.
Even though it is called “upland” rice, it can perform well in lowland.
Please be careful of flood when you plant rice where you don’t know well.



Variety Selection

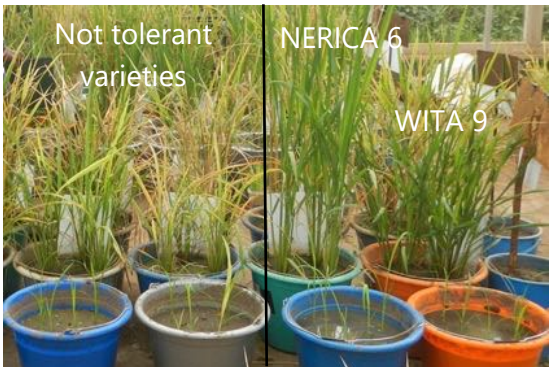
There are several varieties available in Uganda.

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 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

Yield of upland rice depends largely on the rainfall amount, pattern, and agronomic practices like weeding.
If you cannot keep standing water during the cropping season, it is recommended to plant upland rice varieties rather than lowland rice varieties.
If your field is infected by RYMV (Rice Yellow Mottle Virus), planting tolerant varieties is recommended.

WITA 9 has purple color on its stems.

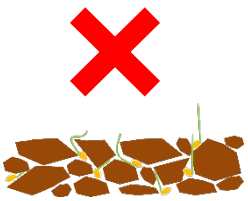


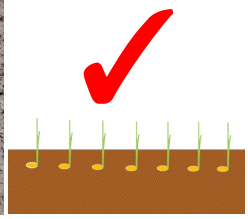
NERICA 6 & WITA 9 have high tolerance against RYMV

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

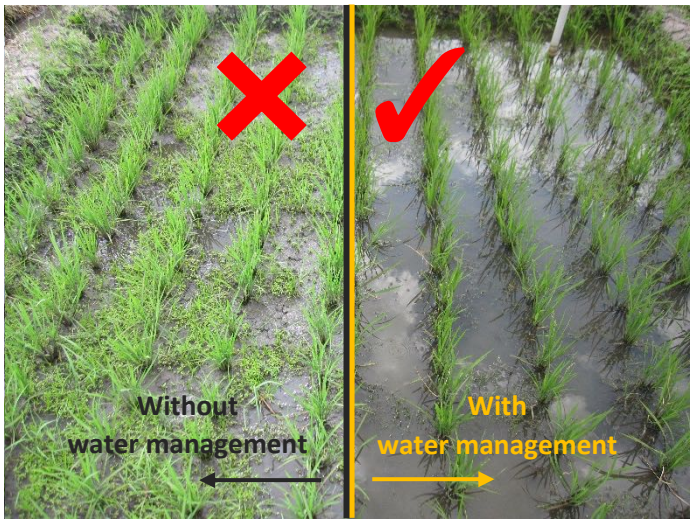
Land Preparation

Upland Rice: Rough soil brings poor germination. Fine soil is recommended.

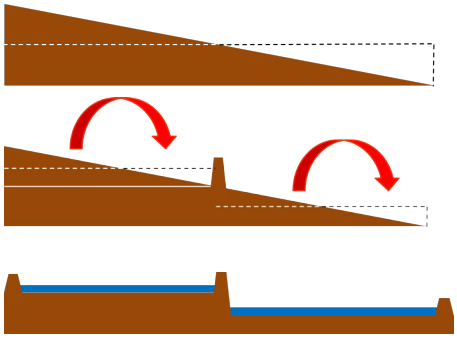




Lowland Rice: Bunding with 30-60cm and Leveling is recommended for higher yield.



Bunds enables you to control the water and better weed management.



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

Levelling contributes to uniformed plant growth

Seed Preparation

Germination Test

1. Count 100 seeds > 2. Soak seeds for 24 hours > 3. Wrap seeds in wet paper for 48 hours > 4. Count the number of seeds that have germinated.

If germination rate is lower than 80%, use higher seeding rate.

Seed Selection

It is difficult to determine seed viability with the 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 (for upland rice)

Method: Line planting (Drilling) or spot planting (Dibbling) is recommended for ensuring optimum seeding depth, plant population and easier weed control.

