Promising Technologies for Rice Production in West and Central Africa

West Africa Rice Development Association (WARDA)

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Contributors: R.G. Guei and S.O. Fagade

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INGER-Africa collaborators in Benin, Burkina Faso, Cameroon, Chad, Côte d'Ivoire, The Gambia, Ghana, Guinea, Guinea Bissau, Liberia, Mali, Mauritania, Niger, Nigeria, Senegal, Sierra Leone and Togo.

WARDA
01 B.P. 2551
Bouaké 01
Côte d'Ivoire

Tel.: (225) 31659300
Fax: (225) 31659311
(225) 22411807
E-mail: *warda@cgiar.org*

Web-site: *http://www.warda.cgiar.org*

FAO
Via delle Termi
di Caracalia
Rome 00100
Italy

Tel.: (30-06) 57051
Fax: (39-06) 57053152
E-mail: *FAO-HQ@fao.org*

Web-site: *http://www.fao.org*

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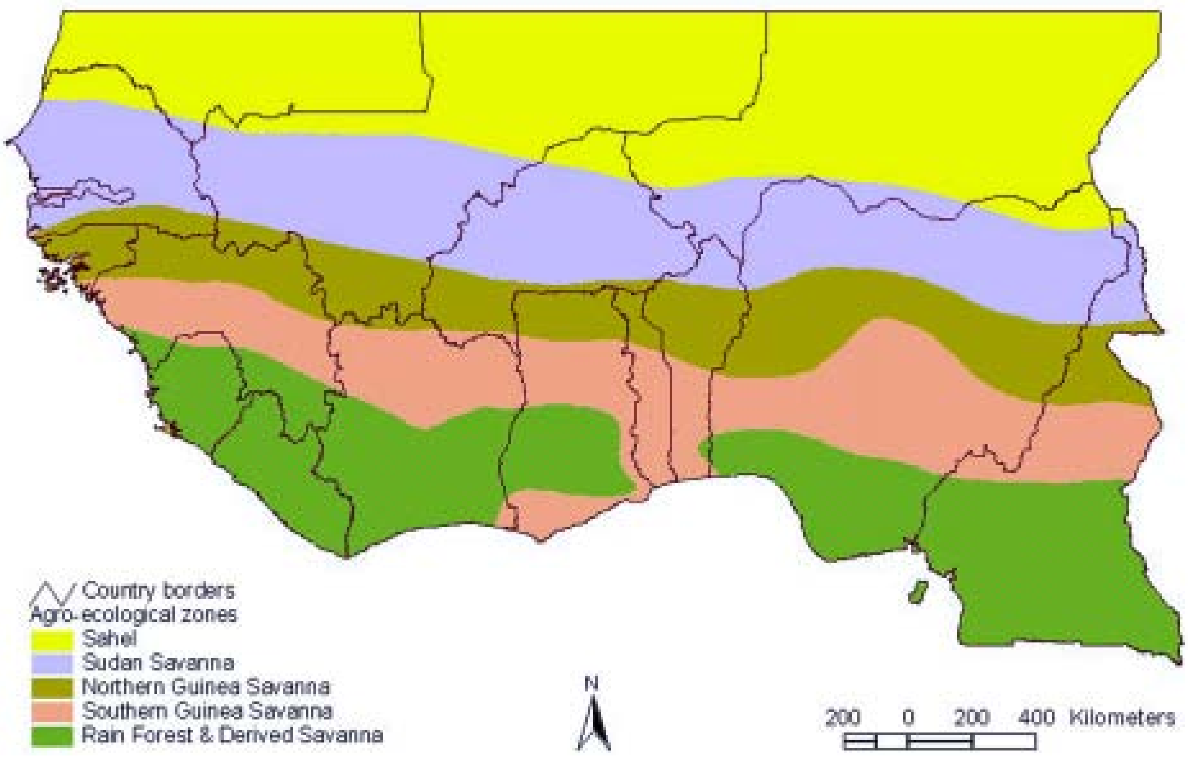
Introduction

Since 1990, when it was given the mandate for rice research in West and Central Africa, the West Africa Rice Development Association (WARDA) has been accumulating information on rice production from every corner of this diverse region. Thanks to the Germplasm Exchange Program, run by the International Network for Genetic Evaluation of Rice in Africa (INGER-Africa), thousands of varieties have been tested to identify those best suited to the stresses of the various ecosystems. As part of its ongoing effort to disseminate information to growers, the Food and Agriculture Organization of the United Nations (FAO) approached WARDA's Genetic Resources Unit in 1997 looking for data on the best rice varieties for the region. Eventually, FAO and WARDA agreed to collaborate to produce the present work.

This booklet presents data collected between 1990 and 2000 from research stations in West, Central and East African countries. First, the rice-growing ecologies and agro-ecological zones of the region are described. Then, to help select the best varieties for a given location, the most promising varieties are listed, according to ecology and zone.



Agro-ecological zones of West and Central Africa.

Agro-ecological Zones in West and Central Africa

The West and Central Africa region stretches between 4° and 25° N latitude and 17° W and 18° E longitude. This is an immense area by any standard, with many different climates and terrains. As we know, climate (rain, temperature, relative humidity [RH], day length), soil type and human activity interact with factors such as management practices to affect crop growth. Given the climatic differences, the performance of a given variety of rice will vary greatly from site to site. Selecting the best variety and crop management for a given site depends on an accurate description of the environment.

WARDA has therefore grouped the different crop environments of the region into six agro-ecological zones (AEZs), defined by the following criteria: climate, vegetation, soil, cropping pattern and altitude. The AEZs are: Rain Forest, Derived Savanna, Northern Guinea Savanna, Southern Guinea Savanna, Sudan Savanna and Sahel.

Rain Forest

The forest zone runs along the southern coast of West Africa. It passes through, from west to east, Guinea, Sierra Leone, Liberia, Côte d'Ivoire, Ghana, Togo, Nigeria, and Cameroon, and comprises some 40 million hectares.

The zone is characterized by high rainfall (mean monthly rainfall varies from <20 mm in January to 100–300 mm in June and July). There is usually a short dry spell in August, particularly in remote areas, but in some years (and along the coast) this dry spell is not sharply defined. Relative humidity is generally high (80% in January/February and over 90% in June/July). This is due to the moisture-laden, tropical maritime air masses that linger in the vicinity for about nine months a year. The average annual mean temperature is 25–28°C, with a mean maximum of 37°C and a mean minimum of 21°C. The Rain Forest is sometimes divided into three sub-zones depending on the distance from the Atlantic Ocean: saline water swamp, fresh water swamp and high forest.

Derived Savanna

There are two types of Derived Savanna. The first is a belt of land that lies between the Southern Guinea Savanna and the Rain Forest. Because of human activity, the trees and vegetation that originally grew in the belt are gone. They have been replaced by vegetation thinner and more deciduous than in the Rain Forest. The second is the coastal savanna found in parts of Ghana, Togo, Benin and Nigeria. This belt is caused by cold coastal waters replacing the warm Guinea currents of the Atlantic, resulting in low rainfall and grass-dominated vegetation. Together, both types of Derived Savanna cover an area of about 20 million hectares.

Annual rainfall is 1300–2000 mm, with rains from April to October. Relative humidity is generally high (as much as 80% in the morning) and nights are hot. Crops and cropping patterns are closely related to those of the adjoining zones.

Southern Guinea Savanna

Vegetation in this zone consists of open forest interspersed with tall, dense elephant grasses. This is a by-product of years of fire and other devastation that have kept the plants in a constant state of trying to adapt to the environment; trees and grasses have structures that enable them to survive the dry season and resist bush fires. The zone is found in all countries of the region except Mauritania and Mali. In countries such as Nigeria, Benin, Togo, Ghana and Côte d'Ivoire, the zone occupies more than half the land area. It covers over 40 million hectares.

The zone has bimodal rainfall of 1200–1500 mm per year. The wet season lasts for 6–8 months. Mean monthly temperature ranges from 23 to 35°C, with the hot months recording a high of 37°C and the cool months a low of 18°C. Upland soils are mainly Luvisols with low cation exchange capacity (CEC). They are deficient in organic matter, nitrogen, phosphorus and iron. However, a wide range of upland cereal crops—maize, sorghum, millet and rice—as well as roots and tubers, are grown. As the rains are erratic and the season short, early-maturing cultivars are preferred. The wetlands—particularly the valley bottoms—are fertile and favorable for rice production. A large proportion (40–45%) of the Rainfed Lowland rice grown in West Africa is in this zone.

