National Rice Development Strategy (NRDS)
Angola

2018 - 2022

Republic of Angola
Ministry of Agriculture and Forestry

July 2018




Executive summary

The Republic of Angola has good soil and water conditions for the development of rice cultivation. Rice cultivation in Angola dates back to the colonial period and continued during a long period (1975-2002). However, having the war as a fundamental cause, a drastic reduction in its production area and in the indices of productivity of the culture has occurred.

The producing regions are located in the provinces of Bié, Moxico, Lunda-Sul, Lunda-Norte, Malanje, Uíge and Cuando Cubango, but there is also potential in Huambo, Cuanza-Sul, Cunene and Luanda.

The consumption of rice is high and is estimated as 450,000 tons/year being the most consumed cereal after maize. But about 90% of its supply in the national market is from import.

In the PND (2018-2022) - National Development Plan, PDMPSA (2018-2022) - Medium Term Development Program of Agricultural Sector and PRODESI (2018) - Program to Support National Production, Diversification and Import Substitution, rice is considered by the Government as a strategy for strengthening food and nutritional security and import substitution.

The re-launch of rice production will require the Government to invest mainly in infrastructure, distribution / marketing, and processing. The Government will play a key role in boosting this sector and should, above all, create a favorable business environment and, whenever possible, operate public-private partnerships and participatory management with beneficiaries.

Although the goals proposed for 2022 in the PND and PDMPSA (2018-2022) are modest and are based on current capabilities (50,000 t/year), if the country's potential allows the implementation of NRDS with adequate technological support and with the recovery of irrigation systems, it is possible in the short term to increase the amount of harvests per year of this crop in a very substantive way, and to increase the total production.

The ARDP (2013-2019) – Angola Rice Development Project with the support of JICA (Japan International Cooperation Agency), helped to select suitable varieties, trained the technicians and farmers, and developed technology packages. This knowledge will be basic to implementation of the NRDS, to expand the culture and to eventually increase farmers' income.

Currently family farming is dominant, with 99.8% of the farms, and responsible for more than 80% of the national agricultural production. It exploits about 97% of the total cultivated area. Hence, this National Rice Development Strategy in Angola is primarily focused on small-scale farmers, assuming, however, it is crucial that medium/large-scale production is supported and encouraged by the Government and partnership with the private sector especially in the processing and commercialization.

The subsectors of seeds, fertilizers, irrigation, pests and disease control, expansion of cultivated area, value chain development and strengthening of the capacity of the research and extension services are diagnosed as the keys for NRDS's, and therefore deserved more specific strategic designs.

In these strategies we intend to use adapted varieties of high yield recommended by the research, and spread preferentially by extension services. For the cultivation system, the technological package developed by the ARDP will be adopted, and for the post-harvest period, it will be proposed to increase and diversify the processing centers and the marketing systems according to the type of producers and the requirements of the market.

With the implementation of NRDS, it is intend to:

- In the short term, adequate varieties determined by the ARDP as well as the respective technological package will be disseminated to the provinces of the Central and Eastern parts of the country considered as potentially more attractive for this crop and, as far as possible, research activities in other areas of the country.

- In the medium term, expanding the cultivated area through irrigation, making a multiplication/production and seed distribution system effective, and through increasing the industrial processing capacity of this cereal.

- By 2022, the goal will be to reduce rice import requirements by increasing domestic production.

The recommended monitoring and evaluation tools will make it possible to regularly assess the efficiency and effectiveness of the strategies for these subsectors, and to indicate timely corrections.

Contents

Abbreviations and acronyms

	Portuguese	English
CRF	Comité de Recursos Fitogenéticos	Committee of Plant Genetic Resources
DNA	Direção Nacional da Agricultura	National Directorate of Agriculture
EA	Empresa Agrícola (empresarial)	Agricultural Company
EAF	Empresa Agrícola Familiar	Family Agriculture
FFS	Escola de Campo do Agricultor (ECA)	Farmers Field School
EDA	Estação de Desenvolvimento Agrário	Agrarian Development Station
EEA	Estação Experimental Agrícola	Agricultural Experimental Station
NRDS	Estratégia Nacional de Desenvolvimento da Cultura do Arroz (ENDA)	National Rice Development Strategy
FAO	Organização das Nações Unidas para a Alimentação e Agricultura	Food and Agriculture Organization
GEPE	Gabinete de Estudos Paneamento e Estatística	Office of Studies, Planning and Statistics
GSA	Gabinete de Segurança Alimentar	Office of Food Security
IDA	Instituto de Desenvolvimento Agrário	Institute for Agrarian Development
IDF	Instituto de desenvolvimento Florestal	Institute for Forest Development
IIA	Instituto de Investigação Agronómica	Agricultural Research Institute
INCA	Instituto Nacional de Café de Angola	National Institute of coffee of Angola
INCER	Instituto Nacional de Cereais	National Institute of Cereals
IRRI	Instituto Internacional de Pesquisa de Arroz	International Rice Research Institute
ISV	Instituto de Serviços de Veterinária	Institute of Veterinary Services
JICA	Agência Japonesa de Cooperação Internacional	Japan International Cooperation Agency
MINAGRIF	Ministério da Agricultura e Florestas	Ministry of Agriculture and Forestry
NGO	Organiação Não Governamental (ONG)	Non Governmental Organization
ARDP	Projecto de Desenvolvimento da Cultura de Arroz em Angola (PDCAA)	Angola Rice Development Project
PDMPSA	Programa de Desenvolvimento de Médio Prazo para o Sector Agrário	Medium-Term Development Programme for the Agricultural Sector
PEDR	Programa de Extensão e Desenvolvimento Rural	Program of Extension and Rural Development
PLANIRRIGA	Plano Nacional de Irrigação	National Program of Irrigation
PND –	Plano Nacional de Desenvolvimento	National Development Plan
PPP-	Parceria Público Privada	Public Private Partnership
PRODESI-	Programa de Apoio à Produção Nacional, Diversificação e Substituição de Importações	Program to Support National Production, Diversification and Import Substitution
SENSE-	Serviço Nacional de Sementes	National Seed Service
SOPIR-	Sociedade de Desenvolvimento dos Perímetros Irrigados	The Society for Development of Irrigated Perimeters
UNACA-	União Nacional das Associações de Camponeses (UNACA-Confederação)	National Union of Farmers Associations

1. Introduction

1.1 General information of Angola

The Republic of Angola is one of the largest countries in Africa, located in south-central Africa, between latitudes 4º 22' S S and 18º 2' S and longitudes 12º E and 24º E. The South is bordered by the Republic of Namibia, the Democratic Republic of the Congo and the Republic of Congo, the Republic of Zambia and the Atlantic Ocean, with a coastline of 1650 km. The South is bordered by Namibia, the North by the Democratic Republic of the Congo and the Republic of Congo, the East by the Republic of Zambia, and the West by the Atlantic Ocean with a coastline of 1650 Km.

The relief is characterized by topographical variations with a narrow plain along the coast which rises abruptly to vast interior plateau. The highest point of the country is the Moco Hill (Huambo), with an elevation of 2,620 m. The climate is tropical and subtropical, characterised by hot and rainy season that usually occurs between August 15 to May 15, and another dry and relatively cooler season. The climatic conditions are strongly influenced by altitude, latitude, and ocean impact (Benguela current).

The country has a total area of 1,246,700 km^2 and a population of 25,789,024 inhabitants (INE, Census 2014). The arable area is estimated as 35 million hectares, but only 16% of the area is cultivated for agricultural activities.

The rural population is roughly 1/3 of the total populátion, (9.6 million inhabitants, 37.1% men and 37.6% women), of which 75% is members of farming households.

Family farming is the basis of the Angolan agriculture with 99.8% of farming households (EAFs), responsible for over 80% of national agricultural production, and operates about 97% of the total area of cultivated lands. This agriculture is mainly of the peasant type directed to the self consumption, and its production and productivity are extremely dependent on the natural conditions of soil and climate.

Angola has favorable conditions for the rice cultivation, with the evidence that the agricultural area devoted to this culture had a great expansion in the last decades durng Portuguese colonization.

Rice production was restarted after the peace agreements in 2002 having grown substantially.

1.2. Purposes to formulate the National Strategy for Rice Development (NRDS)

Rice is one of the most consumed cereals in Angola after maize. It is closely associated with food security and political stability in the country, as in most developing countries.

Most of the rice consumed is imported although the country has a potential for its production. Increasing domestic rice production will contribute to increase food security, substantially reduce the use of foreign currency on import, and will be a source of employment and income. Hence, this crop is included in the Government's strategic priorities for agriculture.

The formulation of the NRDS will make it possible to align all the components of the value chain of this crop and to define the hierarchy of actions to undertake with a purpose of self-sufficiency in this cereal, and identifying and empowering the institutions participating in its value chain.

The main reasons for the formulation of NRDS include:

(1) Identify the challenges of the rice sector

(2) Define the vision

(3) Discuss strategies to overcome challenges

(4) Share the strategy among institutions.

2. Overview of the rice sector in the world

The rice was grown, harvested and consumed for over 10,000 years, which is the longest history among all crops, and is now the stable food for about half the people on Earth. Over 3.5 billion people consume rice that provides them with more than 20% of their daily calories.

2.1 Production

Production of rice in the world is steadly increasing, and currently around 740 million tons (paddy equivalent) are produced annually in the world (Fig. 1). The production increase was achieved both by elevation of cultivated area and yield, although the yield mainly contributed to the production increase by using improved technology of the cultivation. The average yield is now about 4.6 t (FAOSTAT) in the world (FAOSTAT).

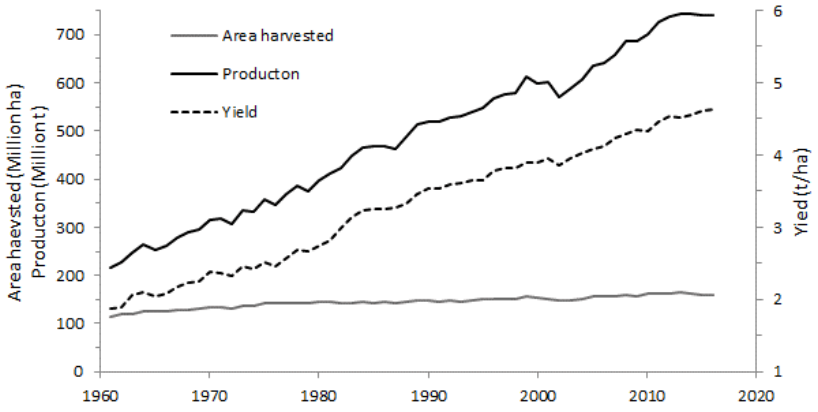


Fig. 1 Rice production in the world
Source: FAOSTAT, 2017. Figure created by NRDS members.

Asian countries produce about 90% of the world's total production. While, Africa, America, Europe and Oceanian countries produce, 4.4, 4.9, 0.6 and 0.04%, respectively, in 2016 (Fig. 2). The main producing countries are China, India, Indonesia, Bangladesh, Viet Nam, Thailand, Myanmar and Philippines (Table I).

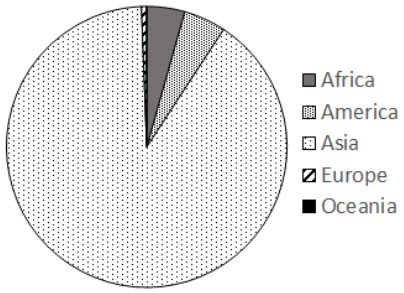


Fig. 2 Rice production in each region.
Data source: FAOSTAT, Figure created by NRDS members

Table I. Rice production of the leading countries (million tons, milled equivalent)

	2015	2016 (estimated)	2017 (forecast)
China (Mainland)	142.6	141.7	141.8
India	104.4	110.2	109.5
Indonesia	45.8	45.6	46.6
Bangladesh	35.0	34.7	34.1
Viet Nam	29.3	28.3	28.2
Thailand	18.2	21.6	22.3
Myanmar	16.5	17.1	17.3
Philippines	11.4	12.1	12.6
Brazil	8.5	7.2	8.4
Japan	7.6	7.7	7.6
Pakistan	6.8	6.8	7.2
United States	6.1	7.1	5.7
Cambodia	5.6	6.0	6.1
Egypt	4.1	4.3	4.4
Korea Rep. of	4.3	4.2	4.0

Source: FAO, 2017

2.2 Consumption

Consumption worldwide has been steadily increasing, reaching 377.3 million tons in 2013 (Fig. 3). This is mainly due to the population increase. Rice consumption per capita in some countries has increased, and decreased in other countries, which means that average per capita consumption has remained unchanged in recent years.

