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Guide to rice production in Northern Nigeria

N. Kamai, L.O. Omoigui, A.Y. Kamara,
F. Ekeleme

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Cover: Mature Rice Plant

Forward and Acknowledgements

This handbook is intended to guide farmers, extension personnel, students of agriculture and researchers in Nigeria to use improved varieties and complementary production practices to increase productivity. The guide draws its lessons from the work and experience of IITA and partners in Research for Development on crop-based systems in Nigeria.

This publication is a production of the Feed the Future Nigeria Integrated Agriculture Activity implemented in targeted locations of Borno and Adamawa states, Nigeria between 2019 and 2021, and was made possible through financial support from the United States Agency for International Development (USAID).

As part of its contribution to the economic recovery process in the North East Part of Nigeria which has been ravaged by the insurgent activities of armed groups, USAID awarded to the International Institute of Tropical Agriculture (IITA) and its Partners (International Crops Research Institute for the Semi-Arid Tropics and Catholic Relief Services) the two-year "Feed the Future Nigeria Integrated Agriculture Activity'' which aims to advance the objectives of inclusive and sustainable agriculture-led economic growth; strengthened resilience among people and systems; and a well-nourished population, especially among women and children in targeted locations of Borno and Adamawa states, Nigeria. The Activity seeks to support vulnerable populations to engage in basic farming activities that will improve food security, increase agricultural incomes and improve resilience among smallholder farmers and their families. It works with a coalition of partners to facilitate improved agro-inputs and extension advisory services to serve vulnerable populations;

strengthen the institutions that form the market system and the networks that serve smallholder farmers who have been disenfranchised by conflict; and facilitate the engagement of youth and women in economic and entrepreneurial activities.

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Contents

Tables

Figures

Introduction

Rice is one of the major staple foods in Nigeria, consumed across all geopolitical zones and socioeconomic classes. Rice consumption is increasing rapidly in Nigeria because of the shift in consumer preference towards rice, increasing population growth, increased income levels, and rapid urbanization. It is commonly boiled and eaten with stew or vegetable soup. It is also used in the preparation of several local dishes that are eaten in every home, especially during festivals and ceremonies. However, rice production falls short of demand; the country depends heavily on rice importation of over 3 million tonnes annually, equivalent to over US$480 million in scarce foreign exchange. The Nigeria agricultural landscape is changing, with increased government policies aimed at stimulating private sector involvement and boosting local production. The efforts are starting to show results, as Nigeria's rice production rose from 3.7 million metric tonnes in 2017 to 4.0 million metric tonnes in 2018. For the record, the major rice producing states in Northern Nigeria are Kebbi, Borno, Kano, and Kaduna. Currently, most of the farmers producing rice rely on traditional technology with low use of improved input technologies. Average rice yields per unit area in the country are low and range between 2.0 and 3.0 t/ha compared to yields of 6–8 t/ha reported on research plots. It is important for farmers to adopt improved varieties and have a good knowledge of rice agronomy to increase rice production and productivity in the various states in Nigeria. Emphasis on the promotion of improved rice production technologies gained a fresh momentum following the recent policy of rice import restriction. Also, it warranted a need to equip extension agents with up-to-date information on crop production practices.

In this guide, we present the recommendations for achieving high rice yield in Northern Nigeria based on years of research of the International Institute of Tropical Agriculture (IITA) Ibadan, the West African Rice Center, (WARDA), Cotonou, Bénin; and the National Cereals Research Institute (NCRI), Badeggi.

Constraints to rice production in Northern Nigeria

Drought

Drought is a major constraint to rice production in Northern Nigeria because rice requires a lot of water for optimum growth and yield. Rice requires about 1200 mm to 1600 mm of rainfall evenly distributed throughout its growing period. This volume of rainfall is rare even in the southern parts of the country that usually receive more rain than the northern parts. The severity of drought is higher in the uplands than in the lowlands (fadamas). Rice varieties recommended for Northern Nigeria, therefore, fall within early and medium maturity classes that have the tolerance to and/or the capacity to avoid drought.