Northern Guinea Savanna

This zone extends across the region from Senegal in the west to Chad in the east. Typically, it consists of tall grasses (3–4 m) and trees (more than in the Sudan Savanna). The appearance of *Isoberlina* spp. is a distinctive character of the transition from the drier zone to the north into this sub-humid area. It covers 28 million hectares.

The zone has monomodal rainfall of 1000–1200 mm per year, most of which falls from April to October. The moisture deficit is moderate in the south to high in the north. The mean monthly temperature ranges from 15 to 48°C, with highs during the dry season (November to March). The tall grasses and woody species are subjected to bush fires most years. Thus, the grasses are deep rooted, enabling them to sprout with the onset of the rains. The upland soils are mainly Luvisols with a low organic-matter content (0.01–0.2%) and a pH of 5.6–6.5; iron deficiency is common. The wetland soils, usually Entric Gleysols, are subject to iron toxicity when poorly drained.

Sudan Savanna

This is a transition zone between the Northern Guinea Savanna and Sahel zones. It is found in Senegal, Mali, Burkina Faso, Niger, Nigeria and Chad, with patches in the northern parts of Cameroon and Benin. The drier, northern parts of the zone are characterized by the sparse savanna grasses and woody species of the Sahel zone, while the wetter southern parts contain more grasses and woody species. The vegetation is mostly short (1.5–2.0 mm) grasses and scattered, stunted trees (mainly *Acacia* spp., silk cotton and baobab). The silk cotton is the tallest of the group, growing to a height of 10–15 meters. Soil type affects the pattern of vegetation.

The zone has monomodal rainfall of 600–1000 mm per year. The high variability in annual rainfall causes drought damage to rainfed upland crops, including rice. Relative humidity is generally below 40%, except in the few wet months when it reaches about 60%. The dry season lasts roughly 6–8 months. Monthly mean temperature varies between 12 and 45°C, with highs of 45–48°C in the hot months and lows of 10–12°C in the cool mornings of the *harmattan* months. The upland soils, generally Regosols (90%) and Luvisols (10%), are subject to wind erosion. This leads to exposed infertile subsoils characterized by a low organic-matter content (0.01–0.03%) and a high pH (6.5–7.5). Iron deficiency is very common. Upland rice farming here requires early and drought-resistant varieties.

The soils in the wetlands of the inland valleys and flood plains are mainly Gleyic Fluvisols and Entric Regosols. The inland valleys are frequently waterlogged in the wet season, while in the dry season, the expanding clays dry, shrink and crack. The flood plains are flooded annually in the wet season. Depending on location, they vary in their morphological, pedological and chemical properties. In this highly populated area, rice is cultivated extensively in the wet season and irrigated vegetables are grown in the dry season. Because of the high risk of drought and the good network of rivers and basins, the Sudan Savanna has the largest concentration of large- and small-scale irrigation systems.

Sahel

The Sahel extends from the extreme north of the region bordering the Sahara Desert to the semi-arid Sudan Savanna. It covers most of the land areas of Chad, Niger, Mali, Senegal and Mauritania and is found to a lesser extent in Nigeria, northern Cameroon and Burkina Faso. Savanna-type vegetation, mainly grasses (*Andropogon* spp., etc.) and sparse woody plants, dominates the landscape.

Annual rainfall varies from less than 200 mm in the north to 500 mm in the south. Most of the rain falls in two months (mid-July to mid-September). Drought is common. Temperatures range from 40–48°C during the day to <12°C at night during the cool *harmattan* months (October to February). Severe sand storms as well as cold, dry winds from the Sahara occur during the *harmattan*. Eighty percent of the upland soils are Regosols, while the rest are mainly Arenosols. These are characterized by a low organic-matter content (0.01–0.03%) and a high pH (6.7–7.5). The low-lying soils of the flood plains and the inland valleys are more fertile, with about an equal distribution of Vertisols, Fluvisols and Gleysols. Organic-matter content is 1.0–2.0% and pH is 6.5–7.0. Desertification is a major ecological problem. With its low rainfall, 90% of the Sahel requires irrigation. Some 200,000 hectares of the West African Sahel is now under full irrigation, with rice as the main crop (some 7% of West Africa's rice area). Irrigation in arid climates like the Sahel leads rapidly to salinization. Nutritional imbalances occur in patches and become widespread if not properly managed.

Rice-growing Ecologies of West and Central Africa

WARDA has established a broad classification of rice-growing ecologies, based on hydrology, which divides the ecosystems into 'upland' and 'lowland.' In the upland ecology, cultivation occurs under rainfed conditions in freely drained soils, without bunding and without water accumulation on the surface of the soil. In the lowland ecology, water accumulation occurs for varying periods during crop growth. The lowland ecology is sub-divided into three types: Rainfed, Mangrove Swamp, and Irrigated. Thus, the four ecologies found in West and Central Africa are:

- Rainfed Upland
- Rainfed Lowland
- Irrigated Lowland
- Mangrove Swamp

Rainfed Upland

Because of the large area involved (2.3 million hectares) and the predominance of cropping systems based on low-input management practices, **Rainfed Upland** cultivation dominates rice growing in West and Central Africa, representing about 40% of the area under rice. However, this translates into less than 27% of the region's rice production. Major upland rice producers are Côte d'Ivoire, Sierra Leone, Nigeria, Liberia, Guinea and Guinea Bissau.

Rainfed rice can best be grown in areas receiving a minimum of 200 mm of rainfall per month for a minimum of three months (based on daily evaporation of 6–7 mm). However, the length of time between rainfalls should not exceed 7–10 days. Thus, upland rice is best suited to areas receiving adequate rainfall throughout the growing period. Such areas are generally found in the Rain Forest. However, there are other areas (such as the Derived Savanna, the Southern and Northern Guinea Savannas and, to some extent, the Sudan Savanna) where annual rainfall is usually adequate.

Rainfed Lowland

Another 38–40% of the area cultivated to rice is in the **Rainfed Lowlands**. Four environments are identified in this ecology: the coastal plains, inland basins, river flood plains and inland valleys.

The **coastal plains** consist of saline- and fresh-water swamps. Rice cultivation in the saline-water swamps is the same as in the Mangrove Swamp. Coastal fresh-water rice production is found from Guinea to Cameroon. Flooding is a major constraint, so the area devoted to rice is relatively small.

The **inland basins** are extensive drainage depressions that occur throughout the region. They are found in the inland deltas of Niger, Mali and Nigeria. The largest basin in West and Central Africa is the Lake Chad Basin, located in the Sahel. Rice production in the lowest areas, which are subject to deep flooding, represents less than 6% of the regional total.

Flood plains occur along the Gambia River, the upper, middle and lower Niger River, the Benue, Charii and Volta Rivers, and many other smaller rivers in West and Central Africa. They are used mainly for rice cultivation, particularly in the wet season. Most are located in the Sudan, Northern Guinea and Southern Guinea Savannas.