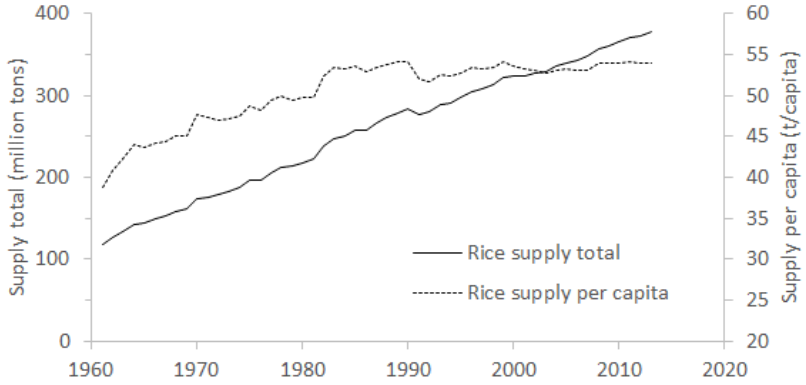


Fig. 3 Change in rice supply in the world (milled rice equivalent)
Data source: FAOSTAT, 2018. Figure created by NRDS members

2.3 Production systems

Rice can grow in different types of environments, unlike other crops. The environments and systems of cultivation for the rice can be divided in three types which are irrigated field, raifed upland and rainfed lowland. Worldwide, some 93 million hectares of irrigated fields provide 75% of the world's rice production (Rice Almanac, FAO, 2017). About 52 million hectares of rainfed lowlands provide about 19% of world production, and while 15 million hectares of rainfed uplands contribute about 4% of the production. Rainfed rice often faces drought problems. The average yield of irrigated rice typically in Asia varies from 3 to 9 t / ha. Meanwhile, the average yield of rice is about 2.3 t / ha in the rainfed lowlands and 1.0 t / ha in the raifed uplands.

2.4. Price

Table II shows the rice export price of selected categories. Overall, the price has declined in recent years with more insidence in 2012. Scented rice is usually traded at a high price, and basmati rice recorded $ 1372 / t in 2013, however, has declined in the last 3 years.

Table II- International rice prices (USD / t)

	Thai 100% B [1]	Thai Broken [2]	US Long grain [3]	Pakistan Basmati
2010	518	386	510	881
2011	565	464	577	1060
2012	588	540	567	1137
2013	534	483	628	1372
2014	435	322	571	1324
2015	395	327	490	849
2016	407	348	438	795

[1] White Rice, 100% second grade, [2] A1 super, [3]US No. 2
Source: Food Outlook, FAO, 2017

3. Overview of the rice sector in Africa

In most African countries, rice used to be traditionally consumed on special occasions, but now it

is eaten daily. Rice is the fastest growing staple food, especially in cities. This increase is associated with the high rate of population growth, increase of women with paid work and the change in consumer preferences. Although rice cultivation is expanding, there are several challenges to meet demand, especially in sub-Saharan countries.

3.1 Demand and production

Rice demand has increased almost 8-fold over the past 50 years (Fig. 4), and now more than 42,000 t are consumed annually in African countries. Rice production in Africa also increased notably and multiplied by six times between 1961 and 2012 (Fig. 4). However, the production is still not able to meet the rapid increase in consumption. The gap between demand and supply is high in sub-Saharan Africa. The importing amount in total reached 10 million tons of milled rice in 2008, costing the region around 3.6 billion USD.

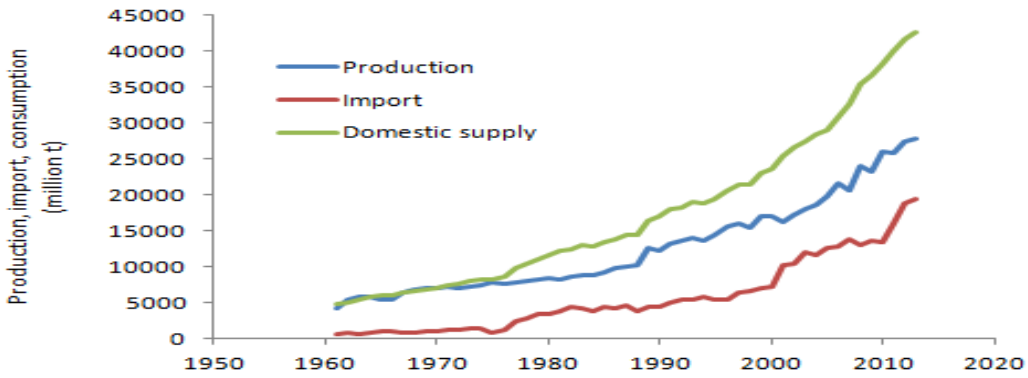


Fig. 4 Rice production, imports, consumption in Africa
Source FAOSTAT, 2018

The issues that limit the increase in production are several, such as the lack of production technology, financial problems (to buy the cultivation materials and machinery), lack of quality seeds and adequate varieties, insufficient irrigation infrastructures, post-harvesting facilities, institutional capacity, and lack of policies to improve rice development.

Figure 5 shows the total area of cultivation and the average yield in the African countries. Unlike the trend in rice production in the world, the increase in production is mainly achieved by the expansion of cultivated area. Although the average yield has increased from 1.7 to 2.6 t / ha in the last 50 years, it is still lower than the average yield in the world (4.6 t / ha).

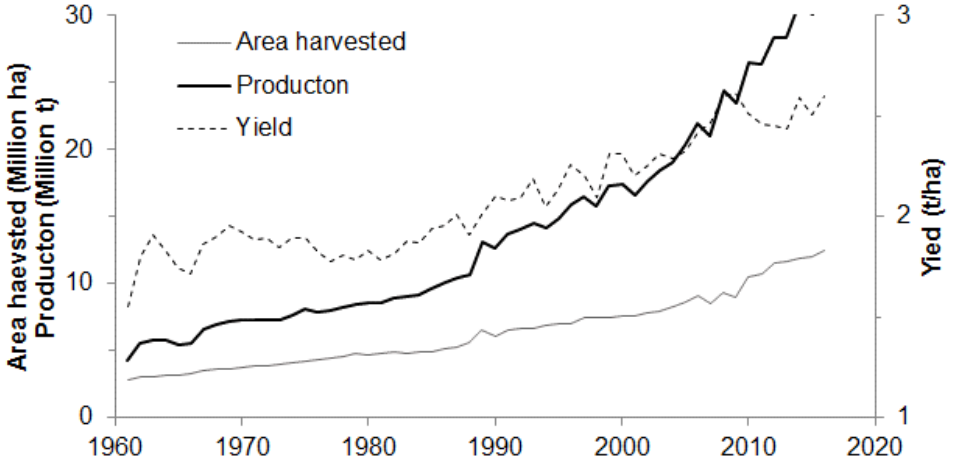


Fig. 5 Factors contributing to rice production increase in Africa
Source: FAOSTAT, 2018

3.2. Production system

More than two-thirds of the African Continent are covered by arid or semi-arid regions, where the rice cultivation without irrigation system is difficult. The central part of the continent, where it is relatively suitable for cultivation, is often reserved for wildlife. However, irrigation facilities for production are under development. Table III shows rice production systems in Africa and Asia. Only 12% of Africa's rice acreage is irrigated, while in Asia it is 54%.

Table III - Area ratio (%) of cultivation system of rice in Africa and Asia

	Africa	Asia
Irrigated	12	54
Rainfed lowlands	38	25
Rainfed uplands	40	13
Flood plain	11	9

Source: FAOSTAT, 2017

3.3. Price

Table IV shows the price of rice in the countries of Southern Africa. The price is highest in Luanda, Angola, among the region's capitals, and was 3.90 USD per kg in 2017. Meanwhile, it was the lowest in Maputo, Mozambique at 0.82 USD.

Table IV. Retail price of rice in Southern Africa

	In 2017 (USD/kg)	Comparisons to earlier price (%)*	
		1 year earlier	2 years earlier
Angola (Luanda)	3.90	37	95
Malawi (Lilongwe)	1.16	13	n.a.
Mozambique (Maputo)	0.82	67	133
Namibia (Windhoek)	1.53	15	29
Zimbabwe (Harare)	1.39	13	1

*Price comparisons were made in nominal local currency units.
n.a. : Data not available
Source: FAO, 2017.

3.4. Policies

Some African countries have developed policies to promote rice production in the country. These policies are mainly aimed at small-scale rice producers and are aimed at stimulating them through import tariffs. Table V shows some examples (FAO, 2017a and FAO, 2017b).

Table V. Some policy developments for rice in African countries.

Country	Policy category	Description
Senegal	Import ban	Suspended all imports of whole-grain rice in order to facilitate the placement of local produce held in private stockpiles.
	Production support	Paddy price is fixed at 125 XOF per kg (225 USD per tons) in order to ensure sufficient returns for rice farmers.
Uganda	Import tariff	Reinstated the 75% (345 USD per ton) import duty on paddy and husked rice.
	Consumer price	A decision restored the duty remission on husked rice in order to lower domestic quotations, with processors committing to keep retail prices at a maximum of 0.8 USD per kg.
Algeria	Tax policy	Raised value added tax (VAT) on imported rice and other products from 7% to 9%.
Nigeria	Import restrictions	Barred imports of rice through established free trade zone (FTZ) to ensure adherence to the ban on rice through land-borders.
Cote d'Ivoire	Price control	Set price caps on imported rice for period of 6 months (from July 2017). Price celling on imported rice range from 0.55 to 0.71 USD per kg at the retail level in Abidjan, but vary depending on the origin and quality of supplies and place os sale, as well as the stage of marketing chain.
Egypt	Export ban	Announced that the ban on rice exports would remain in place in order to ensure sufficient local availabilities and build strategic reserves. The aim would be to stabilize consumer price at 0.4 USD per kg during 2017 season.
Guinea-Bissau	Price controls	Set a maximum retail price of 0.59 per kg of fully broken rice in Bissau, and 0.61 USD per kg for other parts of the country. The government would also take other steps to quell increases in domestic rice prices.
Kenya	Production support	Announced that it would waive 0.9 million USD worth of service charges payable by rice farmers in the Mwea Irrigation Scheme in order to assist them in coping with losses as a result of drought in 2016.
	Important tariff	Import tariffs for paddy, husked, milled and broken rice continue to be 35% (or 200 per tons, whichever is higher).
Rwanda	Important tariff	Import tariffs for paddy, husked, milled and broken rice continue to be 45% (or 345 per tons, whichever is higher).

Source: FAO, 2017a and FAO, 2017b

4. Rice sector in Angola

4.1. Policies to promote the expansion of rice cultivation

Rice consumption in Angola, as in other African countries, is increasing rapidly due to changes in dietary habits and population growth, especially in urban areas. The rice consumed in Angola in the colonial period was mostly imported. Rice production declined in the late 1970s, at the country's independence (1975). Among the main factors of general decline is the war that overthrew and disrupted agricultural production and marketing systems leading to the almost elimination of rice cultivation in Angola.

The general objective of agricultural policy is to make subsistence agriculture into commercial

agriculture in a sustainable and market-oriented way with a view to achieve food security and meeting the needs of the national agro-industry.

Maize is still the focus of policies for cereal production, but the PDMPSA (Agrarian Sector Medium Term Development Program), despite the weaknesses of the agricultural sector, foresees a 7% increase in rice production in 2022 and the PRODESI (Program to Support National Production, Diversification and Import Substitution) highlights the promotion of this culture in the priorities of import substitution priorities.

The agricultural sector program for the period 2018-2022 promotes rice production with the aim of replacing its imports and contributing to food security. The promotion and expansion of rice cultivation in this plan is based on specific measures to increase the level of production such as: increased cultivation area, intensification of mechanization, animal traction, improved processing and effective use of existing irrigation systems. In the context of increased production and productivity, improved varieties, seed production, availability of fertilizers and marketing will be adequately addressed.

