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Comparative analysis of the profitability of rice seed and grain production enterprise among smallholder farmers in Anambra state, Nigeria

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Abstract

This study examines the comparative analysis and profitability of rice seed and grain production among smallholder farmers in Anambra State, Nigeria. The researchers collected data from 400 smallholder rice farmers (200 seeds and 200-grain farmers) using a multi-stage sampling technique. The findings indicate that 56% of the grain farmers and 50% of the seed farmers are male. The average age of grain farmers is 44.14, while seed farmers have an average age of 37.08, suggesting that seed farmers tend to be younger. Additionally, a high percentage of both grain (87.0%) and seed (73.5%) farmers are married. In terms of production methods, 37.0% of grain farmers use broadcasting, while 51.5% of seed farmers practice direct seed sowing. The rest of the seed farmers (48.5%) use nursery and transplanting methods. The profitability index shows that seed production is more profitable than grain production, with indexes of 84.0% and 79.6%, respectively. The factors impeding rice farmers from maximizing their profits are classified into three categories: economic factors, institutional factors, and management factors. Economic factors include poor access to information and scarcity of labour during the farming season. Institutional factors involve high input costs and expensive machinery. The study also highlights cattle-related issues as a management factor that threatens rice farming in both enterprises. Based on the findings, the study recommends the development of a comprehensive agricultural policy to address the challenges identified, taking into account limited resources and the need for improved information access, affordable inputs, and effective management strategies.

Keywords: Profitability; Rice seed; Grain production; Smallholder farmers

1 Introduction

Rice (*Oriza sativa)* is an important staple food for a larger part of the world's human population, especially in the Middle East, Asia, Latin America, West Indies and Africa. Merem, *et al*., opined that rice is a staple food in several African nations that constituted a bigger portion of the diet on a regular basis [1]. In Nigeria, it is tropically cultivated in all parts of the country [2]. Raufun contend that rice in terms of output and cultivated land area is a major staple and most popular cereal crop of high nutritional value grown and consumed in all ecological zone of the country [3]. Aside from a handful of nations that enjoy self-sufficiency in rice cultivation, rice consumption in Nigeria surpassed production thus, a substantial amount of the crop is imported to sustain local demand at the expense of hard-earned foreign currency reserves [4]. Thus, intervention programs should be packaged to help Nigeria attain self-sufficiency in rice production as well as to create rural job and reduce rural-urban migration.

There have been several reforms going on in the Nigerian agricultural sector targeted at bringing about food security and stability in Agro-industry; efforts have also been made to spur the farmers and increase rice production, at the same time; encourage local demands of domestic food products [5-6]. Nigerian has many agricultural policies where

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smallholder farmers are the central focus [7] because the sector is dominated by small-scale farmers who cultivate below 3 hectares [8].

Nwilene, *et al.* stated that many Nigerian rice farmers have continued to recycle grains [9] which explains why the country continues to record low output in rice production. This implies that very few farmers are used to rice seed. To solve this age long issue of low productivity in rice production. Nwilene *et al.* noted that the federal government of Nigeria in 1975 established the National Agricultural Research Institute (NARI) and saddle them with the responsibility to produce breeder's seed [9], while, the former National Seed Service (NSS) was responsible to produce foundation and certified seed. Later on, the Agricultural Development Program (ADP) seed multiplication unit joined NSS to train rice seed farmers to increase the availability of seed to farmers. Since then, many rural farmers have been trained by the ADP to undertake various agribusiness in seed rice out-growers scheme, marketing and consultancy service. Many scholars such like Lanamana; Obianefo, Aguaguiyi, Umebali & Ezeano and Kernalis, Arsyad, & Rir [10-12] have attempted to compare the profit from rice through irrigated and main season production but very few within the study location have study on comparative analysis of the profitability of rice seed and grain production in Anambra State. With this in view, this study will compare the profit from the seed enterprise to that of grain, since the aim of all agricultural production is to maximize profit; the study hope to identify the enterprise with the lowest form of investment and highest return as production gain.

The general objective of the study compared the profitability of rice seed and rice grain farming in Anambra with specific intention to:

- Describes the enterprise characteristics of the rice seed and grain farmers,
- Identify the production methods used by the rice farmers,
- Estimate the cost and returns of rice seed and grain farming, and
- Ascertain the factors militating against the two-production enterprises in anambra state.

The hypothesis will be tested:

Ho_1: The profit from rice seed farmers is not significantly different from grain farmers.

2 Empirical review

A study conducted by Nneka, Ohajianya, Obasi, and Onyeagocha [13] investigated the profitability of rice production in different production systems in Ebonyi State, Nigeria. Data were collected through a well-structured questionnaire administered to 180 rice farmers. The collected data were analyzed using descriptive statistics, budgetary techniques, and inferential statistics. The study revealed that 59% of the rice production enterprise was dominated by male farmers, who had an average age of 49 years and an average farming experience of 21 years. The average farm size was 0.74 hectares. The households of the participating farmers had an average size of 8 people, and the household heads had spent an average of 9 years in school. Regarding rice cultivation practices, it was found that 63% of the farmers cultivated the Faro 44 rice variety, while 82% of them employed the nursery method of sowing. Profitability comparisons among different production systems indicated that upland production yielded a profit of 231.14 USD, lowland production generated 343.48 USD, and swamp production resulted in 438.47 USD.

