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THE IMPACT OF ACCESS TO INPUTS ON RICE YIELD OF FARMERS IN THE CENTRAL RIVER REGION OF THE GAMBIA

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ABSTRACT

This study on the impact of access to agricultural inputs on rice yield was conducted in the Central River Region of the Gambia. The objective is to determine the impact of inputs on rice yield and to suggest strategies to improve farmers' access to inputs. Semi-structured questionnaires were administered through a cross-sectional survey of 384 randomly sampled farmers cultivating rice in the tidal ecologies during the 2016 cropping season. Pearson correlation was used to check the relationship between each of the input accessed and certain socio-economic characteristics with rice yield. The results show that inputs such as chemical fertilizer, seeds and labour have a positive relationship with coefficient scores of 0.620, 0.402 and 0.378 at 5% significant level. On the other hand, with the exception of income which showed a strong association with yield (0.593), other socioeconomic characteristics such as age, household size and educational level of the farmers, all show very weak or negative relationships with coefficient scores of 0.105, -0.55 -0.113 respectively at 5% significant. These indicate that inputs have major impact on rice yield and therefore, it is recommended that farmers' access to agricultural inputs should be improved in order to increase rice yields. This can be done by developing the input sector, provision of input subsidy and giving affordable credit to farmers.

1. INTRODUCTION

1 Background of the Study

Rice scientifically referred to as *Oryza sativa* is a cereal crop consumed worldwide by most people around the globe than any other crop. In other words, it is the primary staple for more than half the world's population. The Food and Agricultural Organization of the United Nations (FAO) (2016) maintains that about 90% of the rice produced in any given year is consumed as food. Saka and Lawal (2009) described rice as the most important food depended upon by over 50 % of the World population for about 80 percent of their food need. Rice farming is the largest single use of land for food production, (Global Rice Science Partnership), (GRiSP, 2013; Pervez et al. 2019). The major

producers and consumers of rice are in the Asia-Pacific region. It accounts for more than 40% of the calorie consumption of most Asians. The largest producers are China and India with more than 90% of world production. Other producers in Asia include Bangladesh, Thailand, Vietnam and the Philippines (GRiSP, 2013). According to the Rice Market Monitor, FAO (2016) trade volume for rice was 44.7 million metric tonnes while annual production value was estimated at $150 billion.

In Africa, rice is a staple food in many countries. During the past years, rice has witnessed consistent increase in demand and its growing importance is evident in the strategic food security policies of many countries on the continent. The demand in most African countries generally exceeds production and large quantities of rice are imported to fill this gap. This contributes to high import cost of recipient nations worth millions of Dollars. According to GRiSP (2013), the production of rice in East and Southern Africa increased by 57% from 1.19 million tonnes in 2000 to more than 1.87 million tonnes in 2010. During this period, the average yield increased by 17.5% from 1.52 t/ha to 1.78 t/ha and the area of production increased by 37% from 782,000 ha to 1.047 million ha. In Burundi, Kenya, Mozambique, Rwanda, Tanzania, and Uganda, total rice consumption in 2010 reached more than 3 million tones or 19 kg/person/year. Rice imports amounted to 1.2 million per year in paddy equivalent, or more than 40% of all rice consumed in the region.

In West Africa however, rice is said to be much more in deficit even though it is equally a very important staple. According to United State Department of Agriculture, (USDA) (2012), in three decades the crop has emerged as the most consumed cereal in the region (15.7 million tonnes), before millet (15.5 million tonnes), corn (15.2 million tonnes) and sorghum (11.1 million tonnes). Countries such as Senegal, Ghana, Benin and Côte d'Ivoire have a self-sufficiency rate lower than 40%. However, the self-sufficiency rate in Mali, Guinea, Nigeria, and Sierra Leone is higher than 60%. This supply deficit is covered by imports from the international market. The estimated import by the region is at around 7 and 8 million tonnes in 2011 and 2012, respectively. This represents about 20% of the world rice trade and nearly cost $3.5 to $4.0 billion. Nigeria, Senegal, Côte d'Ivoire, and Benin account for more than 50%t of the region's rice import International Food Policy Research Institute (IFPRI) (2014).