The policies, guidelines and strategies for the Ministry of Agriculture and Forestry (MINAGRIF) are defined in the PDMPSA (Medium Term Development Plan for the Agrarian Sector) 2018-2022 and are based on four main strategic objectives:

(I) Promote a broad professional training and technology transfer campaign to optimize agricultural production and productivity.

(II) Implement a process of agricultural products and rural transport for the development of family agriculture, corporation and public-private partnership.

(III) Establish an efficient mechanism for coordination and synergy among different sectors and other stakeholders in rural areas, highlighting the participation of society in the National Development Process.

(IV) To support the industrialization process of the country.

4.2. Production and Consumption

In the colonial period (until 1975), although it was not sufficient to meet domestic needs, rice was grown in several provinces of Angola. In the traditional regions, three types of rice cultivation types were distinguished, such as: dryland rice in the Mbanza Congo area (made by peasants), uncontrolled flooding plane or flooding rice with specific incidence in Bié (Ringoma- (Quibala - Cariango) and Lucala, Lunda Sul - Saurimo and Dala, and in Moxico - Alto Zambezi, and in Malanje (Songo - Luquembo), and finally irrigation rice on the lower edges of the Longa (Cazombo).

Consumption and production remained low during the armed conflict of 1975-2002, mainly due to difficulties in its production and imports. Rice production increased from around 5,335 tonnes to

21,337 tonnes (increased by 4 time) between 2000/01 and 2015/16. This was largely due to the expansion of cultivated areas as a result of the return and resettlement of rural populations following the agreement of peace in 2004.

In the last eighteen agricultural seasons from 1997/1998 to 2016/2017, 186,151 tons of rice were produced, with an average yield of 0.9t / ha, by family and business agricultural enterprises (Fig.6).

Currently in Angola, the family sector has the largest area of cultivation. The consumption per capita / year is around 40 kg, being in the group of the most consuming countries in Southern Africa.

The production has been increasing recently mainly due to the expansion of cultivated area and the improvement of the average yield per hectare. Total production over the years shows irregularities, with ups and downs throughout the agricultural seasons due to the lack of regularity in the supply of seeds and technological support.

Consumption practically doubled 239,059 tons (2001/2002) to 457,549 tons in 2016 and over the years maintained a constant growing trend.

Rice imports have increased considerably to 430,625 tons in 2013, equivalent to 240 million USD. Imports in 2022 will be around 400,000 tons / year and production forecasts according to current resources will not exceed 50,000 tons / year.

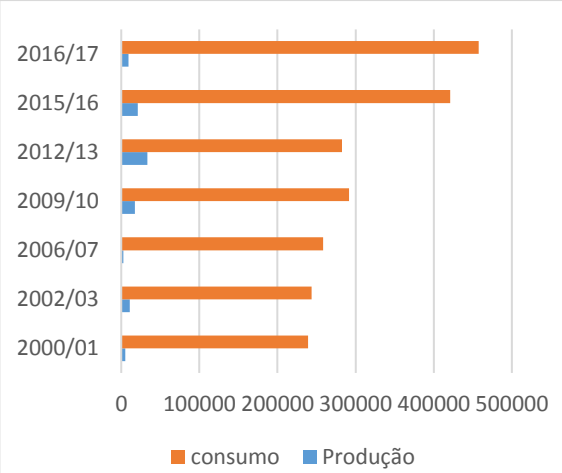


Fig. 6- Rice Production and consumption
Source: GSA, 2018

4.3. Cultivated area

The total average area cultivated does not exceed 6 million hectares per agricultural season (17.1% of total arable land, 35 million hectares). Approximately 5 million hectares are cultivated by EAFs, and 1 million hectares by EAEs. The area under rice cultivation has never exceeded 0.5% of the total cultivated area.

The cultivation of rice by EAFs is mainly intended for self-consumption. In these production systems, the rice is sown in flooded lowland in an area of approximately 5000 m^2, with fallow, without application of chemical fertilizers, incorporating only the grass of weeds and burying the stubble of the previous crop.

In EAFs the workforce is family members, uses manual instruments, grain replaces the seed and the production result depends on the natural conditions in the agricultural season. This segment has no capital, and the access to credit is not easy. In the business sector, it is estimated that about 125 producers are involved in the cultivation of this cereal with an average area of 50 hectares / each.

Year	1998	2001	2003	2007	2009	2011	2014	2015
Area (ha)	5424	3894	7873	6158	25145	28959	16312	10913
Yield (kg/ha)	590	1300	1567	380	701	1069	3124	1879
Production (paddy grain, ton)	3560	5282	10722	2829	17503	33272	21124	9332

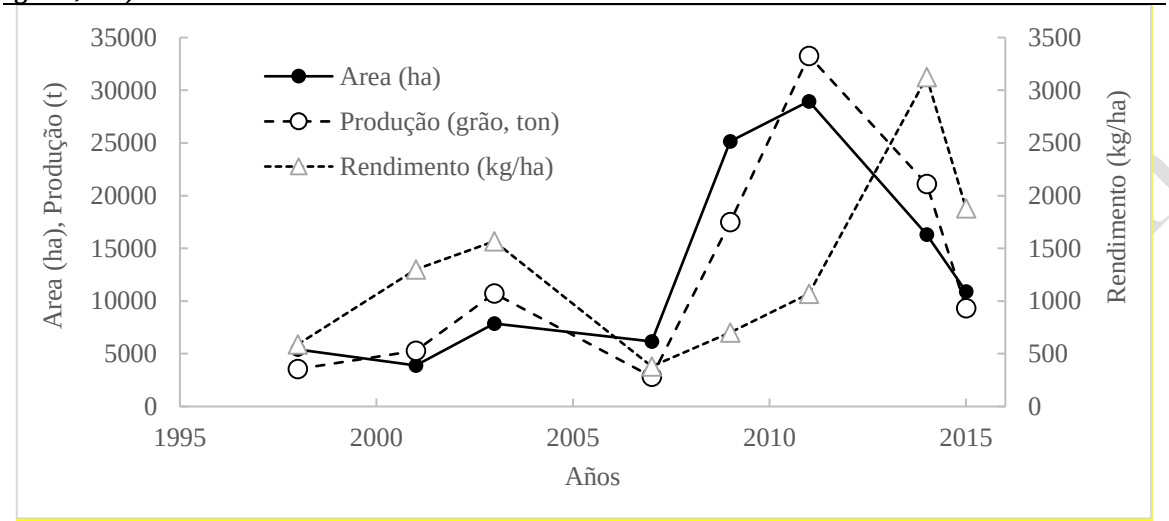


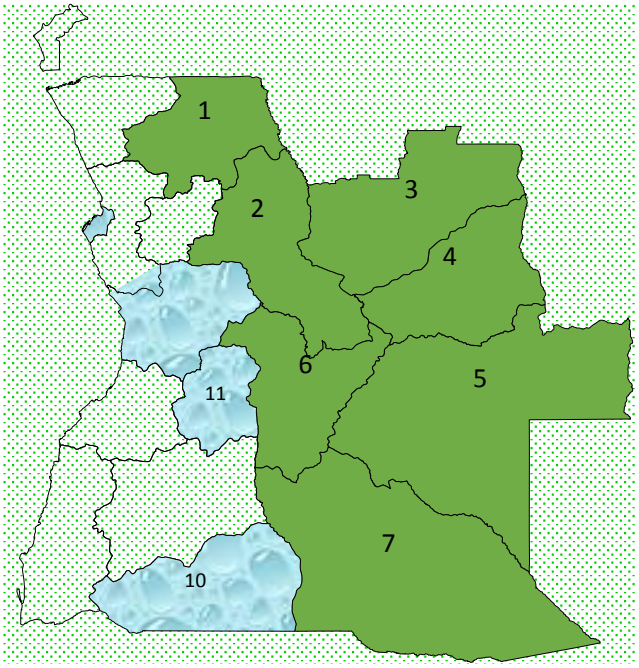
Fig. 7- Change in cultivated area, production and yield of rice in Angola
Source: GSA, 2018

In the context of large-scale agricultural production, the Government created 4 farms (Longa, Sanza-Pombo, Manquete and Camacupa) directed to rice cultivation. These 4 farms and another 5 (Caquenque, Mato Grosso, Luso, Vinevala and Arrozeira) from the private sector constitute the medium / large-scale producers of rice in the country.

Rice cultivation is more pronounced in the provinces of Bié, Uige, Malange, Moxico, Kuando Kubango, Lunda Norte and Lunda Sul, and new expansion areas are planned in the provinces of Luanda, Kwanza-Sul, Cunene and Huambo (Fig.8).

Flooded rice cultivation areas can develop in the valleys of major rivers such as: Kwanza, Cunene, Cubango and plaines covered by *glycosols*. Other suitable areas are those with low permeability such as Vertisols, Luvisols, and Cambisols, near the ends of the Northwest Coast, Kwanza, Midwest, Southeast in the Central and Southwest of the Cunene River basin. The largest area is located in the basins of River Cunene (3,171 km^2), Kwanza (1,731 km^2) and Northwest (1,191 km^2).

The provinces with a relatively high potential for rice cultivation are: Lunda Sul, Cuando Cubango, Moxíco, Uíge, Malange, Bié and Huambo. Adequate research is needed in these provinces to determine the regions and development approaches that are efficient and appropriate to the social and environmental context.



Legenda:

Producing Provinces

1- Uíge
2- Malanje
3- Lunda Norte
4- Lunda Sul
5- Moxico
6- Bié
7- Kuando Kubango

Proposal of new exploration areas

8- Luanda
9- Kwanza Sul
10- Cunene
11- Huambo

Fig. 8-Map of potential producing provinces of rice
Source: GSA, 2018

4.3.1. Provinces visited by NRDS members

Huambo: About 97% of local farmers work in small plots. The rice crop is residual and circumscribed to some villages where it is made in small blocks irrigated through ditches. The province has favorable climatic characteristics. Although the province does not have any large irrigation scheme, it has a high potential with water resources. The farmers are very motivated although they have little knowledge about the culture. However, the good care must be taken to address the issues of low fertility of soils and cold periods that may damage the plants.

Bié: The soil and climatic conditions are favourable for rice crop development, and it is proposed to increase the current area from 200 ha to 3,000 ha, with yields per hectare increasing from 0.87 t to 2.0 t. This achievement could contribute about 20% (17,000 t) of total rice consumption in the province, and rice could be a strategic crop for import substitution. Small-scale production projects can be developed along the Kwanza River and its branches.

Table VI - Currently cultivated area and potential area in the provinces of Huambo and Bié

Province	Cultivated area (ha)	Potential area (ha)	Total area (ha)
Huambo	35	150	185
Bié	217	570	822
Total	252	570	822

Source: Angola Rice Development Project, 2018

Lunda-Sul: The province had 11 pre-war irrigation projects (Table VII) and had the highest rice production in the country during the colonial period. The rice fields in those projects were divided into 1-ha plots, mechanicaly-prepared and hand-sown. They used to have mechanized harvesting and some industrial milling facilities in the province. Today they do not sell rice outside the province and have no milling plants.

It will be easy to reintroduce old large-scale rice production, as in Luvu (Table VII), by rehabilitating the existing irrigation systems. The province has good water resources and good precipitation (1,400 mm / year).

EAFs currently cultivate about 3,000 ha of rice in yields of 0.5 t-0.6 t / ha. A center for soil, water, pests and disease analysis has recently been built to support farmers

Table VII - Active irrigation projects in the colonial period

Location	River for water source	Crop	Area (ha)
Saurimo Municipality			
A1. Capuapua	Tamba	Arroz	1000
A2. Pelengue	Pelemge	Hortofrutícolas	2000
A3. Torrio	Lucrinhos	Arroz	5000
A4. Luari	Luari	Hortofritícolas	2000
A5. Luvu ○	Luvu	Arroz	2000
B. Dala Municipality			
B1. Lauchimo	Lauchimo	Arroz, Hortofutícolas	1000
B2. Cavuma	Luachi	Arroz	2000
B3. Luhemba		Arroz	5000
B4. Luele △		Arroz	10000
B5. Cazagi		Arroz	1000
Muconda Municiplity			
C1. Pemba		Arroz	1000

Source: SOPIR, and Provincial government of Lunda Sul

Note: ○:already rehabilitated, △:under rehabilitation

Moxico: The province was one of the largest producer of rice in colonial times (1961-1971) with a production of 27,000 tons / year and a yield of 1.5 t / ha. The production was by both small and large-scale. Production over the last 5 years is shown in Table VIII.