Tasila, Mabe, and Hamdiyah [14] conducted a study in Northern Ghana to assess technical and resource-use efficiency among smallholder rice farmers. The researchers employed a multistage sampling technique to collect data from 126 smallholder rice farmers in the Tolon District of the Northern Region. The study utilized stochastic frontier analysis (SFA) to identify the factors influencing rice output and measure the technical efficiency of the farmers. Additionally, the marginal value product-marginal factor cost (MVP-MFC) approach was used to estimate the efficiency of resource utilization in rice production. The findings from the SFA indicate that with the exception of weedicide, factors such as farm size, the quantity of weedicide, and fertilizer usage have a positive impact on rice output. However, in terms of resource utilization, factors such as weedicide, fertilizer, and seed were found to be over-utilized in the production process. The study reveals a wide variation in technical efficiency among rice farmers, ranging from 11% to 98% with a mean of 75%. Factors such as age, access to extension services, household size, years of education, and access to credit were identified as influential factors for technical inefficiency among farmers.

Obianefo, Anarah, Osuafor, and Anumudu [15] conducted a study in Ayamelum Local Government Area of Anambra State, Nigeria to determine the factors influencing rainfed and dry season rice farming and to identify the challenges faced by rice farmers in the area during both seasons. The researchers used a structured questionnaire and face-to-face

interviews to gather data from 100 randomly selected rice farmers (70 rainfed and 30 dry-season farmers). Multiple regression and principal factor analysis were employed as analytical tools to analyze the data. The study found that the coefficient of determination (R^2) for rainfed rice farming was 0.8951, indicating that 10.5% of the variations in the outcome were beyond the control of the farmers. For dry-season rice farming, the R^2 was 0.7999, indicating that 20.0% of the variations were beyond the farmers' control. The determinants of rainfed rice farming were found to be fertilizer, urea, agrochemicals, and labour, while labour supply and farm size were identified as the determinants for dry season rice farming in the study area. Environmental factors accounted for 21.42% and 21.79% of the challenges faced by rice farmers during rainfed and dry seasons, respectively. Institutional factors accounted for 15.34% and 17.90% of the challenges during the rainfed season, respectively, while economic factors accounted for 13.51% and 14.37% of the challenges during the rainfed and dry seasons, respectively. In total, these three factors explained 50.28% and 54.06% of the challenges faced by rice farmers during both season in Ayamelum Local Government Area.

Obianefo, Aguaguiyi, Umebali, and Ezeano [11] conducted a study comparing rainfed and dry season rice farming in the Value Chain Development Programme in Ayamelum Local Government Area of Anambra State. A multi-stage sampling technique was used to gather data from 70 rainfed and 30 dry-season rice farmers. Descriptive statistics, budgetary techniques, and inferential statistics (specifically unequal variance t-tests) were employed for data analysis. The study revealed that the average age of rainfed rice farmers was 47 years, while dry-season rice farmers had an average age of 46 years. The mean farming experience was found to be 11 years for rainfed farmers and 15 years for dry-season farmers. Additionally, the average farm size was 1.98 hectares for rainfed farming and 1.14 hectares for the dry season. Rainfed rice farming yielded an average of 4.624 tons per hectare, while the dry season yielded 5.114 tons per hectare. The net returns for rainfed farming amounted to NGN 465,752.47, whereas for the dry season, it was NGN 351,146.60. The difference in profit between the two seasons was significant, with a t-value indicating a 1% level of probability. The challenges reported by rainfed rice farmers included cattle menace, high labour costs, and competition. On the other hand, dry-season rice farmers faced challenges such as the high cost of pumping machines, increased incidents of bird attacks, and expensive inputs.

3 Material and method

3.1 Area of the Study

Anambra state is located in the south-eastern part of Nigeria and comprises o1 Local Government Areas (LGAs) (Aguata, Awka North, Awka South, Anambra East, Anambra West, Anaocha, Ayamelum, Dunukofia, Ekwusigo, Idemili North, Idemili South, Ihiala, Njikoka, Nnewi North, Nnewi South, Ogbaru, Onitsha North, Onitsha South, Orumba North, Orumba South and Oyi). These LGAs are grouped into four agricultural zones (Anambra, Onitsha, Awka and Aguata zone) for easy planning and rural development. Anambra State is bounded by Delta State to the West, Imo State and Rivers State to the South, Enugu State to the East, and Kogi State to the North. The indigenes of Anambra state are mainly farmers, with a prominent history of trade and commerce [16]. Anambra State is situated between Latitudes 5° 32’ and 6°45’ N and Longitude 6°43’ and 7° 22 ’E respectively with an estimated land area of 4,865sqkm2, average annual rainfall of 1544 mm and average annual temperature of 26.8 Degree Celsius [6].

3.2 Sampling Technique and Sample Size

Multi-stage sampling technique will be employed to select the study respondents. In the first stage, the sample frame (population) or list of rice seed and grain farmers was obtained from the ASADP database in March 2021. Due to the finite population size, Taro Yamane sample size determination formula was employed to calculate the sample size for the study. The Taro Yamane formula is defined in Otabor and Obahiagbon [17] as:

$$N = \frac{N}{1+N(e)^2} \ldots\ldots\ldots\ldots\ldots\ldots (10)$$

Where:

N	=	Population of the Study
n	=	Sample Size
(e)	=	Level of significance
1	=	Unit (constant)
Note: (e)	=	0.05

$$n = \frac{18700}{1+18700(0.05)^2} = \frac{18700}{1+18700(0.0025)}$$

$$= \frac{18700}{1+46.75} = \frac{18700}{47.75} \qquad = 391.53.$$

To the nearest unit, the sample size was 400.

In stage two, four LGAs (Ayamelum, Awka north, Orumba north and Ogbaru) well known for rice production in Anambra state were purposively selected. In stage three, two communities were randomly selected, while in stage four, five villages were randomly selected from each community to make it total of forty (40) villages for the study. The researcher divided the sample size of 400 in to two (200 grain farmers and 200 rice seed farmers) to give room for comparative study. Lastly, from the selected forty villages, a cross sectional 200 seed farmers were purposively selected due to their smallness, while the remaining 200 randomly sample grain farmers in the study area.

