



Causes and Progress scenarios of Rice research and development in Ethiopia

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Abstract

In many studies it was indicated that rice introduction in Ethiopia is a very recent phenomena which was done in 1970s due to the famine and starvation escalating in the country during the so-called *Derge* regime. Then on, Rice research and development in Ethiopian become advanced over time through implementation of various strategies and research interventions conducted in the country. Besides, partnerships and strong cooperation among several actors were formed at national, international and regional level. The most breaking and turning point for rice sector was the government tried to considered it as strategic and millennium food security crop. Then on different research and development campaign along with integration the commodity with in various research programs and projects enhanced the rice sector and area expansion across the country. Currently improved rice technologies diffused into many rice producing and potential areas based on its production ecosystems mainly (upland, lowland and irrigated). Large scale demonstration (LSDs) was initiated in Ethiopian Research system through cluster farming approach for different commodities including rice. This approach helped diffusion of potential rice technologies faster particularly in the lowland and upland rice production systems across different parts of the country. Lack of mechanization of rice production and poor grain quality of rice are the two main determinant factors that influences the rice sector not able to be competent enough with imported rice and penetrate the local and international markets. Therefore, the respective governmental and non-governmental bodies need to focus on improvement of rice grain quality and enhancement of rice mechanization in the country.

Keywords: Fogera plain, Lake Tana, millennium crop, *Oryza sativa*, *X.Jigna*,

1. Introduction

1.1. Rice in Ethiopia

1.1.1. Causes and beginnings of rice production in Ethiopia

In the early 1970s Ethiopia was hit by a severe famine which took the lives of hundreds of thousands of human beings (estimations range from 250,000 to 750,000 people) and countless domestic animals (Kebbede, 1988). As a response to this dramatic event

and aiming the long term enhancing of food security, North Korean development cooperation efforts introduced rice cultivation in Ethiopia, first in the Fogera and Gambella Plains (Belayineh et al. 2017). From then on rice cultivation, mostly undertaken by small-scale farmers, has expanded to other plains and wetlands across parts of the country (Alemu et al. 2011). Apart from small scale production, later on new governmental efforts aim the development of commercial rice farming. For instance, around 21% of lands under governmental administration (398,000 ha) have been transferred to local and foreign investors for

commercial rice farming purposes. The total potential area for rice production in Ethiopia is estimated to be 30 million hectares, from which 18.6% (5.6 million ha) are considered to be highly suitable (Dawit 2015)

1.1.2. Potential and released rice varieties in Ethiopia

A limited numbers of rice varieties have been introduced in Ethiopia mainly by the International Rice Research Institute (IRRI) and the Africa Rice

Centre. The introduced germplasm has been used to develop rice varieties for different agro-ecologies and/or rice ecosystems of the country. However, the introduction and evaluation of new rice germplasm for rainfed, lowland, irrigated, and upland systems is highly needed (Tessema 2011). Since 1998, when the first rice variety was released in the country, 36 improved varieties have been released based on different parameters such as yield performance, better biomass, early maturity, cold resistance and market preference (MoA, 2011).

Table.1. Distribution of rice varieties in different regions of Ethiopia

Region	Variety	Type
Tigray	X-Jigna	Local/old cultivar
	NERICA-3	Improved
Amhara	X-Jigna	Local/old
	Gumara	Improved
	NERICA-3	Improved
	NERICA-4	Improved
Oromia	Suparica-1	Improved
	X-Jigna	Local
	White rice	Local
	Gumara	Improved
	NERICA-2	Improved
	NERICA-3	Improved
Somali	NERICA-4	Improved
	Suparica-1	Improved
	NERICA-1	Improved
	NERICA-2	Improved
	NERICA-3	Improved
	Shebelle	Improved
Benishangul Gumuz	Gode-1	Improved
	Hoden	Improved
	White rice	Local
	Gumara	Improved
	Red rice	Local
	NERICA-3	Improved
NERICA-4	Improved	
Suparica-1	Improved	

SNNPR	White rice	Local
	Gumara	Improved
	Red rice	Local
	NERICA-3	Improved
	NERICA-4	Improved
	Suparica-1	Improved
National	X-Jigna	Local
	White rice	Local
	Red rice	Local
	NERICA-1	Improved
	NERICA-2	Improved
	NERICA-3	Improved
	NERICA-4	Improved
	Suparica-1	Improved
	Shebelle	Improved
	Gode-1	Improved
	Hoden	Improved
	Gumara	Improved

Source: National survey result,(Minilik et.al 2013)

1.1.3. Rice production trends in Ethiopia

There is an increasing trend of rice production in the country particularly since 2006 The area allocated for rice production has been increasing in a 10-fold ratio from 6000 ha in 2006 to approximately 57576 ha in 2019. The total number of rice producing farmers

increased in a 4 fold ratio from 32000 in 2006 to 119000 in 2013. Consequently, the annual national rice production increased from 11 thousand tons in 2006 to 161 thousand tons in 2019. The total rice consumption in the country was estimated as 551585 tons.