There are 242 farmers' associations and 10 cooperatives in the province, and some of them produce rice. There is a strategy for rice production that aims to reach the production of 15,550 t at 15,750 ha (Table IX). They also recently planned to invite 4 private companies to grow rice in plots of 500 ha / each. Two companies had already made variety tests and IRGA 424, bred in Brazil, performed well.

Table VIII- Rice production in the province in the last 5 years

Year	Area (ha)	Production (t)
2010/2011	9000	7200
2011/2012	6530	5224
2012/2013	3008	2406
2013/2014	7462	5970
2014/2015	8432	6745

Source: Moxico Province, 2017

Table IX Area and production foreseen in the province's strategy

Munincipality	Area (ha)	Production (t)
A. Zanbeze	5000	5000
Bundas	1500	1500
L. Cameia	4250	4000
Luacano	5000	5000
Total	15750	15550

Source: Moxico Province, 2017

The main challenges found in the expansion of rice production are that there are no processing facilities. There are many farmers interested in expanding the area of cultivation if they can process it in the region.

The area has great potential. Precipitation is sufficient for rice, and soils are fertile. The province continues to discuss the invitation to companies to produce rice in large scale, and the small farmers maintain interest in expanding the area of cultivation.

Cuando Cubango: The province does not have large-scale irrigation systems. Agricultural areas are located in the western part of the province, because the southeastern part is dry and the soils have low fertility. Most crops are rainfed, and are depending on the rainfall (1800 mm on the western side).

The total cultivated area is about 1,600 ha, but a company with Chinese investment in Longa works 1,300 ha of rice. The company of Longa is one of the largest to produce rice. Small-scale rice production is currently insightful, but there is great potential in an area of approximately 2,000 ha in Cuchi on low-lying floodplain near the Canona River. The IDA / EDAs teams are highly motivated to convince small farmers to introduce rice cultivation in this area if they can provide seeds and fertilizers for this purpose.

Uíge: The climatic conditions (precipitation between 1200 - 1400 mm) and soil allow the production of rice. In the past during the colonial period, it was one of the provinces where this culture expanded. Currently smallholder rice production is only for self-consumption.

The areas with the greatest potential are located in Uíge (municipality), Sanza-Pomboe and Alto

Kawale. Sanza Pombo is currently the largest rice-growing region in the province, where there is a large company dedicated to the rice cultivation, with an area of 550 ha.

Activities in relation to rice cultivation in this province should be focused on small producers with guaranteeing processing and market channels. Post-harvest processing can be done by cooperation with private sector partenership.

Malanje:The province has good characteristics for rice production, especially in the Northeast part, where there are vast tracts of lowland that can be flooded during the rainy season and where ferralic and psamo-ferralic soils are predominate. The altitude is between 1000 -1250 m, precipitation between 1200 -1400 mm and average annual temperatures 21- 22 ºC. The provincial government has demarcated a reserve of about 30,000 ha for rice cultivation and seeks to attract entrepreneurial farmers.

The Songo region in the municipalities of Luquembo, Cambundi- Catembo and Quirima, bordering the provinces of Bié and Lunda-Norte is the most traditional rice cultivated land where rice was already cultivated in the colonial period.

At present rice production is practiced only by family farmers, who use the local seeds and those distributed by IDA (mainly Chimbissa, Siam, California and Senta). Irrigation systems are depleted, and cultivation is by flood in the rainy season in lowland (*chanas*). The sowing is done by broadcasting method and the seeds have a considerable degree of mixture. They make fallows and do not apply fertilizers nor apply phytosanitary treatments, even so they can obtain yields around 2,5 t / ha.

The main obstacle to the expansion of this crop beyond the phytotechnical issues is processing. Access roads are still under rehabilitation, difficult to transit, and there are no milling facilities nearby. The manual husking (with the pestle) is painful and time-consuming, and the milled rice, thus, serves almost exclusively for local consumption, since the rice consumed in the capital of the province and in other areas is imported ones.

A Chinese company in a non-traditional rice growing area (Sunginge Field) tested 12 varieties and got 6t / ha in a total area of 180 ha. However, because of lack of milling facilities the province is forced to transport the production to Luanda where it is processed. The rice they produce also serves the workers of the company.

There is a private company who is setting up a processing center on the outskirts of the city of Malanje, and intends mainly to buy rice from private producers (especially small-scale producers) and process it and market it

With the recovery of irrigation systems, the repair of access roads, the use of suitable technological packages and the installation of Processing Centers near the production sites, the province is truthfully

promising as a rice region. As a first step, the focus should be on small family producers who are highly motivated, and it will be easier and less burdensome to regain with their productive potential and increase their incomes, which will undoubtedly result in an improvement of their living conditions.

5. Water resources

The country has an estimated water potential of between 130-140 billion m^3 of water in its 47 river basins.

In colonial times (before 1975) the irrigated area was 350,000-370,000 ha. At present it is estimated that this area does not exceed 86,000 ha due to the deterioration of irrigation infrastructure, which represents 23.4-24.6% of colonial time and 1.4% of total cultivated area (6,000,000 ha) (Table X).

5.1. Surface water resources

The watershed of Angola is very dense, predominating rivers with rapids, impetuous flow, often presenting water falls. The rivers are distributed through four water reception systems: the Atlantic Ocean (the Kuanza, Cunene, Chiloango, Mbridge, Queve and others rivers), Zambezi (Lungue-Bungo, Luanguinga and others) and the Kalahari receiving basin (Kuito, Cubango and others).

Most of rivers of Angola originate in the central mountains and flow into either the Atlantic Ocean or the Congo River. The rivers located in the Southeast of the Country flow into the Okavango marshes in Botswana.

The most important aspect with regard to irrigation is the high seasonal variability of precipitation and runoff. In almost all over the country, the precipitation in the months of June, July, August and September is very close to zero, also generating very low flow in these months. In the southernmost basins there is only some outlets in the months of February, March and April, leaving the rivers practically dry in the remaining months of the year.

This situation does not occur in the Cunene, Cuvelai, Cubango and Cuando rivers, which are permanent rivers, due to the flows generated upstream; however, the tributaries of these rivers in the downstream sections are dry most of the months of the year.

5.2. Groundwater resources

In the South and Southwest regions of Angola, there is an important groundwater abstraction network. Most of the groundwater resources are located in the Southwest part of the country, especially Cunene (40%), Namibe (30%) and Huila (15%), 85%, Benguela (7%) and Cabinda (3%). In the other provinces, the number of catches is very small, although some have flows and river beds.

In Angola, aquifers are classified into 5 categories:

(I) Intergranular permeability aquifers

(II) Discontinuous aquifers on hard rocks

(III) Discontinuous aquifers in flat hard rock structures

(IV) Cyclic aquifers

(V) Aquifers without geographical continuity

It is in the South and Southwest of Angola that there is a better hydrological knowledge of the country due to the existence of an important network of abstractions of groundwater.

Table X- Potentialities and current state of irrigation

	Quantity	Area	Reference
Irrigated area in the colonial period	350.000 a 370.000	ha	Before 1975
Irrigated area with irrigation facilities	86.000	ha	2006
Potential area for irrigation	7.900.000	ha	PLANIRRIGA

Source: PLANIRRIGA, 2011

6. Vision

6.1 Objectives of rice production

The overall objective of the strategy is to increase rice production levels over a 5-year period by increasing area and productivity.

6.2 Goals

• Increase in rice production to 45,000 tons by 2022.

• Increase the average yield to 2.5 t / ha by 2022.

• Supply 4,500 tons of fertilizer for rice cultivation by 2022.

• Select two varieties per eco-system by 2022.

• Establish the rice seed production system to provide 1.7 tons to farmers by 2022.

Table XI- Projection of production of primary cereals (tons) 2018-2022

Crop	2018	2019	2020	2021	2022
Maize	3.007.111	3.402.456	3.849.776	4.355.906	4.928.576
Pearl millet	59.960	65.062	70.598	76.605	83.124
Sorgum	65.923	69.940	74.200	78.721	83.516
Rice	29,733	32,707	35,977	39,575	43,533

Source: GEPE, 2018

Table XII-. Projection of rice production, population, needs, and imports (tons) 2018-2022

Year	Production(ton)[1]	Population (hab.)[2]	Necessity for consumption (ton)[3]	Import needs (ton) [4]
2018	29,733	26 485 328	485,120	**455,387**
2019	32,707	27 200 432	498,218	**465,511**
2020	35,977	27 934 844	511,670	**475,693**
2021	39,575	28 689 085	525,485	**485,910**
2022	43,533	29 463 690	539,673	**494,140**

Source: NDP, 2017

1-Projected productions (PND 2018-2022)

2- Population in 2017 (base year 25,789,024 inhabitants) at a natural growth rate of 2.7% CENSUS 2014, INE.

3- Number of inhabitants times consumption per capita (40kg / person / year 2014)

4- Needs less annual production.

The import requirements laid down in table XII were estimated based on the current consumption and foreseeable population growth until 2022, and conform to current production capacities. The implementation of the results of the Angola Rice Development Project (ARDP), the NRDS, the targeted programs / projects, the internal and external market growth of rice, the existence of available areas, and approachable and traditional varieties (local and introduced) with high productive potential and recovery of irrigated systems will allow this culture can, in the short term, have a very substantial increase in production that will significantly exceed the targets set for 2022 and reverse the increasing trends of import.

7. Challenges and Opportunities

7.1. Priority areas for intervention

Priority areas for intervention include:

(1) Increased production and productivity

• Availability of inputs and small equipments to the producing households (quality seeds, fertilizers, agrochemicals, etc.);

• Research and development of rice cultivation (technological packages adapted to the agro-ecological zones);

• Seed sector (reorganization of the seed production chain); and

• Irrigation (improvement of irrigation infrastructures).

(2) Competitiveness

• Improve post-harvest operations;

• Establish a quality standard for locally produced rice;

• Develop the rice processing chain

• Program for intensifying rice cultivation in the country will have membership of the producer households only when the prices of locally produced rice become attractive and competitive.

(3) Capacity building and coordination

• Training of human resources (Research and Extension);

• Monitoring the production system; rice markets and policies;

• Coordination at community level, ie integration mechanisms between actors in the rice chain;

• Improvement of infrastructures (transport and commercialization);

• Establishment of Regional Implementation Unit; and

• Creation of a Coordination at the Central level.

The main opportunities are:

• Mild weather

• Water availability

• Availability of fertile land

• Motivated farmers

• Growth of the internal market

7.2. Technology and production

One of the main bottlenecks in rice cultivation, mainly in expanding production area, increasing productivity and commercial competitiveness is the poor use of technology. At EAF level, which are the largest producers, the seed is not certified / inspected, there is lack of fertilizer incorporation; a convenient monitoring of the crop cycle; pests and disease management; and adequate storage and processing, which results in low yields and poor commercial value. The main constraints on production are:

• Poor technical assistance

• Lack of knowledge about land preparation

• Lack of knowledge about sowing and nursery methods

• Lack of knowledge of rice processing techniques including technologies for milling the rice grain without breaking

• Difficult access to fertilizers and pesticides

• Difficulty in controling pests and diseases

• Poor access to urban markets

• Weak performance of associativism that would favor the process of learning and managing resources

7.3. Land distribution system and land law

In 2004, the current land law (Law 9 / 04- Lai de Terras) was approved, which has as substantive gain for EAFs with the recognition of customary law on lands occupied by rural / peasants communities. Thus, although most of these lands do not have a formal resistration, they are considered as granted to the communities and they can use them according to their habits and customs, and to formalize them the Government issues Recognition Declarations, which are registered and recorded the exact location.

At this level the land for rice production is not an issue, as it exists and is considered to belong to rural communities. Most of these lands of the peasant families come from the inheritance of their parents, which gives them stability. The main challenge will be the delimitation and registration of these lands so that the recognition of ownership is formalized.

