Improved Rice Seed Production and Marketing: Challenges and Opportunities; the Case of Fogera District of Ethiopia

Afework H. Mesfin[1] & Lemma Zemedu[2]

[1]*Ethiopian Institute of Agricultural Research/Assosa Research Center, Assosa, Ethiopia:*
[2]*School of Agricultural Economics and Agribusiness, Haramaya University, Dire Dawa, Ethiopia*
Corresponding author: ma8280@gmail.com

Received: July 24, 2014 Accepted: September 30, 2015

Abstract: *Ethiopia has the potential to increase rice production and productivity, though the present availability of quality seeds falls well below present demand due to many constraints associated with seed production, marketing and delivery system. Consequently, the study has focused to assess the major constraints and opportunities of seed production and marketing for improved rice varieties. For this study purpose, 151 households were randomly drawn from three randomly selected Kebeles in probability proportional to size method in Fogera district of Ethiopia. The research results revealed that rice production is constrained by seed production and marketing bottle-necks; these includes, serious problems in accessing seed and fertilizer at planting time, lack of seed credit access and fair price of fertilizer, poor delivery systems of inputs, lack of access to farmers club and fair seed price. However, willingness of the households to adopt new rice varieties, training about the new varieties and fair grain prices were among the opportunities to the households. Therefore, to solve these problems, decision makers should pursue policies and investments to boost agricultural production and productivity, particularly with respect to the food staple crops like rice that are critical in reducing poverty. Hence, access and availability to improved production technologies orchestrate through production, marketing and delivery of improved seeds.*

Keywords: Rice seed production, Seed marketing, Constraints, Opportunities

1. Introduction

In the world, the largest volume of rice production is concentrated in countries China, India, Indonesia, Vietnam, Thailand, Bangladesh, Burma, Philippines, Brazil and Japan. The percentage share of the above top ten rice producing countries accounts for about 32.9 ,24.4, 11.0, 7.0, 6.0, 5.4, 5.3 2.9 and 1.8 % of the world production respectively. Ethiopia is 73rd in the world ranking with almost 0.0% (FAO, 2013).

Global rice consumption is expected to exceed rice production in 2016-17 and remain so in the next few years. In its projections for next five years up to 2018-19, the IGC says that global rice production is expected to continue rising over the projection period, but it is likely to be at a decreasing rate. Rice production growth in the period 2014-15 to 2018-15 is projected at 0.8%, lower than the demand growth projected at 1% in the same period. Global rice production is expected to grow to around 488 million tons in 2016-17. In 2017-18, estimated consumption of around 494 million tons is about 2 million tons more than the estimated production of around 492 million tons, while rice consumption of around 498 million tons in 2018-19 is about 3 million tons more than estimated global production of around 495 million tons. The slow growth rate in global rice production is attributed to an expected decline in rice production in China, the world's largest producer and consumer of rice (IGC, 2014).

Rice is an important staple food crop in Africa with a growing demand that poses an economic challenge for the African continent. Annual rice production in Sub-Saharan Africa (SSA) is estimated at 14.5 million metric tonnes (MT), comprising 15 percent of the region's cereal production. Most of this rice is produced by smallholder farmers. In contrast, Africa's rice consumption is about 21 million MT creating a deficit of about 6.5 million MT per year valued at US$ 1.7 billion that is imported annually. Overall, imported rice accounts for roughly 40 percent of Sub-Saharan Africa local rice consumption (AATF, 2013). This indicates that the region needs to

increase production and productivity to fill the gap of demand and supply created in rice consumption.

The Food and Agriculture Organization of the United Nations (FAO, 2013 sited by Nitrogen-Use Efficient, Water-Use Efficient and Salt-Tolerant Rice Project), forecasts that the world's largest proportionate increase in rice consumption over the next 10 years will occur in Africa. The insufficient rice production affects the well-being of over 20 million smallholder farmers who depend upon rice as their main food. SSA countries are spending more than US$ 1.7 billion annually on rice imports. The rice production deficit along with the subsequent large outflow of foreign exchange presents a great development challenge to governments and development agencies in SSA. More than half of the rice consumed in SSA today is imported mainly due to very low yields being experienced by farmers. The average grain yield in Africa (2.2 t/ha) is below the world average (3.4 t/ha) by 49 percent[1]. This further imply that though there is a huge potential to cultivate rice in Africa, improving the productivity level due to the fact that by using, delivering improved varieties and production techniques would enhance and fill the productivity difference of Rice in Sub-Saharan countries and the world. According to the FAOSTAT data, rice production in Ethiopia showed a tremendous increase in production that is from 10,000 metric tons to 121,000 metric tons. Though there is no data on the rice import, Ethiopia imports, 17.412, 30, 44.41 and 22.4 metric tons of rice starting from 2005 up to 2008, respectively. The import level decreased from 44.41 to 22.40 metric tons in 2007 and 2008 respectively. This may be because of the increase in rice production from 11.244 to 71.4 metric tons.