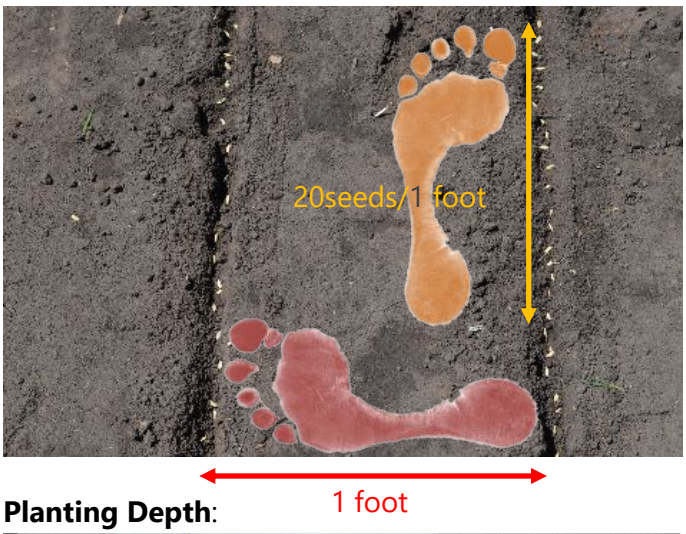
Line Planting
(Drilling)
30cm
between lines

Spot Planting
(Dibbling)
30cm x 12.5cm
7 seeds/hole

Planting fork can be made with metal or wood

Planting fork can reduce the time of planting and ensures the proper distance between the lines.

Spacing, Seeding Rate:

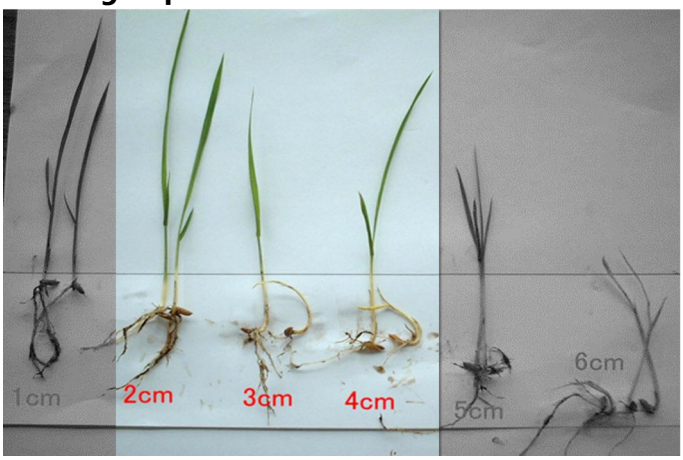


Between lines = **1 foot = 30cm**

In the line = **20 seeds/1 foot (30cm)**

20 kg/Acre is optimum seeding rate

Planting Depth:



It is recommended that upland rice be planted at a depth of **2 - 4** cm.

Deep planting causes low germination and delayed maturity.

Shallow planting has risks of drought and bird damage.

Refilling of missing hills:

Missing hills lead to low yields. It is therefore advisable that you set a small nursery bed beside the mother garden to raise seedlings for the purpose of refilling gaps and missing hills. Gap filling should be done 15 - 20 days after sowing. It is important to water the seedlings after transplanting.

Weeding

Weeds prevent rice to receive **sunshine, soil nutrients, and water**.

Weeds also attract **insects, rats and diseases**

Weeding must be done **at least 2 times** at 3 and 6 weeks after germination either by hand or hoe.

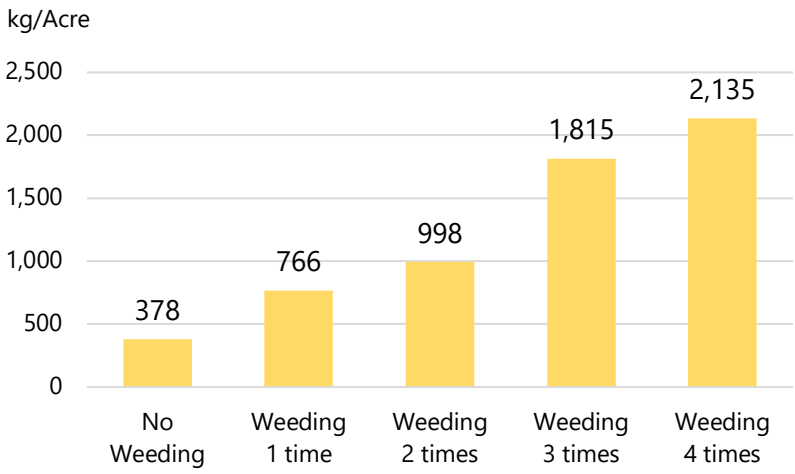
No Weeding

Weeding 1 time (3 WAG)