3.3 Data Analysis

This study used a combination of different analytical tools which include descriptive statistics, enterprise budgeting, principal factor analysis and other inferential statistics such as z-test and sign test. Objective one and two were achieved with descriptive statistics which included table, frequency, percentage and mean. Objective three was achieved with an enterprise budgeting method. Objective four was achieved with principal factor analysis (PFA). The null hypothesis one was tested with Z test.

3.4 Model Specification

- Descriptive statistics for objective one and two are defined as:

$$\overline{X} = \sum \frac{FX}{n}$$

Where:

$\overline{X}$ = mean, X = variable outcome, n = sample size, and F = frequency

- The partial budgeting technique for objective three is defined as

$$GM = TR - TVC$$

$$\pi = \frac{GM}{TR}$$

$$NR = GM - TFC$$

$$NR = TR - TC$$

$$TR = Q_n * P_i$$

$$TC = TVC + TFC$$

$$ROI = \frac{NR}{TC}$$

Where: π = profitability ratio, ROI = return on investment, Q_n = the quantity of output produced (kg/ton), P_i = unit price of each output (₦), GM = gross margin, NR = net returns, TR = Total Revenue, TC = Total Cost, TVC = Total Variable Costs, TFC = Total Fixed Cost

- The principal factor analysis (PFA) for objective four is defined as:

$$Z_i = \delta_{i1}F_{i1} + \delta_{i2}F_{i2} + \cdots \delta_{im}F_{im} + \varepsilon_i$$

Where:
Z_i = observation on variable X_j for the *ith* sample number
F_1-F_m = number of common factors rotated
ε_i = the stochastic error term

δ_{i1} ….. δ_{im} = factor loading (regression weight).

SPSS version 23.0 software was used and promax method of rotation was adopted to restrict variables from loading in more than one component. The benchmark correlation coefficient was 0.30 to enhance the degree of accuracy. Principal factor analysis is a better policy tool than simple ranking because it uses regression approach to explain the construct relationship between the challenges under study.

- The Z test is defined as:

$$Z = \frac{\bar{X}_2 - \bar{X}_1}{\sqrt{\frac{\delta_2}{n_2} + \frac{\delta_1}{n_1}}}$$

Where: Z is the Z-score, $\bar{X}_2$ is the mean profit from rice seed enterprise, $\bar{X}_1$ is the mean profit from rice grain enterprise, δ_2 is the standard deviation of rice seed enterprise, δ_1 is the standard deviation of rice grain enterprise, n_2 is the number of observation of rice seed enterprise, and n_1 is the number of observation of rice grain enterprise.

4 Results and discussions

4.1 Enterprise Characteristics of the rice Farmers in Anambra State

Table 4.1 presents the results of the rice grain and seed farmer's enterprise characteristics.

4.1.1 Sex

The study found that more than half (56.0%) of the grain farmers and 50% of the seed farmers are male. This is an indication that male farmers dominated rice production enterprise, this could be likened to the physicality and masculinity involved in rice production. This result was in agreement with the study of Nneka *et al.* [13] in Profitability of rice production in different production systems in Ebonyi State, Nigeria and Ebido *et al.* [18] who examined the technical efficiency and profitability of rice production in Anambra State, Nigeria and found that male farmers dominated rice production in the study area.

4.1.2 Marital statusZ

The study found that majority (87.0% - grain) and (73.5% - seed) were married, while the rest 13.0% (grain) and 26.5% (seed) are single. The indication is that married farmers dominated the both enterprises. The findings on marital status were in agreement with the work of Falola *et al.* [19] in economic analysis of rice production among the youths in Kwara State, Nigeria who noted that married farmers dominated the enterprise.

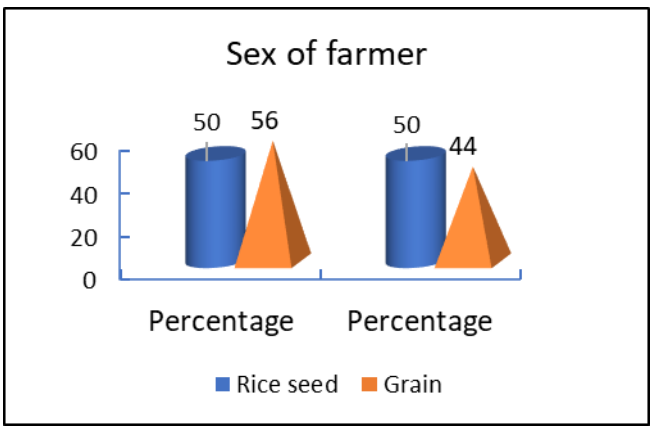

Figure 1 Sex of the respondents

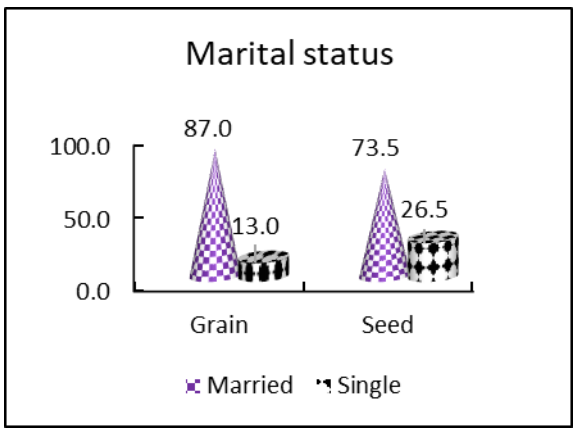

Figure 2 Marital status of the respondents

4.1.3 Age

The table shows that greater proportion (47.0%) of rice grain farmer's age and more than half (55.0%) of rice seed farmer's age are between 36 – 45 years (grains) and ≤ 35 years (seed), while the remaining grain farmers age are between 46 – 55 years (33.0%), ≤ 35 years (11.5%) and 56 years and above (8.5%). The remaining seed farmer's age

