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# Comparative Analysis Of Costs And Returns Of Improved And Local Rice Varieties Production In Anambra Agricultural Zone, Anambra State, Nigeria

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**ABSTRACT**
The study examined the costs and returns of improved and local rice varieties' production in Anambra Agricultural Zone of Anambra State, Nigeria. Multistage and random sampling techniques were used to select 120 rice farmers for the study which included 60 rice farmers of each of the varieties. Data collection was achieved through the administration of structured and pre-tested questionnaires to the farmers using personal interview. Data analysis was attained using descriptive and parametric statistical tools involving enterprise budgeting, profit function and multiple regression analysis. Results indicated that the mean age of the farmers was 48 years, and rice production was dominated by male farmers (70%). Rice production was profitable with per hectare gross margin, net farm income and net return on investment of ₦170,150, ₦152,650 and 0.61 respectively for improved varieties; and ₦110,000; ₦94,720 and 0.41 respectively for local varieties. Result of the comparative mean test further confirmed that improved varieties were more profitable than the local varieties. Maximum variable profits of improved and local rice producers were significantly and commonly influenced by per unit price of output, and farming experience. Common significant determinants of profit for improved and local varieties were age, educational attainment and cost of inputs. The most serious constraint to rice production in the area was high cost of labour, followed by dearth of capital, scarcity and high cost of improved seeds, fertilizer and chemicals, low level of mechanization, poor storage facilities, and non-functional irrigation systems. Government should adequately fund the various rice support projects and research institutions to enhance their capacity to assist rice producers while the farmers should organize themselves into cooperative groups to better their skills, production capacity, profit, hence welfare.
**Keywords**: Improved and local rice; Profitability; Determinants of income; Anambra; Nigeria.

## INTRODUCTION

In Nigeria rice (*Oryza sativa*) has moved from a ceremonial food about four decades ago to a staple food. This development has necessitated a continuous increase in per capita rice consumption from 18g in the 1980s (National Bureau of Statistics (NBS), 2014) to 32g in 2018 (PwC Nigeria, 2018). Rice consumption has also been on the increase due to emerging documented information on its nutritional, medicinal, social and economic benefits. According to Deepak and Kirti (2011), rice is rich in carbohydrates, but contains other nutrients such as proteins, crude fibre, ash and fat; minerals such as Ca, P, Fe, Na and K; vitamins such as thiamine, riboflavin, niacin and tocopherol. The presence of these nutrients in rice enables it play an important role in the amelioration of diseases such as high blood pressure, cancer, Alzheimer, dysentery among others (Oko, Ubani, Efisue and Dambaba, 2012).

The demand for rice has been on the increase as a result of rising population of the country. For instant, the 360,000 tonnes of rice produced in the 1960s was enough to meet local demand, whereas

the three million metric tonnes produced annually since 2012 fell short of annual demand of five million tones. The annual shortfall of about two million tonnes is augmented through smuggling and massive rice importation estimated at one billion US dollars in 2016 (Central Bank of Nigeria (CBN), 2016).

The widening demand-supply gap informed the initiation of policies by Government aimed at boosting rice production, hence supply. Such policies include the Presidential Initiative on rice production (2000), International Fund for Agricultural Development (IFAD) Value Chain Development Programme (2009), Growth Enhancement Support Scheme (GESS) (2010) and the Anchor Borrowers Programme (ABP) (CBN, 2016). The implementation of these policies led to steady increase in rice production as well as national output which rose from 3.1 million tonnes in 1999 to 3.8 million tonnes in 2013.

Based on this backdrop, this study was designed to ascertain the costs and returns of both the improved and local varieties of rice produced by farmers in the Anambra Agricultural Zone of Anambra State, Nigeria so as to imform policy measures for the attainment of self-sufficiency in rice production. Meanwhile, past studies on rice production in the area such as Nwike and Ugwumba (2015), Obiekwe and Ugwumba (2016) and Ebido, Okoli and Ugwumba (2020) respectively investigated the profitability, access to credit and technical efficiency of rice production. There was, therefore, dearth of information on the economics of improved and local varieties of rice in the area, hence this study which compared the profitability of producing improved and local varieties of rice, ascertained the determinants of maximum variable profit and net farm income from both varieties and identified the constraints to rice production in the study area.