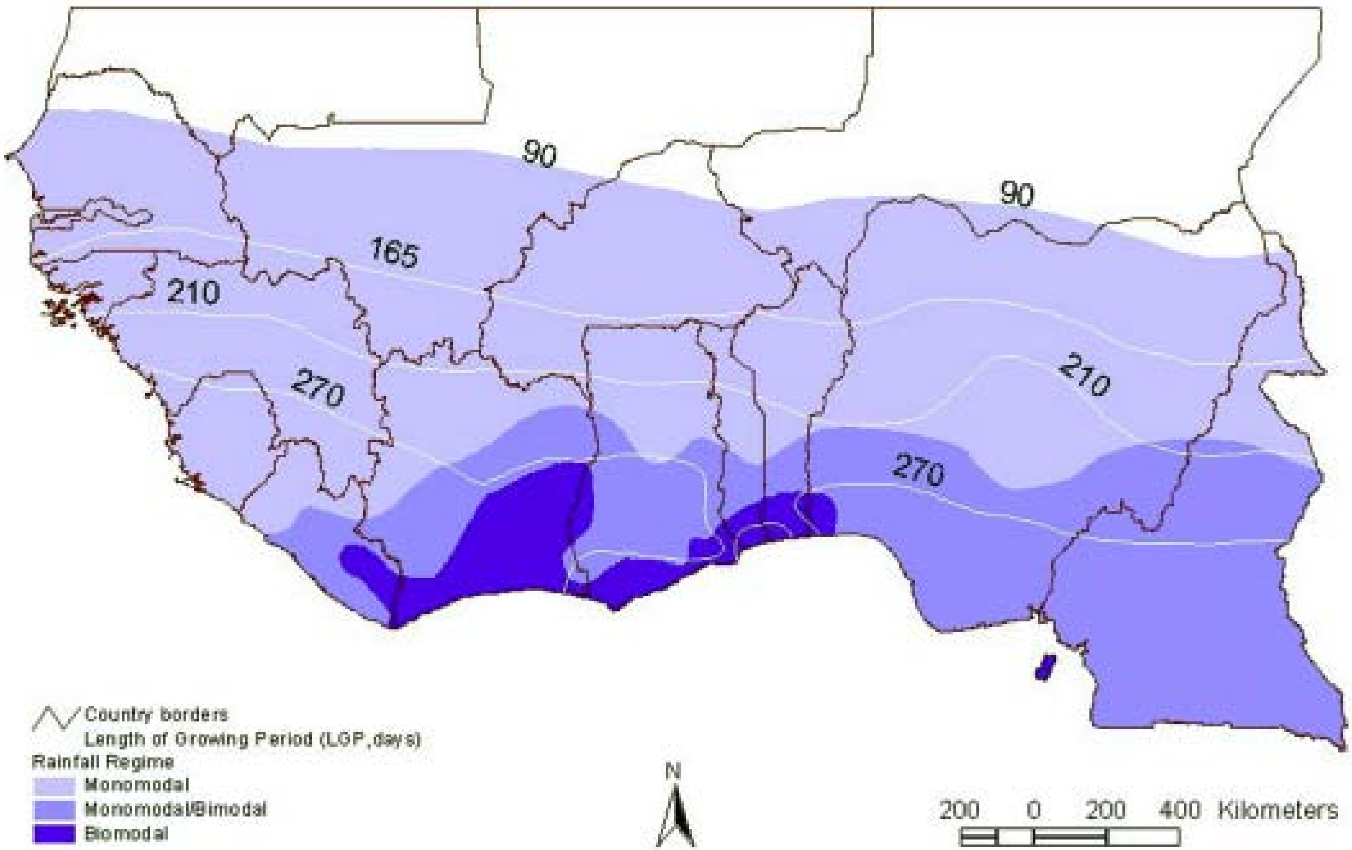
Inland valleys are found in all the agro-ecological zones. They constitute over 35% of the total wetlands in the region and are cropped extensively with rice in the wet season. They are the numerous flat-floored and relatively shallow valleys that occur in the undulating plains and plateaus found all over the region. Crop performance varies widely both within and among valleys. Drainage ranges from poor to moderate and iron toxicity is a major constraint to rainfed lowland rice.

Irrigated Lowland

Irrigated rice-growing areas are divided into three subcategories based on temperature. Two are found in West and Central Africa: favorable-temperature and low-temperature tropical irrigated zones. The latter is restricted to the mid-altitude areas of Cameroon. The former is represented by the dry-season irrigated rice that is found in all agro-ecological zones from the Rain Forest to the Sahel. While nearly all the rice grown in Mauritania (Sahel) is irrigated, only 12–14% (0.5 million ha) of the total rice area in West and Central African is irrigated. This includes substantial areas in the Cameroon (80%), Niger (55%), Mali (30%) and Burkina Faso (20%). Irrigated rice in these countries (except Cameroon) is mainly in the Sudan Savanna and Sahel, which account for nearly 60% of the irrigated rice area in West and Central Africa. In Côte d'Ivoire, about 24,500 hectares (7% of total area) are irrigated. Yield potential (10 t/ha) is higher in these drier zones than in others, because of high solar radiation and low disease stress.

Mangrove Swamp

Mangrove swamp rice is cultivated mainly in the saline-water flood plains of the Rain Forest and Sahel. About 150,000 hectares, representing 4% of the rice area in West and Central Africa, are planted to **Mangrove Swamp** rice in Sierra Leone, The Gambia, Guinea and Guinea Bissau. Although the ecology can sustainably support relatively high yields with little input, its share of the regional rice area is likely to decline as labor costs and environmental concerns rise. The 80,000 hectares of **Mangrove Swamp** in the Niger Delta of Nigeria remain undeveloped for rice cultivation, with only a few hectares utilized by a cooperative group in Warri and for experimental purposes by the National Cereals Research Institute (NCRI).



Rainfall distribution in West and Central Africa.

Crop Management Systems for West and Central Africa

Plant growth and performance are the result of a genotype-by-environment (agro-ecological) interaction. Thus, there are two tracks for rice improvement programs in West and Central Africa. One is to develop varieties suited to the prevailing ecological condition. The other is to modify the ecological condition to suit the improved varieties. However, the rice environment can be modified only to a limited extent, with the high cost of irrigation and drainage facilities limiting the extent of such modifications. Developing and tailoring new varieties with the right characteristics (in addition to the basic characters needed for high yield) is of primary importance. Nevertheless, improving the growing environment as much as possible by using appropriate crop management strategies remains an integral part of the technology package.

The complete package of improved management practices for rice ecologies includes: variety, method of land preparation, optimum planting date and density, fertilizer (dose, timing, application mode), water management, inexpensive but safe pest and disease control, optimum harvesting date, and methods of harvesting, threshing and drying.

These operations are so heavily influenced by location, ecology and AEZ that only a broad regional picture can be provided. The crop management strategies that follow are for the **Rain Forest**. The basic principles are the same for the other ecologies, although the details differ slightly. In the **Sahel**, for example, early-maturing, cold- and drought-tolerant varieties are preferred. Crop and fertilizer management options include close transplanting of healthy seedlings, application of NPK at a rate 60-40-40 kg/ha before transplanting, followed by 40 kg N/ha 20 days after transplanting and at panicle initiation.

Selecting a Variety

For rice production in the **Rainfed Uplands**, the variety must be one that quickly develops a canopy that covers the soil rapidly to control erosion and offer good weed control. It must be resistant to blast, brown spot disease and lodging. Varieties with medium to late maturity (120–145 days) are preferred for wetter areas, so that the crop matures when maximum sunshine hours can aid ripening and crop drying.

In the **Rainfed Lowlands**, weed competitiveness and resistance to iron toxicity, blast and RYMV are the important considerations when selecting a variety. Varieties of medium-to-long duration, which allow ripening when the soil is dry, are good choices for high yield and mechanized harvesting.

The choice for the **Irrigated Lowlands** depends on the cropping pattern. When two or three crops are planted in succession, short-duration varieties are required.

In the **Mangrove Swamp**, salt-tolerant, relatively early maturing (120–145 days) varieties are required for short-season, salt-free areas. Varieties that are photoperiod sensitive, lodging resistant, and late maturing (160–190 days, maturing in late December or early January) are preferred for long-season, deep-flooded areas.

Some varieties are 'plastic,' with a higher response to N fertilizer in all ecologies and are recommended.

In the **Rain Forest**, the major climatic constraints are rainfall, solar radiation, light and low temperature. Solar radiation affects other parameters such as temperature, evapotranspiration and photosynthesis. Due to the combined effects of light intensity and solar radiation, **Rainfed Upland** rice suffers serious yield reductions in this zone. Selecting drought-tolerant cultivars that make use of solar radiation and temperature, in combination with improved crop management, will improve yield. In the **Rainfed Uplands** and **Lowlands** of the **Northern** and **Southern Guinea Savannas**, selecting for early maturity and drought tolerance is a priority. An important phenotypic trait in such varieties is a deep system of thick roots, which when combined with early maturity, help combat the effects of drought.

Planting the Crop

The time of planting is crucial no matter what the ecology. In the **Rainfed Uplands** and **Lowlands**, planting can only start when the rains start, usually in March.

In the **Rainfed** and **Irrigated Lowlands**, do not transplant in August, or from November to February, as the low temperatures will reduce yield. Varieties tolerant to cold temperatures during their early growth stages may be used.

In the **Rainfed Uplands**, the rice crop can be drilled, broadcast sown or dibbled in dry-to-moist soil. There is no significant difference between these methods when seed rates are the same. Dibbling 4–6 seeds per stand, spaced 25 cm apart within and between rows, is optimum. Drilling or broadcasting at a seed rate of 50–80 kg/ha is also effective. Although transplanting may give better yields for medium-duration varieties, it is not significantly superior for short-duration varieties. However, the choice depends on the weed control methods and resources available.

Applying Fertilizers and other Soil Issues

Fertilizing the rice crop is one of the quickest ways to increase its productivity and production. However, due to cost and availability, the farmers of West and Central Africa rarely apply any fertilizer at all, let alone the optimum type and amount. Increasing fertilizer use efficiency through proper soil and crop management is therefore essential.