Rice is a new crop for the country. Before seven years, there has not been any large-scale commercial rice farm (Esayas Kebede, 2011). The author further stated that, currently the development in commercial rice farming is encouraging. The Federal government administers 3.6 million hectares of land in Gambella, Benishangul Gumuz, Oromiya, and SNNP regions. Out of these, around 398,000 hectare of land has been transferred to local and foreign investors. From the total land transferred to investors, the share of rice farms is around 83,000 hectares, which about 21% of the commercial investment land.

Among the target commodities which have received due attention in promotion of agricultural production, rice is the one considered as the "millennium crop" expected to contribute to ensuring food security in the country. Accordingly, Ethiopian Institute of Agricultural Research (EIAR) has treated it as one of nationally coordinated research projects. As the crop is a recent introduction in the country, its research status is at infant stage. Almost all research activities are concentrated on variety development and there are only a few research activities on crop management, while the other research disciplines are yet hardly touched (Sewagegne, 2011).

So far, 20 improved rice varieties have been officially released officially for large-scale production. Of these, seven are upland New Rice for Africa (NERICA) rice varieties including NERICA-4 and NERICA-3 released for rain-fed upland ecosystem and NERICA-1, NERICA-2, NERICA-6, NERICA14 and NERICA-15 released for upland -irrigated ecosystem. NERICA rice varieties have been developed by Africa Rice (the ex-WARDA) scientists, and they are expanding and bringing the rice green revolution in different countries of Africa. Out of the remaining 13 released varieties, four varieties are irrigated, two varieties are lowland rain-fed, and seven varieties are upland rain-fed types. Moreover, Farmers have also given due attention not only for rice production but also for variety development as they have developed two varieties (one upland and one lowland rain-fed types) through selection. The two farmer-selected varieties (Demwoze and Nechu Ruz) have been produced widely in Fogera area (rain-fed lowland) of the Amhara Region and in Guraferda area (upland) of the Southern Nations, Nationalities, and Peoples Region (Sewagegne, 2011).

Therefore, to widely promote, disseminate and scale-up so far released improved varieties to smallholder farmer`s seed systems takes the lion share. However,

[1] Nitrogen-Use Efficient, Water-Use Efficient and Salt-Tolerant Rice Project. pp2.

seed systems and markets are subject to many constraints, of which mainly associated with failures that complicate early stages of seed market development. These constraints are contestable property rights relating to the improvement of cultivated varieties (cultivars); absent institutions in the market for improved cultivars; and information asymmetries in the exchange of seed between buyers and sellers (Gisselquist and Meer 2001; Hassan *et al.* 2001; Morris, 1998; Tripp and Louwaars, 1997).

Furthermore, rice seed systems in Africa in general and West Africa in particular faces both an opportunity and challenges. Among the sub-regional opportunities mentioned are initiatives to intensify cereal production, emergence of new better qualified stakeholders in the seed sector, availability of promising varieties (e.g. NERICA varieties), and establishment of new seed policies to account seed harmonization and legislation), However, lack of establishing a dynamic and profitable seed system, lack of stakeholders capacity in different segments of the seed sector, lack of linkage to ensure joint planning of supply and demand, lack of producers access to credit and quality seed and timely provision of performing varieties are among the challenges (Omar, 2010).

In Ethiopia, progress in developing the seed system has already been made, and can be built on, including further development of improved varieties, increased farmer knowledge about input potential, and a clear policy direction that involves all stakeholders. Increasing quality and usage of improved seed (along with other best practices such as irrigation, fertilizer adoption, and mechanization) has the potential to dramatically increase Ethiopia's annual crop production. This implies that creating a vibrant seed sector through enhanced access and availability of seed has the potential to greatly improve smallholder productivity; there is currently a substantial gap between the country's production of commercial seeds and farmers' demand, knowledge, access and usage of these seeds. A series of constraints span both the hybrid maize and Self Pollinating seed systems (Dawit, *et al*., 2008).

Generally, the seed systems in Ethiopia are considered inefficient and inadequate. Hence, infrastructure, delivery system and vague estimates of the actual demand for improved seed amongst smallholder farmers, barriers to seed dissemination result because of a number of socio--economic constraints, like price and price variability, preferences and practices (Dawit *et al*., 2008).

As a result, this research paper tried to identify challenges and opportunities in rice seed production and marketing in Fogera, which is the potential rice growing area in Ethiopia. Generally, production, marketing and biological constraints, challenges and opportunities of rice seed system were analysed to improve the seed marketing system of rice at households and institutional levels are identified to address the stated objective of the study.

Results of the study would help the development planners and policy makers in preparing the rice production and supply plan as an alternative strategy for food security problem for the study area, taking into consideration the local factors. Hence, these information will be necessary when designing and improving farm input policy, modelling seed distribution systems and crafting strategies to improve adoption and reduce poverty in rural areas.