The establishment of the Africa Rice Centre (Africa Rice), formerly West Africa Rice Development Agency, (WARDA) in 1971 demonstrates the importance African countries attach to rice. This centre is the leading pan-African rice research organization committed to improving livelihoods in Africa through strong science and effective partnerships with twenty-six member countries covering West, Central, East and North African regions. The New Rice for Africa commonly known as (NERICA) was specifically developed by the scientists of Africa Rice to address the problem of low productivity of upland rice in Sub-Saharan Africa. This created a big opportunity for Africa's rice farmers (Appa, Awoyemi, & Babayemi, 2016).

In the Gambia to rice is the number one staple crop. However, like many African countries, the domestic rice supply continues to be outpaced by growing population demand. MOA (2013) data from National Agricultural Sample Survey shows that the national consumption requirement for milled rice was estimated at 219, 960 metric tonnes while the current total national production was 41, 822 metric tonnes, representing 19% of domestic production. This exposes a significant gap of 178 138 metric tonnes. That is 81% deficit which has to be imported from other countries usually from Asia to make up for the gap.

Notwithstanding, the government of The Gambia has not been resting on its laurels. The country in collaboration with the Africa Rice first introduced the NERICA in the Gambia in 1998. Since then,

giant strides have been made by the National Agricultural Research Institute (NARI) under the Ministry of Agriculture and non-governmental organizations in successfully spreading this upland variety across the entire country. At present, the NERICA varieties have spread across all agricultural regions of the country with fertilizer and irrigation schemes to support to farmers (Dibba, Fialor, Diagne, & Nimoh, 2012.)

Rice production in the Gambia is not without challenges. Although significant gains for the upland production has been made due to the introduction of the NEWRICA variety, efforts to provide improved varieties for the lowland has not been forthcoming. The rice sector continues to be affected by drought, poor soil fertility, environmental degradation, high production costs, low net returns as well as inadequate access to inputs by farmers such as improved seeds, fertilizer, pesticides and herbicides, labour and agricultural credit. This study was therefore undertaken to assess the impact of access to agricultural inputs by rice farmers.

Statement of the Research Problem

Each cropping season, rice farmers are faced with the daunting task of getting inputs at the right time and in the right quantities for rice production. Inadequate access to inputs such as improved seeds chemical fertilizer, pesticides and herbicides, credit and labour pose serious challenges to rice farmers in the Gambia. Despite the fact that several researchers have broadly addressed the factors influencing rice productivity ranging from ecology, type of variety, agronomic practices and input use, they have not adequately looked into the supply and demand of the agricultural inputs. Therefore, to the best of my knowledge, there has been no previous research on the nature of the agricultural input system, the factors affecting farmers' access to inputs and how these impacts the yield of rice farmers. This study attempts to fill this gap. This study determined the impact of access to agricultural inputs on rice yield was conducted in the Central River Region of the Gambia.

Significance of the Study

This work is important because it investigated the access to inputs and how this influences the rice yield of farmers in The Gambia. The knowledge and understanding of the key factors which affect the yield of rice farmers, the main staple of the country is of great importance for designing agricultural policies, strategies and programmes and their ultimate implementation on the food security agenda of the Gambia. If reliable empirical evidence on factors affecting input access and impact on yield unearthed, the study can provide a useful platform to evaluate the effectiveness of existing food security policies, programmes and strategies. Findings from the study will put rice farmers in the spotlight as key actors and highlight assistance they need to increase their production and productivity in the quest to enhance national food security for the population.

Scope of the Study

The study was conducted in the Central River Region, the main rice-growing zone in the Gambia. The research used survey data from semi-structured questionnaires administered to respondents based on 2016 cropping season. It was centred on farmers growing rice in the tidal ecologies of the study area. The research looked into the impact of access to inputs such as seeds, chemical fertilizer, pesticides and herbicides, labour, credit and extension services.

2. THE IMPACT OF INPUTS ON RICE YIELD

Agricultural inputs have a significant impact in enhancing efficiency of rice production. A historical reference to impact of inputs on rice production and productivity is the Green Revolution which began in the 1960s. Overall yield growth was majorly attributed to access by farmers to quality seeds and

chemical fertilizer. This period saw the development and release by the International Rice Research Institute (IRRI) of fertilizer responsive and high yielding variety of rice seed called IR8 (GRiSP, 2013). This variety impacted significantly on rice yield across the world as the seeds spread across rice farmers. Rice yields were increased between 6.0 and 10.0MT /ha with total volume of rice production increased 75% between 1965 and 1980 (GRiSP, 2013). This clearly demonstrates how quality seeds can impact positively on rice yield. Khush (2001) reported that during the period several genetic traits were selected to increase the yield stability and wide-scale adaptability of rice, maize and wheat varieties. These according to the scholar included the selection for higher yield potential, short maturity period, high grain quality resistance to pests and diseases and tolerance to stresses such as drought and flooding.

