OVERVIEW: RICE IN AFRICA

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Unit 1 – The importance of rice in Africa

Africa has become a big player in international rice markets, accounting for 32% of global imports in 2006, at a record level of 9 million tonnes that year. Africa's emergence as a big rice importer is explained by the fact that during the last decade rice has become the most rapidly growing food source in sub-Saharan Africa (Sohl, 2005). Indeed, due to population growth (4% per annum), rising incomes and a shift in consumer preferences in favor of rice, especially in urban areas (Balasubramanian *et al.*, 2007), the relative growth in demand for rice is faster in this region than anywhere in the world (WARDA, 2005). This is occurring throughout the sub-regions of sub-Saharan Africa (SSA).

In recent years (2001–2005), rice production has been expanding at the rate of 6% per annum, with 70% of the production increase due mainly to land expansion and only 30% being attributed to an increase in productivity (Fagade, 2000; Falusi, 1997; Africa Rice Center, 2007). Much of the expansion has been in the rainfed systems, particularly the two major ecosystems that make up 78% of rice land in West and Central Africa (WCA): the upland and rainfed lowland systems (Dingkuhn *et al.*, 1997). Nonetheless, demand for rice in WCA has far outstripped the local production (Africa Rice Center, 2007).

According to OSIRIZ ([1]CIRAD's Observatory of International Rice Statistics), Africa cultivated about 9 million hectares of rice in 2006 and production, which surpassed 20 million tonnes for the first time, is expected to increase by 7% per year in future. In West Africa, where the rice sector is by far the most important in SSA, the situation is particularly critical. Despite the upward trends in international and

[1]CIRAD: Centre de coopération Internationale en Recherche Agronomique pour le Developpement (FRANCE)

domestic rice prices, domestic rice consumption is increasing at a rate of 8% per annum, surpassing domestic rice production growth rates of 6% per annum. The production-consumption gap in this region is being filled by imports, valued at over US$ 1.4 billion per year. The share of imports in consumption rose from an average of 43% from 1991 to 2000, to an average 57% by 2002–2004 (WARDA, Rice Trends in Sub-Saharan Africa, Third Edition, Cotonou, 2005, p. 31 and FAOStat; IRRI, Rice Almanac, 3rd Edition, Los Banos, 2002, p. 79).

The Food and Agriculture Organization of the United Nations (FAO) estimated in 2006 that current rice imports into the West and Central Africa sub-regions had grown to more than 6 million tonnes costing over $1 billion in scarce foreign exchange each year. The cost of importing rice therefore remains a heavy burden on trade balances in the region.

Rice production and productivity, quality and local institutions

While rice is very much a cash crop for small-to medium-scale farmers in the East and Southern Africa (ESA) region, it is more of a subsistence crop in West Africa where most of the continent's rice is produced. In West Africa, 75% of the total production of rice in 1999/2003 is from upland, hydromorphic and lowland ecosystems, with about 25% from irrigated fields (Table 1). Rice is also produced in mangrove production systems and in flooded environments. Research on the mangrove ecology is coordinated by the Rokupr rice research station in Sierra Leone.

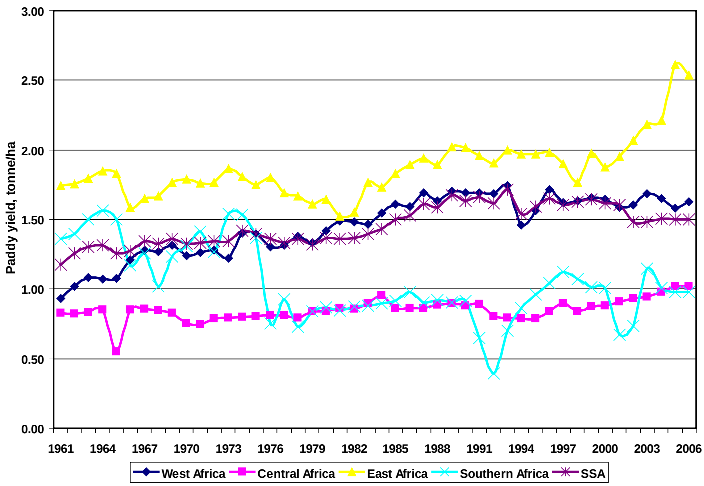
Low yield constitutes one of the main challenges of rice production in SSA. In recent years (2001–2005) average rice yields in SSA exhibited a highly variable trend, positive or negative across sub-regions and countries (Africa Rice Trends, WARDA, 2007). The overall rice production increase during the same period was mainly due to the expansion of rice production into marginal areas in West Africa where most production occurs (Table 1).