Weeding 2 times (3 &6 WAG)

Weeding 3 times (3,6 & 9 WAG)

* WAG = Week after germination



More you weed, more you harvest.

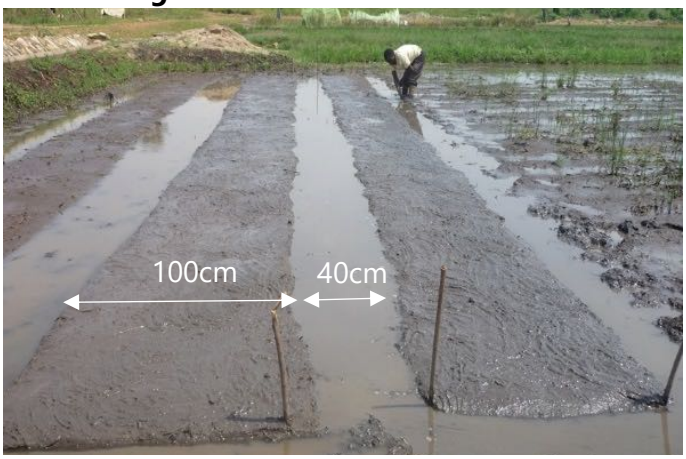
Line planting is highly recommended to reduce the time for weeding.

Nursery Bed

Pre-Germination

After seed selection by floating empty grains, it is recommended to incubate seeds before making nursery bed with following procedure. 1) Soak seeds for 24 hours in clean water. 2) Incubate the seeds for 36-48 hours by keeping it in a sack with wet condition

Bed Making



Recommended width of nursery bed is **100cm (1m)** and width between the beds is **40-50cm**.

Sowing

Step 1)
Sow pre-germinated seeds on the nursery bed

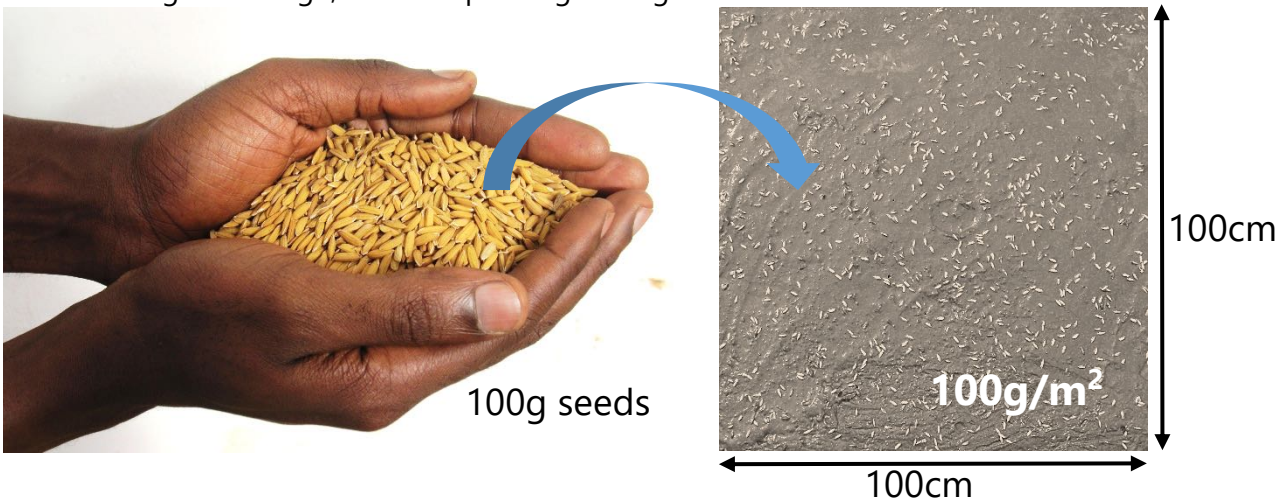
Step 2)
Cover seeds with soil by pushing down gently