The development of fertilizer-responsive high-yielding varieties of rice and their widespread adoption by farmers resulted to a significant increase in rice yields across Asia and Latin America (GRiSP, 2013). The increase in yields, according to Evenson and Gollin (2003) was complemented by heavy use of chemical fertilizer and mechanization which the revolution aggressively promoted. FAO (2016) report on fertilizer use in sub-Saharan Africa, says that one-third of the increase in cereal production worldwide and half of the increase in Asia has been attributed to increased fertilizer consumption. Most of the gains took place in Asia, and to a degree in Latin America. Little has been accomplished in sub-Saharan Africa.

To this day, the major rice producers such as China, Vietnam, Japan, Philippines and Thailand are known for the adoption of improved rice seed varieties couple with intensive use of chemical fertilizer. Thus, average rice yield remains higher in Asia than any other continent. According to Baltzer and Hansen (2012), between 2002 and 2003, on average, sub-Saharan African farmers used 9 kg of fertilizers per hectare of arable land compared to 100 kg per hectare in South Asia, 135 kg per hectare in Southeast Asia and 73kg per hectare in Latin America. Consequently, while agricultural productivity in these regions remains high, they have generally remained low in Africa largely because of low level use of quality seeds and chemical fertilizer.

Recent exploits in the development of New Rice for Africa (NERICA) portray a similar story. The introduction of the NERICA has contributed to farmers' access to improved seeds for upland rice production and has also significantly increased farmers' productivity (Kimija, Otsuka & Sserenkuuma, 2008). Good seed varieties generally increase the yield of farmers due to qualities such as disease-resistant, early maturing, large grain size and high yielding potential. Awotide and Diagne (2012) in their study of the NERICA variety found that there is a positive relationship between the adoption of this variety of rice and increase in the productivity of farmers.

Agrochemicals such as pesticides, fungicides and herbicides play an important role in enhancing rice yield. Insect pest and other disease-causing agents attack the rice plants and cause significant damage leading to losses in yields. According to Gianessi, (2014) who conducted a case study on international pesticide benefit, rice diseases such as blast and sheath blight results in a yield reduction of 10-15% in Tropical Asia. Most of these chemicals are recommended for application if pests which include stem borers, grasshoppers and leaf folders attack crops. Application of fungicides has resulted in yield increase of 30-34% increase in rice yield in the South East Asia region (Gianessi, 2014). The increased threat of higher crop losses to pests has to be counteracted by improved crop protection whatever method it will be (biologically, mechanically, and chemically) (Popp, Pet & Nagy 2013). If farmers fail to apply pesticides may crop yield drop and actual losses could account for more than 50 % of the attainable production Herbicide is an important chemical for controlling weeds which compete

with rice plant for air, space, sunlight, nutrients and water thus hindering the normal growth and development. Weed control is necessary to attain maximum yield potential. Gianessi (2014) reported that on average, yield gap due to weed hindrance in Asia was determined to be 43-51%.

There are many empirical studies that have found a positive link between access to credit and rice yield or productivity. A scholar who investigated farmers' access to credit found a positive relationship between the credit and yield. Credit in rice farming had positive and significant impact on rice yield. Users of credit harvested an additional (157.2 kg per hectare) of paddy (Kinkingninhoun, Diagne & Biaou 2010). These results were found by these experts in their study of investigating the impact of credit in rice farming on rice productivity and income in Benin.

In his analysis of the "Impact of agricultural Credit on Farm Productivity" using the quantile regression and Stochastic Frontier Analysis techniques and responses from 654 farmers sampled from Mekong Delta region of Pakistan, Duy (2012) revealed that the rice yield and technical efficiency of farmers increased tremendously because of access to credit, educational levels of farmers and high level of technology. In the same vein, Dong, Lu, and Featherstone, (2010), revealed that productivity and income of credit unconstrained farmers were higher than credit-constrained farmers. Mahoukede *et al*., (2015) posited that access to credit has improved farmers' use of inputs in rice farming reducing financial constraints faced by producers in accessing certain inputs. Most of these scholars argue that facilitating access of rice farmers to agricultural credit is a good strategy for supporting rice sector development, and therefore contributing to food security and poverty alleviation in Benin. Therefore, providing affordable credit to farmers is paramount to enhancing production and yield.