Table 2: Rice production trends in Ethiopia:

Year	2006	2007	2008	2009	2010	2011	2012	2019
No. farmers	32250	61862	80500	126432	92232	93286	115832	119497
Size (ha)	6421	6100	13000	47739	29866	30649	41811	57576
Production(ton)	11244	11244	71394	103128	90412	88619	121042	161212
Yield(ton/ha)	1.8	1.8	5.5	2.2	3	2.9	2.9	3.1

Source; national survey (Dawit 2015)

The national rice research and development strategy prediction scenarios was prepared to implement for the next 9-10 years. As per the prediction depicted below on the figure, the area coverage in 2030 will be enhanced to the level of 345,794 hectares from 57,576.00 hectares in 2019. The total paddy production will reach to 1,733,943 hectares from

161,212 tons in 2019. The milled production will be increased to 1,127,063 hectares from 104,788 tons in 2019. The total consumption will be also increased and the country will approach to 91% self-sufficiency in 2030. The national average productivity will be enhanced to 5 tons from 2.8 tons in 2019

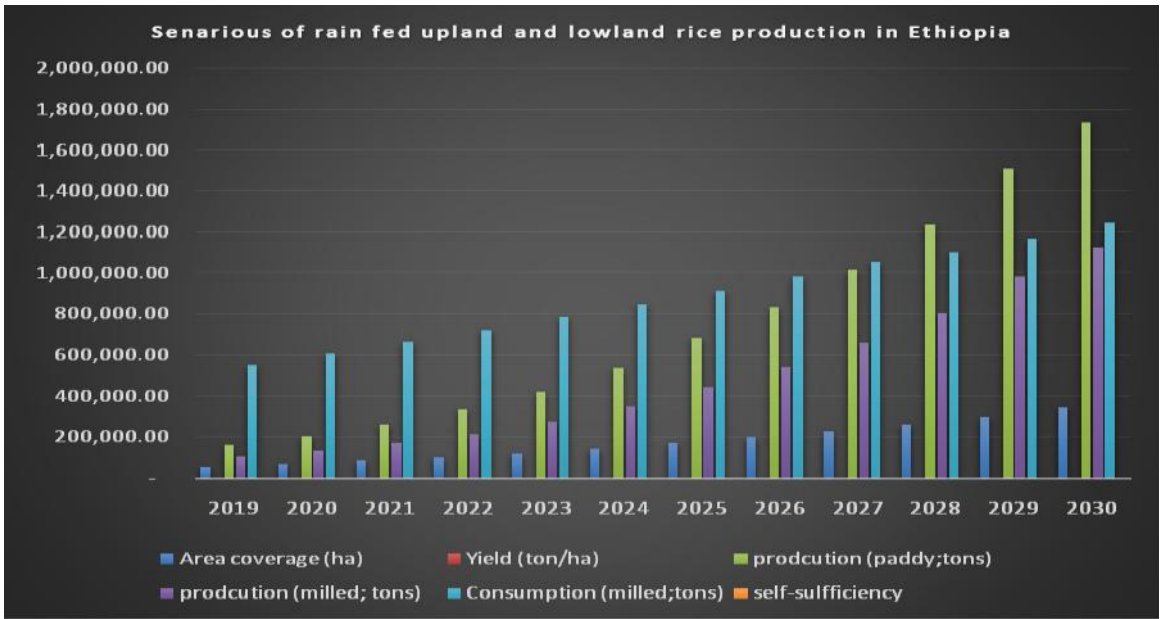


Figure1. Calculation and prediction scenarios for lowland and upland national rice research and development strategy of Ethiopia

The total area coverage of irrigated rice production will be enhanced to 158097 hectares in 2030 from 1300 hectares. The average productivity will reach to 8.54 tons in 2030 from 4.5 tons in 2019. Paddy production volume and domestic consumption will be

increased with in in the next nine to ten years. Self sufficiency in irrigated rice production is fast as compared with upland and lowland rice production. It will reach over 70% in 2030