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

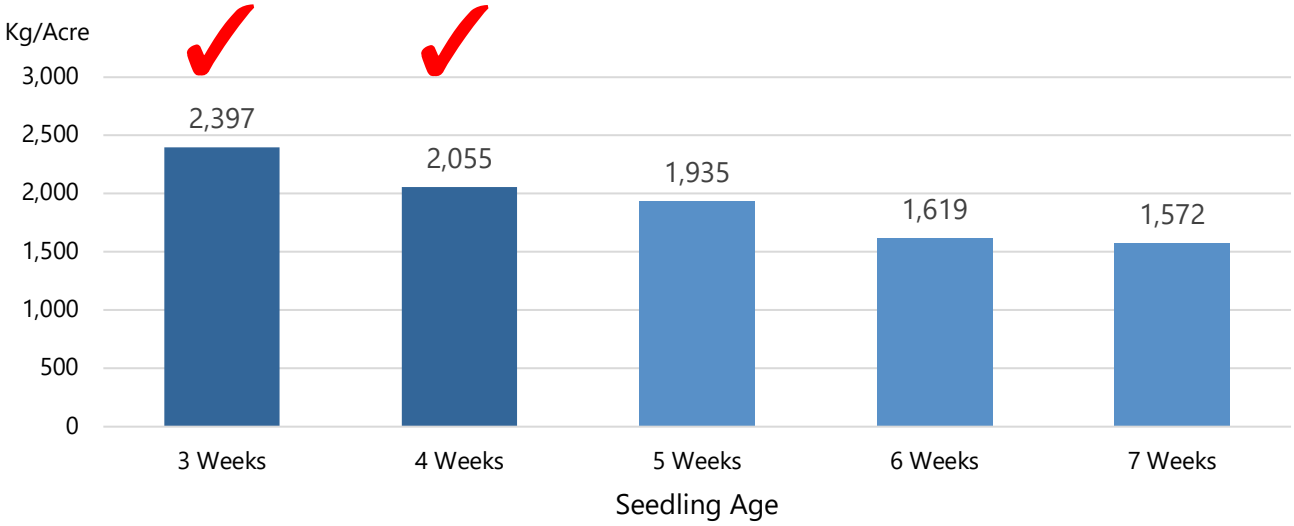
For healthy seedling growth, seeding rate on the nursery bed is supposed to be 100 – 200 g/m^2.
If the seeding rate is high, late transplanting damage will be increased.



Transplanting (Seedling Age, Planting Depth)

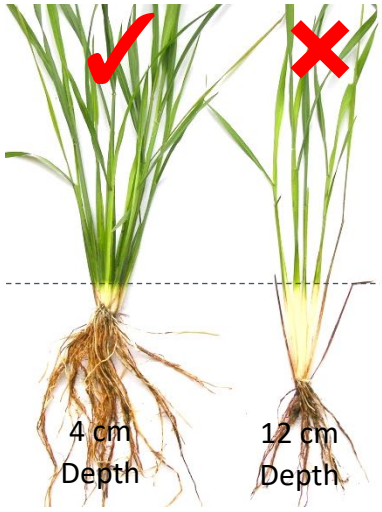
Seedling Age

It is recommended to start transplanting about **3 weeks after sowing**.
Rice starts tillering in this stage and if they are still in the nursery bed they will not be able to get enough nutrients and lose the time for tillering. However, in case you find the snail damage with young seedlings, transplanting 4 weeks after sowing will be accepted.



Planting Depth

Recommended transplanting depth is **3 – 4 cm**.



Deep planting will cause poor tillering

Damage caused by deep planting

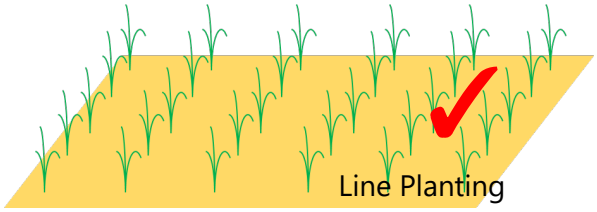
If the seedlings are too tall to stand, you can **cut off** the tip of the seedlings to avoid deep planting.