Agricultural labour cannot be ignored in the production mix. Labour comes from two sources, hired labour and family labour. Labour can increase the level of both production and productivity. Most farming in Africa relies on family labour which to work on the farm for free. According to FAO (2016), African agricultural growth differed significantly from that of Asia or South America. In Asia, growth was driven largely by intensification, whereas in South America, it was the result of significant improvement in labour productivity arising from mechanization. By contrast, strong growth in sub-Saharan Africa agricultural output has accrued predominantly from area expansion and intensification of cropping systems, as opposed to large-scale improvement in labour productivity (NEPAD, 2014; Brink and Eva, 2009). While the agricultural labour force has expanded, NEPAD (2014) notes that productivity per agricultural worker has improved by a factor of only 1.6 in Africa over the past 30 years, compared to 2.5 in Asia. Tchale (2009) reported that the larger the family size with effective members, the more labour is available for farming operations and thus increase in the production of farmers.

Most African agriculture is traditional and characterized by labour intensives production and excess demand for labour often occur during a period of land preparation, weeding and harvesting (Ramaila, 2011). In the views of this author, labour availability at these critical times is often a major constraint. When there is labour shortage, crop production and productive is seriously hampered. One of the main causes of labour shortage in African agriculture is migration. Several scholars have painted a negative picture between migration and labour supply in agriculture. Reporting on this, Rigg, (2007) said that out-migration causes a shortage of labour in the agricultural sector when rural people, especially young workers, go to work in non -farm activities in other areas of the country or even in other countries. In the views of Rigg (2005a), many villages in Southeast Asian countries such as Thailand, Indonesia, the Philippines, and Malaysia have become 'deagrarianised' in that most people who live in the village earn their livelihoods through non-agricultural employment in towns (Lawal & Okeowo, 2014). Studying

the Effects of Rural-Urban Migration on labour supply in cocoa production in Ondo East local government area of Ondo State, Nigeria, Lawal and Okeowo (2014) are of the view that movements of people from rural to urban areas have been identified to be one of the major reasons why agricultural production is still low despite the vast resources that abound in Nigeria. Rural-urban migration is known to have adverse effect on farm labour supply, which will consequently reduce farm output.

3. METHODOLOGY

a. Research Setting

This study was conducted in the Central River Region of The Gambia. It is located between latitude 13°13´22.52"N and longitude 16°34´55.13"W. This region has five districts covering a total land area of about 2, 894 km² and a population of 226, 018 the Gambia Bureau of Statistics (GBoS) (2013.) The main inhabitants are Mandinkas, Wolofs, Fulas and Sarahules. Split in the middle by The River Gambia into Central River North and South, it boasts of a large area of arable land with rich alluvial soils and freshwater suitable for both dry and wet season rice production. In other words, it holds the comparative advantage for rice production in the country and therefore often regarded as the potential food basket of the nation. Janjangbureh is the administrative headquarters of the region and houses the office of the Regional Governor.

The economic activities in this area include rice production, livestock rearing, artisanal fishing and trading. The region hosts at least eight regular weekly markets spread across north and south. These markets are very popular and draw people from different kinds of businesses both from the region and across the borders from Senegal.

In spite of its potential for income generation, the central River Region has a startling poverty prevalence rate. Findings by the World Food Programme (WFP) (2011) in a survey on food security and vulnerability analysis, Central River Region North and South showed 82. 8% and 74.1% poverty rate respectively. A map of the study area is shown in figure 1.