Most private companies, especially large / medium-sized ones, have land titles that can be used for up to 50 years with renewable and transferable rights.

7.4. Production of suitable seeds and varieties

Seed is considered the most important factor in agricultural production. Its relaunch presupposes the use of high quality seeds. The lack of a functional system of seed production, involving several partners such as specialized private companies, governmental, a single farmer, farmers associations and NGOs contribute to the low availability of seeds in the market.

The formal import-dominated system, despite representing 80% of the seed marketed in the country, is expensive and characterized by delays in the arrival of the seed and the purchase of varieties not recommended by the National Seeds Service (SENSE). On the other hand, the companies that operate in the Angolan market are not oriented to the production of rice seeds.

In the country there is a high potential for the production of rice seed from the genetic resources resulting from the great diversity of local varieties and the agro-ecological variability, that allows the introduction of a large number of exotic varieties.

As in seed production of other crops, the approach to rice is also mentioned in the legislation on seed policy. They are namely the Seed Law No. 7/05 of 11 August, Regulation of Seed Law No. 93/16 of May 9 and the Technical Regulation on the Production and Certification of Cereal Seeds, support to a set of processes, normative procedures and standards involving the rice seed production chain.

7.4.1. Suitable Varieties

The selected varieties will be based on the results of the completed and ongoing research, particularly those of the Angola Rice Development Project (ARDP).

Currently there is a partnership with the Chinese company Win-All-HiTec that is carrying out two researches, one of crossing to create new varieties and another one of adaptability studies of 30 varieties of rice.

7.5. Fertilizers

Within the scope of the Government's strategic plan, MINAGRIF has developed measures aimed at implementing strategies for increasing the production factors based on the establishment of partnerships. They are creation of mechanisms for the allocation of foreign exchange and assistance to entrepreneurs in order to offer the supply chain, and high-quality inputs with more affordable prices in a timely manner.

The strategy for the increase of the fertilizer supply in Angola is aiming to promote and encourage the establishment of technological partnerships in a bilateral framework with companies that produce fertilizers worldwide. This would ensure the availability of fertilizer in the national market, thus closing the existing deficit.

8. Institutional capacity

The MINAGRIF offers essential structures to ensure all the procedures of rice production, from the seed research and information provision.

However, these structures are weak. The main weaknesses are the lack of human resources (number, and with specific training); and the limited financial and technological resources available.

8.1. Seeds sector

Institutionally (MINAGRIF) the seed sector is coordinated by SENSE (National Seeds Service). For the effective implementation of the NRDS, a set of means must be gathered, so that the technical and material conditions are met. In terms of seed production, SENSE is responsible for:

- Coordinate the National Seed System;
- Control the level of application of standards of seed production regulations;
- Certification of seeds;
- Perform the Distinction, Uniformity and Stability (DHE) and Cultivation and Use Value (VCU) tests of seed varieties;
- Catalog the selected varieties.

Currently the SENSE counts on a total of 78 employees and should be framed the others to fulfill the purpose of the NRDS. The lack of technicians to implement the strategy will be solved by hiring the eventual staff obeying the criteria established by law. In this respect, ten (10) technicians are

required for the certification of rice seed, as described by level of training.

Table XIII: Needs for human resources for certification of rice seed up to 2022

workspace	Existence				Need: training or hiring			
	Lic.	MSc.	PhD.	Total	Lic.	MSc.	PhD.	Total
Seed Technology	0	0	0	**0**	6	1	1	**8**
Seed Physiology	0	0	0	**0**	1	0	0	**1**
Seed Pathology	0	0	0	**0**	1	0	0	**1**
Total	**0**	**0**	**0**	**0**	**8**	**1**	**1**	**10**

Source: SENSE, 2018

For the national rice seed certification strategy, the construction, installation and equipping of support infrastructures (Centers for evaluation, control and certification of seeds, and Seed Control office and Seed Certification Station) and acquisition of equipment for the control of quality of the seed, according to the province.

Table XIV: Needs for support infrastructures for certification of rice seed up to 2022

Province	Existence			Need: construction and equipment		
	Centers for seed control, analysis and certification	Seed control office and certification stations	Total	Centers for seed control, analysis and certification	Seed control office and certification stations	Total
Uíge	0	0	**0**	1	1	**2**
Malange	0	0	**0**	1	1	**2**
Lunda Norte	0	0	**0**	1	1	**2**
Lunda Sul	0	0	**0**	1	-	**1**
Moxico	0	0	**0**	1	1	**2**
Bié	0	0	**0**	1	-	**1**
Kuando Kubango	0	0	**0**	1	1	**2**
Luanda	0	0	**0**	1	2	**3**
Kwanza Sul	0	0	**0**	1	-	**1**
Cunene	0	0	**0**	1	1	**2**
Huambo	0	0	**0**	1	-	**1**
Total	**0**	**0**	**0**	**11**	**8**	**19**

Source: SENSE, 2018

Other resources will be purchased by the producers themselves on the basis of the financing arrangements that are adopted.

8.2. Investigation

The Institute of Agricultural Research, IIA, in charge of research in Angola has ten experimental stations, five scientific departments, a documentation center, twenty laboratories and an entomology museum. The IIA strategic plan defined rice culture as one of the research priorities during this decade. However, there are currently only two researchers for rice cultivation throughout the country, although there are several topics to be studied, such as varieties, cultivation methods, fertilizer

management, pests and disease control, etc. The limited public investment in technological development strongly influences the performance of agriculture in Angola.

Table XV: Human resource requirements for rice growing up to 2022

Work place	Existence				Formation and contract needed	
	BSc.	MSc.	PhD.	Total	MSc.	PhD.
Breeding	0	1	0	1	1	1
Entomology	0	0	0	0	1	1
Phytopathology	0	0	0	0	1	1
Phytotechnology	1	0	0	1	1	1
Harvesting	0	0	0	0	1	0
Transfer of technologies	0	0	0	0	1	0
TOTAL	**1**	**1**	**0**	**2**	**6**	**4**

Source: Dr. Manuvanga, 2018

8.3. Extension

Agricultural extension services are carried out by the Agrarian Development Institute (IDA), which is a body under MINAGRIF and is represented in all provinces. The PEDR (Extension and Rural Development Program) is the main support of all extension programs. Technical assistance is guaranteed by the EDAs through the methodology of Farmers Field Schools (FFS.) and demonstration fields. These two approaches are already being applied by the ARDP (Angola Rice Development Project), benefiting 67 Field Schools in Huambo province and 372 in Bié province.

Participation in the formulation of public policies is done through the Institute of Agrarian Development (IDA) and, in some cases, the structures of the National Union of Farmers' Associations (UNACA - Confederation).

In the field of extension, the existing programs and instrumental policies are based on the guidelines which aimed at expanding the teaching of rural populations in order to provide them with the essential knowledge to the success of farming and to ensure a better standard of living.

Associated activities in the programs are activities aimed at promoting access to micro-credit, agricultural credit for the countryside and co-financed projects for the development of market-oriented agriculture.

For extension, family producers are organized into farmers associations and cooperatives with a reasonable organizational level, but often with lack in training for better performance.

At the extension level, the priority areas for action are technical assistance to promote productivity increase, to promote quality improvement, to provide continuous training for producers and to exchange experiences (e.g. processing, storage, conservation and marketing).

For the dissemination activity, there are relatively sufficient extension technicians. However, the means of transport are very limited. Extension agents have difficulty in carrying out their field

activities due to a lack of mobility, in order to expand the elimination of technology transfer. It is necessary to create incentives (subsidies) for extension agents and researchers.

9. Social problems

The main social problems are listed below:

- Damaged social infrastructure in particular, the lack of roads and bridges, which would allow farmers access to markets, is a major obstacle to trade. Poor availability of access to agricultural inputs and other goods needed for production, lack of seeds and fertilizers.
- The level of farmers organization is relatively low, although there are many associations and cooperatives. There is little participation of farmers' organizations in the formulation of public policies.
- Poverty is more widespread in rural areas, 38% of the population does not have access to potable water, and only 30% of the population has access to public health facilities. There is a low level of literacy, low technical-cultural level and weak capacity of mobilization of financial resources by the associations.
- The social role of women in rural areas depends on traditional education, and is governed by discriminatory logics that undermine women. Thus, the social role of women is linked to marriage, motherhood, the home and the education of the children. Despite this, their social visibility is reduced, and their intervention in community life does not go beyond the domestic context. In this context "the woman is the farmer-mother-wife-housewife- blood donor - lineage." Overall, the entire agrarian effort in some communities is developed by the females.

10. Strategies for subsectors

Rice cultivation in Angola is in a relaunch phase. Rice varieties and technologies used go back to colonial times and have low productivity and poor expansion of their cultivated area.

In practice, the relaunch of rice cultivation will be a pioneering activity in which the Government should play a central role as a catalyst. It includes the burden of dynamizing and structuring the whole value chain of this crop, particularly in guaranteeing the quantity and quality of seeds, research, dissemination, technological packages, rehabilitation of roads and irrigation infrastructures, processing and stimulation of commercialization / distribution circuits, as well as strengthening and supporting private initiatives in this sector.

The low supply of domestically produced rice, which is currently mostly met by imports, makes the cultivation of this cereal a priority in the country's food security policy, especially in terms of nutritional and import substitution issues. The country's agricultural and irrigation potential coupled with strong domestic and regional demand make rice cultivation an attractive and promising business

capable of generating income and employment.

In the current context according to rice needs and potential, the key strategies for the development of culture in Angola should focus on: (1) seeds; (2) fertilizers; (3) irrigation; (4) pests and disease control; (5) expansion of rice cultivation area; (6) development of the value chain; (7) research and extension capacity.

10.1. Seeds

Lack of quality seed is one of the major constraints on rice seed development. Seed breeding is one of the most important components in the process of modern agriculture. NRDS aims to guide quality seed production in order to substantially increase current levels of agricultural incomes, to meet the food needs of the Angolan nation, to generate surpluses for export and to gradually reduce the financial resources used to import them. In this sense, the strategy should be based on:

- Signing seed multiplying contracts with producers and establishing partnerships in bilateral and multilateral cooperation;
- Creation of external partnerships with internationally renowned seed research and production agencies, in order to ensure transfer of technology to Angolan companies. Partnerships between public institutions and some national private companies should also be established with proven initiative in the field of seed production;
- Establishment of internal partnerships in the national context between research institutions (CRF and IIA), development and supporting institutions (IDA, INCA, IDF, INCER, DNAP and ISV) and specialized private companies;
- Production of basic seed by (IIA), and certified by seed producers / multipliers;
- Creation of intervention mechanisms to improve the chain from the production of basic seed, quality control and guarantee to the small producer of access to quality seed;
- Granting of credits to small producers and multipliers;
- Strengthening public, private sector capacity in seed production;
- Organization of small producers in cooperatives;
- Training of cooperative staff in seed production, processing, storage and marketing techniques.

10.1.1. Selection of varieties

The JICA-supported project, ARDP, started in 2013, studied the varieties: Silewah, FOFIA 3737, WAB 189, NERICA 1, NERICA 4, NERICA-L 19 (introduced by JICA), Limpopo, Sertaneja, UN 10 (introduced by IDA), Cahilahila, Carolina, Macau, Chimbissa (local varieties), on the basis of research. These varieties were selected after trials at different altitudes and were determined according

to the following criteria: (1) yield (2) disease tolerance (3) growing period (4) deicence (5) plant height and (6) taste.

TABLE XVI- Varieties recommended by the ARDP

Variety	Selected varieties according to altitude		
	< 1500 m	1500 – 1600 m	>1600 m
Silewah	○	○	○
FOFIA 3737	○	○	○
WAB 189	○	○	
NERICA 1	○	○	
NERICA 4	○	○	○
NERICA L 19	○	○	○
Limpopo			
Sertaneje	○	○	
UN 10			
Cahilahila	○	○	○
Carolina	○	○	
Macau			
Chimbissa			
Material			

Source: ARDP, 2017

These adaptability tests are being conducted in Bié and Huambo. According to the results of the investigation (ARDP), it was concluded that the UN10 and Limpopo rice varieties should not be recommended due to their high risk of diseases damage such as blast (*Pyricularia oryzae*), especially in high altitude areas.