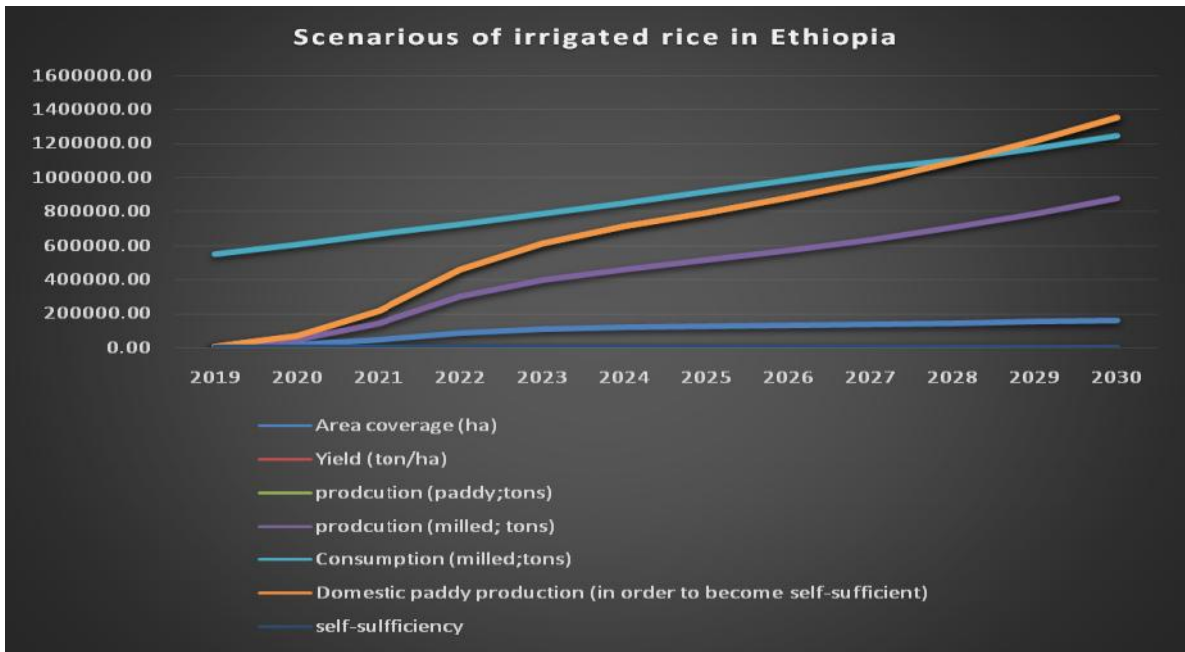


Figure 2. Calculation and prediction scenarios for irrigated national rice research and development strategy of Ethiopia

1.1.4. Strategies by the government and factors for rapid rice production increase in Ethiopia

a) Food price hike and government actions

Food prices have been rising since the early 2000s, and spiked in the years 2007-2008. Price hike in 2007–2008 was the biggest spike on world food markets. This was mainly for three of the world's major cereals (rice, wheat and maize), (FAO, 2010). The results of these crises impose considerable impact in developing countries where rice is a staple food for consumers. The government of Ethiopia in collaboration with other actors responded to the crises by recognizing rice as one of the millennium and strategic food security crops. The government of Ethiopia has started to give emphasis to rice cultivation through promotion of private sector investment in rice production by allocation of land for private investors, (e.g. a Saudi investor in Gambela region with a capital \$13.3 billion), irrigation development and supporting the increase of areas for rice production (Dawit 2015)

b) Technology, inputs, research and extension

The National Rice Research and Development Steering committee coordinates the overall rice research and development direction in the Ethiopia. Parallely, the Agricultural Development and Partnership Linkage Advisory Council (ADPLAC), which is organized at federal, regional and district levels facilitate the research and extension linkage to foster the information exchange feedback mechanisms. The Ethiopian Institute of Agricultural Research (EIAR) together with Regional Agricultural Research Institutes (RARIs), and Universities conduct adaptation and agronomic trials to supply improved rice technologies and practices, multiply source of rice seed and promote the technologies to the farmers through pre-extension demonstration and pre-scaling up programs (Dawit 2015). Recently cluster based large scale demonstration of improved rice technologies was initiated in Ethiopian Agricultural system. This research strategy fosters to expand rice towards out reached areas. Adoption of various promotion approaches, such as community-based seed multiplication, pre-scaling up of technologies, and on-farm demos, promotion of improved rice technologies, the national rice research & development strategies of Ethiopia (NRRDSE). The National Rice Research and Development Strategy was developed to promote the

rice sector in order to ensure food security at the national level. Establishment of Rice Research and Training Centre supported by Japan International Cooperation Agency (JICA), relatively higher productivity as compared to other main staple crops.