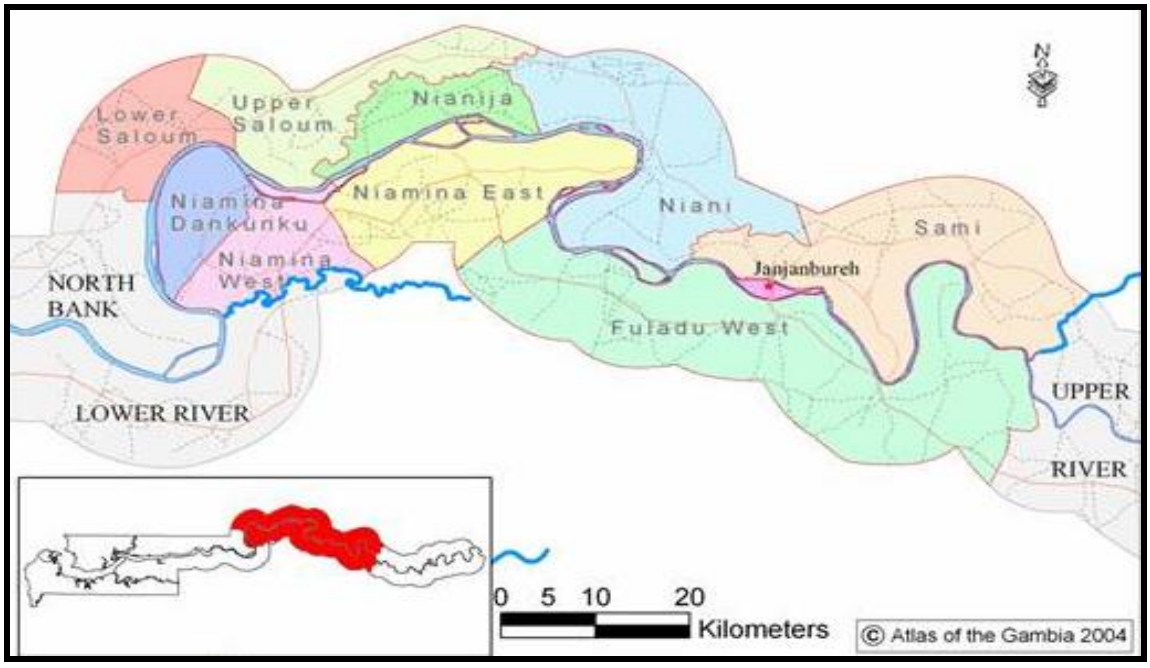

Fig 1. Map of the Central River Region of the Gambia**,** **(**Source: http://www.columbia.edu/~msj42/CentralRiver.htm)

b. Research Design

The study adopted a cross-sectional survey method which allows data to be collected at a single point at a time through farmer-to-farmer administered questionnaires. This design is chosen because the study uses non-experimental approach. In other words, no field trial was needed to make the assessment. Instead survey is reliable enough to give respondents the opportunity shares their views on inputs access and rice production.

c. The population of the Study

This region has a total population of 226, 018 consisting of 20, 559 households (GBoS, 2013. The population of the study comprises all the rice farmers in the Central River Region of the Gambia. However, data obtained from the registry of the Agribusiness Service of the Department of Agriculture puts the population of registered farmers in the study area at 9217.

d. Sample Size Determination

The sample size was calculated by using Yamane Taro's (1967) formula with 5% margin of error and a 95% confidence level. Therefore, 384 respondents were used as the sample size. This was used to further calculate the number of respondents in each of the selected villages for Central River Region north and south.

Table 1 Number of respondents across selected villages in the study area

Region	District	Communities	No. of respondents p/qxr	Survey date
		Brikama Ba	192/384 x 112 = 56	8/09/2017
Central River Region North	Lower Fulladu West	Saruja	192/384 x100 = 50	11/09/2017
		Jahaly	192/384 x 80 = 40	14/09/2017
		Pacharr	192/384 x92 = 46	17/092017
Sub-total			**192**	
		Jarumeh Koto	192/384 x82 = 41	21/09/2017
		Kuntaur	192/384 x 100 = 50	24/09/2017
Central River Region South	Niani	Wassu	192/384 x 110 = 55	27/09/2017
		Sukuta	192/384 x92 = 46	31/09/2017
	Sub-total		**192**	
TOTAL			**384**	

Source: Field Survey, 2017

e. Sampling Procedure

The Central River Region was purposively selected for this study due to its comparative advantage in rice production, especially for the tidal ecology. This production zone mainly lies in two districts of Lower Fulladu West in the South and Niani in the North. A total of 8 villages were selected using simple random sampling. List of villages was obtained from the Population and Housing Census report by GBoS in 2013. Then the village was allocated numbers and four villages drawn out for each of the north and south. The district extension officer and the researcher conducted a visit to each of the selected villages and made arrangements with the village head and the village development committees. After agreeing on a date, arrangements were made to gather all the rice producers in that community either at the compound of the village head or at the village square. Upon arrival by the team of data collectors, rice farmers were registered on the spot and each was allocated a number

whose cut-outs were selected randomly and then the extension agents and researcher administered the questionnaires to the rice farmers allocated with that numbers. A total of 384 respondents were surveyed.

f. Method of Data Collection

The primary data was collected by administering semi-structured questionnaires. In addition to this, a separate set of questionnaires were administered to key informants to gather their opinion on the issue. These included the Director-General, Regional Directors, Deputy Directors and extension agents.

g. Techniques of Data Analysis

Data were analysed by computing all responses from the survey into the statistical package for social science (SPSS) software, version 23 and then run the analysis. Descriptive statistics were first analyzed to show the frequencies, percentages, mean, median, mode, standard deviation, maximum and minimum values.