Currently there is a partnership with Chinese company, Win-All-HiTec, that is carrying out two researches, one is breeding to create new varieties, and another one is adaptability studies of 30 rice varieties.

Table XVII shows the results of taste evaluation test of the rice varieties. The criteria for the evaluation were: taste, texture, aroma, etc. The evaluation test of taste was done by the ARDP team and local farmers. These results need to be considered in recommending varieties of preference of the local population, and is an important market factor.

Table XVII - Results of the test of organoleptic characteristics ARDP team, 2018)

Order	Variety	Performance
1	NERICA L19	23
2	Sertaneja	22
3	Silewah	22
4	Chimbissa	19
5	NERICA 1	19
6	MATERIAL	16
7	Cahilahila	16
8	WAB 189	13

9	NERICA 4	13
10	UN 10	12
11	Limpopo	12
12	FOFIFA 3737	11
13	Carolina	9
14	Macau	6

Source: ARDP team, 2018

10.1.2 Seed production

The main strategic line in production will be the increase in supply of quality seeds. The goal is to produce 1.7 tons of seeds to reach a production of about 45,000 tons in 2022, and cover an area to be sown of 18,000 ha. In the seed production system, the aim is to improve the informal system based on family farming, stabilize the formal system based on medium and large-scale producers, and to improve SENSE's services.

10.1.3 Seed distribution

The appropriate seed distribution system shall be established according to the area and variety required by the soil and climatic zones.

In order to increase the multiplication of rice seeds, it is proposed to form a specific sub-committee for the multiplication of rice seeds.

The organization of the seed system is proposed in the flowchart below (Fig. 9).

Organização do sistema das sementes

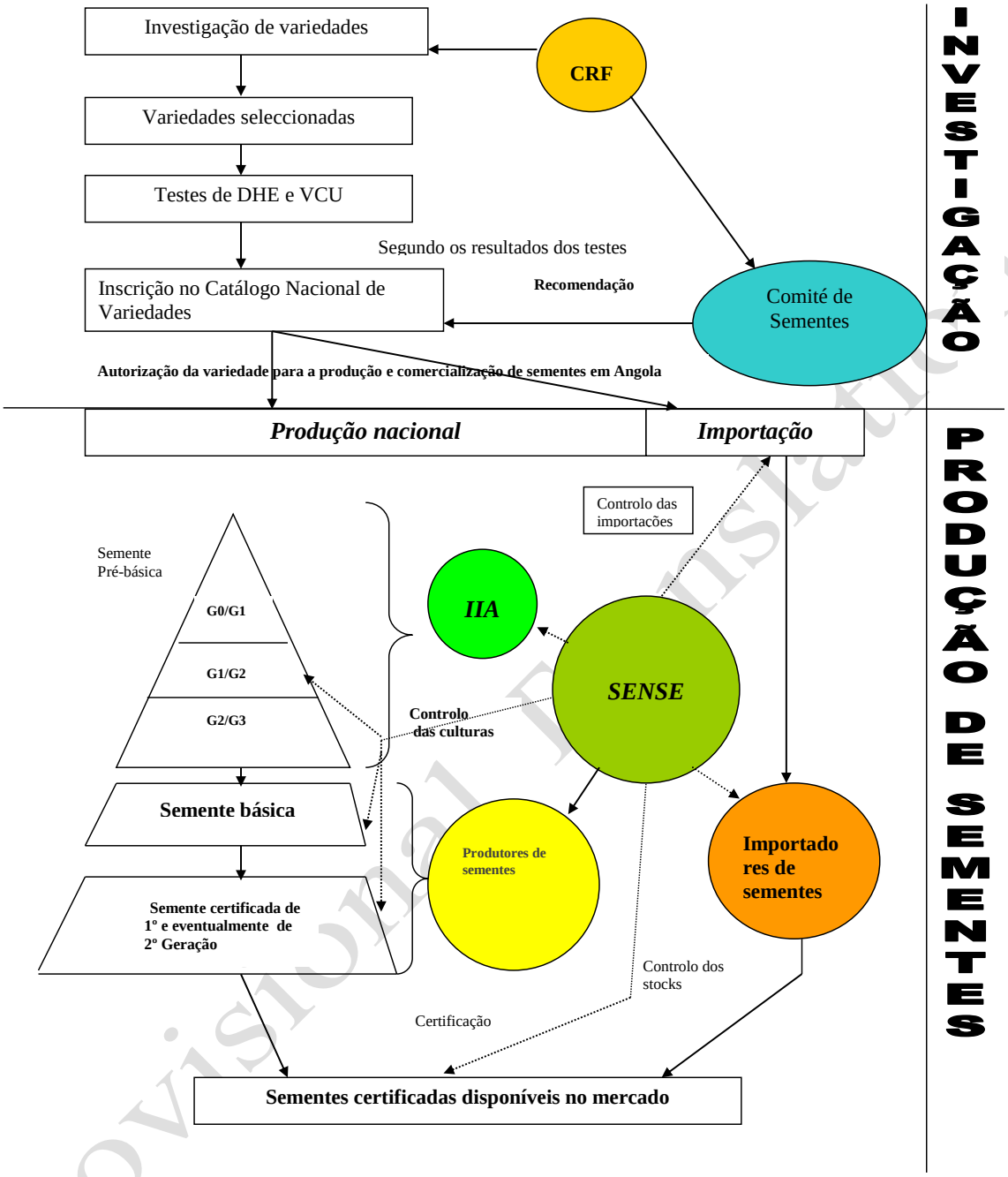


Fig 9- Organization of seed system
Source: SENSE, 2018

10.2. Fertilizers

Low fertilizer use is one of the causes of low rice yields in EAF. Proper use of the fertilizer application can double or triple the yield per hectare.

Many of the small farmers in rural areas are low income, and even with the subsidy they can not get the fertilizers in the right quantity and in the right time.

The strategy for increasing the use of fertilizers will have the intervention of the Government in the reduction of the price and the increase of its availability, guaranteeing a greater access mainly to

the small producer. The Government will intervene mainly in the operationalization and control of the import channels, in the sale by credit by campaign, and sponsoring in the country of the installation of companies to blend and packaging the fertilizers.

10.2.1. Distribution of fertilizers

The country has no factories, although it has raw material to produce fertilizers. Fertilizers are imported and this determines their price and consequently their use.

The distribution of fertilizers to farmers is done by direct selling of economic agents, linked to importers or selected by the Government for this purpose and also by community organizations (cooperatives / associations and others), the latter form is only practiced for family agriculture. For the private sector the fertilizer is paid at the time of purchase, and for the family farmers this can be provided on a subsidized loan and reimbursed at the end of the harvest. The system of supply, distribution and reimbursement of fertilizer for family agriculture is controlled by the IDA / EDAs and made possible by community organizations (Cooperatives / associations, solidarity groups) or / and civil society, NGOs, churches, etc.

10.2.3. Method of fertilizers application

Knowledge about fertilizer application to rice and its better management are still poorly controlled and needs to be researched in order to achieve the best efficiency and sustainable costs.

The basis for the fertilization of the rice will be properly adapted to those recommended in the technological package developed by the ARDP. According to this package the standard to be applied will be on average 250 kg / ha of fertilizer.

10.3 Irrigation

Prior to the armed conflict in Angola, agricultural activities were already underway with irrigation. The destruction of existing irrigation systems has made irrigated agriculture practically non-existent.

In the last ten years, the Government has been engaged in the recovery of some irrigated perimeters, having created for this purpose a Public Limited Company (SOPIR), of which it is the main shareholder.

Some 34,739 ha were rehabilitated for irrigation in Matala (Huíla), Caxito (Bengo), Luena (Moxico), Mucoso (Kwanza-Norte), Missombo (Kwando Kubango), Matumbo (Kwanza-Sul), Ngangelas (Huila)

The National Irrigation Director Plan (PLANIRRIGA) was elaborated, which carried out an approach towards the infrastructure for irrigation in the regions characterized by greater water deficit, that is, all the coastal and southern strip of the territory of Angola. The remaining territory of Angola

is characterized by less water shortages, making possible the existence of irrigated agriculture using rudimentary and less expensive infrastructure where irrigation is essentially complementary, particularly on a small scale.

Within the framework of PLANIRRIGA, it is planned to re-establish zones for irrigation in:

Benguela (Cavaco Dam of Dungo, Catumbela, Hanja, Hanha, Canjala); Cunene (Calueque, Manquete); Lunda-Sul (Cupuepua); Huíla (Quipungo, Sendi, Chicungo, Chicomba, Waba, B.Neves, Paeia, Cuê); Namibe (Bero, Giraul); Kuanza Norte (Luinga).

Studies for the construction of dams and small irrigation schemes in Benguela, Cuanza-Sul, Cunene, Namibe and Cuando-Cubango.

10.3.1. Rehabilitation of small-scale irrigation systems

For rice cultivation, irrigation is inevitable to ensure stable production, especially to minimize damage caused by climate change. Small-scale systems should be ensured by the assistance of technicians specializing in the design of small dams and irrigation ditches.

As for the rehabilitation of small-scale irrigation systems, producers should be called upon to participate in the works, mainly through local manpower and materials. It should be emphasized that the management of irrigation infrastructures should be participatory and in accordance with the customs and rules of the communities and the State should improve the management of irrigation infrastructures with the participation of the beneficiaries.

The scarcity or absence of precipitation that has occurred in certain regions of Angola, irregularities in its distribution throughout the year, makes it imperative to construct water capture and storage works as an essential factor in creating conditions for the development of rice production in Angola. In traditional irrigation irrigation is usually done in small plots where small farmers not only have control of activities but also use technology appropriate to their knowledge.

10.3.2 Rehabilitation of large-scale irrigation systems

In approximately 126 existing irrigation schemes, only six projects have been rehabilitated, and are under the management of ex-SOPIR. Based on the results of evaluation of agricultural land of approximately 18 million hectares according to the classification and evaluation of soils with a high potential for aptitude for irrigation in about 7.9 million hectares according to PLANIRRIGA data.

TABLE XVIII - Potential agricultural land for irrigation

Hydraulic Basin	Potential area (ha)
Cabinda	11.725
Midwest	1.061.832
Cuando	422.178

Hydraulic Basin	Potential area (ha)
Cubango	365.170
Cunene	3.054.186
Cuvelai	574.277
Kwanza	1.546.639
Noroeste	551.145
South-west	157.394
Zaire	116.665
Zambeze	32.958
Total	7.894.170

Source: PLANIRRIGA, 2012

Based on the results of the water balance analysis, three scenarios were created for the development of irrigation technical and financial feasibility, taking into account the following:

(Scenario: 1) Current situation without the adjustment of river water; irrigation of 3,065 million ha is the maximum possible;
(Scenario: 2) Regulate river flow: irrigated area of approximately 1.96 million ha is increased, and a possible area throughout the country for irrigation of 5.025 million ha / ha;
(Scenario: 3) With high investment in water retention, regulation and water supply infrastructure irrigation reaches 5,466 million hectares;

Promote public-private partnerships that act as distributors of knowledge, production technologies, management and organization systems, rehabilitation and construction of new irrigation projects proposed by the PPP.

In the midst of the development of rice cultivation, rehabilitation of irrigation systems is urgent, so PPP should be encouraged to provide irrigation services, technical and financial services as well as equipment and storage structures.

The provinces of Bié, Huambo, Malanje, Moxico, Kwanza Norte, Uíge, and Lunda Sul are traditionally producers, but cultivation has only begun in the last 2 years. For a full development of rice production, the rehabilitation of irrigation systems is urgent, and it is necessary for the State to provide irrigation services by investing in its technical and financial components, equipment and storage facilities.

Investments for maintenance and operations of irrigated perimeters are often achieved with resources to large public funds, placing a heavy fiscal burden on governments. However, changing the context in the sector with decentralization of responsibilities, empowerment of farmers and local actors, and market growth offer renewed opportunities for the modernization of research as well as the involvement of private sector investors in irrigation development. Several PPP (Public Private Partnerships) scenarios are based on various aspects (project design, construction, operation and maintenance, financing) with the private sector.

PPPs can encourage the provision of irrigation, technical, and financial services for the development of rice cultivation.