## RESEARCH METHODOLOGY

A survey research design was used in the study. The study population was made up of the 1105 registered rice farmers in the agricultural zone (Anambra State Ministry of Agriculture (ASMA), 2017). Agriculture is the main occupation of the rural folks employing over 70% of the population. Major crops farmed include rice, yam, cassava, cocoyam, maize, vegetables and tree crops. Rice is grown both as rain-fed and as irrigated crop. Both upland and lowland rice are cultivated in the zone with the later being more predominant. Various local and improved varieties of rice are planted by farmers in the area.

The study population was made up of all the 1105 registered rice farmers in the agricultural zone. Multistage and random sampling techniques were used to select 120 respondents from the sample frame. Data were collected from primary source using well-structured and pre-tested questionnaire administered to the respondents through personal interview. About 180 copies of the questionnaire were administered through the help of trained enumerators while 120 well completed copies of the questionnaire were sorted out and used for data collation. Data were collected on socio- economic factors of the respondents such as age, gender, household size, marital status, educational level, amount of credit obtained, farming experience, and contact with extension agents. Data on production variables such as farm size, material inputs, labour supply and use, output of rice with their current market prices, and rice production constraints were also elicited. Non-parametric statistical tools such as mean, ratio, frequency and percentage, and parametric statistics in multiple regression were used for data analysis.

The budgetary method and profit function analysis were used to examine enterprise profitability. The budgetary method used to access enterprise profitability is given as:

GM = TR – TVC

NFI =GM – TFC or TR – TC

MNFI = NFI/n

NROI = NFI/TC

Where:

GM = Gross margin

TR = Total revenue

TVC = Total variable cost

TFC = Total fixed cost

TC = Total cost

NFI = Net farm income

MNFI = Mean net farm income
NROI= Net return on investment

The profit function analysis was used to estimate the profitability levels of individual resource inputs and socio-economic variables on maximum variable profit. The model is implicitly specified as:

$$\prod^{*} = \prod^{*}\left(Py, P_1, P_2, P_3, Z_1, Z_2, S_1, S_2, S_3, S_4, S_5\right)$$

Where:

$\prod^{*}$ = Amount of maximum variable profit (₦)
Py = Per unit price of output (₦)
$P_1$ = per unit price of rice seeds (₦)
$P_2$ = per unit price of fertilizer (₦)
$P_3$ = per unit price of labour (₦)
$Z_1$ = Rental value of land (₦)
$Z_2$ = Annual depreciation value of machete, hoe, wheelbarrow/basket (₦)
$S_1$ = Age of farmer (years)
$S_2$ = Educational level of farmer (years)
$S_3$ = Farming experience (years)
$S_4$ = Household size (number)
$S_5$ = Extension visits (number of visits per farming season)

Note: $Z_1$ and $Z_2$ are fixed cost items and were not included in the analysis since the analysis was based on short-run effect of input prices (Arene and Mbata, 2008).

The multiple regression model adopted to establish the effects of socio-economic characteristics of farmers on net production income is specified implicitly as:

$Y = f(X_1, X_2, X_3, X_4, X_5, X_6, X_7, X_8, X_9, X_{10})$

Where:
Y = Net farm income (₦)
$X_1$ = Gender (dummy: male = 1; female = 2)
$X_2$ = Age (years)
$X_3$ = Marital status (dummy: married = 1; otherwise = 2)
$X_4$ = Household size
$X_5$ = Educational level (years)
$X_6$ = Farming experience (years)
$X_7$ = Cost of inputs (₦)
$X_8$ = Extension visits (number of times per production season)

The production function was fitted with four functional forms of the regression model namely linear, exponential, semi-log and double-log. The explicit expressions of the models are:

Linear: $$Y = b_0 + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + b_6X_6 + b_7X_7 + b_8X_8 + e_i$$

Exponential: $$\ln Y = b_0 + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + b_6X_6 + b_7X_7 + b_8X_8 + e_i$$

Semi - log:

$$Y = b_0 + b_1 \ln X_1 + b_2 \ln X_2 + b_3 \ln X_3 + b_4 \ln X_4 + b_5 \ln X_5 + b_6 \ln X_6 + b_7 \ln X_7 + b_8 \ln X_8 + e_i$$

Double-log:

$$\ln Y = b_0 + b_1 \ln X_1 + b_2 \ln X_2 + b_3 \ln X_3 + b_4 \ln X_4 + b_5 \ln X_5 + b_6 \ln X_6 + b_7 \ln X_7 + b_8 \ln X_8 + e_i$$

The ordinary and transformed values of the dependent and independent variables were fitted into the respective models and analyzed using the MINITAB statistical package. The regression output which

produced the best result in terms of number of significant parameters, values of t-statistic, F-statistic and coefficient of multiple determination ($R^2$) was chosen as the lead equation.