4. RESULTS AND DISCUSSIONS

The results present the socio-economic characteristics of respondents, the nature of the input system, factors affecting farmers' access to inputs and the impact of inputs and some socio-economic characteristics on rice yield.

1. Socio-Economic Characteristics of the Respondents

Table 2 Socio-economic characteristics of respondents

Description	Frequency N=384	Percentage %=100	Mean
Gender			
Male	132	34	
Female	252	66	
Marital Status			
Single	18	5	
Married	357	93	
Widowed	9	2	
Age			45.4
20-30	49	13	
31-41	127	33	
42-52	106	28	
53-63	66	17	
64 above	36	9	
Household size			9.6
1-5	62	16	
6-10	196	51	
11-15	90	23	
16 above	36	9	
Level of Formal Education			
Primary	40	10	
Secondary	46	12	
Tertiary	0	0	
Non-formal education	298	78	
Farmers Organizations			

Member	285	74	
Non-Member	99	26	
Annual Income	-	-	13, 382.00
Land ownership			
Self-owned	367	96	
Rented	17	4	
Area Cultivated	-	-	
			1.25

Source: Field Survey, 2017

Table 2 shows the socio-economic characteristics of the 384 respondents. The gender composition shows that the population of female respondents was higher than that of the males. The females constituted 66% compared to 34% for the males. This shows that female folk are more active in the rice sector than their male counterparts.

Table 2 shows the respondents' marital status. The majority of the farmers (93%) surveyed were married. The rest, 5% and 2% were single and widowed respectively. This implies that farmers are responsible people with families working to provide for the livelihood of their members. It shows that being married is an integral part of adult people living in rural society and rice being the main staple is critical for the survival and wellbeing of the family in the Gambia.

The mean age of the respondents surveyed was 45.4% as shown in Table 4.1. In fact, about 60% of them fall between the ages of 41-52 years. Only 13% were aged between 20-30 years. This suggests that most of the rice farmers are in their middle ages. It is an indication that there is a low level of youth participation in agriculture as well. The result on the age composition is consistent with the findings of Dibba *et al.* (2012) who also found out that mean age of respondents in Central River Region North and South were 40 and 44 years respectively while Sanyang (2010) showed that the age range of most of the rice growers he surveyed was 41-50 years old.

The low activities of youths in agriculture have been a concern to government and development partners in the Gambia. The youths who constitute the majority (60%) of the country's population are either unwilling or do not have the necessary motivation to venture into agriculture. They prefer to migrate to cities in search of better jobs and more recently to Europe through perilous journeys across the Mediterranean Sea commonly called the "back way" in pursuit of greener pastures. This is where they expect to get high paying jobs and better livelihoods. The apparent lack of prospect in farming, low returns, poor infrastructure, lack of market and inadequate support to farmers are obvious push factors to the youths.

In table 2, the average household size is 9.6, a score slightly above the national average of 8.6. The Gambia has a high fertility rate like most African countries, 5.8% according to the United Nations Development Programme, ((UNDP) (2015). Marriages are usually polygamous especially among the Muslims who form the bulk of the population (almost 90%) and there is general perception that more children are a blessing from Allah. Therefore, household sizes are usually large especially in the rural settlement where people live in extended family systems.

Table 2 shows the educational level of the respondents. It reveals that 78% of them have no formal education while only 10% and 12.0% received primary and secondary education respectively. No single farmer has acquired tertiary education. That is to say, none has attended or obtained a college diploma or university degree. Thus, with regards to Western education, illiteracy among farmers is very high. It also implies that those who are educated are not active in rice production but probable is engage in other

occupation such as civil service and manufacturing and service industries.

In terms of belonging to an organization, 74% of the respondents in Table 2 have acknowledged being a member of a farmer group, an association or a cooperative society while 26 % reported being non-members. It suggests that there are indeed organizations existing in the rice production zones. This is not surprising because historically, rice growers have generally been organized into groups, mostly cooperative societies or associations to facilitate government and non-governmental support.