10.3.3 Improvement of irrigated rice production

To improve irrigated rice production, appropriate projects should be designed. Data collection for the preparation of projects should include:

(i) Study of the use of water in the irrigated area;

(ii) Applicability of new irrigation technologies;

(iii) User associations, present state of water;

(iv) Feasibility of implementation of small, medium and large-scale projects.

The rice crop production plan shall be included in the rehabilitation project, taking the following into account:

1) Pattern of rice cultivation (varieties),

2) Requirement of water for the cultivation of rice, including the water sheet for planting,

3) Rice processing plan (milling, storage and logistics) etc.

10.4 Pest and disease control

Pest and disease control is central to increasing crop productivity. However, increasing productivity also requires the use of good agricultural practices, improved varieties, appropriate growing period, soil management, water management, weed control, and harvesting methods.

10.4.1 Disease monitoring

The control method with monitoring to identify the disease must be carried out in the experimental fields of both the Project and the farmers (depending on the disease and its causes).

The monitoring of rice diseases conducted by ARDP in 2017 identified six types (diseases) in the area of implementation of the Project.

The observations revealed two bacterial diseases, bacterial brown stripe caused by *Acidovorax avenae* (*Pseudomonas avenae*) and bacterial sheath brown rot by *Pseudomonas fuscovaginea*, and four fungal diseases, blast by *Pyricularia oryzae*, brown spot by *Cochliobolus miyabeanus*, narrow brown leaf spot by *Sphaerulina oryzina* (*Cercospora oryzae*) and stackburn by *Alternaria padwickii.* All of the diseases belong to seed-borne disease. The diseases are transmitted through the infected seeds.

Monitoring in other regions is necessary and should be used technology experienced in the provinces of Huambo and Bié.

10.4.2 Integrated disease management

One of the fastest and easiest way to control disease is to spray the growing corrosal corners with chemicals. In the case of seed-borne diseases, disinfection with chemicals also helps. However, the availability of agrochemicals is extremely limited in the country, and prices on the market are not available to small farmers.

For these reasons, it is recommended to practice the integrated management without agrochemicals (Fig. 10), in which the proposed methods are;

(1) Use of resistant varieties;
(2) Cultural methods;
  (i) Improve drainage;
  (ii) Soil Nutrient management;
  (iii) Increased distances between plants;
  (iv) Decomposition of fresh organic materials in the field;
(3) Treatment of seeds with hot water for disinfection;
(4) Adequate seed storage;

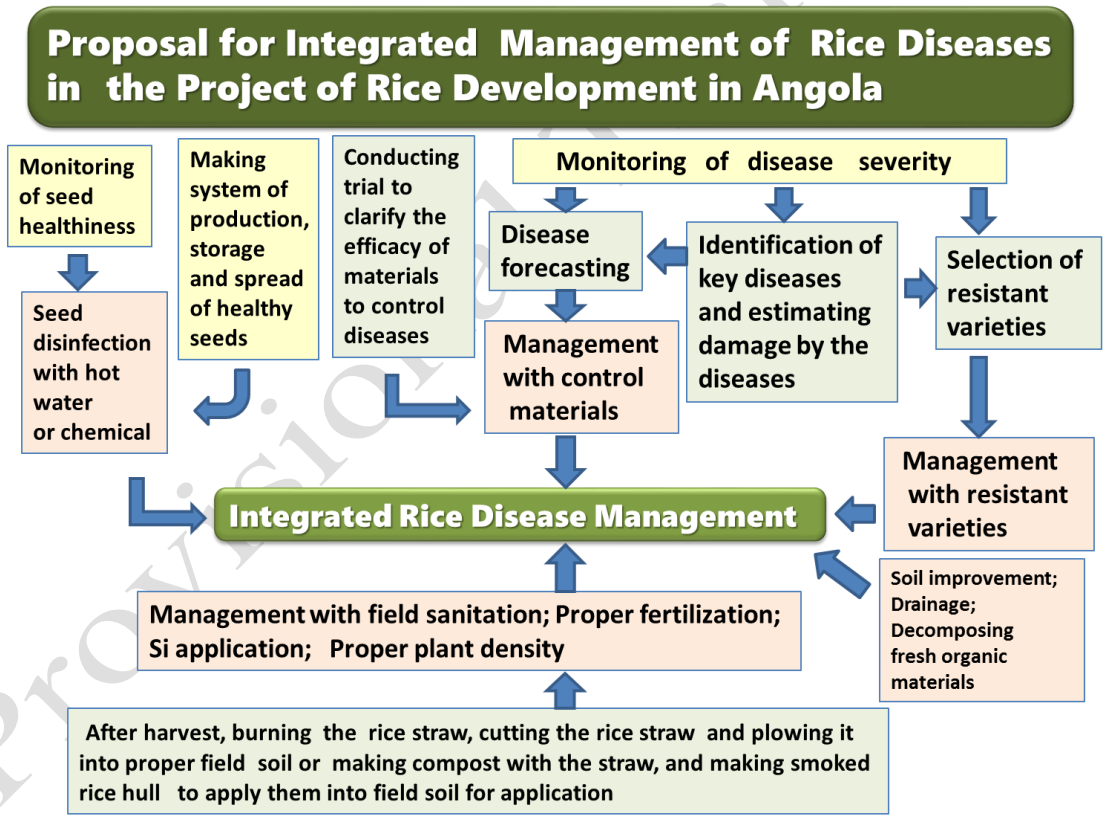


Fig. 10. Management of rice diseases in Angola
Source: Koizumi, 2017

10.4.3 Conservation of improved seeds

The use of improved seeds is essential to have positive results in cultivation. For this, a system of certified seed distribution must be developed and functional, since the majority of farmers who grow rice use seeds that are multiplied by themselves and have insufficient control of diseases.

To disinfect the seeds, hot water treatment (60 ºC for 10 min.) of rice grain is common in Japan when the chemical is not available. However, for the introduction of this system in Angola, it is necessary to confirm that hot water treatment does not give any damage on germination of the seeds used. Thus, effect of the hot water treatment on the germination shall be surveyed using the rice seeds of recommended varieties.

Seeds can be easily contaminated if we mix the healthy seeds with the unhealthy ones, and if they are stored under unfavorable conditions. One of the major causes of contamination is storing seeds in moist areas, so dry environment is recommended to avoid deterioration.

10.5. Expansion of cultivated area

Most farmers' land is small (less than 2 ha). The size is mainly determined by the size and composition of the household and the available technological capacity. To increase the supply of rice is one of the premises the expansion of the current cultivated area. The strategy in the coming years is to expand the area of rice cultivation in the provinces of Huambo, Bié, Moxico and Lunda Sul that are already traditional in the cultivation and have good potential for cultivation with irrigation possibilities.

10.5.1 Mechanization

The percentage of land used for mechanization in Angola is very low. It is around 1%, and it only includes cultivating and harrowing operations. The percentage of land prepared with animal traction does not exceed 20%. The expansion of areas planted by farmers to extend the national rice production is intended to replace imports and create self-sufficiency, presupposing a significant increase in the use of mechanization and animal traction.

Due to the size of the areas worked, especially in family farming, the most correct way to increase the use of mechanical and animal traction will be through the rental of machinery or the purchase / rental of boards by groups of farmers (cooperatives / associations and others), providing these services and using credits or PPPs (public-private partnerships) to cover the costs.

The current capacity of mechanization in the country is limited, not exceeding the possibility of mechanizing 1,000,000 ha. The Government through MINAGRIF and the private sector will create mechanization brigades in the provinces and subsidize 75% of the services they provide focused on family agriculture.

10.5.2 Motivation of Farmers

The family farming in Amgola is mostly focused on self-consumption. Hence, the most important crops are those that are traditionally part of their diet. In the case of maize particularly in the central

and southern regions of the country, is the most important crop. Rice, although widely consumed and prone to increase, is still little known.

The great demand constraining with a very limited supply allows to affirm that with an increase in rice productivity, and its dual importance: i) in the diet of households and ii) cash crop with guaranteed and promising market inside and outside the country is a major motivation factor for farmers. The market will be an incentive not only to increase production but also to improve its quality, since domestic production will have to be competitive, especially in relation to imported rice.

With the ARDP project it is possible to convey lessons for a profitable rice production and transfer technologies with the training of technicians and farmers in order to gradually expand the rice area of the country. In this campaign to expand the areas of rice cultivation, the use of means of communication and dissemination at various levels (national, provincial, municipal, etc.) is of great importance. The use of such means would increase the effectiveness of catapulting rice cultivation to the highest levels in the country's cereal production and attracting investors, donors and attracting interest in international institutions.

10.5.3 Use of the technical package

The technological package developed with the support of the ARDP will be of paramount importance in the expansion of the area of rice cultivation, since it incorporates the good practices to maximize the production and the benefits, and to reduce the risks. The technological basis of these packages should be tested in the different agrosystems selected, so that the cultivation practices to be adopted are most adequate.

10.6 Development of the value chain

To sustain the profitability of rice production and at the same time increase the motivation of farmers, it is essential to establish the right channel for the disposal of the produce from the field to the consumers. The production outlets should be able to minimize post-harvest losses, stabilize the price of rice, and provide the conditions to create a favorable environment.for processing and marketing.

10.6.1. Post-harvest Technology

Research and extension programs should be carried out in a practical and appropriate manner for post-harvest technology, such as threshing, drying, storage, husking, milling and packaging, taking into account the production costs for small farmers.

10.6.2. Storage, processing and marketing

Manual post-harvest processing of rice is laborious and time-consuming. It is one of the main limiting factors to the expansion of rice cultivation, especially in rural communities.

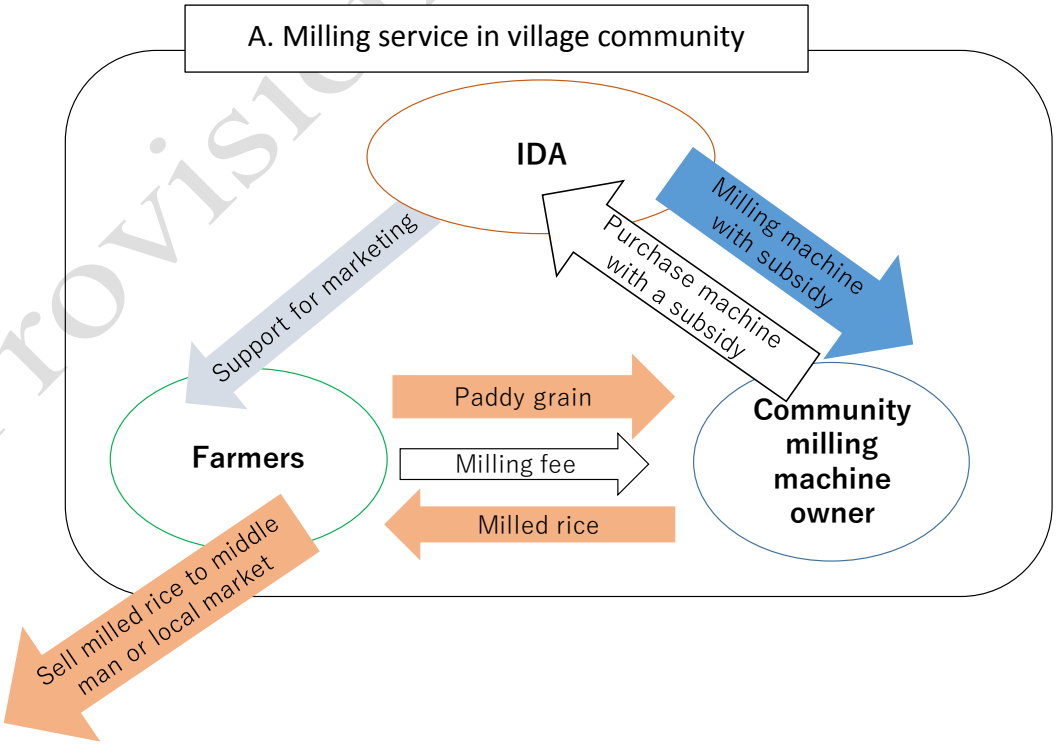
The Government, through MINAGRIF / IDA, should provide facilities for private companies to acquire and install industrial processing centers, and, on the one hand, provide subsidized credit service to small-scale farmers (Fig. 11A and B) in a policy similar to that adopted for the distribution of maize mills.