2. Materials and Methods

2.1. Description of the study area

Based on the CSA (2008), Amhara Region has a population of 17.2 million of which about 8.6 million were men and 8.5 million were women. Urban inhabitants were 2.1 million or 12.3% of the total population. With an estimated area of 0.16 million square kilometres, this region has an estimated population density of 108.15 people per square kilometre. For the entire region about 4 million households were counted. This results to an average of 4.3 persons per household. The average family size in urban and rural area is 3.3 and 4.5 persons, respectively.

Fogera Wereda is one of the 106 Woredas of the Amhara Regional State and found in South Gondar Zone. It is situated at 11^{0} 58 N latitude and 37^{0} 41 E longitude. Woreta is the capital of the Woreda and is found 625 km from Addis Ababa and 55 km from the Regional capital, Bahir Dar. The woreda is bordered

by LiboKemkem Woreda in the North, Dera Woreda in the South, Lake Tana in the West and Farta Woreda in the East. The Woreda is divided into 29 rural kebeles and 5 urban Kebeles (RDBOA, 2007/8).

The total land area of the Woreda is 117,414 ha. The current land use pattern includes 44 percent cultivated land, 24 percent pasture land, 20 percent water bodies and the rest for others. The total population of the Woreda is 251,714. The rural population is estimated at 220,421. The proportion of male and female population is almost similar in both rural and urban areas. The number of agricultural households is 44,168.

The mean annual rainfall is 1216.3 mm, with Belg and Meher cropping seasons. Its altitude ranges from 1774 up to 2410 masl allowing a favourable opportunity for wider crop production and better livestock rearing (IPMS, 2005). Most of the farm land was allocated for annual crops where cereals covered 51,472 hectares; pulses cover 9819.98 hectares; oil seeds 6137 hectares; root crops 1034.29 hectares; and vegetables 882.08 hectares (CSA, 2003). The major crops include *teff*, maize, finger millet and rice, in order of area coverage. According to IPMS (2005), average land holding was about 1.4 ha with minimum and maximum of 0.5 and 3.0 ha, respectively.

2.2. Method of Data Collection and Analysis

2.2.1. Method of data collection

The data for this study were collected from primary sources and from different secondary sources. Primary data were collected from samples of the respondents. The data was collected through a questionnaire survey on input usage, credit facilities, and agricultural extension service, marketing information, and institutional support activities and used to analyze production and marketing support services in improved rice seed production and marketing. Samples of respondents that cultivate both upland and lowland rice varieties were selected randomly proportional to their population size. The sample frame of the study is the list of households obtained in the Fogera Woreda of agricultural office. Hence, out of 29 rural KAs with population size of 44, 168 only 15 KAs and with population size of 12,162 cultivate both upland and lowland varieties. Three KAs were selected randomly in order to get adequate information about the subject matter. Finally 151 (see appendix 1) households were selected using probability proportional to size from each Kebeles. Appendix 1 shows clearly the population size of each Kebele Administration with respect to rice grower households in each Kebele using the following formula.

$$n = \frac{N}{1+N(e^2)}; \quad (1)$$

Where

n = sample size to be computed
N = total households in the study area
e = level of precision

Before selecting households to be surveyed, rice growers were identified in collaboration with the aforementioned stakeholders.

2.2.2. Method of data analysis

The collected data from the sample respondents were analyzed using appropriate software for analysis purpose. The challenges and opportunities of rice seed production and marketing were identified. The descriptive analysis made use of tools such as mean, percentages, standard deviation and frequency. Econometric analysis was used to identify the major constraints and opportunities of rice seed production and marketing. The statistical significance of the variables was tested using chi-square (χ^2) to make inferences. To analyze the challenges and opportunities of rice seed production and marketing, we employed chi-square (χ^2) and t-test in the analysis because most of the variables are limited dependent variables (dummy) and OLS and other econometric models are difficult to use for analysis and inferential purposes.

3. Results and Discussion

3.1. Rice Production Characteristics

3.1.1. Land holding and allocation pattern

The study indicated (Table 1) that the average size of land held by the households is 1.58 with standard deviation of 0.58. The maximum is 3 hectares while the minimum is 0.5 hectares. The average size of own land held by the household is 1.27 with standard

deviation of 0.55. The maximum is 3 hectares and the minimum is 0 hectares. The average area of cultivated own land is about 1.1 hectares maximum of 2.5 hectare and minimum of 0.0 with standard deviation of 0.46. Moreover, the average size of shared in cultivated land is 0.18 hectares with standard deviation of 0.25. The maximum is 1.0 hectare and the minimum is 0.00. Thus, this shows that the households in the area allocate more land for rice cultivation.