Poor soil fertility

Soil fertility in Northern Nigeria has progressively declined due to increased pressure on land resources arising from rapid population expansion, which is forcing farmers to adopt continuous cropping coupled with the use of an inadequate amount of fertilizer or other soil amendments. Several studies have shown that the soils in Northern Nigeria are deficient in nutrients, being far below critical levels for the production of most crops, including rice. For example, the total nitrogen present in soils ranges from 0.136 to 0.151% in the southern Guinea savanna, from 0.16 to 0.194% in the northern Guinea savanna, and from 0.141 to 0.153% in the Sudan savanna. Available phosphorus and exchangeable potassium are similarly low. There is also widespread micronutrient deficiency across agroecologies of northern Nigeria, thereby indicating a need to avoid acid-forming fertilizers and a review of current fertilizer formulations to include micronutrients to enhance rice yields in Northern Nigeria.

Pest attack

One of the major reasons for the low yields of rice in Nigeria is attack by insect pests. The rice plant is an ideal host for a large number of insect pests, root-feeders, stems borers, leaf feeders, and grain feeders. However, pests, especially birds, African rice gall midge, and Striga attacks, are major constraints to rice production in Northern Nigeria.

Important steps in growing rice

Site selection

In Northern Nigeria, rice can be grown in two main areas:

Lowland areas: These are lowlands on the edges of flooded fadamas (inland valleys) and irrigation schemes where water is available for 4½ to 5 months. In some areas, water may be available for more than 5 months.

Upland areas: These are areas with good soil and rainfall of over 700 mm. Select fertile land.

Recommended rice varieties

The recommended rice varieties for Northern Nigeria are presented in Table 1. These varieties produced by GoSeed mature earlier and produce significantly higher yields than the varieties, which farmers in Northern Nigeria have been growing.

Research by IITA (Promoting Sustainable Agriculture Project - PROSAB) has shown that with good management, up to 3–7 t/ha of paddy yield can be obtained with some of the recommended rice varieties. The recommended varieties also produce more tillers and compete better with weeds than the farmers' varieties.

Figure 1. . A scientist examines the NERICA rice variety.

Table 1. Some rice varieties recommended for Northern Nigeria.

Variety	Habitat	Characteristics								
		Adaptation	Tillering capacity	Potential yield (t/ha)	Days to maturity (days)	Plant height (cm)	Stem base coloration	Ligule type/ length	Husk color at maturity	Amylose content
FARO 44	Irrigated lowland	Shallow swamp	High	7	95–110	100–115	Green	Long grain	Straw	Intermediate (22.9%)
FARO 52	Irrigated lowland	Shallow swamp	High	6	125–135	115–120	Straw	Long grain	Straw	Intermediate (22.9%)
FARO 61	Lowland	Shallow swamp	High	5	100–115	90–100	Straw	Long grain	Straw	Intermediate (22.9%)
FARO 59	Upland	Rainfed upland	Medium	3	95–100	100–120	Light purple	Intermediate	Golden	Intermediate (22.9%)
GAWAL R1	Irrigated Lowland	Rainfed upland	High	10	90–05	100–115	Green	Long	Straw	Tolerance to blast disease

Source: GoSeed (Business Incubation Platform, IITA)

Land preparation

Proper land preparation is necessary for rice production to minimize competition with weeds. Two harrowings provide sufficient tilth for rice growth. Ridging is not necessary and is often a waste of space. In the southern parts of Adamawa and Borno states where the soils are more fragile and prone to erosion, minimum or zero tillage is recommended. Where zero tillage is to be adopted, the field should be sprayed with glyphosate at the rate of 4 L/ha (about 2⅓ Peak milk tins of chemical/15-L sprayer) to kill emerged weeds. About 10 days after spraying glyphosate, slash or mow the dead weeds.

Figure 2. Land preparation for rice production on (a) upland and (b) lowland

Seeds and seed preparation

After deciding on the rice variety to use, select plump, viable seeds that will grow vigorously.