In the **Rainfed Uplands** of the **Rain Forest**, rice is the first crop planted after the land is cleared. As such it does not require a complete fertilizer (application of single fertilizers depends upon the specific needs of the locality). In depleted soils, nitrogen is generally the limiting nutrient, and a compound (NPK) fertilizer is usually applied. When single fertilizers are used, P and K should be applied at land preparation and worked into the soil. Phosphorus and K fertilizers are not readily lost from the soil (as N is) and so are available to the crop throughout its life.

The first application of NPK should be done 14 days after sowing (a single N application should also be done at this stage). The rate of application ranges from 40-80-80 kg/ha in Sierra Leone to 90-60-45 in Ghana, with intermediate levels in other countries. The coarse-to-fine, freely draining **Rainfed Upland** soils need a minimum of 2 or 3 split applications of N at early tillering and/or maximum tillering, plus panicle initiation. Weeding before fertilizing (rather than after) is recommended.

Fertilizers should be broadcast and worked into the soil with small hand hoes. In some countries, soil acidity is corrected by an annual application of 150–200 kg of magnesium limestone per hectare. This rate can be higher (1–3 t/ha) if the problem is severe. Other improved management practices aimed at fertilizer use efficiency, soil conservation and correction of nutrient deficiencies include: application of organic manure (animal waste), zero tillage, growing legumes (mixed cropping, rotating and intercropping), mulching and application of crop residues. These fertilizer-saving practices must be encouraged.

Nutrition for **Rainfed Lowland** rice in the **Rain Forest** depends upon eliminating the major soil and climatic constraints. In this labor-limited ecosystem, iron toxicity is the major soil problem. Potassium deficiency is usually associated with iron toxicity, so a complete fertilizer is recommended in addition to iron-level-reduction techniques such as raised crop beds (small ridges) and drainage. Recommended fertilizer rates range from 40 kg N/ha in Sierra Leone to 80–90 kg N/ha in Côte d'Ivoire, Ghana, Nigeria and Togo. Deep placement and split application (half basal, half at panicle initiation) of N result in significant yield increases in medium-duration varieties. No one method or time of P application is consistently superior in the **Rain Forest**, except on sandy, degraded P-fixing soils where a late or split application may be superior. Conventional, non-acidifying N sources (urea and calcium ammonium nitrate) are as good as ammonium sulfate the first year and may be superior after continuous use in acid soils. The field should be bunded and some form of water control used.

In the **Mangrove Swamp**, nitrogen and phosphorous are the most important nutrients required. In most areas, 40–60 kg N/ha is recommended. Phosphorous is essential in the tidal-limit areas of the **Mangrove Swamp**. A rate of 40 kg P_2O_5 per hectare is appropriate. The most-used source of fertilizer in this ecology is urea, applied in 3 or 4 splits (basal, 4, 12 and 18 weeks after transplant), depending on the variety's duration. In high-tide areas, N fertilizer may be increased to 80 kg N/ha.

Fertilizer management in the **Irrigated Lowlands** is similar to that in the unbunded **Rainfed Lowlands**. With good water control, drainage during accumulation of high levels of Fe^{2+} is achievable and encouraged. Since there is no carry over of nitrogen fertilizer to the succeeding crop, slow-release fertilizers are better for this ecology.

The soil factors in each agro-ecological zone that affect crop performance include: cropping system, parent material, degree of weathering, soil reaction, hydrology, type of clay and relief. These factors largely determine the development, intensity and management of a particular constraint. In the **Mangrove Swamp** ecology of the **Rain Forest**, early-maturing, salt-tolerant varieties are required. Farmers in the drier mangrove areas (i.e. Casamance in Senegal, Guinea Bissau and The Gambia) seed or transplant rice onto ridges as part of their salt- and iron-toxicity management. Rice that is grown in the **Mangrove Swamps** may experience aluminum toxicity or acidity during early growth, leading to reduced growth and yield. An integrated approach—combining genetic tolerance, represented by variety choice, plant nutrition and crop management—can reduce iron toxicity. The application of a balanced fertilizer (NPKZn) and ridge planting can significantly reduce iron toxicity.

An integrated approach is also required in the **Rainfed** and **Irrigated Lowlands** of the **Rain Forest** and the **Northern** and **Southern Guinea Savannas** for the control of iron toxicity. Salinity is a common soil problem in the arid and semi-arid environments of the **Sudan Savanna** and **Sahel**. Using salt-tolerant varieties is one way of coping with the problem. Other management options to increase yield, such as land-leveling, weed control and optimum water management, will reduce the rate of land abandonment, thereby preventing the soils from drying out.

Managing Water

The choice of sowing date in the **Rainfed Uplands** is related to a given variety's water requirement. This requirement is met by making the most of the available moisture from the rains. The variety must be planted so that from panicle initiation to heading (the period of highest water need), it will receive rainfall. As short periods of drought are common, reduced tillage with mulch is an effective practice for water conservation.

Water management in the **Rainfed Lowlands** of the **Rain Forest** is closely related to other management practices such as fertilizer management and weed control. Bunding of a field for water control is a primary strategy. However, fields may have to be drained to remove excess the Fe^{2+} usually associated with this ecology and zone. Drainage can be difficult during periods of peak rainfall. At other times, farmers are unwilling to drain for fear of fertilizer loss, worries about when the next rainfall will be and increased weed growth. A good balance can be struck by taking into account the characteristics of the locality. In the **Rain Forest**, there is usually an adequate water supply. Continuous flooding along with draining for application of fertilizer is recommended. Fields are also drained when high levels of Fe^{2+} are found in the paddy. The availability of water for recharging after drainage, loss of applied nitrogen and weeds are problems associated with intermittent flooding.

Managing Weeds

Weed control in farmers' fields in West and Central Africa is often inadequate because of factors such as cost, timing, improper land preparation and poor leveling. This reduces yield. The extent of the reduction is not only a matter of variety choice, but also of ecosystem, management practices such as spacing/plant density, method of planting and water management. The most practical, economically viable and environmentally friendly method of weed management is hand-weeding combined with practices such as the use of weed-suppressing cultivars, mulching (**Rainfed Uplands**), and water management (**Rainfed** and **Irrigated Lowlands**). Two hand-weedings or hoeings 14 and 28 days after seeding in the **Rain Forest** zone or transplanting are also effective. The weed problem in the **Rainfed Uplands** is compounded by the fact that rice is usually sown with other crops. The moist environment of the **Rainfed Lowlands** favors weed growth. More weeds grow in rice seeded directly into dry soil than in transplanted rice, since, with good water management, many weed species will not germinate or survive under flood conditions. As with insect pests and diseases, integrated management provides a longer-lasting and environmentally sound solution to weed problems.

Controlling Pests and Diseases

The major insect pests are *Chilo zacconius* (striped borer), *Marliarpha* spp. (white borer), *Scirpophgaga* spp. (yellow borer), *Sesamia calamistis* (pink borer), *Diopsis* spp. (stalk-eyed fly) and *Orselia oryzivora* (African rice gall midge). *Sesamia calamistis* is more important in the Rainfed Uplands of the **Rain Forest** and **Guinea Savannas**. In Burkina Faso and Mali, *D. thoracica* is limited to areas with sufficient humidity in the dry season. It is found in humid **Irrigated Lowlands** in Côte d'Ivoire and Benin, and less frequently in the **Rainfed Uplands** and **Lowlands**. African rice gall midge (AfRGM) is principally a pest of lowland rice.

The major diseases of rice in West and Central Africa are blast, rice yellow mottle virus (RYMV), leaf scald, brown spot, sheath bight, glume discoloration and bacterial leaf blight. Developing resistant varieties has been the main focus of blast control in the region. Although many traditional upland landraces have shown significant levels of resistance to RYMV, no exotic lowland rice variety has been found to be resistant.

The Varieties

Each year, hundreds of nurseries are sent out from WARDA to rice research stations throughout the region. The map opposite provides information about each of these sites.

From the data collected, WARDA has identified promising varieties. They are classified, according to ecology, as follows:

Ecology	Target yield	No. varieties
Rainfed Uplands	>3 t/ha	41
Rainfed Lowlands	>3 t/ha	46
Irrigated Lowlands		
Sahel	>5 t/ha	21
Sub-humid/humid	>4 t/ha	426
Mangrove Swamp	>3 t/ha	341

At least two outstanding varieties have been identified from each ecology for each agro-ecological zone. In the **Irrigated Lowlands** of the **Rain Forest**, only promising late- and medium-duration varieties are available, although early or very early maturing varieties could be used for double cropping or for a second dry-season crop. Breeding efforts are yet to produce varieties that are early maturing and iron-toxicity tolerant for the **Rain Forest**. In some dry agro-ecological zones (**Northern Guinea Savanna**, **Sudan Savanna** and **Sahel**), which require very early maturing cultivars because of the short growing season, improved very early to early maturing cultivars are still needed.