Table 1 Average land holding and allocation patterns for the households (in ha)

Description	N	Minimum	Maximum	Mean	Std. Dev.
Total land holding size	151	0.50	3.00	1.58	0.58
Own land	151	0.00	3.00	1.27	0.55
Cultivated own land	151	0.00	2.50	1.09	0.46
Rented out own land	151	0.00	0.50	0.013	0.07
Shared out own land	151	0.00	0.25	0.002	0.02
Rented in total land	151	0.00	1.75	0.08	0.24
Rented in cultivated land	151	0.00	1.75	0.09	0.25
Fallow own land	151	0.00	0.75	0.17	0.17
Rented in fallow land	151	0.00	0.75	0.02	0.08
Shared in cultivated land	151	0.00	1.00	0.18	0.25

The survey results showed that the households' possession of cultivable land ranged from the smallest 0.5 ha to the highest 3 ha (See Table (1)). The average size of cultivable land owned by the sample respondents was about 1.58 ha. Non-adopter households owned on the average 1.39 ha of land and the corresponding figure for the adopters was 1.84 ha. The mean difference of total land holdings for the two groups was significant at 1 % significance level (Table 2). This means, adoption tends to increase as farm size increases. This is probably because farmers perceive improved rice technologies cultivation practices take proportionally more land to avert risk of cultivating the rice new cultivars. Hence, on small land holdings the farmers allocate more land for their variety other than the new varieties.

The mean land cultivated by the households was 1.09 ha. The mean area under cultivation for non-adopters and adopters was 0.94 ha and 1.29 ha respectively. The adoption status and cultivated land of the respondents was significant at less than 1 % of probability level (Table 2). Moreover, the mean area allocated for rice for non-adopters and adopters was found to be 0.81 ha and 1.13 ha of land respectively. The difference in area allocation for rice in the cropping season was significant at less than 1% statistical level of significance for the groups (Table 2). This implies that households that allocate land for rice adopt new varieties to increase production and productivity.

Table 2 Farm assets ownership of sampled households in 2013

Characteristic	Non-Adopters	Adopters	Total	Difference	t-test
Total land holdings of the HHs	1.39	1.84	1.58	-0.45	-5.147***
Area under cultivation	0.94	1.29	1.09	0.35	-4.952***
Total Land allocated for rice	0.81	1.13	0.95	-0.31	-4.229***

***, ** and *statistically significant at 1%, 5% and 10 % respectively

3.1.2. Supply of rice to the Market

As indicated in Table 3, the minimum area of land allocated for rice in the production year was o.25 ha. (Table 3), shows that the minimum amount of rice produced by a household is 4.0 quintal. This gives per hectare productivity of 5.20 tons of rice is produced per hectare of land. However, this figure deviates more from the average productivity of rice for the District for the production year, which was 4.58 tones ha^{-1}. This result was consistent with Tilahun *et al.,* (2012), a survey done on rice value chain at Fogera district of Ethiopia. This variation of productivity is attributed to input usage differences mainly improved seeds and fertilizers. Moreover, incidence of flood was reported during the survey.

Table 3 Rice produced and sold (in Qt) by households in 2013

Description	Minimum	Maximum	Mean	Std. Dev.	Percent supplied to market
Production of rice in quintal per household	4.00	100.00	43.10	21.25	
Rice supplied to market in quintal per household	0.0	60.00	20.56	16.07	48.39

The survey indicated that 48.39 percent of rice produced by farmers in 2013 was supplied to market. As indicated on the table below, about 14.2 percent of it was consumed and 9.21 percent was retained for home consumption. About 2.45, 1.45 and 1.17 was used payment in kind for land, labor and seed respectively. The average production of rice per household was 45.80 quintal with standard deviation of 21.25. The maximum production per household was 100.0 quintal and the minimum was 4.0 quintal. The average amount of rice supplied to market per household was 20.56 quintal with standard deviation of 16.07. This implies that there is a variation on the utilization of rice among the households for home consumption and supply to the market i.e. the maximum amount of rice supplied by farm households was 60 quintal and some of the households produce rice for home consumption purpose only.

Table 4 Households rice production and utilization in 2013 (in Qt)

Description	N	Minimum	Maximum	Mean	Std. Dev.	Proportion
Rice produced in 2013	151	4.00	100.0	43.10	21.25	48.39
Rice sales	151	0.00	60.0	20.56	16.07	23.08
In-kind payments for land	151	0.00	30.0	2.18	5.13	2.45
In kind payments for labor	151	0.00	18.0	1.29	2.82	1.45
Stored for seed	151	0.25	2.10	1.04	0.51	1.17
Rice consumed	151	1.25	33.0	12.69	6.91	14.25
Available stock for consumption	151	0.50	32.00	8.20	6.47	9.21

3.2. Major Rice Seed Production and Marketing Constraints

There are a number of rice seed production, marketing and delivery constraints and opportunities. Those, which are considered as major ones, are discussed below.

3.2.1. Production constraints

Irrespective of the availability of favorable climatic condition that allow rice/ rice seed production, in Fogera District, out of the randomly selected households, only 65 (43.05 %) were improved rice users. This is due to different bottle necks which are related to technical inputs, shortage of capital, lack of sound extension services and other related problems. Each of the problems is discussed in detail below.