Sources of improved rice seeds

Contact any of the following sources nearest to you for your supply of viable rice seeds:

- Agricultural Officer or extension worker
- State Agricultural Development Project that includes rice in its production programs
- River Basin Development Authority
- Branch officer of the National Agricultural Seeds Council
- Seed companies
- Other rice farmers
- Research Institutes with a mandate for rice production

Procedure for sorting seeds for planting

- To separate the heavier seeds from the lighter ones, soak them in 12% common salt solution or muddy water for about two minutes.
- To prepare the salt solution, dissolve 2 Peak milk (standard size) tins full of salt in 18 L of water (about a bucket full).
- The seeds that sink to the bottom of the solution are the healthy seeds.
- Separate the seeds.
- Wash the heavier seeds free of salt.
- Dry the seeds after washing and then sow.

Accelerate germination by soaking the seeds in cold water for 24 hours or overnight; then drain and incubate them in a warm moist place for 36 to 48 hours. The germinating seeds should be sown immediately after incubation.

Tips for testing seed germination rate

- Select about 200 seeds randomly from the seed to be planted.
- Soak the seeds in water for 24 hours.
- Place a wet paper towel in a container.
- Arrange the soaked seeds in a grid pattern of 100 each on the paper towel and close the container or cover with another moist paper towel.
- Ensure that the paper remains moist but not too wet, otherwise, the seeds will rot.
- Count the germinated seeds at 3 and 5 days and record the germination percentage. Seed should have at least 80% germination to be considered good.

Why it is important to use good rice seed

- Gives a higher level of germination
- Reduces the need to replant or fill the gaps
- Leads to more uniform plant stands

- Leads to more vigorous growth at early stages which
- enables the rice to compete better with weeds
- Increases resistance to insect pests and diseases
- Increases paddy yield

Characteristics of good rice seed

- Good rice seed is pure, usually of the chosen variety, mature and uniform in size, and viable (produces more than 80% germination with excellent vigor, free of weed seeds, diseases, insects, or other matter).
- Good rice seed is usually properly labeled with its name.

Note: Often, harvested rice seeds include seed of different sizes and other non-seed matter such as weeds and trash. Such harvests should be properly cleaned by winnowing with natural air or an electric fan. Winnowing can also be achieved by pouring the seed slowly from a height of 1–1.5 m.

Seed rate

It is advisable to use good quality seed from a reliable source for sowing. If the farmers plan to use their own seed, it is important to first sort out unfilled grains before sowing to enhance good germination. Lowland rice: Use 50–60 kg/ha of seed. Upland rice: About 40–50 kg of seed are required to plant a hectare when sowing is conducted by dibbling.

Figure 3. A well established rice field

Time of sowing

The time for sowing rice depends on the available kind of land, whether it is lowland or upland and on the agroecology where the farm is situated. The recommended time for sowing rice in Northern Nigeria is indicated in Table 2. The actual timing of sowing should, however, be adjusted in accordance with the time of the establishment of the rains.

Table 2. Time of planting rice in Northern Nigeria.

Ecology	Time of planting
Southern Guinea savanna	Between weeks 1 and 2 in June
Northern Guinea savanna	Between weeks 1 and 2 in June
Sudan savanna	Between weeks 3 and 4 in June

Lowland rice: From late May or early June, depending on the time of rain establishment or if irrigation water is available. As much as possible, adopt the recommended sowing date for your area, as indicated in Table 2.

Spacing

Lowland rice: Sow rice seeds by drilling in rows at a spacing of 20 cm or 30 cm apart. For transplanting method, transplant seedlings at a rate of 2–3 seedlings per hill, to a depth of 3–4 cm, and at a spacing of 30 × 30 cm (best for late-maturing cultivars), or 20 × 20 cm when soil is fertile or sufficient fertilizer is available.

Upland rice: Dibble 5–6 seeds at a spacing of 20 × 20 cm or 30 × 30 cm and later thin to 3 to 4 seedlings per stand at 2 to 3 weeks after sowing.