The table on page 18, Promising Rice Varieties for West and Central Africa, provides information about the 100 most promising varieties. In most countries, irrigated rice performed the best, but good yields were also obtained from **Rainfed Lowland** rice in Côte d'Ivoire and The Gambia.

The table on page 20, Varieties Promoted by INGER-Africa and Later Released, lists the improved rice varieties that have been released for widespread cultivation. WITA 3 and WITA 8 were outstanding in Cote d'Ivoire.

INGER-Africa participating countries.

Promising Rice Varieties for West and Central Africa

	Site	Ecology	Variety	DM	Yield (t/ha)
Benin	Niaouli (INRAB)	Rainfed Lowland	IR 1529-680-3	115	7.6
	Lema (IPGRI)		ITA 212	133	8.5
	Moussourou/Bohicon	Rainfed Upland	WABIS 18	121	3.3
			DJ 11-307-15-3	140	3.5
	Niaouli/Allada	Irrigated Lowland	FARO 20	129	6.7
			TOX 3107-56-1-2-2-5	133	7.4
BF	Farako-Ba/Bobo Di.	Rainfed Upland	IDSA 27 (IRAT 306)	110	4.4
			TOX 1011-4-A2	102	4.6
Cameroon	Maga*	Irrigated Lowland	TOX 3050-6-E2-3-4	155	5.3
	Bokle/Garoua	Irrigated Lowland	IR 68	133	6.3
			S 818 B-10-2	122	6.6
	Bokle (IRA)	Rainfed Upland	TOX 1010-21-5-12-4	125	4.8
			WAB 384-B-B3L2	135	5.8
Chad	Lai (DRTA)	Rainfed Lowland	TOX 3562-15-3	170	6.6
			CT 6240-12-2-2-3-6P	115	7.1
	Lai (FSM)	Rainfed Upland	WAB 32-80	112	4.0
			WABIS 550	111	4.5
Côte d'Ivoire	M'bé	Irrigated Lowland	IR 22082-41-2	152	4.1
	M'bé (WARDA)	Rainfed Lowland	WITA 3 (TOX 3100-32-2-1-3-5)	125	8.5
			WITA 8 (TOX 3440-176-1-2-1)	120	8.6
	Bouaké (IDESSA/DCV)	Rainfed Upland	IDSA 27 (IRAT 306)	110	4.2
			IRAT 314 (7441)	128	4.9
The Gambia	Dankunku & Waddu (NARI)	Irrigated Lowland	IR 54	145	5.5
		Mangrove Swamp	IR 54	113	5.5
	Bakindik (NARI)	Rainfed Lowland	BR 4	171	6.5
			Cisadane	140	6.9
	Brikama (NARI)	Rainfed Upland	WAB 56-39	90	3.3
			IR 47701-6-3-1	114	3.6
Ghana	Kumassi (CRI)	Rainfed Lowland	TOX 3100-37-3-3-2-1	117	4.3
			ITA 330	143	4.7
		Rainfed Upland	WAB 99-10	127	2.1
			TGR 75	128	2.3
Guinea	Faranah	Rainfed Upland	WAB 450-I-B-P-160-HB (NERICA 6)	105	2.7
			WAB 450-I-B-P-20-HB (NERICA 7)	90	1.4
	CRA/Koba	Mangrove Swamp	WAR 100-3-15-2-B-B-B-1	180	3.6
			ROK 5	150	5.0
	Kindia (KILLISI CRA)	Rainfed Upland	IDSA 13 (IRAT 265)	116	2.0
			TOX 1889-7-105-2-1	115	2.0
			WABIS 18	115	2.9
			WABIS 550	119	2.9
	Sedougou (CRA)	Rainfed Upland	ITA 335 (TOX 1889-3-102-1-1-2)	116	2.0
			TGR 78	126	2.0
			CNA 6656	116	4.3
			WAB 99-H-14-HB	119	5.0
Guinea Bissau	Carboxanque (DEPA)	Mangrove Swamp	WAR 77-3-2-2	140	4.9
			WAR 1	135	5.6
		Irrigated Lowland	CK 4	151	5.2
			TOX 3081-36-2-3	113	5.2
	Caboxanque (DEPA; INPA)	Mangrove Swamp	WAR 115-111-2-3-B-B-1	132	5.2
	Contuboel (INRA)	Rainfed Lowland	ITA 324	128	3.2
			BW 384-1	130	4.1
			J 104	120	4.2

* Mid-altitude lands in Camaroon; DM = days to maturity; BF = Burkina Faso.

Rain Forest | Derived Savanna | Southern Guinea Savanna

Site	Ecology	Variety	DM	Yield (t/ha)	
Contuboel (INRA) (cont.)	Rainfed Upland	WAB 56-104	105	2.2	Guinea Bissau
		WAB 30-24	106	2.3	
Lon Gorola (IER/CRRA)	Rainfed Upland	SIK 49-314-3	134	4.6	Mali
		BR 4	171	6.6	
Nwno-Kogoni-Kayo	Irrigated Lowland	MR 84	135	6.0	
		SEBERANG	138	6.0	
Kaedi	Rainfed Lowland	IR 28128-45-3-3-2	145	7.8	Mauritania
	Irrigated Lowland	TOX 3093-35-2-3-1	129	7.1	
		4418 X IR 6115-1-1-1	133	7.2	
Boghe, Rosso & Foum Gleita	Irrigated Lowland	IR 31851-96-2-3-2-1	110	6.4	
		IR 32307-107-3-2-2	108	5.4	
		ITA 344	127	7.5	
		ECIA 31-6066	127	7.0	
		TOX 3241	132	7.2	
Ibadan (IITA)	Irrigated Lowland	B 3894-22C-78-5	119	5.3	Nigeria
		S 818 B-10-2	116	5.3	
	Rainfed Lowland	IR 14632-2-3	117	5.0	
		IR 33461-39-3	155	5.4	
Ibadan (NCRI)	Rainfed Upland	FARO 43	132	3.9	
		TOX 1010-21-5-12-4-7	129	4.0	
Samaru Kataf	Irrigated Lowland	AT 85-2	121	4.4	
		RP 1125-604-1-1	132	4.6	
Bende (NCRI)	Irrigated Lowland	BR 50-120-2	143	7.3	
		SUAKOKO 8	140	7.3	
	Rainfed Lowland	BR 50-120-2	137	7.3	
		SUAKOKO 8	148	7.3	
Merogun (NCRI)	Mangrove Swamp	WAR 77-3-2-2	130	2.9	
		WAR 1	135	2.9	
Abakaliki (SJFU)	Rainfed Upland	WABIS 844	135	4.2	
		TRG 78	126	4.9	
Badeggi (NCRI)	Irrigated Lowland	TOX 3154-17-1-3-2-3	127	7.5	
		TOX 3100-44-1-2-3-3	125	8.7	
	Rainfed Lowland	FARO 37	133	5.1	
Edozhigi (IITA)	Rainfed Lowland	IR 46375-CPA-19-3-1	129	5.2	
Birnin Kebbi (NCRI)	Rainfed Lowland	TOX 3866-27-3-1-2-2-1	159	4.6	
Mangu (NTAM-PADP)	Rainfed Upland	RY 1	143	3.9	
		IR 47686-18-6-1	126	4.3	
Birkama (ISRA)	Mangrove Swamp	WAR 77-3-2-2	130	4.6	Senegal
		ROK 5	130	4.7	
Djibelor (ISRA/CRA)	Rainfed Upland	IRAT 314 (7441)	98	3.5	
Podor & Matam	Irrigated Lowland	IR 31851-96-2-3-2-1	113	7.6	
		IR 32307-107-3-2-2	113	8.2	
Ross Bethio, Ngallenka & Bokhol	Irrigated Lowland	ITA 344	123	7.9	
		ECIA 31-6066	122	8.2	
		TOX 3241	123	8.2	
Rokupr (RRS)	Rainfed Upland	WABIS 18	114	2.2	Sierra Leone
Makeni (RRS)	Irrigated Lowland	IR 68	128	7.0	
		IR 54742-18-1720-15-2	125	7.3	
Saiama (RRS)	Mangrove Swamp	CP 4	162	5.3	
		ROK 10	140	5.4	
Adeta/Kpalime	Irrigated Lowland	TGR 75	115	5.7	Togo
Mission –Tove/Lomé	Irrigated Lowland	IR 70	125	5.7	
Adeta (INCV/DNRA)	Rainfed Lowland	TGR 1	120	6.5	
		TGR 26	123	7.0	