are between 36 – 45 years (25.5%), 56 years and above (13.5%) and 46 – 55 years (6.0%). The average age of the farmers was found as 44.14 (grain) and 37.08 (seed). The indication is that rice farmers at both enterprises are young and active in their farming operation., though, seed farmers are younger than grain farmers. At this age, they can cope with the physicality involved in rice production. The study also revealed that rice seed farmers are younger than grain farmers. This is possible because seed farming is more tedious than grain production; this is so because good agronomic practice must be maintained in seed production. Due to the cost involved, seed production is often sponsored by States ministry of agriculture and their targets are mainly the youths. The grain farmer's age was in agreement with Obianefo *et al.* [11] in comparative analysis of rainfed and dry season rice farming in Value Chain Development Programme in Ayamelum Local Government Area of Anambra State whose finding reported 47 years, while the seed farmer's age was in agreement with Ohen and Ajah in cost and return analysis in small scale rice production in Cross River State, Nigeria whose average age was 35 years [7].

4.1.4 Level of education

The study reported that greater proportion (43.5%) of rice grain farmers attended primary school, while the greater proportion (48.5%) of the seed farmers attended secondary school. On the other hand, the remaining grain farmers attended secondary school (43.0%), tertiary education (11.5%) and post graduate programme (2.0%). Also, the remaining seed farmers attended primary school (25.5%) and tertiary education (26.0%), none of the seed farmers attempted post graduate programme. The average years spent in formal education was found as 10.99 (grain) and 9.15 (seed), the implication is that farmers at both enterprises attempted secondary school and are fairly literate to understand some basic farming principles. This finding is in agreement with the work of Sanjiv *et al*. [20] in technical efficiency of rice production in Terai district of Nepal who noted that rice farmers attended secondary school, but disagrees with the earlier study of Ogunniyi *et al.* [21] on production efficiency of rice production in Kwara State, Nigeria who reported that majority of the farmers attended primary school.

4.1.5 Farming experience

The researcher found that greater proportion (31.5%) of the grain farmers had 16 years and above farming experience, while 33.5% of the seed farmers had 6 – 10 years of farming experience, the remaining grain farmers had their farming experience between 6 – 10 years (23.5%), 11 – 15 years (22.5%) and 1 – 5 years (22.5%). On the other hand, the remaining seed farmers had farming experience between 1 – 5 years (30.0%), 11 – 15 years (24.0%) and 16 years and above (12.5%). The average age of farming experience was fund as 13.02 (grain) and 10.63 (seed). These findings have shown that the farmers in the study have gained enough experience required to understand the rudiment of rice production in the study area. The grain farmer's experience was in agreement with Sanjiv *et al*. [20] whose average farming experience was 13.2, while the seed farmer's experience was in agreement with the findings of Obianefo *et al.* [11] whose farming experience was 11 years.

Household size

The study found that majority (58.5% - grain) and (69.0% - seed) have a household size of 5 – 8 people, while the remaining farmer have 1 – 4 people (40.0% - grain and 23.0% - seed) and 9 people and above (1.5% - grain and 8.0% - seed). The average household size was found as 5.21 (grain) and 5.76 (seed). Household size is capable of supplying the farmers with consistent and cheap labour capable of minimizing cost of production. These findings disagree with the 10 person per household reported by Olusegun [22] in economic evaluation of certified rice seed production among out-growers in Katsina state, Nigeria.

4.2 Income after harvest

The table show that greater proportion (45.5% - grain) and (38.5% - seed) of the farmer's income after the annual harvest ranges from 600,001 and above, while the remaining grain farmer's income ranges from 100,001 - 300,000 (30.5%), 300,001 - 600,000 (17.5%) and ≤ 1000,000 (6.5%). On the other hand, the remaining seed farmer's income ranges from 300,001 - 600,000 (25.5%), 100,001 - 300,000 (24.5%) and ≤ 1000,000 (11.5%). The average annual income after the year harvest was found as ₦1,145,460.06 (grain) and ₦1,209,980.98 (seed). This result revealed that seed farmers have more income than grain farmers. With this income size, the farmers can afford to diversify or practice mechanized farming, or better adopt improved technology in their farming operations.

Extension contacts

Table 1 shows the result of extension contact, it was revealed that majority (79.0%) of grain farmers and greater proportion (38.0%) of the seed farmers had 1 – 5 extension contacts, while the remaining had their extension contact ranging from 6 – 10 (19.0% - grain and 32.0% - seed) and 11 and above (2.0 – grain and 30.0% - seed). The average

number of extension contact was found as 3.27 (grain) and 7.59 (seed). This result has shown that seed farmers have more access to extension service than their grain counterpart. This could be because seed production is technical and requires more supervision than conventional rice grain farming. Only the finding on grain farmer's contact was in agreement with Olusegun [22] in economic evaluation of certified rice seed production among out-growers in Katsina state, Nigeria whose average extension contact was 3 times.

4.2.1 Farm size

The study revealed that greater proportion (40.5% - grain and 46.5% - seed) of the farmers have a farm size of ≤ 1.00ha, while the remaining grain farmers farm size ranges from 1.51 - 2.00ha (28.0%), 2.01ha and above (20.0%) and 1.01 - 1.50ha. The remaining seed farmer's farm size ranges from 2.01ha and above (30.5%), 1.51 - 2.00ha (14.5%) and 1.01 - 1.50ha (8.5%). The average farm size was reported as 1.76ha (grain) and 1.89ha (seed), this indicates that seed farmers hold more cultivable lands than the grain farmers in the study area. This result revealed that both enterprises are still practiced at a small scale despite the fact that the enterprise looks lucrative. This finding was in agreement with Madu and Aniobi [23] in profitability analysis of paddy production who noted that the majority of the farmers operate in less than 2ha of land.