Depth of planting

Plant the rice seed at a depth of 2 to 4 cm. When rice is planted at a depth of more than 5 cm, the emergence of the young seedlings is delayed. Also, the seed may rot and the plant stand will not be uniform.

Fertilizer

The amount of fertilizer to apply depends on the quantities and level of residual nutrients in the soil and the type of fertilizer materials available. It is advisable to apply fertilizer doses based on soil test results and expected yield. Studies by PROSAB and collaborators have found that soils in Northern Nigeria are deficient in key nutrients for rice production. The following recommendations for lowland rice are similar to those recommended for irrigated rice schemes and swampy areas where there are proper water control and distribution. The water level on the field at the time of fertilizer application must be maintained at 3–5 cm to ensure the efficient use of the applied fertilizer. If the water on the field is more than 10 cm, it will cause a loss of nitrogen fertilizer through volatilization, therefore, drain the field before fertilizer application.

Lowland rice: Apply 60–80 kg of nitrogen and 13 kg of phosphorus (i.e., 30 kg P_20_5/ha) and 25 kg potassium/ha (i.e., 30 kg K20/ha). The nitrogen should be applied in two doses in between stands properly incorporated (buried) in the soil to avoid losses. This is about 4 bags of NPK 15: 15:15 applied at sowing and about 2 to 3 bags of urea applied at 6–8 weeks after sowing.

Upland rice: Upland rice responds well to nitrogen fertilization.
The application of 60–80 kg/ha of nitrogen and 30 kg/ha each of

phosphorus and potassium (50–30–30) is recommended. This is about 4 bags of NPK 15:15:15 applied at sowing. Incorporate (bury) the fertilizer in the soil properly to avoid losses. The second dose of about 2 to 3 bags of urea fertilizer should be applied at 6–7 weeks after sowing. Where land that has been under one- to two-year fallow is cropped with rice, apply a moderate rate of N (60 kg/ ha) and on older soils, apply a higher rate (80 kg/ha). Top dressing of N fertilizer should be applied between the rows and buried. The P and K fertilizers may be applied by broadcasting before sowing if applied separately.

Organic manure

Rice straw, husk/bran, should not be wasted but used as organic manure, especially for sandy soils. Heap the straw after harvesting and water regularly if possible (see tips for making compost below). The straw will decompose and form useful manure. Apply the decomposed straw to the field at the rate of 500 kg/ha and mix thoroughly with the soil.

Undecomposed straw can also be used. Spread the straw on the field and flood thoroughly. After about 30 days, mix the soil and the straw and spread out on the field while applying fertilizers. Where organic manure has been used, the recommended rate of fertilizers should also be applied unless soil test results show that the soil has adequate nutrients, in which case the rate to be applied should be adjusted such that enough nutrients are available to the rice crop. The application of straw will, however, improve the water and nutrient retaining capacity of the soil, thus raising yields, especially on sandy soils.

How to make compost from rice residue

After harvesting or milling, the rice straw and/or husks are often left in piles, but this is not the best method. Convert them into compost. Composting converts crop residue into better organic fertilizer. Although organic fertilizers, including rice compost, are low in major nutrients such as nitrogen and phosphorus, they can be highly beneficial because they contain micronutrients, enzymes, and microorganisms that are not found in inorganic fertilizers. Composted rice straw is richer in potassium (up to 2%) and calcium (up to 41%) than composted cow manure. The nutrients in compost are released slowly and are less likely to be lost by leaching.

The keys to good compost making are adequate nitrogen supply and moisture content as well as abundant microorganisms. Choose a level, well-drained site under shade; chop the compost materials into small pieces of 3–5 cm. Where possible, compost heaps should be built in layers consisting of cereal materials combined with legume or manure waste. This could be mixed in a ratio of 2:1. Keep compost heaps moist but not too wet (water should drain from the compost pile; if straw cracks when bent, it is too dry). To hasten decomposition, sprinkle decaying materials such as cow dung slurry, cow urine, or a diluted solution of nitrogen fertilizer such as urea on the compost heap. Mix and turn the compost heaps every 2 weeks. When moisture and temperature conditions are good, compost will be ready in 4–8 weeks.