c) Partnership and linkage

The Japan International Cooperation Agency (JICA) has been supporting Ethiopian rice sector particularly in seed production and multiplication, capacity development in terms of personnel education and training, facilities and supplies, development of Ethiopian Rice Research and Development Strategy (Kiyoshi 2011). Additionally, Supports from Partners and Donors such as International Rice Research Institute (IRRI), Africa Rice, Japan International Research Centre for Agricultural Sciences (JIRCAS), Alliance for Green Revolution in Africa (AGRA), Saasakawa Global (SG2000), World Bank (WB) through improved access to germplasm exchange, human capacity building, and sharing of experience in rice Research and Development (Dawit 2015) and (Tariku 2011). The Sasakawa Africa Association administers and manages Sasakawa Global 2000, a program to bring about food security in sub-Saharan Africa. Sasakawa Global 2000 is a program through which smallholder farmers are taught modern farming methods, including the use of quality seed and small amounts of fertilizer. It has succeeded in increasing production by 2-6 times for the farmers that use its methods.

The association's other activities include teaching Agro-processing in Africa, to increase the economic viability of the Sasakawa Global 2000 program and improve the links between Africa's farms and urban areas (<http://www.saa-safe.org/>). In early 2000, Saasakawa African Association/Saasakawa Global SAA/SG 2000 received information that a large number of smallholder farmers in the Fogera plains are producing rice. Based on this information, a delegation from SAA/SG2000 visited Adet Agricultural Research Centre (ARC), Amhara Bureau of Agriculture (ABoA), Fogera Woreda Development Agents, several rice producing farmers in the Fogera plain, and also Pawe Agricultural Research Center to learn more about the status of rice research and production in that part of the country. SAA/SG 2000 delegates found out that the production of rice crop in the Fogera plains enabled farmers in the area to become self-sufficient in food crop production. The team also noted that a serious food shortage problem

has existed in those plains due to mainly the seasonal inundation of the farmlands. Following the visit, the SAA/SG2000 decided to assist the national research and extension systems in the re-introduction, field-testing, and transfer of improved rice production technologies. In the meantime, it also decided to popularize rice production among smallholder farmers in other localities that have similar ecologies. For this purpose, the Oromia Zone of Amhara Region was identified as the first area for SAA/SG 2000 intervention (Debela et al. 2011).

d) Market demand, availability of rural labour and land

In the country demand for rice consumption is increasing because rice is used for different purposes and food types. It is compatible with various traditional food recipes like injera (traditional Ethiopian bread), and local beverages (like “tela” and “areki”). Total current rice consumption is about 353,998 tons with estimated annual average import of 21,724 tons over the last ten years. (MoARD,2010). Thus, Ethiopia’s rice annual production has still a potential for a twofold increase in order to satisfy the internal market demand. In fact as a consequence of this non-satisfied and increasing demand for rice in the local market farmers from small to big scale have started to acquire and development additional rice farms in different parts of the country (Temesgen et al. 2014). Higher price value of rice grains over other cereals, increased rice consumption habit of consumers along with income increase and urbanization, integration of rice value chain through improved processing (promotion of quality machineries) and integration of value chain actors (ensuring service provision by private sector). Existence of huge unexploited lands and diverse ecosystems such as the uplands, rain fed lands and flash flood prone areas (during the rainy seasons), (Dawit 2015)

1.1.5. Challenges of rice sector in Ethiopia

Ethiopian rice sector still faces remaining challenges such as high competition with imported rice, poor grain quality, poor infrastructure, insufficient mechanization and post-harvest processing technologies, lack of skilled manpower and research facilities, poor marketing infrastructure and channels (Belayineh et al. 2017).