## RESULTS AND DISCUSSION

### Profitability of improved and local rice varieties in the area

Enterprise budgeting technique and profit function analysis were used to examine the profitability of improved and local rice varieties' production. Result of the enterprise budgeting analysis (Table1) showed per hectare gross margin, net farm income and net return on investment values of ₦170,150; ₦152,650 and 0.61 respectively for improved varieties. It also showed gross margin, net farm income, mean net farm income and net return on investment values of ₦110,000, ₦94,720 and 0.41 respectively for local varieties. The net return on investment of 0.61 and 0.41 respectively recorded by farmers of improved and local varieties implied that ₦0.62 and ₦0.41 were returned for every ₦1.00 invested in the enterprise. This result is in consonance with Raufu (2014), Nwike and Ugwumba (2015), Okam*et al*. (2016) which commonly noted that rice production was profitable. Meanwhile, producers of improved rice varieties had a larger net farm income and net return on investment than the local rice producers probably due to the higher yield advantage of improved rice varieties. This finding is in accordance with that of Kudi (2010) and West African Rice Development Agency (WARDA) (2008) which reported significant yield and revenue gap between improved and local rice varieties in favour of the improved varieties.

**Table 1: Estimated profit per hectare per farmer of improved and local rice varieties**

| Variable | Improved Varieties | | Local varieties | |
|---|---|---|---|---|
| | Amount(₦) | % | Amount (₦) | % |
| **Total Revenue** | 403,500 | | 325,600 | |
| **Variables Cost:** | | | | |
| Rice Seed | 22,500 | 8.97 | 9,980 | 4.32 |
| Fertilizer | 33,000 | 13.16 | 26,750 | 11.59 |
| Insecticides/Herbicides | 23,500 | 9.37 | 20,600 | 8.92 |
| Machinery lease | 10,000 | 3.99 | 8,200 | 3.55 |
| Labour | 110,650 | 44.11 | 121,850 | 52.78 |
| Rent | 10,000 | 3.99 | 10,000 | 4.33 |
| Transport | 18,300 | 7.30 | 10,200 | 4.42 |
| Miscellaneous | 5,400 | 2.15 | 8,000 | 3.47 |
| **Total Variable Cost** | **233,350** | **93.02** | **215,580** | **93.37** |
| **Fixed Cost:** | | | | |
| Dep. On Sprayer | 1,200 | 0.48 | 1,000 | 0.43 |
| Dep. on Matchet/Hoes | 1,000 | 0.40 | 1,250 | 0.54 |
| Dep on Wheelbarrow | 800 | 0.32 | 800 | 0.35 |
| Dep. on Threshers | 5,000 | 1.99 | 3,800 | 1.65 |
| Dep. on Motorcycles | 4,200 | 1.67 | 4,000 | 1.73 |
| Interest on Loans | 5,300 | 2.11 | 4,450 | 1.93 |
| **Total Fixed Cost (TFC)** | **17,500** | **6.98** | **15,300** | **6.63** |
| **Total Cost (TC= TVC + TFC)** | **250,850** | **100** | **230,880** | **100** |
| **Gross Margin (TR-TVC)** | **170,150** | | **110,000** | |
| **Net Farm Income (NFI=TR-TC)** | **152,650** | | **94,720** | |
| **Net Return on Investment (NROI = NFI/TC)** | **0.61** | | **0.41** | |

**Source: Field survey, 2018. Note: Dep. - depreciation**

Further assessment of profitability using the profit function regression is presented in Tables 2 and 3. The results indicated that per unit price of output was statistically significant for the improved varieties while per unit price of output, per unit price of fertilizer and per unit price of labour were statistically significant for the local varieties. The coefficient of per unit price of output for both varieties was positive and had significant influence on the amount of maximum variable profit. This conforms to *a priori* expectations that higher the price of output, higher the income and profit expected from the enterprise. More so, the coefficient of per unit price of fertilizer and labour was negative and significant at 1% level of probability. This implies that increase in the prices of fertilizer and labour will result to a decrease in income and profit expected from the enterprise. This finding

contradicts Ohaka *et al*. (2013) who reported negative though not significant relationship between per unit price of fertilizer and maximum variable profit.