Cannot stand

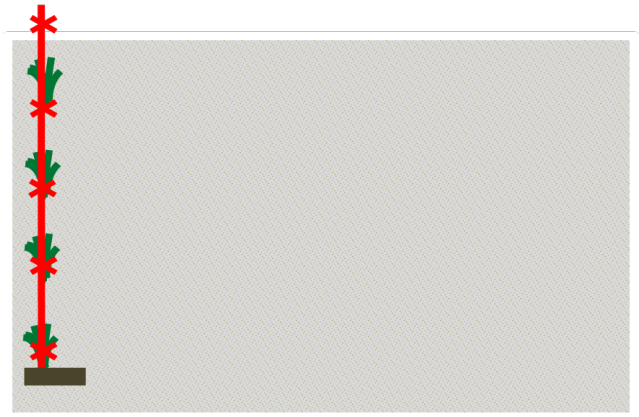
Easy to stand

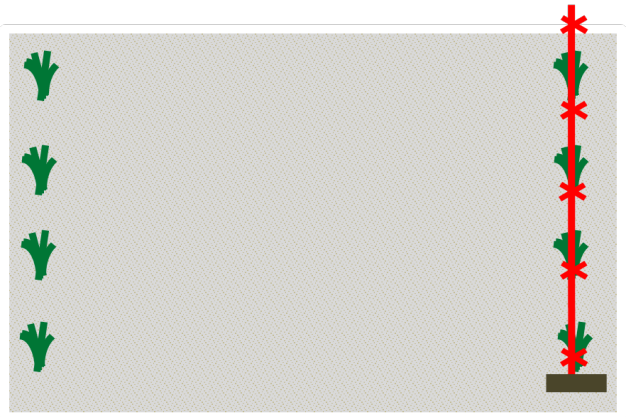
Transplanting (Method, Spacing)

Line planting is recommended for uniformed plant growth, easier weeding, and better diseases and pests control. Recommended spacing is **30cm x 15cm** or 20cm x 20cm but 30cm x 15cm has more advantage to reduce transplanting work and better weed management.

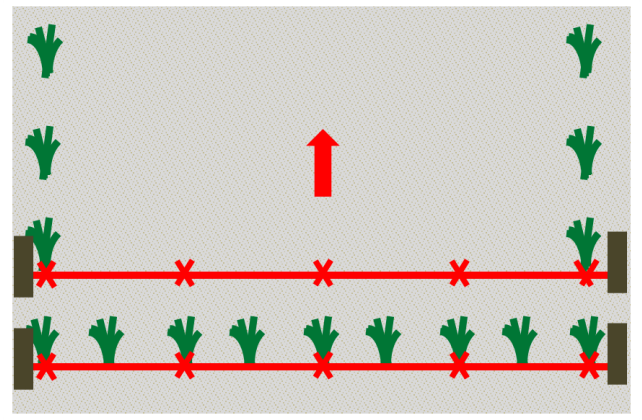


Transplanting method with several farmers (Prepare a rope which has mark (or knot) each 30cm)
Step1. Transplant seedlings in 30cm on both side of the field by using a marked rope





Step 2) Stretch the ropes between the seedling planted on the both sides and transplant where there is mark and between the marks on the ropes



A transplanting tool for an individual farmer

Harvesting

The stems of the rice 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-coloured and the grains of the lower part of the panicle are in the hard dough stage.

Immature Best Over stayed

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.

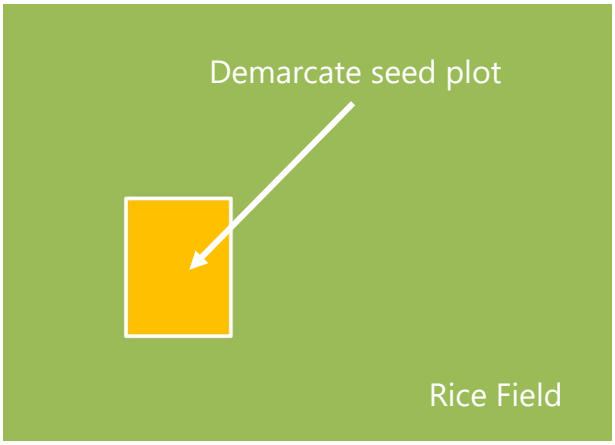
Drying

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.