Weed control

A number of methods can be combined to control weeds in rice. Examples of such methods are fallowing, land preparation, use of a competitive rice variety, water control, hand weeding, and herbicides.

Hand weeding

Rice fields should be weeded regularly, especially during the early stages of growth. For lowland rice, maintain the field bunds, which are essential for good water control. Maintain an even water depth of about 10 cm all over the fields except when fertilizer is being applied.

If the field to which rice is to be sown is well prepared, then the weed problem should be minimal. However, weeding should be carried out twice, at 2–3 weeks and 5–6 weeks after sowing. Pull out weeds by hand or with a small hand hoe; heap the weeds outside the field.

Figure 4. Manual weeding on rice. field

Note: Hand weeding can be relatively ineffective, particularly in controlling many of the perennial weeds (e.g., *Cyperus spp.*), which have underground tubers and rhizomes from which they can rapidly re-establish.

Use of herbicides

Herbicides can be used in large- and small-scale rice farms, seed multiplication schemes, and in other schemes, particularly where labor is limiting. Various types of weeds are associated with the rice crop; it is advisable to use an appropriate herbicide that kills various types of weed as recommended (Table 3). It is important to note that special skills are required in handling and using herbicides to ensure effectiveness and to avoid poisoning the user. Read and follow the instructions on the product label before using any herbicide.

Figure 5. A farmer spraying his rice field.

Table 3. Recommended herbicides for upland and lowland rice production.

Treatment formulation	Commercial name	Rate	Time of application	Remarks
Pendimethalin (455 g/L)	Stomp CS	2.53 L/ha	Pre-emergence	Apply within 2−3 days of planting (for upland and lowland rice). For annual grass and small-seeded broadleaf weed control.
Propanil + 2,4-D amine (360+200 g/L) EC	Vespanil plus	1.25−2.5 L/ha	Post-emergence	Applied at 1–4 leaf weed stage, irrespective of the stage of the rice or 14–21 days after seeding or transplanting. Selective to rice with broad-spectrum weed control.

‡DAS = Days after sowing, DAT = Days after transplanting
One L/ha is approximately 100 ml/15L sprayer; thus, 3 L/ha will imply approximately 300 ml/15l sprayer. A peak milk tin standard size is about 150 ml.
Always read the herbicide label for appropriate instructions before use. Wear protective equipment when applying herbicides.

It is important to note that herbicides will not be effective if land preparation is poorly done. Non-selective herbicides, such as glyphosate and glufosinate ammonium are sometimes used during land preparation to reduce the problem of perennial weeds, such as *Cyperus* spp. and *Oryza longistaminata*, which are difficult to control with most herbicides selective to rice.

Pest and disease control

Pests

Rice is less affected by field and storage pests than other cereals grown in Northern Nigeria. The major pests of rice are borers and armyworms.

Borers

These are one of the most destructive groups of insects that attack rice. They attack the crop from seedling to maturity. Borers lay their eggs above or below the leaves or leaf sheaths in clusters. The larvae, which emerge later, damage the internal structures of the stems. The damage caused by various borer species is identical, i.e., the borer cuts off the growing part of the plants from the base, feeds inside the stem, and causes the plant or tiller to die. This condition is commonly known as “dead heart”, indicated by dried growing points especially in young plants. Borer attack during the flowering state usually results in empty panicles, i.e., “white heads”. Some other borers do not usually result in the two problems above, but they are manifested in reduced grain filling.

Cultural control: After harvest, burn all stubble from the previous crop. This will destroy the semi-active resting stages of the borers that normally inhabit the stubble. Alternatively, the infested rice field could be flooded after harvest for a week to completely submerge the rice stubble, thereby drowning the borers.

Chemical: Lamdacyhalothrin at the rate of 1 L/ha. Chemical control measures should be implemented when about 20% of the field is infested.