Table 1 The enterprise characteristics of the rice farmers in Anambra State

	Grains			**Seed**		
Variables	**Frequency**	**%**	**Mean**	**Frequency**	**%**	**Mean**
Age (years)						
<= 35	23	11.5		110	55.0	
36 – 45	94	47.0	44.14	51	25.5	37.08
46 – 55	66	33.0		12	6.0	
56 and above	17	8.5		27	13.5	
Level of education						
Primary (1 – 6 years)	87	43.5		51	25.5	
secondary (7 – 12 years)	86	43.0	10.99	97	48.5	9.15
Tertiary (13 – 18 years)	23	11.5		52	26.0	
Post-graduate (19 years and above)	4	2.0		-	-	
Farming experience (years)						
1 – 5	45	22.5		60	30.0	
6 – 10	47	23.5	13.02	67	33.5	10.63
11 – 15	45	22.5		48	24.0	
16 and above	63	31.5		25	12.5	
Household size (people)						
1 – 4	80	40.0		46	23.0	
5 – 8	117	58.5	5.21	138	69.0	5.76
9 and above	3	1.5		16	8.0	
Income after harvest (₦)						
≤ 1000,000	13	6.5		23	11.5	
100,001 - 300,000	61	30.5	1,145,460.06	49	24.5	1,209,980.98
300,001 - 600,000	35	17.5		51	25.5	
600,001 and above	91	45.5		77	38.5	

Extension contacts (No)						
1 – 5	158	79		76	38	
6 – 10	38	19	3.27	64	32	7.59
11 and above	4	2		60	30	
Farm size (ha)						
≤ 1.00	81	40.5		93	46.5	
1.01 - 1.50	23	11.5	1.76	17	8.5	1.89
1.51 - 2.00	56	28.0		29	14.5	
2.01 and above	40	20.0		61	30.5	
Rice variety						
Faro-44	160	80.0		192	96.0	
Faro-52	32	16.0		8	4.0	
Both variety	8	4.0				

Source: Field Survey Data, 2021.

4.2.2 Rice variety

The study also found that majority (80.0%) of grain farmers and (96.0%) of seed farmers cultivate Faro-44 rice variety, while other grain farmers cultivate Faro-52 (16.0%) and 4.0% of them cultivate the both varieties. Equally, the rest 4.0% of the seed farmers cultivate Faro-52 variety. This was in agreement with Nneka *et al.* [13] who reported that majority of farmers in their study cultivate Faro-44 variety.

4.3 Identification of the Production Methods used by the rice Farmers

The production methods practiced by the farmers is presented in table 2. The farmers have three methods (broadcasting, direct seeding and nursery planting) available to them, the result revealed that greater proportion (37.0%) of the grain farmers practice broadcasting planting method, while the remaining practiced nursery (35.5%) and direct seeding (27.5%). Puja (2020) noted that broadcasting is usually practiced in areas where labour is scarce, it is the easiest method that requires minimum inputs and in return the yield is also minimum due to competition (Puja, 2020). On the other hand, majority (51.5%) of the seed farmers practiced direct seeding, while the rest 48.5% practice nursery planting. (Puja, 2020) equally allude that direct seeding and nursery operation is more tedious but necessary where the labour is available, this method ensures adequate spacing and the yield is usually commendable. Rice seed farming requires more carefulness which explains why many of the farmers involved use direct seeding in their operations but could maximize their production more if practice nursery operation. This study resolved that seed farmers practice better agronomic operations that the grain farmers.

Table 2 Production methods used

	Grain			**Seed**		
Methods of cultivation	**Frequency**	**%**		**Frequency**	**%**	
Broadcasting	74	37.0		-	-	
Direct seeding	55	27.5		103	51.5	
Nursery planting	71	35.5		97	48.5	

Source: Field Survey Data, 2021

4.4 Estimate of the cost and returns of grains and rice seed farming

Table 3 (grain) and 4 (seed) presents the results of the cost and returns of grain and seed rice production in the study area

4.4.1 Grain

Table 3 revealed that variable inputs take up 51.8% of the total cost of grain production, labour take up 45.4% of the total cost of production while depreciation on fixed asset take up 2.8% of the total cost of production. The cost of variable inputs expended in grain production was ₦195,975.76 and the labour cost is ₦172,167.9 to make the total variable cost (TVC) ₦368,143.66. This represents 97.2% of the total cost of production. Again, the total fixed cost of equipment used in the production was ₦10,420.95. These collectively made the total cost (TC) incurred in grain farming as ₦378,564.61. The revenues realized from the sale of rice by the grain farmers was ₦1,805,115.80. From this, it is evident that the gross profit (GM) attained by the grain farmers was ₦1,436,972.14, while the net returns was ₦1,426,551.19. Thus, the study evidently revealed that the profitability index was 79.6% and the return on investment (ROI) was 3.77. This profitability index in an indication that the profit from the sale of grain can take care of the next season variable production cost by 79.6%. Furthermore, the ROI value of 3.77 is an indication that the farmers earn ₦3.77 from every ₦1 investment made in grain production. This finding corroborates the assertion of Olusegun [22]; Madu and Aniobi [23]; Obianefo *et al.* [11] among other reviewed who purport that rice farming is a profitable enterprise in Nigeria.

4.4.2 Seed

Table 4 revealed that variable inputs take up 27.6% of the total cost of seed production, labour take up 61.6% of the total cost of production while depreciation on fixed asset take up 10.9% of the total cost of production. The cost of variable inputs expended in rice seed production was ₦212183.446 and the labour cost was ₦473950.76 to make the total variable cost (TVC) ₦686134.20. This represents 89.2% of the total cost of production. Again, the depreciation on total fixed cost of equipment used in the production was ₦83,916.03. These collectively made the total cost (TC) incurred in rice seed farming as ₦770,050.23. The revenues realized from the sale of rice by the seed farmers was ₦4,802,518.5. From this, it is evident that the gross profit (GM) attained by the seed farmers was ₦4,032,468.27, while the net returns was ₦3,948,552.24. From these, the study evidently revealed that the profitability index was 84.0% and the return on investment (ROI) was 5.13. This profitability index in an indication that the profit from the sale of rice seed can take care of the next season variable production cost by 84.0%. Furthermore, the ROI value of 5.13 is an indication that the farmers earn ₦5.13 from every ₦1 investment made in seed production.