Technical inputs

Improved seeds availability: Recently, there are more than six rice seed varieties released for Fogera areas namely, NERICA-4, NERICA-3, SUPPERICA, TANA- , EDGET and GUMARA and X-Jigna (which is used for more than 4 decades). According to the survey results, Edget is relatively widely used type of improved rice seed followed by NERICA-4 and Gumara. Though the availability of rice varieties released to the area, about 114 (77.47 %) of the sampled households responded that there is no adequate improved rice seeds both in time and quantity (see Table 5). In line with this, availability of rice seed is significantly related with adoption of improved rice seeds at 5 % probability. Thus, it indicates that adequate availability of improved rice seed will enable farmers use improved varieties. Therefore, development endeavors needs to supplement with rice inputs supply and delivery systems both spatially and temporally.

Quality of improved rice seeds: To increase production and productivity and to enhance local seed business certified seed availability is basic and paramount. Seed quality problem occurred more probably with lack of seed multiplication site, availability of experts like seed technologist, seed mixture, and other capital problems. Due to those reasons, almost all the households (95.63 %) responded that lack of quality of improved rice seed is a problem. Table 5 shows that there is a statistically significant relationship between seed quality and adoption at less than 1 % probability level showing that seed quality is an important variable to participate in adoption of improved rice varieties. This implies that delivering quality seed will enable farmers in sustainably using improved rice seeds.

Fertilizer: However, soil sample analysis has not been done due to financial constraints of the researcher. Because perceptions are often difficult and result in varied outcomes as it depends on various factors such as knowledge, experience, etc...; as suggested by the reviewers of the paper. However, we suggest soil scientists to proof or disproof the farmers' perception using soil sample analysis and its results. The survey result showed that fertilizer is not commonly used for rice production in the district.

However, due to yield reductions of their respective plot, farmers are starting application of fertilizer in recent years. As a result, about 83.44 percent of them mentioned unavailability of fertilizer as one of their problems. According to Table 5, fertilizer availably is significantly related to use of improved rice seeds at 5% significance level. This implies that to cultivate improved varieties, availability of fertilizer on time is crucial and contributes to use of improved varieties.

Table 5 Rice seed and grain production, marketing, processing and biological constraints

Type of Constraint	Adoption Status				Total		$\chi 2$
	Non-adopters		Adopters				
Production constraints	Yes	No	Yes	No	Yes	No	
Lack of rice seed availability	61	25	56	9	117	34	4.92**
Lack of rice seed credit availability	61	25	55	10	116	35	3.89**
Lack of fertilizers availability	67	19	59	6	126	25	4.43**
Lack of fair price of fertilizers	60	26	59	6	126	25	9.78***
Lack of fertilizers credit availability	68	18	49	16	117	34	0.2882
Marketing constraints							
Lack of fair price of improved seeds	57	29	62	3	119	32	18.78***
Lack of improved seed market information	80	6	64	1	144	7	2.47
Cooperative membership	24	62	43	22	67	84	21.94***
Access of training about improved rice seeds	3	83	60	5	67	84	120.1***
Processing Problems							
Lack of Miller Machine	84	2	63	2	147	4	0.08
Biological Challenges							
Flooding	45	41	20	45	65	86	7.02***
Insect and pests	54	32	18	47	71	79	17.75**
Disease problem	60	26	20	45	80	71	22.60***
Perceptions of soil fertility problems	68	18	61	4	129	122	6.49**

Source: survey results, 2014

***, ** and *statistically significant at 1%, 5% and 10 % respectively

In addition to the above statement, price of fertilizer is the major constraint to the households and about 83.44 % were responded price of fertilizer is high. From Table 5, price of fertilizer is strongly related to adoption of improved rice seeds at 1 % level of probability. It implies that, fair price of fertilizer will contribute to cultivate improved varieties both adequately and timely to individual smallholder farmers. Furthermore, about 77.48 % of the sampled households respond lack of availability of credit to fertilizer is also a major constraint.

Capital: Like unavailability of credit on fertilizer, unavailability of credit on seed was also mentioned by 76.82 percent of the respondents. Availability of capital to the smallholder farmers is a key problem in the study area. As shown in Table 5, capital availability to purchase seed is statistically significant at 5 % probability level with adoption status. It implies that availability credit to seed contributes to participate in improved rice cultivation.

According to Table 6, 42.86 % of the households were not responded for the reason for not accessing credit for seeds. However, 18.49 percent of the respondents were mentioned borrowing is risky.

Lack of credit associations and high cost of capital (interest rate) was mentioned by 13.45 and 12.61 percent of the respondents respectively.