Table 2 shows that 96% own their land through the traditional customary system where the land is allocated for free by the village head, family head or head of the clan. On the other hand, 4% claimed to have rented the land during the 2016 cropping season. This shows that most rice growers own their land and the traditional land tenure system is quite prevalent.

Table 2 shows the cultivated land size of respondents in hectares. The average area of land cultivated with rice was 1.25 hectares. This is typical in the Gambia. Rice growers often cultivate in small fields or plots which mostly ranges between 0.5 hectares to 1.0 hectares. This implies that majority of rice growers are subsistent small-scale farmers growing rice mainly to feed their families rather than commercial purposes.

The farm size is mostly used to categorize such type of farmers. For example, the Food and Agricultural Organization characterizes smallholder farmers as those who often farm less than a threshold size of 2 hectares. Today, the smallholder sector is known for its small farms that are labour-intensive, uses traditional production techniques and often lack institutional capacity and support (Pienaar & Traub, 2015).

Table 2 shows the respondents' annual income. The average farm income is D 13 382.00 about USD$ 282.31 at today's exchange rate of D47.40 to $1. This income level is less $1 a day and reflects the typical scenario of the poverty level of the majority of the Gambia's population who are mostly farmers. Such low-income level confirms the World Bank's characterization of low-income country whose citizens leave below the poverty line of less than $2 a day. The Gambia is among the poorest countries in sub-Saharan Africa. UNDP and GBoS (2011) in their joint report on Integrated Household Survey reported mean per capita household income of D15, 930.00.

2. Impact of Inputs on Rice Yield

Table 3. Distribution of Respondents on the Basis of Yield Produced

Yield (tonnes per hectare)	**Frequency N=384**	**Percentage %=100**
Less than 1.0	265	69.0
1.0-2.0	79	21
2.1.0-3.0	22	6
3.1.-4.0	13	3.4
4.1-5.0	2	1
5.1 above	3	1
Mean	1.1	
Median	0.6	
Mode	0.5	
Standard Deviation	1.4	
Maximum	8.0	
Minimum	0.1	

Source: Field Survey, 2017

Table 3 shows the distribution of respondents on the basis of yield. The average yield was 1.1 tonne per hectare, the median was 0.6 tonne per hectare, the most common yield was 0.5 tonne per hectare and the standard deviation was 1.4 tonne per hectare. The table shows that a very significant percentage of 69% of the farmers produce yields less than 1 tonne of paddy while 21 % produced between 1-2 tonnes. These depict the problem of low yields of rice farmers in the Gambia.

Table 4 Impact of Inputs on Rice Yield

Pearson correlation	**Coefficients (*r*)**	**Means Comparison (Independent T-test)**					
		N	**Mean**	**Std.Dev**	**Std. Error**	**T score**	**Sig.**
Fertilizer	0.620**	300	3232.14	1729.14	188.66	16.23**	0.000
		84	165.12	91.29	9.76		
Seeds	0.402	71	1772.54	1973.60	234.2	6.10**	0.000
		313	342.96	58.73	6.97		
Agro-chemicals	0.015	27	5372.22	1391.99	267.87	28.61**	0.000
		257	827.79	733.53	38.83		
Labour	0.378	-	-	-	-	-	-
Credit	-0.381	13	6476.92	1121.12	310.94	19.65**	0.000
		371	960.56	990.54	514.2		
Extension service	-	239	2372.07	1663.12	138.12	18.02**	0.000
		145	404.29	229.71	14.86		

In Table 4, all the detailed analyses of the impact of access to inputs on rice yield are provided. This was done by running Pearson Product Moment Correlation and t-

Table 4. shows the results of the correlations and T-tests. Bivariate correlation was used to determine the relationship between each input accessed and rice yield. The T-tests were conducted to check whether differences exist in terms of yield between groups based on access and non-access to each type of input covered in this study. The null hypothesis for the T-test would be that there is no significant difference in yield between groups based on access and non-access for each category of inputs.