Armyworms and Termites

Upland rice is also commonly attacked by armyworms and termites (root-feeder), especially when the rain stops at the beginning of the season. Application of Cypermethrin or Lamdacyhalothrin at 1 L/ha is effective against armyworms.

Birds

Bird attacks are serious problems in rice production. Some varieties may have resistance to bird damage. The engagement of bird scarers is commonly adopted. Planting rice too early or late exposes the crop to severe bird damage, hence planting should be properly timed.

Striga hermonthica

Striga is increasingly becoming a serious problem in rice production in Northern Nigeria where Striga hermonthica also attacks maize and sorghum. This weed is a parasite which germinates only when the plants (hosts) which it attacks are present.

Striga is common in soils that have been used continuously and are poor in nutrients. The symptoms of Striga damage on the host crop can be seen before the parasite emerges from the soil. Usually, the symptoms are similar to those on drought-affected crops and include stunted growth, wilting, yellowing, and scorching of the leaves, lower yield, and plant death in severe attacks.

Figure 6. Rice field attacked by Striga plants.

Striga produces numerous tiny seeds that make it easy for the parasite to spread from place to place.

The seeds can contaminate the crop during harvest (paddy/straw), which may be carried from one farm to another, or by animals when they feed on the straw or may attach to their feet as the animals pass by Striga-infested areas, or by machine tools during land preparation. Striga seeds are also easily dispersed by wind and water.

Control: Some of the measures recommended for the control of Striga in rice include the use of Striga-free seed, proper cleaning of farm tools especially after working on infested fields, proper fertilization (use of organic manure and inorganic fertilizer), crop rotation especially with soybean and groundnut, and intercropping as well as timely weeding. Rice farms should be weeded before Striga produces to reduce the Striga seed in the soil. A combination of the control measures, often referred to as the integrated Striga control approach is recommended and is more effective than the individual control measures.

Major diseases affecting rice fields and their control

Brown leaf spot

This is caused by the fungus, *Helminthosporium oryzae.* This disease is widespread on rice in many northern states. However, the intensity of the disease varies from one locality to another and from year to year. The disease is seed-borne and can be transmitted to new crops through infected seed carried over from infected crop residues of the previous season, alternative crop and weed hosts, and contaminated irrigation water. Unlike blast, brown leaf spot is more severe on older plants than on seedlings. The disease is characterized by dark brown oval spots (about 3.8 cm long) on the leaves. The large spots usually have lighter colored centers and dark brown margins. The spots on the glumes are dark brown, and in some cases, the entire glume may be covered with a velvety black mass of spores. Late in the season, the fungus attacks the basal node of the rachis, producing a blast, which can be distinguished from that caused by Pyricularia by the color and velvety appearance.

Cultural control: Burn all crop residues and alternative hosts and use seed from healthy plants. Also, apply seed dressing chemicals and fertilizer correctly at the right time and in the right quantity.

Chemical control: Apron XL® at the rate of 10 g/5 kg seed before sowing. When symptoms are observed, spray Dithane M-45 weekly at the rate of 1.5 kg/ha (this is about 2–3 small matchboxes full per 15-L sprayer) for 3 weeks.

Blast

Blast disease is caused by the fungus, Pyricularia oryzae. It is very prevalent in lowland rice. It damages plants, especially during the seedling stage. It appears as neck rot and panicle blast after flowering.

Figure 7. Rice field infected with blast disease.

The disease appears first on the seedling leaves as minute brown specks, which then enlarge to become spindle-shaped, pointed at both ends. The center is greenish-grey often with a water-soaked appearance. This later dries and changes to a straw color with a brown margin. Under very damp conditions, several spots may conglomerate and the whole leaf then withers. This is usually most severe on seedlings in the nursery where plants may be completely killed. Damage is most severe when the uppermost node of the flowering stem is attacked. The lesions often occur near the uppermost node. The uppermost node is most vulnerable, especially during the early emergence of the panicle. It becomes less susceptible as the panicle matures. Grey-brown lesions usually occur girdling the uppermost node. Eventually, the node falls off. If the attack occurs before the milk stage, the grains are usually empty. In a later attack, the grain may be partly filled, but the kernels are often chalky and brittle. The disease may also appear on the nodes of the culms. When this happens, the nodes are usually black and brittle. Blast disease causes approximately 60–100% yield loss where disease conditions are favorable.