The private owners (Fig. 11 B) of the processing units should make purchase contracts for the production and guarantee the technical assistance to the producers during the crop season. It means providing the appropriate technological packages for the production and harvesting of rice, and buying the production at the producer (individual or associated).

The company purchased the production will be respnsible of these (private) processing and sales in the market (internal and external).

By increasing production in the communities, the Government support for the private sector can be reduced, as these (private) farmers will be able to purchase paddy rice from small producers and establish with these assisted commercial production contracts.

The fees charged for the milling service will vary by area. Milling companies must have a sustainable plan with the structure of the operating and maintenance costs to calculate the processing rate. If the farmers do not have money to pay for the milling, they should be allowed to pay by rice grain in the same way as for maize in some regions.



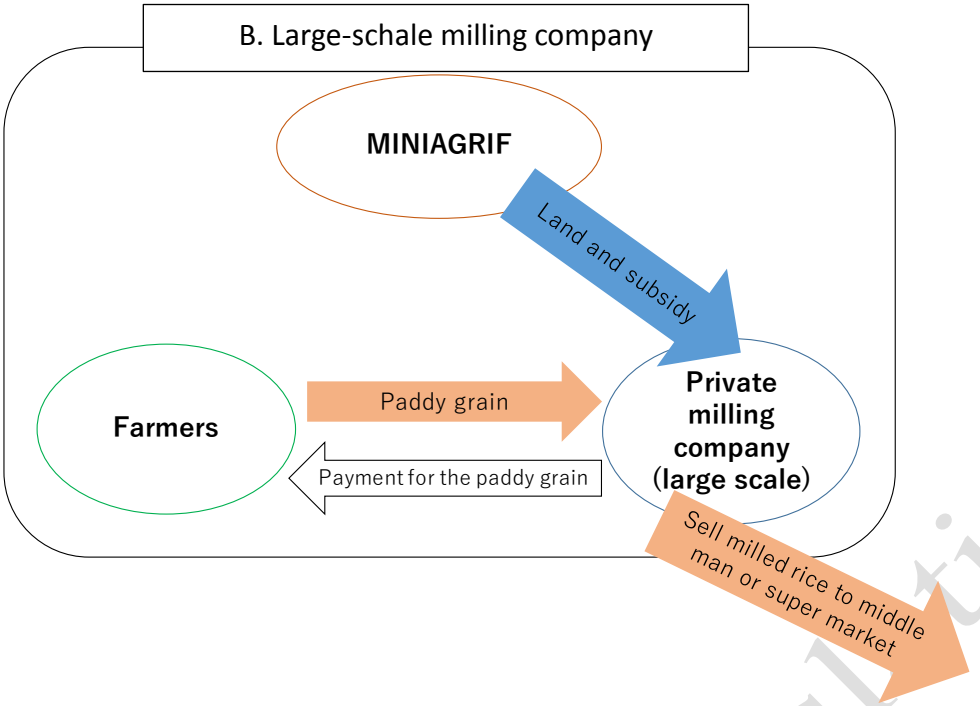


Fig. 11- Flow of grain and money in post-harvest processing
Source: NRDS Group, 2018

10.7 Strengthening the capacity of research and extension services

The cultivation of rice is a practice that is being relaunched in the country. It is obvious to the business and family farmers that they lack knowledge of their cultivation. Adequate expansion of production areas to sustain sustainability should be supported by research and extension institutions. The necessary activilties are selection of the best varieties, cultural practices, soils, etc. and the transmission of this knowledge and technical assistance to producers, and help them maximize results. The research and extension missions are not respectively entrusted to the IIA and IDA, bearing these institutions are indispensable together in the process of expanding rice cultivation.

10.7.1 Rice research

The IIA currently has 2 full-time rice researchers. To improve rice cultivation in Angola, at least 8 full-time researchers need to be allocated to the research work, ie 1 post-harvest operations specialist, 3 breeders, 2 phytopathologists, 1 entomologist and 1 agro-economist. To improve the results of the research the IIA should work closely with IDA in order to bring innovators to the producers and collect their problems to better support in increase of their production.

Research should focus on this first phase in the selection of variances, adaptability tests, fertilizer and water requirements, planting time and density, disease control and post-harvest technology.

Research activities for rice cultivation, currently concentrated in the IIA of Chianga, in the province of Huambo, should expand to other farms, namely Malanje, Cela (Kwanza-Sul) and Mazozo in Luanda Province. Partnerships with International Research Centers such as the Africa Rice Center

and the International Rice Research Institute (IRRI) should focus on joint research programs and the exchange of germ plasm. Universities, especially those with courses related to agriculture or related fields, should be included in the research system.

10.7.2 Extension Service

Extension Service is one of the most important tools for increasing rice production throughout the country. Training programs should be carried out in large numbers by EDA extensionists in the field and in the classroom. The technical packages prepared by the ARDP can be used, adjusted to the problems experienced by farmers.

The technology transfer from extensionists to farmers for each stage of rice field management can be done through farmer field schools (FFS) and demonstration fields.

Good technologies and good practices should have a technical-scientific knowledge base to provide skills and develop skills that enable farmers to make decisions that lead to significant and sustainable improvements in their activities.

Programs should be aligned with national strategies for rice cultivation and should have institutional material and financial support at various levels to ensure their success. Institutions of relevance in the strategy (see diagram below) should have a strong relationship between them and a responsible intervention ensuring the flow of solutions to the desired scope.

Rice cultivation is unique compared to other crops. It requires well-leveled ground to retain water in fields other than water management methods in other crops. Options on the best approach to water management should be set by local farmers, especially in areas where rice cultivation is poorly understood

Activities to extend the rice cultivation goals and farmers' expectations and needs should be within the domain of the EDAs and shared with the provincial IDA. The problems encountered by farmers should be informed by IIDA / EDA to IIA. The IIA will conduct appropriate research to find a solution to these problems by developing appropriate technologies (appropriate varieties, optimization of fertilizer use, etc.) to solve them and transfer them to farmers through IDAs / EDAs. IDA / EDA / farmers and IAA interactions must be permanent (Fig. 12).

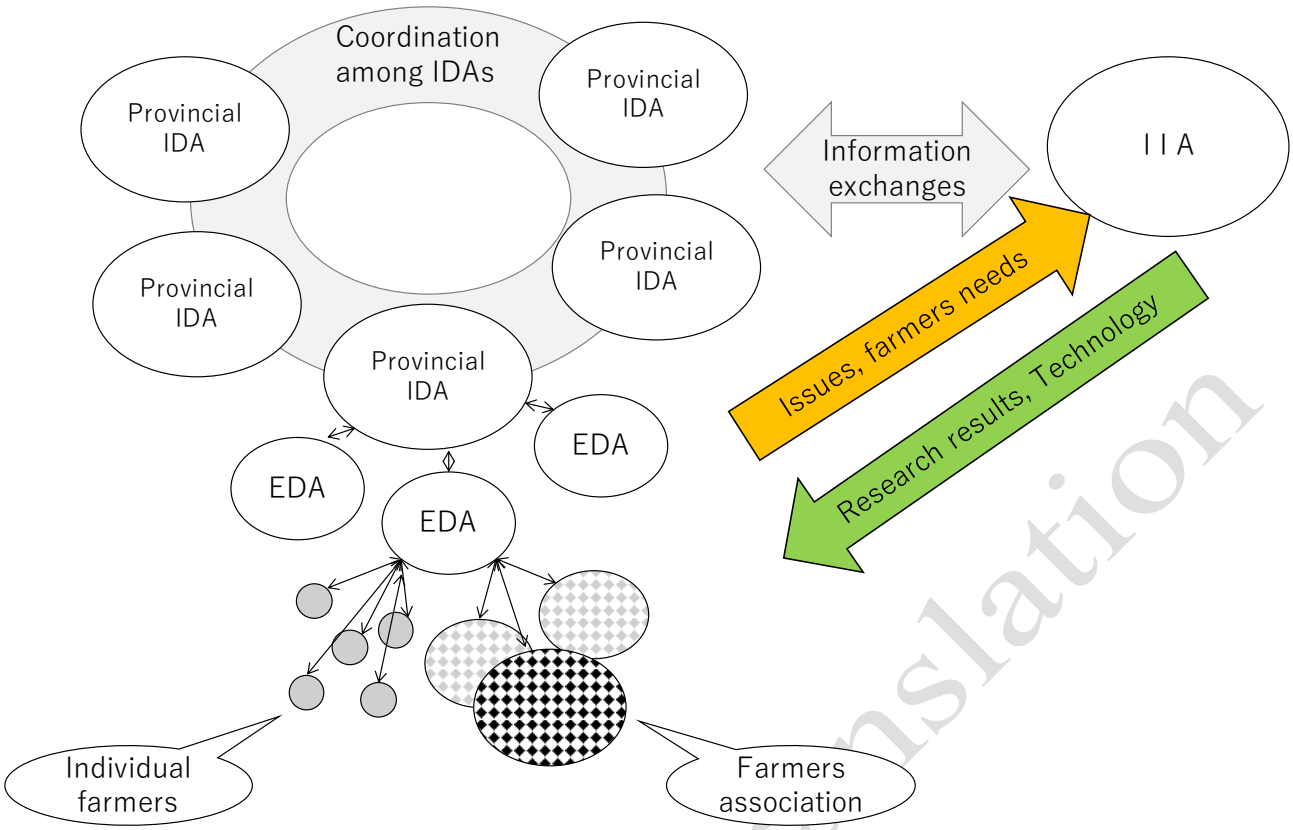


Fig. 12 Strategy for extension
Source NRDS group, 2018

11. Implementation

11.1. Coordination of NRDS

The National Coordination Committee of NRDS will be coordinated by the GEPE, and will integrate the following institutions: IDA, IIA, DNA, SENSE, INCER and NGOs.

The main tasks of the Committee are;

- To propose projects from the strategy in NRDS.
- To provide necessary information required by development partners (donors);
- To create partnerships with national and international organizations such as IRRI, AfricaRice, JIRCAS, etc.
- To formulate projects with development partners;
- To monitor projects;

The Committee is responsible for formulating and executing the projects through the coordination of the national and provincial actors of IDA, IIA, DNA, INCER, SENSE, NGOs and GEPE to evaluate the implementation and achievements of these strategies.

At the Provincial level, the Committee will be coordinated by the DPA, and will integrate the following institutions: IDA, IIA, INCER, SENSE, NGOs, Associations, Cooperatives and Solidarity Groups of farmers.

The main tasks are:

- To encourage farmers to grow rice;
- To assess farmers' demand and cultivation conditions;
- To implement the projects with the support of the NRDS Coordination Committee;
- To monitoring the projects and report to the Committee;

11.2. Monitoring and evaluation

For the success of the NRDS, it will be essential that it be subject to monitoring and evaluation, which will enable it to achieve its objectives and obtain information on the state of implementation of the planned actions, modify them and mobilize the internal and external support necessary for its good implementation.

Monitoring and evaluation programs will be annual and under the responsibility of the NRDS Coordination Committee at different levels.

The main indicators to be measured annually in addition to the financial indicators will be:

- Number of farmers, focusing on family farming and quantity of area sown in different rice production systems (flooded, rainfed, irrigated)
- Total rice production in the different production systems (area, total production, yield / ha)
- Number of organizations (Cooperatives / Associations, others) of existing rice producers in action
- Percentage of domestically produced rice in consumption relative to imported rice
- Main constraints to rice crop expansion

12. Conclusion

Expansion of cultivated area and increased rice productivity are the primary objectives pursued with NRDS 2018-2022, in order to reduce imports, improve food and nutritional security, and provide a source of income and employment.

- In the short term, adequate varieties determined by the ARDP as well as the respective technological package will be disseminated to the provinces of the Central and Eastern parts of the country considered as potentially more attractive for this crop and, as far as possible, research activities in other areas of the country.
- In the medium term, it is intended to increase rice through irrigation and to make an effective asystem of multiplication / production and distribution of seeds, and to increase the industrial processing capacity of this cereal.
- By 2022, the goal will be to reduce rice import requirements by increasing domestic

production.

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