Table 3 Estimated cost and returns of grains farming per hectare

Items	**Quantity**	**Unit Price (₦)**	**Amount (₦)**	**Percentage**
Revenue				
Sales (kg/ha)	4931	366.08	1,805,115.80	
Inputs				
seed (kg)	113.75	750	85312.5	
Urea (kg)	224.605	172.7	38789.284	
NPK (kg)	255.85	164.25	42023.363	
Herbicide (kg)	7.99	1885.75	15067.143	
Pesticide (kg)	2.42	2453.5	5937.47	
Transportation	-	8846	8846	
Total			195975.76	51.8
Labour				
Land preparation (man-day)	4	7729.5	28521.86	
Planting	4	2416	99720.4	
Fertilizer application	2	5076	8654.58	
Agrochemical application	2	4415	7880.78	
Bird scaring	5	2806.5	13288.78	
Harvesting	7	2014.5	14101.5	

Total			172167.9	45.4
Total variable cost (TVC)			368143.66	
Fixed cost (FC)				
Rent	2.215	3505.83	7765.42	
Interest	1	0	0	
Tractor	0	1600	0	
Irrigation	0.005	1200	6	
Thresher	0	400	0	
Hauler	0	0	0	
Truck	0	0	0	
Hoe	2.89	429.25	1240.53	
Cutlass	2.94	479.25	1409	
TFC			10420.95	2.8
Total cost (TC)			378564.61	
Gross margin (GM)			1,436,972.14	
Net returns			1,426,551.19	
Profitability index			79.6	
Return on investment			3.77	

Source: Field Survey Data, 2021.

The findings corroborate the assertion of Olusegun [22] focused on economic evaluation of certified rice seed production among out-growers in Katsina state, Nigeria who noted that seed rice production in Katsina state is more profitable than grain production. However, from the result above, it is clear that seed farming is more profitable than grain production in the area.

Table 4 Estimated cost and returns of seeds farming per hectare

Items	**Quantity**	**Unit Price (N)**	**Amount (N)**	**Percentage**
Revenue				
Sales (kg/ha)	6347.50	756.6	4802518.5	
Inputs				
seed (kg)	190.83	348.35	66473.8888	
Urea (kg)	44.09	228.00	10053.09	
NPK (kg)	346.80	240.00	83232	
Herbicide (kg)	12.27	2323.50	28497.7275	
Pesticide (kg)	3.49	2786.00	9709.21	
Transportation	14217.53	1.00	14217.53	
Total			212183.446	27.6
Labour:				
Land preparation (man-day)	16	18877.50	306193.05	
Planting	13	4993.90	62698.41	

Fertilizer application	23	2128.25	48524.10	
Agrochemical application	11	1865.00	20552.30	
Bird scaring	5	1496.00	7771.72	
Harvesting	9	3214.95	28211.17	
Total			473950.76	61.6
Total variable cost (TVC)			686134.20	
Fixed cost (FC)				
Rent	3.92	15475.00	60700.69	
Interest	0.20	375.00	75.00	
Tractor	0.94	6275.00	5867.13	
Irrigation	0.08	1100.00	88.00	
Thresher	1.87	3505.00	6536.83	
Hauler	0.37	1540.00	569.80	
Truck	0.19	2290.00	423.65	
Hoe	3.63	1436.00	5212.68	
Cutlass	3.26	1364.75	4442.26	
TFC			83916.03	10.9
Total cost (TC)			770050.23	
Gross margin (GM)			4032468.27	
Net returns			3948552.24	
Profitability index			84.0%	
Return on investment			5.13	

Source: Field Survey Data, 2021.

4.5 Factors Militating against rice seed and grain production enterprise

The factors militating against rice farmers at both enterprises adopted the Promax pattern of principal factor analysis used in Uchemba, *et al.* [24], the result of the grain farmers is presented in table 5, while that of seed farmers is presented in table 6. The least number of factors which can account for the common variance (correlation) of a set of variables were selected. Down the table was a model adequacy analysis result. According to Obianefo, Osuafor, Ezeano and Anumudu [25], the rule of thumb suggests that Kaiser-Meyer-Okin (KMO) up to 0.50 is adequate to proceed with the PFA analysis. Again, the cumulative Eigen-value must at least equal 53% and must be none negative definite which means that the determinant must exceed zero [25]. The PFA was rotated into three component factors named as economic, institutional and management factors. The good thing about this approach is that only variables whose communalities are from 0.3 to 1 form part of the factor rotation; this means that only variables with communalities of 0.3 and above are peculiar to the study area. This explains why some variables found in grain table are not in seed table and vice versa.

4.5.1 Grain

The economic factor explained 27.81% of the variance of factors militating against grain rice production in the study area. The institutional factors explained 19.62% of the variance of factors militating against grain rice production in the study area and the management factors explained 12.98% of the variance of factors militating against grain rice production in the study area. Hence, the three factors cumulatively explained 60.42% of the total variance of factors militating against grain rice production in the study area.

Furthermore, the variables that constitute the economic factors with their effect size are poor access to information (0.845), inadequate storage facility (0.794), and inadequate access to quality foundation seed (0.717), off-takers

disappointment (0.686) and transportation issue (0.608). Those found in institutional factor with their effect size include high cost of machines (0.820), high cost of input (0.792) and scarcity of labour during farming season (0.635). Those that constitute management factor with their effect size are cattle menace (0.911), high cost of water management (0.623) and heavy reliance on traditional tools (0.470).