Table 6 Reason for not accessing credit for seed

Reasons	Frequency	Percentage
Too much paper work	8	6.72
No credit associations available	16	13.45
Borrowing is risky	22	18.49
interest is high	15	12.61
Expected to be rejected	7	5.88
Not voluntary to respond	51	42.86
Totals	119	100.00

3.2.2. Marketing constraints

In addition to production constraints, rice seed marketing is constrained by different factors. The most prominent ones are the following:

Price of Improved seed: According to the survey results, households in the study area considered that the price of improved rice varieties is expensive. However, the grain and seed price in the study area is almost the same. The farmers assumed that as the cost of their own seed is zero, they are not willing to buy seed from the seed suppliers and prefer to use their own rice seeds. Consequently, about 119 (78.80 %) of the surveyed households responded price of improved rice varieties is a major problem. Table 5 shows that seed price is significantly related to adoption status at 1 % probability level. This indicates that policies that subsidize the input side will enable to enhance technology participation. Alternatively, engaging participant farmers in local seed business by creating linkage with consumers of rice seeds can encourage farmers in accepting and disseminating improved seeds.

Lack of market information: The study results revealed that there are underdeveloped market information and lack of knowledge/understanding on the incentive for improving productive capacity and quality of the households. About 95.36 percent of the households responded that market information is a constraint and the remaining did not.

Cooperative membership: It is obvious that different cooperatives/ farmers participate in developmental activities by delivering inputs like fertilizer, seeds, plant protection chemicals, and other related services. As a result, farmers' club membership and / or availability of cooperatives in the nearest locality may enable farmers to those agricultural inputs. Moreover, farmers would have bargaining power in input and output marketing due to the information and service delivered by the cooperatives. During focus group discussions, the smallholders pointed out that, they trust cooperatives/farmer groups than any other traders in the locality.

Table 6 also indicates that about 55.63 percent of the respondents are members of farmers club. Further, the table shows that farmers' club membership and adoption are statistically significant at 1 % probability level. It implies that, access and or participation to such institutions will enable farmers to get services and improved seed distribution scheme.

Lack of market linkage or liaison service: Seed quality is very important in production activities and maximum care is needed to seed qualities. Part of this, adequate knowledge on production, packaging, transportation, storing and marketing of seeds is crucial. According to focus group discussion with farmers, the farmers pointed out that linkage between different stakeholders in the seed production, marketing and delivery system is very weak.

About 55.63 % of the respondents reported that they never attend any training on improved practices of rice before and after 2013, while 44.37 % of the respondents were attending /ed training on improved management related to rice and about 95.24 % of the households that got training were adopters.

According to the statistical test table below, training on any improved practices of rice and adoption status were highly related and significant at 1 % probability level. Thus, implies that capacity building on farmers training centre, contact with DAs, and Woreda experts will contribute to the use of improved technologies by gaining knowledge and skills among farmers and experts.

In line with the above statement, during the focus group discussion the farmers explained that extension agents, Woreda experts and sometimes researchers give some service on production aspects, but the farmers carry out marketing of agricultural products without significant support from any institutions. The farmers and dealers reported that they want a supporting institution for liaising (linking) them with useful organizations for selling rice seed produce

Table 7 Means of accessing market information

Source of Information	Frequency	Percent	Valid Percent	Cumulative Percent
Not sold	6	3.97	3.97	3.97
Observation	60	39.74	39.74	43.71
Discussion	62	41.06	41.06	84.77
Telephone	23	15.23	15.23	100.00
Total	151	100.00	100.00	

According to the survey results, lack of marketing linkage was one of the constraints and about 41.06 percent of the households' access market information through informal discussion with their peer groups followed by personal observation and telephone, which accounts 39.74 and 15.23 percent respectively. Consequently, the grain and improved rice seed price is equal in the study area. During the focus group discussion, the farmers and dealers mentioned that there were no incentives to seed growers except some technical feedbacks from experts on production aspect only.

3.2.3. Processing problems

Lack of milling machine: Though availability of milling machines seems to have no relationship with seeds, it is important that availability of miller contribute to use improved rice varieties by selling their paddy rice through value addition. Table 5, shows that almost all (97.35 %) of the sampled households faced lack of miller in their locality.

3.2.4. Biological challenges

Flooding: Fogera area is known as swampy area, which is very comfortable especially for lowland rice varieties. However, due to high rainfall amount in the area, flooding is the major natural hazard for 43.05 % of the respondents and it is not a problem for the remaining 56.95 %. According to focus group discussion, the farmers explained that flooding is a problem especially at seedling age of crop. Table 5 above shows that flooding is strongly related to the use of rice varieties at 1 % significance level. Thus, it implies that working on strong stock rice cultivars and /or flood break will assist to enhance improved rice cultivations in the study area.

Insect and Pests: Like other commodities, rice production is constrained by many environmental factors like insects and pests. The common types of insects and pests in rice include stalked eyed flies, termite, stem borers, stick bug, rice mealy bug, and weevil. About 47.01 % of the households responded that insect and pests are the major biological challenges in the area. Table 14 also shows that pest infestation is highly related with adoption of improved varieties. This further implies thatstrengthen pest management activities will contribute for better seed production.