Table 1. Estimation of rice production trend by each rice production ecology in West Africa during 1984 and 1999/2003

	Area (million ha)		Production (million tonnes/year)		Yield (t/ha)	
	1984	1999/2003	1984	1999/2003	1984	1999/2003
Upland	1.5	1.8	1.5	1.8	1	1
Rainfed lowland	1.5	1.8	0.75	3.4	1.4	2.0
Irrigated lowland	0.23	0.56	0.64	1.9	2.8	3.4
Total	**2.6**	**4.7**	**3.4**	**7.7**	**1.3**	**1.6**

Source: CCER on Integrated Genetic and Natural Resources Management, Gurdev Kush, Toshiyuki Wakatsuki and Glitho Isabelle Adole, 22 January – 10 February 2006. Cotonou, Benin: WARDA.

Another challenge is the inferior quality of domestic rice *vis à vis* imported rice. Domestic rice is of uneven quality, has impurities, and is usually sold in bulk in unbranded 5kg bags at a discount of 30% to 50% compared to imported rice. There are exceptions to this, as in Guinea (Conakry) and in Mali, where local rice (for certain varieties) receives a price premium. In order to improve quality of local rice, institutional innovations are needed that make producers more responsive to end-user requirements and attach much more importance to milling and cleaning, and to identity preservation (no mixing of different rice varieties).



Source: WARDA (2007) Africa Rice Trends.

Figure 1. Evolution of paddy rice yields in sub-Saharan Africa (1961–2006)

The institutional environment for the development of rice production in SSA represents a third challenge. It is gradually improving as a result of NEPAD's (New Partnership for Africa Development) focus on agriculture with the CAADP (Comprehensive Africa Agricultural Development Programme), the African Rice Initiative (ARI), and efforts by WARDA and its many partners, particularly its Council of Ministers (COM). How to create and support effective institutions is a major challenge.

The truth of the matter is that in SSA growth in rice demand as a preferred staple is so strong that production intensification and higher yields per hectare will not be sufficient to fill the gap and meet rice demand. Unlike in Asia during the green revolution, productivity gains are likely to come in small increments due to the diverse nature of Africa's cropping systems (Balasubramanian *et al.*, 2007). Yet the potential for growth in the African rice sector is enormous. A rapid increase in the area under rice, irrigated as well as rainfed, is necessary. In particular, the development of new irrigated rice schemes is vital. Only about 17% of the rice area in Africa is irrigated. Asia, in contrast, has about 57% of the rice area under irrigation, but has little or no room for further expansion. Indeed, Ram C. Chaudhary and Dat Van Tran (1999) seriously consider whether Africa can be the future rice bowl for Asia. By 2010, Asia may no longer have net rice exports because of increasing population and consumption, and decreasing land, labor, water and other resources. Instead, by 2020, it is expected that Asia may become a rice-importing continent. Chandhary and Dat Van Tran highlight that millions of hectares of land appropriate for rice growing lie idle in Africa. Water and other resources are available and plentiful. They add that there are other comparative advantages of Africa, which can complement Asian strengths. In addition, they argue that Asia-Africa cooperation in rice production can convert many African countries from net rice importers to net rice exporters, as well as provide hope for Asian countries to continue filling their rice bowls.

Unit 2 – Major rice production systems in sub-Saharan Africa (SSA) and their environments

West African rice ecosystems are conventionally classified as irrigated, rainfed-lowland, rainfed-upland, mangrove swamp and deep-water systems. The total area under rice cultivation is currently about 4.4 million hectares (ha), with the rainfed upland and rainfed lowland ecosystems each accounting for about 1.7m ha and irrigated rice for another 0.5m ha, making these the high-impact ecologies (see Table 2).

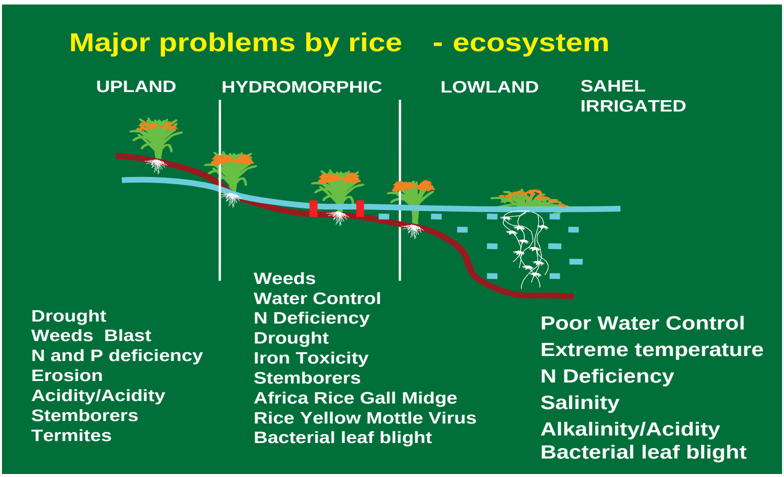
Table 2. Total area (hectares) under rice cultivation in various ecologies across countries in West Africa