Table 5 Factors militating against rice grain production enterprise

Sn.	ID	Constraints	Economic	Institution	management
1	X	Poor access to information	0.845		
2	VII	Inadequate storage facility	0.794		
3	V	Inadequate access to quality foundation seed	0.717		
4	XII	Off-takers disappointment	0.686		
5	XI	Transportation issue	0.608		
6	VIII	High cost of machines		0.820	
7	III	High cost of input		0.792	
8	IV	Scarcity of labour during farming season		0.635	
9	I	Cattle menace			0.911
10	III	High cost of water management			0.623
11	VI	Heavy reliance on traditional tools			0.47
Measure of sample adequacy					
		% variance of factor 1	27.81		
		% variance of factor 2	19.62		
		% variance of factor 3	12.98		
		Total % variance	60.42		
		Determinants	0.011		
		Kaiser-Meyer-Olkin (KMO)	0.573		

Source: Field Survey Data, 2021.

Table 6 Factors militating against rice seed production enterprise

Sn.	ID	Constraints	Economic	Institution	Management
1	IV	Scarcity of labour during farming season	0.904		
2	VI	Heavy reliance on traditional tools	0.855		
3	V	Inadequate access to quality foundation seed	0.845		
4	VII	Inadequate storage facility	-0.807		
5	III	High cost of input		0.859	
6	XII	Off-takers disappointment		0.678	
7	VIII	High cost of machines		0.664	
8	IX	Inadequate access to finance for expansion		0.523	
9	I	Cattle menace			0.781

10	X	Poor access to information			-0.775
11	II	High cost of water management			0.72
		% variance of factor 1	32.36		
		% variance of factor 2	18.75		
		% variance of factor 3	16.53		
		Total % variance	67.64		
		Determinants	0.001		
		Kaiser-Meyer-Olkin (KMO)	0.509		

Source: Field Survey Data, 2021.

4.5.2 Seed

The economic factor explained 32.36% of the variance of factors militating against seed rice production in the study area. The institutional factors explained 18.75% of the variance of factors militating against seed rice production in the study area and the management factors explained 16.53% of the variance of factors militating against seed rice production in the study area. Hence, the three factors cumulatively explained 67.64% of the total variance of factors militating against seed rice production in the study area.

Furthermore, the variables that constitute the economic factors with their effect size scarcity of labour during farming season (0.904), heavy reliance on traditional tools (0.855), inadequate access to quality foundation seed (0.845) and inadequate storage facility (-0.807). Those found in institutional factor with their effect size include high cost of input (0.859), off-takers disappointment (0.678), high cost of machines (0.664) and inadequate access to finance for expansion (0.523). Those that constitute management factor with their effect size are cattle menace (0.781), poor access to information (-0.775) and high cost of water management (0.720).

4.6 Test of Hypotheses

4.6.1 The profit from rice seed farmers is not significantly different from grain farmers.

The hypothesis that no significant difference exist in the profit of the grain and seed farmers was tested with Z-test. The table 7 reported a standard deviation of 1286916.36 (grain) and 10205104.22 (seed) which is high enough to show variability in farmer's profit. The absolute Z-score value of 4.55*** was significant at 1% level of probability which implies that the profit from each enterprise differs greatly. This study has been able to clearly present to the readers that seed rice production is more profitable that those involved in grain production. Thus, hypothesis two was rejected.

Table 7 Significant difference in profit from rice seed and grain

Items	**Grain**	**Seed**	**Z**
Mean	1,436,972.14	4,032,468.27	
Std. Dev.	1286916.36	10205104.22	-4.55
Obs.	200	200	

Source: Field Survey Data, 2021. (*,**,***) Significant at 10%, 5% and 1% respectively.

5 Conclusion

It was an interesting study to compare the profit from rice grain and seed production enterprise, this a good and logical study as its findings explicitly revealed to the audience the best option to venture in order to maximize their profit. The study showed that the profitability index for grain was 79.6% and 84.0% for seed which means by comparison that seed production was 4.4% more profitable enterprise. The return on investment (ROI) for grain was 3.77 and 5.13 for seed which also implies that seed enterprise earns ₦1.36 more than grain on every capital investment made on a long run. Being anchored on the methods of production adopted, the study has revealed that those practicing direct seeding and nursery records more returns. Thus, extension workers should intensify their effort in ensuring that the farmers adopt the best technique in their production.

Recommendations

The study, therefore, recommends that extension agents should ensure that information on the best technique or methods of production is disseminated to the farmers as well as guide them towards adoption and implementation. Government should ensure farm inputs are subsidized to the farmers as this will help to encourage more farmers into rice production if found profitable.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

References

[1] Merem, E. C., Twumasi, Y., Wesley, J., Isokpehi, P., Shenge, M., Fageir, M., Crisler, S., Romorno, C., Hines, A., Hirse, G., Ochai, S., Leggett, S., Nwagboso, E. (2017). Analyzing Rice Production Issues in the Niger State Area of Nigeria's Middle Belt. *Food and Public Health*, 7(1): 7-22.

[2] Abu, B.S., Abdur, R.S., Mohammad, C.R., Afroza, C., Shajedur, R., Limon, D. (2017). Rice farmers' technical efficiency under abiotic stresses in Bangladesh. *Asian Journal of Agriculture and Rural Development,* 7(11): 219-232.

[3] Raufun, M.O. (2014). Costs and Returns Analysis of rice production in Kwara State Nigeria. Under Sawah technology. *Advance in Agriculture and Biology* 1(2). pp. 79-83.

[4] Ayinde, O.E. (2013). Evaluation of the Effects of Climate Change on Rice Production in Niger State, Nigeria. *Ethiopian Journal of Environmental Studies and Management*. 6(6), 763-773.