Diseases: The common diseases in rice includes rice blast, rice yellow mottle virus, brown spot, sheath blight, leaf scaled, and grain root. According to the household survey result, about 52.93 % of the households respond that disease is a major problem. The statistical test table below indicates that, disease is strongly related with adoption status at 1 % significance level. Thus, implies that disease resistance and tolerance contributes to households to adopt the cultivars.

Fertility Status: Soil fertility is a key factor for rice cultivation. According to the survey results, soil fertility is recently a major problem for the households. About 85.43 % of the households reported that soil fertility is the main problem. The table below shows that, fertility is significantly related with adoption status at 5 % probability level. Thus, it implies that practices that enhance soil fertility will contribute for the use of improved technologies.

Generally, we have tried to identify the challenges in the production system as described above. However, this research is limited to identification of challenges and their degree of association between production and marketing challenges. Therefore, we suggest that other researchers could work on the identified problems to what extent could the identified problems affect production and marketing of rice.

3.3. Opportunities for Rice Seed Production and Marketing

Reasonable grain prices: The ultimate goal of innovation in agriculture especially in developing countries is to achieve food security and then profitability by implementing the new practices at the ground. It is therefore, using agricultural inputs like seed under normal condition will enable farmers to enhance production and productivity. As a result, production is valued by the market price of the commodity under investigation. This indicates that grain price directly or indirectly affects the use of improved technologies. For instance, the current grain price will affect next year farmers' production decisions.

Table 8 below, indicates that about 80.79 % of the households, respond that the market price of rice is fair relative to the past years. During the survey, the researcher discussed with farmers to have some insight on the historical trends of rice seed production and marketing. The farmers generally reported that grain and seed price is equal though the price varies from time to time. As a result, almost all the farmers sell rice to the market for grain traders. The seed producers are also expected premium price to produce seed otherwise. Since the grain and seed price are equal, this discourages farmers to produce quality rice seed. Moreover, rice grain and seed production was not profitable at the study area before 2010 as per the focus group discussions with smallholder farmers.

However, they reported that in 2010/11, with introduction of improved rice, seed price increased from 5 to 12 Birr/kg during the cropping season. Consequently, even the rice grain price is currently about Birr 10.31 kg^{-1} on average. To inquiry into this matter, the researcher analyzed gross profitability for the 2013 production year at smallholder farmer's level.

During the focus group discussion the farmers reported that, upland rice varieties (like NERICA-4) are now days become popular in the area and the price of rice seed/ grain is almost nearest to teff, irrespective of their yield differences. From the same table of test of statistical significance, fair grain price is highly related to cultivation of rice varieties at 1 % probability level. This implies that availability of fair market price will enable the farmers to be profitable by engaging in cultivating improved rice cultivars.

Cultivable Land Availability: The average land holding size of the surveyed households of Fogera area is twice than that of national average land holding size. Hence, this opportunity will enable farmers to produce improved rice seeds and distribute to another areas. Moreover, Fogera district is swampy area that makes it conducive environment for both upland and lowland rice varieties.

Table 8 Rice seed production opportunities

Variables	Adoption Status				Total		$\chi 2$
	Non-adopters		Adopters				
	Yes	No	Yes	No	Yes	No	
Availability of reasonable grain prices	60	26	62	3	122	29	15.66***
Willingness to get training and adopt new rice varieties	63	23	60	5	122	29	8.90 ***

***, ** and *statistically significant at 1%, 5% and 10 % respectively

Availability of comfortable agro-ecology to cultivate rice - Fogera District is well known for its favorable agro ecology for rice cultivation in Ethiopia. That is why the national rice research training center of Excellency is Fogera National Rice Research Center. However, the potential has not yet been utilized due to production as well as marketing constraints.

Interest in and willingness to plant improved rice varieties- Willingness of the smallholder farmers to be trained on management practices of improved rice varieties, input market information and output market is important in the agricultural inputs production and delivery system. About 80.79 % of the sampled households were willing to participate in capacity building on new varieties, input and output markets. Table 7 indicates that there is high and strong relation in willingness to get training on improved rice seeds, input and output markets. Thus, it implies that increasing support for smallholders will enable in achieving plan for modern agriculture.

High Population: Since rice is one of the staple food crops both in Ethiopia and Sub-Saharan Africa, increase in the population in regional and country level assures presence of sustainable demand for rice products.

4. Conclusions and Recommendations

The production constraints are related to technical inputs; including improved seeds availability, quality of improved varieties, fertilizer availability and fertilizer price availability, capital; (including credit availability to buy fertilizer and improved rice seeds). In addition to production constraints, rice seed marketing is constrained by different factors. The most prominent ones include price of improved seed, lack of market information, farmers group (cooperatives) and lack of market linkage or liaison service. The major processing constraint is also lack of availability milling machine in the locality. Fogera area is known as swampy area, which is very comfortable for both upland and lowland rice varieties. However, it is obvious that agriculture is under the gamble of nature. As a result, environmental factors' including flooding, insects and pests, diseases, and soil fertility problems affect rice production according to the survey results collected from sampled households.