Table 5. Impact of Socio-Economic Characteristics on Rice Yield of Respondents

Socio-economic characteristics	Correlation coefficient
Age	0.105
Income	0.593**
Household size	-0.55
Educational level	-0.113

** Correlation is significant at the 5%l

i. **Age**

The results in Table 5 indicate that the relationship between age and yield of farmers is extremely weak at 0.105 at 5% significant level. This suggests that age plays a very negligible role on yield. This is not surprising owing to the fact that most farmers are in their middle ages where energy for work begins to decline, one would expect that their labour output has a weak association with yield. Our results are supported by Ayoola *et al*., (2011) who conducted a study on Socio-economic factors influencing rice production among male and female farmers in Northern Guinea Savanna Nigeria. These scholars found a coefficient of 0.141 at 5% significant level.

ii. **Income**

Table 5 shows that there is a strong and positive relationship between income and yield at 0.593, roughly 60%. This suggests that yield of farmers is associated with the farmer's income. That is to say when income is large enough yields are expected to be high because with larger income farmers are able to afford the cost of necessary inputs for production such as quality seeds, fertilizer, labour and agrochemicals and others.

iii. **Household Size**

Table 5 shows that there is a negative relationship between household size and yield. The coefficient score was -0.55 at 5%. Given the high number of households from the survey which on averaged was 9.6, this suggests that an increase in the number of household members does not correspondingly increase the yield of farmers. Well, the reason is simple, a large household needs to spend on basic necessities such as food, clothing and shelter. Given that most of the rural people survive on less than $2 a day, the spending on these basic needs would mask the opportunity to buy inputs such as fertilizer, seeds, agrochemicals and farm tools.

However, others are of the view that a larger household is an opportunity for the increased source of labour since most of the subsistence farming is dependent on labour provided by family members. For example, Urgessa (2015) said that when the number of household member was increased by 1 unit the labor productivity of the household was increased by 0.22 units and it was significant at 5%.

iv. **Education**

In Table 5 the results show that there is a negative relationship between education and rice yield among the respondents. The correlation coefficient was -0.113. This is not unexpected because nearly 80% of the respondents reported no formal education and only few attended primary or secondary education. This result is consistent with that of Sanyang (2010) whose results showed that the coefficient of literacy to technical efficiency was also negative at -0.1513 at 5% level of significance. Others such as Oladele and Kemisola (2016) reported that educational level was positively and significantly related to productivity. Meaning that as the number of years spent in formal education increases, it makes the rice farmers more productive because education promotes the adoption and use of yield-increasing technologies/inputs and encourages more efficient farm management practices (Mbam & Edeh, 2011).

5. CONCLUSION

This research on the impact of access to agricultural inputs on rice yield in the Gambia was carried out in the Central River Region. The study surveyed 384 respondents. Findings revealed that the majority of the rice growers were women constituting 66%. The average household size was 9.6. Most of the farmers (60%) were in their middle ages and less than 15% were aged between 18-31 years old. Furthermore, 78% of the respondents reported no formal education, 10% attended primary education and 12. % attended secondary education but none attained a college or university. The mean income of respondents was D 13 381.70.

The results have shown that access to inputs (fertilizer, seeds, pesticides and herbicides, credit and labour) had positive effects on rice yield either by correlation or independent t-test among groups.

Therefore, inputs play a significant impact on the yield of rice farmers. This conforms to our assumption that agricultural inputs are the major determinants of rice yield. Although socio-economic characteristic played a role but with the exception of income which was found to have a major impact, age, education and household size had no significant impact on yield.

Recommendation

This study has unearthed major issues of concern in the agricultural inputs sector. Therefore, in order to improve rice yield and national food self-sufficiency and food security, the following recommendations are critical:

1. Government and development partners through the Ministry of Agriculture (MOA) should work hand in glove to establish a vibrant seed system to promote the production and supply of high-quality certified rice seeds at affordable prices for farmers. This can be done by increasing funding to the National Research Institute (NARI) to develop breeder, foundation and certified seeds.
2. The government should formulate an efficient and effective fertilizer subsidy programme in order to enhance the affordability of fertilizer by rice growers. Increase in the budget allocation for agriculture from below 10% to 25-30% would avail more funds to purchase and subsidize fertilizer.
3. The government should develop and effectively enforce regulation to control the supply into the input system of fake, adulterated and poor-quality seeds, fertilizer, pesticides and herbicides.
4. The government should increase funding and attract investors to venture into agricultural mechanization to boost rice production and productivity with commercial orientation and reduce the drudgery, low production and labour intensive nature of subsistence rice farming.
5. Government and its development partners should invest more in higher education. Efforts should be made to train more extension workers to significantly close the gap between extension agents to farmer ratio. Recruitment and regular training of more extension agents with emphasis on specialized disciplines such as agronomy, crop protection and soil science are vital. This can be done by selecting qualifies personals to pursue higher education in Bachelor's, Masters and Doctorate programmes in agricultural universities around the globe.
6. Government and development partners should support the youths with financing incentives or provision of inputs to actively partake in rice production.

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