Northern Guinea Savanna *Sudan Savanna* *Sahel*

Varieties Promoted by WARDA and Later Released

	Ecology	Variety	DM	Yield	Traits
Benin	RL	11365			
	RL	DJ 11-307-15-3	130	2.0	High yield
	RL/IL	ANDY 11	140	1.9	High yield
	RL/IL	BG 90-2	120	1.6	High yield
	RL/IL	IR 5	120	4.0	High yield
	RL/IL	IR 8	125	5.0	High yield
	RL/IL	IR 22	130	5.0	High yield
	RL/IL	IR 529-228-3-3	120	4.0	High yield
	RL/IL	IR 937-55-3	125	5.0	High yield
	RL/IL	ITA 212	120	3.0	Salinity tolerant
	RL/IL	ITA 222	120	3.0	Salinity tolerant
Burkina Faso	RU	FARO 43 (CNA 6675)	120	5.0	Blast and Lodging resistant
	RU	TOX 1011-4-A2	105	3.4	Blast resistant; Drought tolerant
	RU	WAB 56-125	105	4.5	Blast resistant; Drought tolerant
	RU	WAB 56-39	109	3.5	High yield; Blast resistant
	RU	WAB 56-50	108	4.0	Acidity and Drought tolerant; Blast resistant
	RU/RL	ITA 257	105	3.0	Blast resistant
	RU/RL	IRAT 10	100	3.0	High yield
	RU/RL	IRAT 144	110	3.0	High yield
	RL	4418	125	5.5	Blast resistant
	RL	4458	120	4.5	High yield
	RL	TOX 728-1	120	6.0	Lodging and Blast resistant
	RL/IL	BR 51-319-3	115	5.0	High yield
	RL/IL	C74	130	4.5	High yield
	RL/IL	IR 8	130	5.0	High yield
	RL/IL	IR 1529-680-3	135	5.6	High yield
	RL/IL	ITA 212	120	3.0	Salinity tolerant
	RL/IL	ITA 222	120	3.0	Salinity tolerant
	RL/IL	RP 1125-1526-2-2-3	125	3.0	High yield
	IL	IR 64	120	3.5	Poor soil; Low input
	IL	ITA 123 (FKR 28)	120	7.0	Grain quality
	IL	Sahel 108 (IR 13240-108-2-2-3)	110	6.0	High yield; Blast resistant; High input
	IL	4456	120	6.5	Blast resistant
	IL	IET 2885	134		
Cameroon	RU	WAB 96-1-1	115	4.0	Low input; Weed competitive
	RU	WAB 384-B-B-1-2	120	3.2	High yield
	RL	CICA 8	130	6.4	High yield
	RL/IL	D114H	130	6.0	High yield
	RL/IL	IR 8	125	5.0	High yield
	RL/IL	IR 20 (FARO 19)	130	5.0	High yield

DM = days to maturity (approximate average); Yield = average yield in t/ha; RU = Rainfed Uplands; RL = Rainfed Lowlands; IL = Irrigated Lowlands; MS = Mangrove Swamp.

Ecology	Variety	DM	Yield	Traits	
RL/IL	IR 42	120	4.0	Blast resistant	Cameroon
RL/IL	ITA 212	120	3.0	Salinity tolerant	
RL/IL	ITA 222	120	3.0	Salinity tolerant	
RL/IL	ITA 306	130	6.0	High yield; Blast resistant; Fertilizer	
RL/IL	Jaya	135	4.0	High yield	
IL	IR 24	130	4.0	High yield	
IL	IR 28	125	4.5	High yield	
IL	IR 46	140	7.0	High yield	
IL	IR 7167-33-2-3				
IL	B2161C-MR-57-1-3-1	135	6.0	High yield	
IL	TOX 3145-34-2-3	130	5.0	High yield	
IL	BKN 7033	145	7.0	High yield	
IL	BKN 7167	150	6.0	High yield	
RL	BW 348-1	115	6.5	High yield	Chad
RL	CT 6240-12-2-2-3-6P	115	7.0	High yield	
RL	FARO 20	118	5.5	High yield	
RL	TOX 728-1	120	6.0	Yield stability; Blast and Lodging resistant	
RL/IL	IR 4218	120	4.0	High yield	
RL/IL	TOX 3440-16-1-2	125	5.0	High yield	
RL/IL	ITA 212	120	3.0	Salinity tolerant	
RL/IL	ITA 222	120	3.0	Salinity tolerant	
RL/IL	ITA 230 (FARO 50)	163	3.0	High yield	
IL	TOX 3109-73-4-4-4-2-5	140	4.0	High yield	
IL	IR 46	140	7.0	High yield	
RU	IM 16				Côte d'Ivoire
RU	Favori (IDSA 6)	110	3.0	Lodging and Blast resistant; Drought tolerant	
RU	Iguape Cateto	138	2.5	Acidity tolerant	
RU	IRAT 109	110	1.3	High yield	
RU	IRAT 136	120	3.0	Blast resistant	
RU	IRAT 170	108	3.0	High yield	
RU	Wabson (WAB 56-104)	105	4.0	Blast resistant	
RU	Toubako (WAB 56-125)	105	4.5	Blast resistant; Drought tolerant	
RU	Gblagnin (WAB 56-50)	108	4.0	Blast resistant; Drought and Acidity tolerant	
RU	Roso (WAB 96-1-1)	115	4.0	Low input; Weed competitive	
RU	Keah (WAB 450-11-1-P31-1-HB; NERICA 2)	95	4.5	Weed competitive; Early	
RU	Bonfani (WAB 450-I-B-P-38-HB; NERICA 1)	95	4.5	Weed competitive; Early	

Fertilizer = responsive to fertilizer application; Grain quality = good grain quality; High input = adapted to high level of inputs; High yield = high yield potential; Low input = yields well under low-input conditions; N responsive = responsive to nitrogen fertilizer application; Poor soil = does well in poor soils; RYMV = rice yellow mottle virus; Yield stability = broad adaptation with high yield.

Country	Ecology	Variety	DM	Yield	Traits
Côte d'Ivoire	RU	ITA 112	135	2.5	High yield
	RU	Moroberekan	135	4.0	High yield
	RU/RL	IRAT 13	130	4.0	High yield
	RU/RL	IRAT 144	150	2.0	High yield
	RL	Dourado Precose	120	3.0	High yield
	RL	Akadi (WAB 638-1)	135	6.0	Grain quality
	RL/IL	IR 5	120	6.0	Grain quality
	RL/IL	BG 90-2	120	8.5	Grain quality; Fertilizer
	RL/IL	DJ 8-341 (SANTO)	100	4.0	Grain quality
	RL/IL	Jaya	135	4.0	Grain quality
	RL/IL	Yabra (WITA 1)	130	9.0	Iron-toxicity tolerant; Blast resistant
	RL/IL	Gagnoa (WITA 7)	125	8.0	RYMV resistant; Blast tolerant
	RL/IL	Sanbela (WITA 8)	120	8.0	RYMV resistant
	RL/IL	Nimba (WITA 9)	120	7.1	RYMV resistant
	IL	IR 46	140	7.0	High yield
	IL	IR 1561-288-1-1	130	7.0	High yield
	IL	Kossou (WITA 3)	125	9.0	Iron-toxicity tolerant; Blast resistant
The Gambia	RU	WAB 56-50	108	4.0	Acidity tolerant; Blast resistant; Drought tolerant
	RL/IL	BG 90-2	150	1.8	Drought tolerant
	RL/IL	BR 4-34-13-5	120	6.0	High yield
	RL/IL	I Kong Pao	141	7.8	High yield
	RL/IL	IR 36			
	IL	IR 28	141	7.8	High yield
	IL	IR 64	120	3.5	Poor soil; Low input
	IL	IR 28128-45-3-3-2	120	3.0	Poor soil
	IL	ITA 212	120	3.0	Salinity tolerant
	IL	ITA 222	120	3.0	Salinity tolerant
	MS	ROHYB 4	130	2.5	High yield
	MS	WAR 1	135	4.0	Salinity and Acidity tolerant; High input
	MS	WAR 77-3-2-2	130	3.0	Salinity and Acidity tolerant; Lodging resistant; High input
	MS	WAR 115-108-1-8	130	3.0	High yield
	MS	ROHYB 6 (ROK 21)	168	3.1	High yield
	MS	ROK 5	140	3.6	High yield
Ghana	RU	ITA 302	120	3.0	Blast resistant
	RU/RL	IRAT 10	120	3.0	High yield
	RU/RL	IRAT 13	121	3.0	High yield
	RL	TOX 3108-56-4-2-2-2	120	6.0	Grain quality; Insect and Disease resistant
	RL	IR 1750-F5BN-5	134	5.0	High yield
	RL	IR 1820-210-2	130	4.0	High yield

DM = days to maturity (approximate average); Yield = average yield in t/ha; RU = Rainfed Uplands; RL = Rainfed Lowlands; IL = Irrigated Lowlands.