4-5cm 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 next season and yield is NOT going to be decreased as long as the seed maintained. Seed purity can be maintained by farmers.

It is recommended that a farmer separates seed multiplication plot from other areas and removes off-types (variety you do not want) in the plot. 100m^2 seed multiplication plot is enough to get seed for 1 acre for next season.

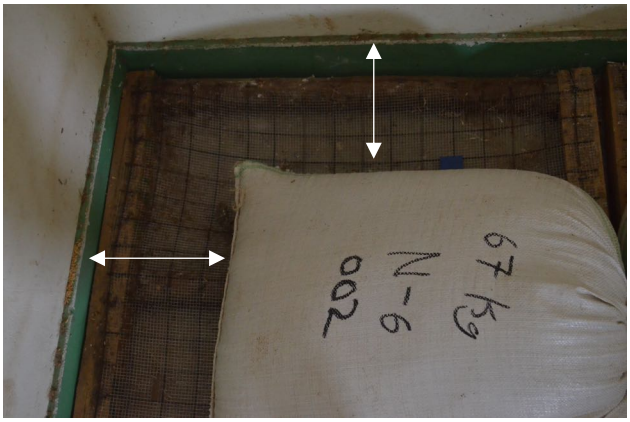
Off-types can be detected by the difference in maturity period, plant height, plant shape, grain colour, grain shape, etc.

Off-type identified by plant height

Different grain color

Seed Storage

Harvested seed should be stored in dark cool place. It should be avoided to put seeds directly on the ground and .



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 tissues, 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

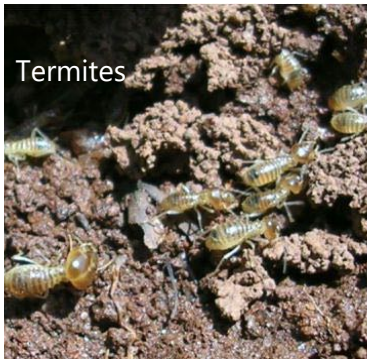

Damaged Rice

Termites: Termites eat and cut the stem of rice plants. Severe damage is experienced in dry soils.

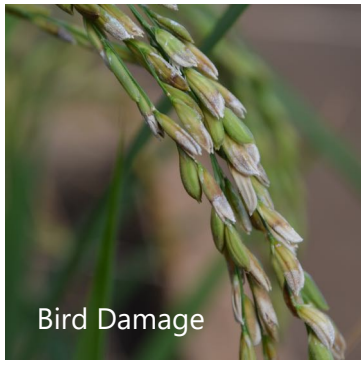
* Usually insect damage does NOT require chemical control since it does not reduce yields significantly.

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

Birds: Chasing by human labor is the best solusion. Bird chasing is needed during the period only 1 month from heading to harvest