With regards to the effects of socio-economic factors of farmers of improved varieties on maximum variable profit (Table 2), the coefficients of age, educational level, farming experience and household size were positively signed and significant. This means that increase in these factors would result to a higher amount of maximum variable profit. For farmers producing local varieties (Table 3), the coefficients of farming experience and extension visits were positively signed and significant at 5% probability level. This implies that increase in these variables would lead to a higher income and profit expected from the enterprise. This finding is in tandem with Giro and Adebayo (2007) and Ekpe and Alimba, (2013) that farming experience and extension visit have significant effect on maximum variable profit.

**Table 2: Profit function regression output for improved rice varieties**

| Predictor | Coefficient | StDev. | T-ratio | Probability |
|---|---|---|---|---|
| Constant | 15.840 | 2.27 | 6.98 | 0.000 |
| PPO | 1.562 | 0.94 | 1.87* | 0.097 |
| PPS | 0.002 | 0.01 | 0.20 | 0.844 |
| PPF | -0.290 | 0.67 | -0.43 | 0.667 |
| PPL | -0.699 | 1.81 | -0.86 | 0.019 |
| AGE | 4.733 | 2.39 | 12.22*** | 0.000 |
| EDU | 0.045 | 0.11 | 2.39** | 0.00 |
| FAE | 0.994 | 0.11 | 8.76*** | 0.000 |
| HOS | 0.927 | 0.15 | 5.99*** | 0.000 |
| EXV | -0.013 | 0.02 | -0.69 | 0.492 |
| $R^2$ | 65.7% | | | |
| $R^2$ (adjusted) | 64.3% | | | |
| F-Statistics | 46.56 | | | |
| Durbin-Watson Statistic | 2.76 | | | |

**Source: Computed from survey data, 2018. Note: ***, **, * means significant at 1% 5% and 10% levels of probability. St Dev. - standard deviation.**

**Table 3: Profit function regression output for local rice varieties**

| Predictor | Coefficient | StDev. | T-ratio | Probability |
|---|---|---|---|---|
| Constant | 24.37 | 9.20 | 0.47 | 0.64 |
| PPO | 0.4212 | 0.20 | 3.24*** | 0.000 |
| PPS | 0.4177 | 0.09 | 0.52 | 0.068 |
| PPF | -0.3333 | 0.48 | -2.83*** | 0.80 |
| PPL | -0.5619 | 0.09 | -3.89*** | 0.00 |
| AGE | 0.1831 | 0.46 | 1.00 | 0.30 |
| EDU | 0.1994 | 0.63 | 1.35 | 0.41 |
| FAE | 0.2036 | 0.49 | 1.99** | 0.211 |
| HOS | 0.2641 | 0.48 | 0.82 | 0.03 |
| EXV | 0.4112 | 0.39 | 2.58** | 0.002 |
| $R^2$ | 76% | | | |
| $R^2$ (adjusted) | 72.5% | | | |
| F-statistics | 10.28 | | | |
| Durbin-Watson statistic | 1.89 | | | |

**Source: Computed from survey data, 2018. Note: ***, **, * means significant at 1%, 5% and 10% levels of probability. St Dev. – standard deviation.**

The $R^2$ values of 65.7% and 76% for improved and local varieties respectively indicated that only 34.3% and 24% variations in their maximum variable profits were due to error from the predictor variables. The F-statistic values of 46.56 and 10.28 for improved and local varieties was statistically significant, an indication of overall significance of the regression.

**Determinants of net farm income realized by farmers of improved and local rice varieties**

Table 4 and 5 show the results of the multiple regression analysis on the determinants of net farm income realized by farmers of improved and local rice varieties in the area. Based on the magnitude of the coefficient of multiple determination ($R^2$), t-ratios, F- statistic, Durbin-Watson statistic, the signs and appropriateness of signs of the parameter estimates, as well as number of significant variables, output of the exponential function was chosen as the lead equation for improved rice varieties while output of the linear function was chosen as the lead equation for local rice varieties.

The coefficients of multiple determination ($R^2$) of 96.2% and 95.4% obtained for improved varieties and local varieties respectively implied that 96.2% and 95.4% variations in the profits realized by the producers of improved and local rice were accounted for by the predictor variables while the remaining 3.8% and 4.6% respectively were due to random disturbances. The F-statistic values of 1145and 1005.50 for improved and local cultivars respectively indicated that the socio-economic characteristics of the rice farmers together, significantly determined the profit levels. The Durbin-Watson statistic values of 1.73 and 1.79 for improved and local rice varieties respectively which lie within the bench mark of 2.0, signifies the absence of autocorrelation among observations of the regressors.