Ecology	Variety	DM	Yield	Traits	
RL	C168	135	3.0	High yield	
RL/IL	BG 90-2	130	3.0	High yield	
RL/IL	BR 4-34-13-5	120	6.0	High yield	
RL/IL	FARO 15 (GR 21)	167	4.0	High yield	
RL/IL	IR 5 (MATNA)	143	4.0	High yield	Ghana
RL/IL	IR 8	143	4.0	High yield	
RL/IL	IR 20	130	5.0	High yield	
RL/IL	IR 42	125	4.0	High yield	
RL/IL	IR 422	125	4.0	High yield	
RL/IL	ITA 306	130	5.0	High yield	
RL/IL	TOX 516-19-5LR	130	6.0	High yield; Blast resistant; Fertilizer	
IL	IET 2885	125	5.0	High yield	
IL	IR 3273-P339-2	130	6.0	High yield	
RU	CK 7	120	4.0	High yield; Blast resistant	
RU	IDSA 6	110	3.0	Blast resistant; High yield; Drought tolerant	
RU	IDSA 16 (IRAT 216)	110	1.6	High yield	
RU	IDSA 85	120	1.8	Grain quality	
RU	IRAT 112	110	2.5	Blast resistant	
RU	IRAT 114 (FARO 39)	105	3.0	Blast resistant; Drought tolerant	
RU	LAC 23	120	3.0	Drought tolerant	
RU	TOX 1011-4-A2	105	3.4	Blast resistant; Drought tolerant	
RU	WAB 450-I-B-P-28-HB (NERICA 3)	107	3.4	Weed competitive; Early	
RU	WAB 450-I-B-P-91-HB (NERICA 4)	105	2.9	Weed competitive; Early	
RU	WAB 450-11-1-1-P31-HB (NERICA 5)	116	3.0	Early; Drought tolerant; Grain quality; Blast resistant	Guinea
RU	WABIS 675	125	3.1	Weed competitive; High yield	
RL	BG 90-2	120	6.0	High yield	
RL	Bouaké 189	125	5.0	High yield	
RL	SUAKOKO 8 (ROK 24)	150	4.7	Iron-toxicity tolerant	
RL/IL	IR 5			High yield	
RL/IL	Taichung Sen 30	143	4.0	High yield	
IL	GAMBIACA	150	5.0	High yield	
MS	B38D2	130	2.0	Salinity tolerant	
MS	BW 295-5	136	3.8	High yield	
MS	ROHYB 6	140	3.6	High yield	
MS	ROK 5	130	3.0	Salinity tolerant	
MS	WAR 1	135	4.0	Salinity and Acidity tolerant; High input	
MS	WAR 73-1-M-1	130	3.0	Salinity tolerant	
MS	WAR 77-3-2-2	130	3.0	Salinity tolerant; Lodging resistant; High input	

Fertilizer = responsive to fertilizer application; Grain quality = good grain quality; High input = adapted to high level of inputs; High yield = high yield potential; Low input = yields well under low-input conditions; N responsive = responsive to nitrogen fertilizer application; Poor soil = does well in poor soils; RYMV = rice yellow mottle virus; Yield stability = broad adaptation with high yield.

Country	Ecology	Variety	DM	Yield	Traits
Guinea Bissau	RU	IDSA 16 (IRAT 216)	110	3.6	High yield
	RU	IRAT 109	110	3.3	High yield
	RU	IRAT 110	110	3.5	High yield
	RU	IRAT 112	110	2.5	Blast resistant
	RU	PEKIN	99	3.5	High yield
	RU	WAB 56-50	108	4.0	Acidity and Drought tolerant; Blast resistant
	RL	BG 90-2	120	6.0	High yield
	RL/IL	BG 400-1	138	4.5	High yield; Popular in northern dry zones
	RL/IL	IR 4 22	138	4.5	High yield
	RL/IL/MS	BG 380-2	131	7.8	High yield
	MS	RD 15	115	4.0	High yield
	MS	BG 367-4	135	4.0	High yield
	MS	CK 4	136	3.5	High yield
	MS	DJ 684-D	127	3.0	High yield
	MS	ROHYB 4	130	3.5	High yield
	MS	ROHYB 6	140	3.6	High yield
	MS	ROK 5	130	3.0	Salinity tolerant
	MS	WAR 1	135	4.0	Salinity and Acidity tolerant; High input
	MS	WAR 77-3-2-2	130	3.0	Salinity and Acidity tolerant; Lodging resistant; High input
	MS	WAR 102-1-3-1	130	4.5	High yield
	MS	WAR 115-111-2-3	130	3.0	High yield
	MS	WAR 81-2-1-2	125	4.0	High yield
Liberia	RU	WAB 56-50	108	4.0	Acidity and Drought tolerant; Blast resistant
	RU	WAB 56-104	105	4.0	Blast resistant
	RU	WAB 96-1-1	115	4.0	Low input; Weed competitive
	RL/IL	ANDY 11	140	1.9	High yield
	RL/IL	IR 5	143	4.0	High yield
	RL/IL	Suakoko 8 (ROK 24)	140	4.7	High yield
	RL/IL	Suakoko 12			
Mali	RL	Bouaké 189	125	5.0	High yield
	RL	KHAODAWK MALI 105	160	4.0	Grain quality
	RL/IL	BG 90-2	120	6.0	High yield
	RL/IL	IR 8			
	RL/IL	IR 50			
	RL/IL	IR 1529-680-3	131	5.8	
	RL/IL	IR 2070-414-3-9			
	RL/IL	Jaya	135	4.0	High yield

DM = days to maturity (approximate average); Yield = average yield in t/ha; RU = Rainfed Uplands; RL = Rainfed Lowlands; IL = Irrigated Lowlands.

Ecology	Variety	DM	Yield	Traits	
IL	IR 1561-288-1-1		6.0		Mali
IL	IR 1561-228-3-3	120	6.0	High yield	
IL	IR 32307-107-3-2-2	120	6.0	High yield; Grain quality	
IL	AD 9246	120	6.0	High yield	
IL	ECIA 36-2-2-1-4	140	6.0	High yield	
IL	LEIZHONG 152	135	6.0	High yield	
IL	RPK N2	105	5.0	High yield; Grain quality	
RL/IL	BG 90-2	120	6.0	High yield	Mauritania
RL/IL	China 988	120	5.0		
RL/IL	IR 422	125	5.0		
RL/IL	IR 1529-680-3	130	5.0		
RL/IL	Jaya	135	4.0	High yield	
IL	IR 1561-288-1-1				
IL	IET 1444	122	2.5	High yield	
IL	Sahel 108 (IR 13240-108-2-2-3)	110	6.0	High yield; Blast resistant; High input	
IL	Sahel 201 (BW 293-2)	125	9.0	High yield; Blast tolerant; High input	
IL	Sahel 202 (ITA 306) (FARO 37)	130	5.0	High yield; Blast tolerant; High input	
RL/IL	BG 90-2	120	6.0	High yield	Niger
RL/IL	BR 51-46-5	120	7.0	Grain quality; Lodging resistant; Fertilizer	
RL/IL	D52-37				
RL/IL	IR 1529-680-3	125	6.0	High yield	
RL/IL	IR 8	130	7.0	High yield	
RL/IL	IR 22	125	6.0	High yield	
IL	IR 54	135	5.8	High yield	
IL	WITA 8	120	8.5	RYMV resistant	
IL	WITA 9	120	7.1	RYMV resistant	
RU	FARO 3 (Agbede)	120	1.5	Early; Drought tolerant	Nigeria
RU	FARO 11 (OS 6)	120	2.0	Blast and RYMV resistant; Popular in southwest and southeast	
RU	FARO 25 (FAROX 56/30)	120	2.5	Blast and RYMV resistant; Drought tolerant; Popular in southwest and southeast	
RU	FARO 40 (FAROX 299)	120	2.5	Drought tolerant; Blast resistant	
RU	FARO 41 (IRAT 170)	120	2.5	Blast resistant; Drought tolerant	
RU	FARO 42 (ART 12)	120	2.5	Blast resistant; Drought tolerant	

Fertilizer = responsive to fertilizer application; Grain quality = good grain quality; High input = adapted to high level of inputs; High yield = high yield potential; Low input = yields well under low-input conditions; N responsive = responsive to nitrogen fertilizer application; Poor soil = does well in poor soils; RYMV = rice yellow mottle virus; Yield stability = broad adaptation with high yield.