Given the current potential and demand in production, marketing and consumption of rice, both at domestic and foreign markets, improving the production and marketing of rice through adoption of improved varieties is needed. Based on the results of the study, the following recommendations are drawn:

- To increase production and productivity and to enhance local seed business, certified seed availability is basic and crucial. An intervention is needed in areas of outsourcing information on rice seed production: quality management and marketing to improved quality seed delivery scheme. Moreover, sourcing information and knowledge in areas of disease control, insect and pest management, soil and water management and watershed management enables to minimize the risk of environmental factors.
- Agricultural inputs like seeds and fertilizer needs to be delivered both spatially and temporally so as to produce quality seeds and the market actors in the seed system. In line with this, credit access facility and setting fair price of fertilizer will contribute

to produce healthy rice seeds and to deliver timely to individual smallholder farmers.

- Cooperative institutions should be strengthened to enhance the bargaining power of households in input and output marketing due to the information and service delivery system. As a result, access and participation to such institutions will enable farmers to get services and improved seed distribution scheme. Moreover, cooperatives must be empowered both in capital and material like storage, and transportation.
- Training on improved practices of rice on producing, packaging, transporting, storing and marketing of seeds is very important in improving knowledge and skills of the rice seed market actors. Therefore, linkage and synergy with stakeholders in seed production, marketing and consumption must be established. This could be achieved by creating linkage and capacitating building on farmers training centre, contact with DAs, and Woreda experts, traders and cooperatives.
- Entrepreneurial training and advice should be given to smallholder farmers on rice seed and grain agribusiness to take the advantage and add value at farmers' level. This can be achieved through establishing rice processing plant at the nearest area or linkage should be created to processors at the country level to milk the advantage of fair grain prices.

References

African Agricultural Technology Foundation, 2013. Nitrogen use efficient, water use efficient and salt tolerant rice project.

BFED, 2002. *Annual Statistical Bulletin*. Amhara National Regional State, Bahir Dar.

CSA, 2008. Agricultural Sample Survey 2007/2008: Volume I - Report on Area and Production Crops (Private Peasant Holdings, Meher Season). Statistical Bulletin 417. Addis Ababa: June 2008.

CSA, 2009. Annual Agricultural Sample Survey.

Esayas Kebede, 2011. Trends and challenges on Rice investment in Ethiopia. Challenges and Opportunities of Rice In Ethiopian Agricultural development. Empowering Farmers Innovation. Series No. 2. EIAR/FRG II, Addis Ababa, Ethiopia.

FAO, 2013. Rice Market Monitor. Food and Agriculture Organization of the United Nations.Volume XVI-Issue No. 1.

Gisselquist, D., and C. Van Der Meer. 2001. Regulations for Seed and Fertilizer Markets: A Good Practice Guide for Policy Makers. Rural Development Working Paper 22817. Washington, D.C. World Bank.

Hassan, R.M., M. Mekuria, and W.Mwangi. 2001. Maize Breeding Research in Eastern and Southern Africa: Current Status and Impacts of Past Investments Made by the Publicand Private Sectors 1966–97. Mexico, D.F.: CIMMYT.

International Grains Council, 2014. Global rice production and consumption January, 30. http://oryza.com/news/rice-news/global-rice-consumption-exceed-production-2016-17-igc-says#sthash.JAKOQHha.dpuf

IPMS. 2005. Fogera Pilot Learning Woreda diagnosis and program design.

IPMS. 2010. Fogera Pilot Learning Woreda progress report for the period September 2009 to April 2010. (Unpublished).

Ministry of Agriculture and Rural Development. 2010. National Rice Research and Development Strategy of Ethiopia. The Federal Democratic Republic of Ethiopia, Ministry of Agriculture and Rural Development, Addis Ababa, Ethiopia. 48pp.

Morris, M.L., ed. 1998. Maize Seed Industries in Developing Countries. Boulder, CO: Lynne Rienner Publishers.

Sewagegne Tariku, 2011. An Overview of Rice Research in Ethiopia. Challenges and Opportunities of Rice in Ethiopian Agricultural Development. Empowering Farmers Innovation. Series No. 2. EIAR/FRG II, Addis Ababa, Ethiopia.

Seyfu Ketema, 1993. Breeding Genetic Resources Agronomy, Utilization and Role in Ethiopian Agriculture, IAR.

Tripp, R., and N. Louwaars. 1997. Seed regulation: Choices on the road to reform. Food Policy 22: 433–446.

Oumar Niangad, 2010. Varietal development and seed system in west Africa: Challenges and opportunities.Second Africa Rice Congress, Bamako, Mali, 22–26 March 2010: Innovation and Partnerships to Realize Africa's Rice Potential.

RDBOA, 2007/8. Rural Development Bureau of Agriculture, Fogera Woreda Report, 2007/8. (unpublished paper).