[5] Obianefo, C. A., Okafor, I. P., Bola-Audu, I. and Umebali, E. E (2019). Assessment of the Education Background on Perception of Single Digit Interest Rate among Members of Farmers Cooperative in Anambra State. International Journal of Trend in Scientific Research and Development, 5(3), 1 13-117.

[6] Obianefo, C.A., Nwigwe, C.A., Meludu, T.N. and Anyasie, I.C. (2020). Technical efficiency of rice farmers in Anambra State value chain development programme. *Journal of Development and Agricultural Economics*, 12(2), 67-74.

[7] Ohen, S.B. and Ajah E. A (2015). Cost and return analysis in small scale rice production in Cross River State, Nigeria. *International Research Journal of Agricultural Science and Soil Science*, 5(1); 22-27.

[8] Oyeyinka, R.A. and Bolarinwa, K.K. (2009). Using Nigerian Agricultural Cooperate and Rural Development Bank Smallholder Direct Loan Scheme to increase agricultural production in rural, Oyo State, Nigeria. International Journal of Agricultural Economic and Rural Dvelopment-2(1): 1-10.

[9] Nwilene, F.E., Shaibu, A.A., Oyetunji, O.E., Oladejo, O.B., Popoola, B. Agbeleye, A. and Shittu, A. (2017). Rice seed production for youth entrepreneurs; training manual, page 70. AfricanRice Center. Ibadan Nigeria.

[10] Lanamana, W.L. (2019). Measurement Of Economic Efficiency Of Upland Rice Farming In Different Land Ownership Status In Mausambi Village, Maurole Sub- District, Ende Regency. AGRISEP, 18(2): 387 – 402.

[11] Obianefo, C.A., Aguaguiyi, N.F., Umebali, E.E. and Ezeano, C.I. (2019). Analysis of Rainfed and Dry Season Rice Farming in Value Chain Development Programme in Ayamelum Local Government Area Anambra State. International Journal of Science and Research, 8(7), 1655-1659.

[12] Kernalis, E., Arsyad, L. & Riri, O.U. (2019). Analysis of Profit in Upland Rice Farming and Its Contribution To The Farmer's Household Income In Jangkat Subdistrict Of Merangin District. AGRISEP, 19(2): 269 – 278.

[13] Nneka Chidiebere-Mark, Ohajianya Donatus, Obasi Polycarp & Onyeagocha Steve (2019). Profitability of rice production in different production systems in Ebonyi State, Nigeria. Open Agriculture. 2019; 4: 237–246.

[14] Tasila, D.K., Mabe, F.N. and Alhassan, H. (2019). Technical and resource-use-efficiency among smallholder rice farmers in Northern Ghana. Cogent Food & Agriculture (2019), 5: 1651473. Doi: https://doi.org/10.1080/23311932.2019.1651473

[15] Obianefo, C.A., Anarah, E.S., Osuafor, O.O. & Anumudu O.O. (2019). Determinant of Rainfed and Dry Seasons Rice Farming in Ayamelum Local Government Area of Anambra State, Nigeria. International Journal of Agricultural Economics, X(X): 1-6.

[16] Okafor, I.P. (2019). Effects of agricultural extension services on the performance of members of women agricultural cooperatives in south east, Nigeria. A dissertation submitted to the Department of Cooperative Economics and Management Faculty of Management Sciences, Nnamdi Azikiwe University, Awka, pp: 1-193.

[17] Otabor, J.O. and Obahiagbon, K. (2016). Statistical approach to the link between internal service quality and employee job satisfaction: A Case Study. *American Journal of Applied Mathematics and Statistics.* 4(6), 178-184.

[18] Ebido, C.E, Okoli, T.O and Ugwumba, C.O.A. (2020). Technical Efficiency and Profitability of Rice Production in Anambra State, Nigeria. *International Journal of Innovative Agriculture & Biology Research,* 8(2), 29-39.

[19] Falola, A., Ayinde, O.E., Ojehomon and Vivian E.T (2013). Economic Analysis of Rice Production among the Youths in Kwara State, Nigeria. Albanian Journal of Agricultural Sciences, 12(3): 503-510.

[20] Sanjiv S., Yuga N.G, Meena K., Surya P.A, Jiban S. & Bibek K.S. (2020). Technical efficiency of rice production in Terai district of Nepal. *Journal of Agriculture and Natural Resources*, 3(2), 32-44.

[21] Ogunniyi, L.T., Komolafe, O.D., Fanifosi, G.E., Rasaki, W. (2015). Production Efficiency of Rice Production in Kwara State, Nigeria. *J Agri Crop Sci*., 8(3), 339-345.

[22] Olusegun, O. (2016). Production efficiency and profitability of certified rice seed production among out-growers in Katsina State, Nigeria. A dissertation submitted to the school of postgraduate studies, Ahmadu Bello University, Zaria, pp 1-102. Accessed 9 August 2021 from http://kubanni.abu.edu.ng/jspui/bitstream/123456789/8167/1/production%20efficiency%20and%20profitability%20of%20certified%20rice%20seed%20production%20among%20outgrowers%20in%20katsina.pdf

[23] Madu A.B. & Aniobi U.J. (2018). Profitability analysis of paddy production: A case of agricultural zone 1, Niger State Nigeria. *Journal of Bangladesh Agricultural University*, 16(1), 88-92.

[24] Uchemba, V.U., Nenna, G.M. and Obianefo, C.A. (2021). Adoption of Improved Cassava Production Technologies among small-scale Farmers in Anambra State, Nigeria. *Journal of Plant Sciences*, 9(4): 119-127.

[25] Obianefo, C.A., Osuafor, O.O., Ezeano, C.I. and Anumudu, O.O. (2020). Mediation effect of adoption of good agronomic practice in rice productivity in Anambra State, Nigeria. *International Journal of Agriculture and Rural Development*, 23(1): 4913-4926.