Country	Total area (ha)	Mangrove swamp	Deep water	Irrigated lowland	Rainfed lowland	Rainfed upland
Mauritania	23,000	0	0	23,000	0	0
Senegal	75,000	6,000	0	33,750	35,250	0
Mali	252,000	0	161,280	52,920	30,240	7,560
Burkina Faso	25,000	0	0	6,750	16,250	2,000
Niger	28,000	0	14,000	14,000	0	0
Chad	31,000	0	28,520	620	1,860	0
Cameroon	15,000	0	0	14,700	300	0
Gambia	19,000	2,660	0	1,330	12,160	3,040
Guinea-Bissau	65,000	31,850	0	0	14,300	18,850
Guinea	650,000	84,500	65,000	32,500	162,500	305,500
Sierra Leone	356,000	10,680	0	0	103,240	245,640
Liberia	135,000	0	0	0	8,100	126,900
Côte d'Ivoire	575,000	0	17,250	34,500	69,000	454,250
Ghana	81,000	0	0	12,150	12,150	56,700
Togo	30,000	0	0	600	5,400	24,000
Benin	9,000	0	0	360	360	8,190
Nigeria	1,642,000	16,420	82,100	262,720	788,160	492,600
Total West Africa	**4,011,000**	**160,440**	**360,990**	**481,320**	**1,243,410**	**1,764,840**

Source: Lançon F. and O. Erenstein (2002)

Rainfed upland

Rice yields in upland systems average about 1 t ha^{-1}. Weed competition is the most important yield-reducing factor (Johnson *et al*., 1997) followed by drought, blast, soil acidity and general soil infertility. Farmers traditionally manage these stresses through long periods of bush fallow. More recently, population growth has led to a dramatic reduction in fallow periods and to extended periods of cropping in many areas, with resulting increases in weed pressure and in soil infertility. Additional weed competition further reduces labor productivity in upland rice-based production systems, which are already generally limited by labor availability during the main cropping season. Farmers also face increased risks of crop failure and generally lower productivity levels. Very early maturing varieties with tolerance to drought and blast are required in the dry zones where the growing season is short, while medium to late maturing and acid-tolerant varieties are needed for higher rainfall areas. Desirable agronomic traits include good vigor at seedling and vegetative stages for weed suppression, intermediate to tall stature, lodging resistance and moderate tillering ability. Of great importance is tolerance to soil acidity and P deficiency. Modest inputs of organic or inorganic fertilizer or soil amendments, such as rock phosphate, or the use of fallow legumes may counter soil fertility decline in the upland environments and improve yields. Fallow legumes may also reduce weed infestation levels in the following rice crop.



Source: Africa Rice Center (WARDA)

Figure 2. Rice production constraints across ecosystems in West Africa

Rainfed lowland

Rice yields in rainfed lowlands (flood plains and valley bottoms) depend on the degree of water control and vary from 1 to 3 t ha^{-1}. These systems have a high potential for intensification, which is pushed by local land pressures and pulled by urban market demand. With improved water control, use of external inputs may become attractive and rice yields may be increased rapidly in these systems that are inherently much more stable than the upland areas. Biophysical factors affecting rice yield in rainfed lowland systems include weeds, drought, flooding, soil nutrient supply, iron toxicity, blast, rice yellow mottle virus (RYMV) and African rice gall midge (AfRGM). High yield potential is the priority objective in breeding for rainfed lowlands, combined with weed competitiveness, short duration, resistances to blast, RYMV and AfRGM, and tolerance to iron toxicity. The major socio-economic constraints include resource availability, production risk, knowledge on best-bet crop management practices, and human health problems.

Irrigated rice

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 rainforest 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 Africa is irrigated. This includes substantial areas in 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 ha (7% of total area) is irrigated. Yield potential (10 t/ha) is higher in these drier zones than in others, because of high solar radiation and low disease stress.

Unit 3 – Addressing the challenge of low productivity in African rice ecologies: NERICA® varieties

Nearly half of sub-Saharan Africa's 700 million people live below the poverty line (World Development Indicators, 2004). With population growth rate exceeding the growth rate in regional food production, and with only limited foreign resources to sustain increased levels of imports, the future for Africa's poor appears grim.

WARDA's breakthrough in producing the 'New Rice for Africa' (NERICA), based on crossings between African rice (*Oryza glaberrima* Steud.) and Asian rice (*O. sativa* L.), offers welcome relief to Africa's rice farmers. It is a new and unique opportunity for sustainable agricultural development in the rainfed environments where most of Africa's rice farmers earn a living.

NERICA varieties have high yield potential and short growth cycle. Several of them possess early vigor during the vegetative growth phase and this is a potentially useful trait for weed competitiveness. Likewise, a number of them are resistant to African pests and diseases, such as the devastating blast, to rice stemborers and termites. They also have higher protein content and amino acid balance than most of the imported rice varieties. Participatory varietal selection (PVS) trials in rainfed environments across WCA have met with an enthusiastic response from farmers.