A total of eight regressors were included in the model. For improved rice varieties, six of them (gender, age, educational attainment, farming experience, cost of inputs and extension visits) were significant while the other two (marital status and household size) were not significant. For the local varieties, five predictors, namely marital status, household size, age, education and cost of inputs were statistically significant while gender, farming experience and extension visits were statistically not significant.

For farmers of improved rice varieties, the coefficient of gender was positive and statistically significant at 1% level of probability. The coefficient of marital status and household size of the farmers of local varieties was negatively and positively significant at 1% and 10% probability levels respectively. This means that local rice varieties' farmers that were married and had a large household size were more likely to produce more at a lower production cost since there would be minimal use of hired labour thereby increasing the net farm income. This finding is consistent with Bashiya, Sarka, Ansari and Prackash (2015) who reported a positive relationship between farmers' household status and yield of different rice varieties grown in Eastern Malayam region of India.

**Table 4: Estimated determinants of net farm income realized by farmers of improved rice varieties**

| Variable constant | Linear | Exponential | Semi-log | Double Log |
|---|---|---|---|---|
| Constant | 42017 | 3.290 | 593042 | 2.9601 |
| | (8.40) | (49.35) | (7.35) | (4.95) |
| GEN | 53433 | 315.21 | 46725 | 1.03135 |
| | (1.27) | (23.41)*** | (5.36)*** | (1.30 |
| AGE | -524.20 | 1.2141 | 321005 | -.3281 |
| | (-9.41)*** | (31.40)*** | (11.05)*** | (-1.29) |
| MAS | 2478 | 1.3529 | 020296 | -1.3792 |
| | (0.48) | (1.29) | (0.61) | (2.36)** |
| HOS | 251.2 | 1.02819 | 62 | 1.31537 |
| | (1.63) | (0.98) | (0.986) | (2.01) |
| EDU | 4012.19 | 1.0032 | 4.201 | 0.14026 |
| | (3.48)*** | (7.96)*** | (2.09)** | (3.68)*** |
| FAE | 198.46 | 1.22436 | 20143 | 0.9654 |
| | (30.12)*** | (19.12)*** | (9.64)*** | (21.12)*** |
| COI | 0.3496 | 1.00001981 | 621.6 | 0.17924 |
| | (3.79)*** | (5.09)*** | (0.32) | (1.76)* |
| EXV | 22751 | 200.48 | 19112 | 1.15943 |
| | (2.36)** | (8.96)*** | (3.45)*** | (1.31) |
| $R^2$ | 94.7 | 96.2 | 93.8 | 93.7 |
| $R^2$ Adjusted | 96.1 | 93.7 | 93.2 | 93.2 |
| F.Statistic | 1306.69 | 1145.0 | 1003.2 | 1114.8 |
| D-Wat. Stat. | 1.79 | 1.73 | 1.68 | 1.60 |

**Source: Computed from survey data, 2018. Note: ***, **, * means significant at 1%, 5% and 10% levels of probability. D-Wat. Stat= Durbin Watson Statistic. Figures in () are t-ratios. GEN, AGE, MAS, HOS, EDU, FAE, COI, EXV are as earlier defined.**

The coefficient of age was positive and significant at 1% level of probability for farmers of improved rice varieties. This means that older farmers had more years of farming experience hence, they were likely to produce more and realize more net farm income than the younger farmers. While the

coefficient of age for farmers of local rice varieties were negative and significant at 5% level of probability. This could be attributed to the fact that younger farmers would be more energetic to work than ageing farmers thereby leading to a higher productivity and net farm income. This is in agreement with the findings of Anigbogu *et al.* (2005) and Ajah and Ajah (2014) which reported an inverse relationship between age and output level of farmers.

Furthermore, the result showed positive and significant relationship between net farm income and educational level for farmers of both varieties at 1% probability level. This meant that farmers with higher level of educational attainment had higher level of output and net farm income than those with lower education. This finding is expected considering that the educated farmers were more likely to adopt modern farming techniques that woukd boost production level than their less educated counterparts. This result conforms with *apriori* expectations and corroborates the studies of Raufu (2014) and Okam, Yusuf, Abdulrahman and Suleiman (2016) who reported positive effect of higher educational attainment on production output and profit from rice production.