Nigeria

Ecology	Variety	DM	Yield	Traits
RU	FARO 43 (ITA 128)	120	2.5	Blast tolerant; Popular across zones
RU	FARO 46 (ITA 150)	110	2.0	Good grain quality; Early; Blast tolerant
RU	FARO 47 (ITA 117)	120	2.5	Aluminum-toxicity tolerant
RU	FARO 48 (ITA 301)	125	2.5	Popular in high rainfall areas
RU	FARO 49 (ITA 315)	125	2.5	Popular in high rainfall areas
RU	WAB 36-2L-FX		4.0	High yield
RU	WAB 36-34-FX		4.0	High yield
RU	WAB 56-125	105	4.5	Blast resistant; Drought tolerant
RU/RL	FARO 38 (IRAT 133)	105	2.0	Early; Drought tolerant; Blast resistant
RU/RL	FARO 39 (IRAT 144)	105	2.0	Early; Drought tolerant; Blast resistant
RU/RL	FARO 45 (ITA 257)	105	2.0	Drought tolerant; Popular in dry zones
RL	Progeny of BP 1-76			
RL	FRRS 162B-11-1			
RL	FARO 18 (Tjina)	140	3.5	Blast resistant
RL	Progeny of TN 1			
RL/IL	FARO 1 (BG 79)	174	3.0	Early
RL/IL	FARO 2 (D114)	175	3.0	Iron-toxicity tolerant
RL/IL	FARO 8 (MAS 2401)	160	3.0	Iron-toxicity tolerant
RL/IL	FARO 9 (SIAM 29)	220	3.0	Long grain
RL/IL	FARO 12 (SML 140/10)	160	3.0	Long grain; Blast tolerant
RL/IL	FARO 15 (FRRS 62)	160	3.5	Iron-toxicity tolerant
RL/IL	FARO 23 (IR 5)	150	3.5	Iron-toxicity tolerant
RL/IL	FARO 24 (De Gaulle)	120	4.0	
RL/IL	FARO 27 (TOX 103=IR 790-35-5)	115	3.5	N responsive; Blast resistant
RL/IL	FARO 29 (BG 90-2)	140	4.0	High yield; Popular in all zones
RL/IL	FARO 35 (ITA 212)	135	4.0	High yield; Popular in all zones
RL/IL	FARO 36 (ITA 222)	135	4.0	High yield; Popular in all zones
RL/IL	FARO 37 (ITA 306)	140	4.0	High yield; Popular in all zones
RL/IL	FARO 44 (SIPI 692033)	120	4.0	Early-to-medium; Blast resistant
RL/IL	FARO 50 (ITA 230)	135	4.0	High yield
RL/IL	FARO 51 (Cisadane)	135	4.0	AfRGM tolerant
RL/IL	FAROX 188A			
RL/IL	FAROX 228-2-1			
RL/IL	FAROX 228-3-1-1	110	3.0	High yield
RL/IL	FAROX 228-4-1-1	115	4.0	High yield
RL/IL	FAROX 2331-1-1-1	110	3.5	High yield
RL/IL	FAROX 239-2-1	110	4.5	High yield
RL/IL	IR 8	120	5.0	High yield
RL/IL	IR 20	120	5.0	High yield
RL/IL	IR 269-26-3 (TOs78)	120	5.5	High yield
RL/IL	IR 627-1-31	115	4.5	High yield

DM = days to maturity (approximate average); Yield = average yield in t/ha; RU = Rainfed Uplands; RL = Rainfed Lowlands; IL = Irrigated Lowlands.

Ecology	Variety	DM	Yield	Traits	
IL	FARO 21 (TN 1)	110	3.5	Stiff straw; Lodging resistant	Nigeria
IL	FARO 30	115	4.0	High yield; N responsive	
IL	FARO 31	115	4.0	High yield; N responsive	
IL	FARO 32	115	4.0	High yield; N responsive	
IL	FARO 33	115	4.0	Long grain; Early; Blast and RYMV resistant; Popular in dry zones	
IL	FARO 34	115	4.0	Long grain; Early; Blast and RYMV resistant; Popular in dry zones	
MS	BG 380-2	138	4.5	High yield	
MS	ROHYB 4	130	2.5	High yield	
MS	ROHYB 6	140	3.6	High yield	
MS	WAR 77-3-2-2	130	3.0	Salinity and Acidity tolerant; Lodging resistant; High input	
MS	WAR 81-2-3-3-3-1	140	4.0	High yield	
RU/RL	IRAT 10				Senegal
RU/RL	IRAT 133	105	2.0	High yield	
RL	BW 248-1	128	5.0	Blast resistant	
RL	TOX 728-1	120	6.0	Yield stability; Blast and Lodging resistant	
RL/IL	D52-37				
RL/IL	I Kong Pao	141	7.8	High yield	
RL/IL	IR 8				
RL/IL	IR 13240-108-2-2-3	110	6.0	High yield; Blast resistant; Fertilizer	
RL/IL	IR 1529-680-3				
RL/IL	ITA 306	130	6.0	High yield	
RL/IL	Jaya	135	4.0	High yield	
RL/IL	TOX 103 (IR 790-35-5)	115	3.5	High yield	
IL	IET 1444	122	2.5	High yield	
IL	BG 90-2	120	8.5	Grain quality; High input; Lodging resistant	
IL	BR 51-46-5	120	7.0	Grain quality; High input; Lodging resistant	
IL	BW 248-1	128	5.0	High yield; Blast resistant	
IL	Sahel 201 (BW 293-2)			High yield; Blast resistant; High input	
IL	ITA 123 (FKR 28)	120	7.0	Grain quality	
IL	IR 11561-288-1-1				
IL	Sahal 108	110	6.0	High yield; Blast resistant; High input	
IL	Sahal 202 (ITA 306)	130	5.0	High yield; Blast resistant; High input	
MS	ROK 5	130	3.0	Salinity tolerant	
MS	WAR 1	135	4.0	Salinity and Acidity tolerant; High input	
MS	WAR 77-3-2-2	130	3.0	Salinity and Acidity tolerant; Lodging resistant; High input	
MS	WAR 81-2-1-3-1	125	4.0	Grain quality; Salinity tolerant	

Fertilizer = responsive to fertilizer application; Grain quality = good grain quality; High input = adapted to high level of inputs; High yield = high yield potential; Low input = yields well under low-input conditions; N responsive = responsive to nitrogen fertilizer application; Poor soil = does well in poor soils; RYMV = rice yellow mottle virus; Yield stability = broad adaptation with high yield.

Country	Ecology	Variety	DM	Yield	Traits
Sierra Leone	RU	WAB 96-1-1	115	4.0	Low input; Weed competitive
	RU	FAROX 299	110	2.5	High yield
	RU	IDSA 6	110	3.0	High yield
	RU	IRAT 235			
	RU	ITA 235	114	2.7	High yield
	RU	LAC 23 white	135	1.3	High yield
	RU	Suakoko 8	140	1.9	High yield
	RL/IL	ANDY 11	140	1.9	High yield
	RL/IL	ANDY 301			
	RL/IL	Anethoda/BG 79			
	RL/IL	BG 90-2	120	6.0	High yield
	RL/IL	BG 400-1	147	5.6	High yield
	RL/IL	BR 4-34-13-5			
	RL/IL	IR 58	109	5.6	High yield
	RL/IL	IR 442-2-58			
	IL	Azucena/Faya	136		
	IL	MASHURI (ROK 25)	150		High yield
	MS	CP 4-CI			
	MS	ROHYB 4	150	2.5	High yield
	MS	WAR 1	135	4.0	Salinity and Acidity tolerant
	MS	WAR 81-2-1-2	125	4.0	High yield
Togo	RU	IDSA 6	110	3.0	Blast resistant; Drought tolerant; High yield
	RU	IRAT 112	110	2.5	Blast resistant
	RU	IRAT 113	120	3	Blast resistant
	RL	WITA 4	125	7	Drought and Iron-toxicity tolerant
	RL/IL	ANDY 11	140	1.9	High yield
	IL	IET 1444	122	2.5	High yield
	IL	IR 28			High yield
	IL	IR 46	140	7	High yield
	IL	IR 841	120	6	High yield

DM = days to maturity (approximate average); Yield = average yield in t/ha; RU = Rainfed Uplands; RL = Rainfed Lowlands; IL = Irrigated Lowlands.