Termites


Snail


Bird Damage

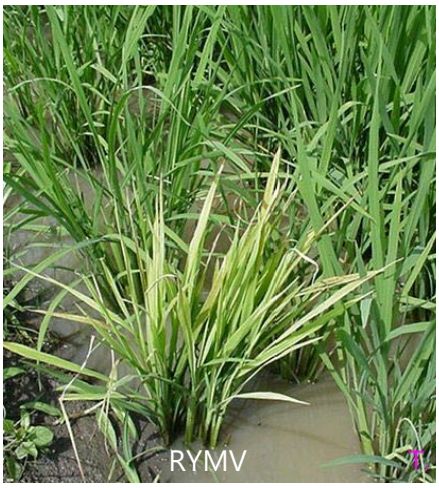
Diseases

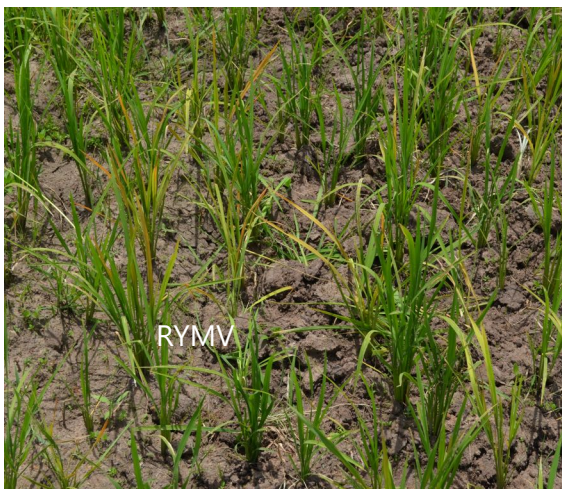
Rice Blast: It is one of the most destructive fungal diseases of rice. The fungus produces spots or lesions on leaves, nodes, panicles and grains. The spots are usually elongated and pointed at each end. Damage is often characterized by 50% of yield reduction. Control can be done by planting resistant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

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

Brown Spot: It is common in soils that are poorly drained or deficient in nutrient. The symptoms are brown spots on the leaf and grain. The most effective way of controlling brown spot is to grow plants in good soil and provide adequate fertilizer.

False smut: The fungus changes single grain 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 weather favourable to the development of false smut also favours good crop production. Usually, damage of this disease is minimal, no control measures are necessary.





Chemical Use

Fertilizers

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 to apply fertilizer to upland rice. The rice plant usually becomes taller and requires more water when fertilizer applied. If you cannot get enough rain after rice plants big, drought damage to rice would be more serious.
* Urea contains 46% of Nitrogen. DAP contains 18% of Nitrogen and 46% of Phosphorus.

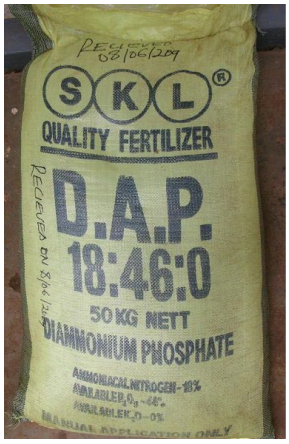
Herbicides

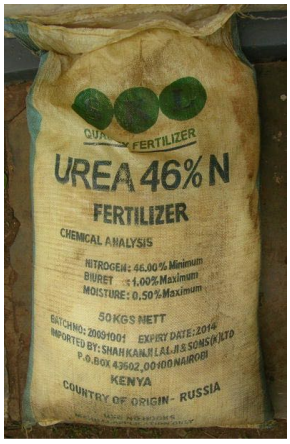
Common herbicides available in Uganda is shown below.
Glyphosate: Non-Selective, Pre-plant, Foliar applied (Round Up, Weed Master etc.) *
Butachlor: Selective, Pre-emergence, Soil applied (Butanil-70, Butanil-S)
Benthiocarb: Selective, Pre- & Post-emergence, Soil applied (Hasunil, Satunil)
2,4-D: Selective, 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 much effective.
** 2,4-D is going to prevent tillering of rice also, 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 will 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 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.