1.2. Rice in Fogera

Fogera plain is known as the major supplier of rice production in the country. It accounts 70% of the rice grain supply comes from this plain. Before starting cultivation of rice in Fogera, the district was food aided in 1970-1980s and so far the area was known typically by grazing land, livestock rearing, small-scale crop production using residual moistures, as well as sparsely populated. (Tilahun, pers. comm.2018) and (<https://www.future-agricultures.org>). Rice cultivation started in July 1984 in seasonally flooded plains of Lake Tana (submerged in water every rainy season) as a pilot project entitled “Ethio-Jigna Development Project” including the agricultural Cooperatives Jigna and Shaga cooperatives including thirty (30) young farmers supported by 9 North Korean agricultural experts. The objective of the pilot project was to establish and promote rice and horticultural crops first in the two cooperatives. The introduction of rice cultivation in the region changed the livelihood of the farmers in the Fogera plain radically. Apart from playing an important role in abating the problem of food-insecurity in the Fogera, rice cultivation increased the revenues of farming households considerably. Fogera has become a densely populated area and non-flooded agricultural production (onions, legumes) crops is flourishing. Nowadays, in local terms, a rice farmers from Fogera are considered to be “rich”. (Temesgen et al. 2014). That was the reason the first introduced variety still called as x.Jigina. The introduction of x.Jigina in the region changed the livelihood of farmers from the poorest to wealthiest and currently in the Fogera plain, rice plays an important role in abating the problem of food-insecurity of the farming community.

1.2.1. Rice varieties, productivities and expansions in Fogera

X.Jigina

After the successful completion of the above-mentioned rice cultivation pilot project, the remaining seed was collected locally. The North Korean experts had involved the pioneer rice farmers in a selection process leading to the choice of a robust, white cold tolerant variety with grains, good organoleptic properties for the elaboration of injera and palatable straw for cattle. This variety was multiplied and used since then not only in the regions where the project started by nationwide. No genetic information of the variety are known and since the first cultivation place

in Ethiopia was the Jigna kebele it was called *X.Jigina*. But this variety was become commonly infected by seed born disease called sheath rot. The productivity of this cultivar gradually become lower as compared with recently released varieties.

Gumara

Gumaravariety has been the second dominant variety next to X-Jigina cultivar under Fogera plain rice production over the last many years. It is characterized relatively as a late maturing variety, with strong culms, high tillering capacity and high performance under ponded conditions areas. This variety was released by Adet Research Center. It has relatively a better resistance to pest and diseases and is higher yielding than X.Jigina. The grains of Gumara are **red** which influences the market value and according to

the judgment of farmers its organoleptic properties for the elaboration of injera are inferior to that of X.Jigina.

Recent varieties

Four varieties (Shaga, Wanzaye, Ereb and Abay) were recently released by Fogera National Rice Research and Training Center in 2017 for rainfed lowland rice production. These varieties were compared to X.Jigina and two of them, Shaga and Wanzaye, ranked the first and second respectively by farmers and researchers. The main selection criteria were: biomass, yield, disease resistance and cold tolerance. At the moment these varieties are replacing those old varieties and they are undergoing the process of commercial multiplication.

Table.3. Recently released rice varieties and productivities on farm and on station

Variety name	Year release	of	Appropriate ecology	Yield t/ha at	
				Farmers' field	Research
Shaga	2017		lowland	5	6.8
Wanzaye	2017		lowland	3.9	6.5
Erib	2017		lowland	4.1	5.3
Abay	2017		lowland	4	5.3
Fogera 1	2016		upland	3.2	4.2
Adet	2014		upland	2.4	4.2
NERICA 13	2014		upland	3.3	3.8
NERICA 12	2013		upland	3.4	4.1
Ediget	2011		lowland	3.2	5.2

4. Conclusion

Different efforts and strategies by the government and cooperation among relevant partners and stakeholders brought rice sector to the front line of research and development campaign in the country. The area expansions gradually become distributed across different parts of the country. The governmental and non-governmental stakeholders need to focus on grain quality and mechanization of rice production in the country to be competent with imported rice and so as to the enhancement of domestic production by respective commercial farming or small holder-based production.

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	Website: www.ijarbs.com
	Subject: Agriculture
Quick Response Code	
DOI: 10.22192/ijarbs.2022.09.02.007	

How to cite this article:

Misganaw Anteneh Tegegne. (2022). Causes and Progress scenarios of Rice research and development in Ethiopia. *Int. J. Adv. Res. Biol. Sci.* 9(2): 64-71.

DOI: <http://dx.doi.org/10.22192/ijarbs.2022.09.02.007>