Cultural control: Cultural control methods include planting resistant varieties and avoiding close planting in the nursery, and adoption of recommended fertilization regime.

Chemical control: Apply Mancozeb or Dithane M-45 at I–1.5 kg/ha when signs of disease are observed. Repeat application weekly for 2 weeks.

Harvesting

Rice is ready for harvesting when the grains are hard and are turning yellow/brown (about 30–45 days after flowering). Rice is fully mature for harvesting when 80–85% of the grains are straw color. To harvest, cut the rice stems with a sickle at about 10–15 cm above the ground. Tie the panicles in bundles. Then place the tied-up bundles of the harvested rice crop in an upright position for drying before threshing.

Threshing and winnowing

Thresh on hard surfaces by beating the grains out from the ears. Winnow to separate the chaff and empty grains from the well-filled mature grains. Dry the paddy to a safe moisture level of between 12 and 14% before storing. Freshly harvested paddy does not store well under high temperatures.

Figure 8. Threshing of harvested rice.

Remove foreign matter in the paddy to avoid localized heating spots. Drying should be on mats spread on concrete floors and should be done slowly for the first few days to reduce breakage during milling. Avoid drying on bare floors to minimize the introduction of sand and pebbles and other foreign matter as they reduce the quality of the rice.

Figure 9. Drying of threshed rice.

Storage

Rice paddy intended for storage should be properly dried. Clean the storage container, such as a rumbu, before pouring in your paddy. To protect the paddy against insect pests, use 1½ matchboxes full of Coopex 2.5 to dust about 25 kg of paddy. Store in cool, dry rodent-proof conditions. Infested paddy should be fumigated with phostoxin in air-tight containers/rooms at the rate of one tablet/jute bag (100 kg paddy) or 10–15 tablets/ton of paddy.

Figure 10. Storage structures used for paddy rice. (a) Traditional and (b) Modern

Yield

Increase yield through improved agronomic practices, more use of fertilizers, and efficient water management. Shortage of water at the critical stages of growth and tillering, panicle initiation, and flowering will reduce yield considerably. Paddy yields of the recommended lowland varieties range from 6.2 to 8.0 t/ha while for upland varieties, paddy yields range from 4.0 to 6.0 t/ha.

Parboiling

All the varieties recommended above are medium to long grain rice and therefore need parboiling. Parboiling involves soaking the paddy in hot water at specified temperatures that vary with the varieties. For all the recommended varieties, parboiling can be done by soaking paddy rice for 5–6 hours in hot water at 70 ºC (hot enough for your fingers to withstand the temperature for about 2 seconds).

The paddy is later steamed for a short time (6–10 minutes) until the husks are just open. Steaming dextrinizes the kernels and drives the vitamin thiamine and other water-soluble nutrients from the testa into the starchy core; after parboiling, dry under shade gradually to reduce breakage during milling.

Parboiled rice has better storage and cooking quality. It is richer in food value, devoid of unpleasant odor, and breaks less during milling. Parboiling can be done in an earthen pot or empty petrol drums depending on the quantity of rice. After parboiling, store when thoroughly dry in clean, dry grain stores (rumbu). Milled rice for sale is best kept in clean sacks in the grain stores until prices in the market are better. Where it is not possible to parboil, the paddy should be taken to the market as early as possible to avoid losses in storage.

Drying parboiled paddy

Drying. Parboiled paddy should be dried to 14% moisture for safe storage or milling. Parboiled paddy is more difficult to dry and requires more energy than field paddy because its moisture content is much higher. However, higher air temperatures help reduce drying time.

Figure 11. Threshed rice being parboiled.

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Who we are

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