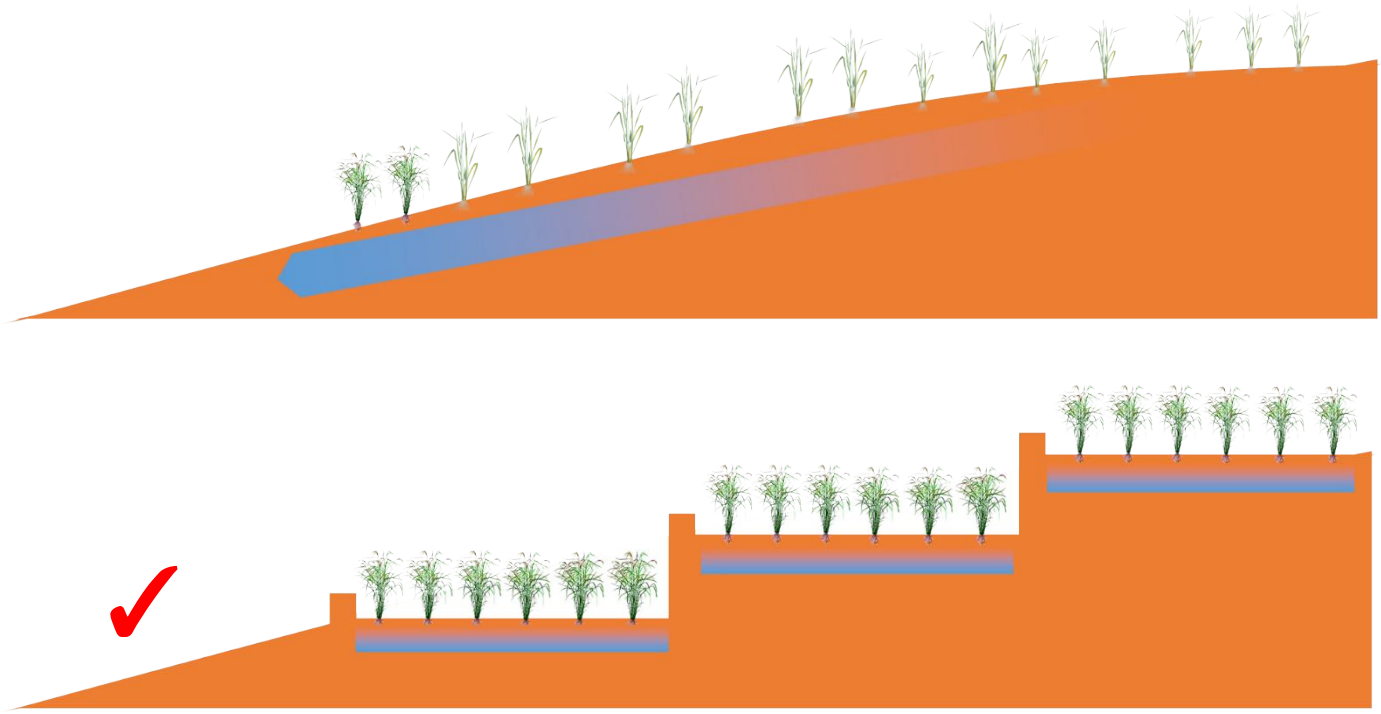




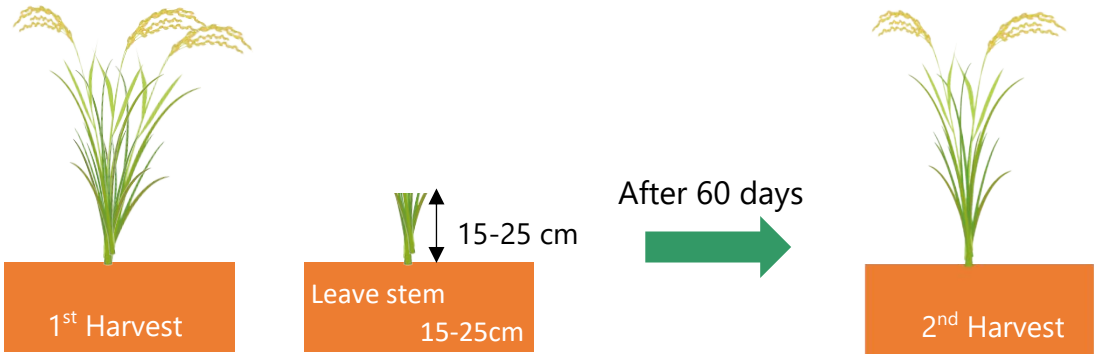
Common Herbicides in Uganda

Advanced Techniques

Terracing: Terrace enable you to keep rainfall water in your garden longer and gives you higher yield.



Ratoon Crop: After harvest, rice plant produce new shoot and panicle as long as it receives enough water. About 0.4 – 1.0 t / Acre can be harvested within 60 days after harvest. Height of harvested rice plant (stubble) should be 15-25 cm. This technique is recommended to the area which has longer rainy season (for about 6 months).



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

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	

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*Only for lowland rice farmer

Harvest	kg/Bags	Sold Price	Ush/kg

Year		Season		Variety		Area	

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Harvest	kg/Bags	Sold Price	Ush/kg

Year		Season		Variety		Area	

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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

MEMO

MEMO

Ministry of Agriculture,
Animal Industry and Fisheries