**Table 5: Estimated determinants of net farm income realized by farmers of local rice varieties**

| Variable constant | Linear | Exponential | Semi-log | Double Log |
|---|---|---|---|---|
| Constant | 44329 | 50142 | 39928 | 30129 |
| | (7.02) | (28.85) | (0.19) | (10.21) |
| GEN | 4018 | 1.01973 | 20143 | 0.0331 |
| | (0.69) | (1.21) | (0.98) | (1.25) |
| AGE | -301.1 | -1602757 | 7982 | 1.01377 |
| | (1.98)** | (-1.21) | (2.49)** | (1.87)* |
| MAS | 89134 | -1.13828 | 32781 | 101222 |
| | (3.81)*** | (-2.83)*** | (0.98) | (1.29) |
| HOS | 302.8 | 1008113 | 2994 | 0.018761 |
| | (1.87)* | (1.02) | (0.23) | (2.39)** |
| EDU | 804.9 | 1.28125 | 12976 | 1.2165 |
| | (3.41)*** | (2.02)** | (1.98)** | (0.98) |
| FAE | 41.15 | 0.231713 | 4091 | 2.08683 |
| | (1.34) | (1.82) | (2.83)*** | (1.21) |
| COI | 1.0079 | 1.12008015 | 9324 | 1.01377 |
| | (3.91)*** | (2.60)** | (2.29)** | (2.41)** |
| EXV | 5071 | 3014 | 0.9814 | 0.29473 |
| | (0.87) | (-5.60)*** | (1.2013) | (1.48) |
| $R^2$ | 95.4 | 89.9 | 95.1 | 92.7 |
| $R^2$ Adjusted | 89.8 | 88.0 | 93.9 | 90.6 |
| F.Stat. | 1005.50 | 1132.0 | 1198.7 | 1010.20 |
| D.W.Stat. | 1.79 | 1.72 | 1.81 | 1.69 |

**Source: Computed from survey data, 2018. Note: ***, **, * means significant at 1%, 5% and 10% levels of probability. D-Wat. Stat= Durbin Watson Statistic. Figures in () are t-ratios. GEN, AGE, MAS, HOS, EDU, FAE, COI, EXV are as earlier defined.**

The coefficient of farming experience for farmers of improved varieties had a positive and significant effect on net farm income at 1% level of probability. This conforms to *a priori* expectations that more experienced farmers are expected to have higher output and net farm income than farmers with less or no experience. This result agrees with the findings of Kudi (2010) and Igboji, *et al.* (2015) that higher farming experience leads to acquisition of more skills which translate to higher output and consequently higher profit. The coefficient of extension visits was positive and significant at 1% probability level for farmers of improved varieties. This implies that increase in the number of extension visits will increase profitability hence a higher net farm income.

The coefficient of cost of inputs was positive and statistically significant at 1% level for both the improved and local rice varieties. This implied that higher the cost of inputs, higher the profit expected by both the improved and local rice farmers. This is contrary to *apriori* expectation of negative relationship between cost of inputs and profit. It could be that majority of the farmers increased their scope of operation (investment) which translated into higher output and profit. This

finding corroborates Nwike and Ugwumba (2015) who deduced a positive and significant relationship between cost of inputs and net farm income. However, it contradicts Ajah and Ajah (2014) who opined a negative relationship between cost of inputs and production output.

**Constraints to rice production in the area**

Rice production in the area was constrained by factors such as inadequate capital, high labour cost, scarcity of improved seeds, pest and disease infestation, low level of mechanization, poor technical knowledge, poor product price among others. Analysis of the constraints was achieved by comparing the calculated mean scores with the cut-off point (mean) of 2.50, obtained using a 4-point Likert-type scale. Items with mean scores of 2.50 and above were regarded as constraining factors to rice production while those below 2.50 were not seen as constraints. Again the calculated means were also ranked in order to determine the order of seriousness of the factors of production.

Result of the analysis as presented in Table 6 indicated that high cost of labour was considered by the farmers as the most serious production constraint in the area with mean score of 3.79. The findings are in line with Raufu (2014) who identified labour cost as a serious constraining factor to rice production in Kwara State. Cost of labour according to Nwike and Ugwumba (2015) accounted for over 75% of total cost of rice production in Aguata Agricultural Zone of Anambra State. Scarcity of able bodied young men serving as hired labour in the agrarian rural communities was found to be the main reason for the hike in labour price. The shortage of labour was attributed to rural-urban drift of able bodied young men and women in search of white collar jobs (Ghandiv, 2008; and FAO. 2014).

The second major constraint to rice production in the area was inadequate capital as judged by the mean score of 3.74. Inadequate capital includes, cash, simple farm tools and equipment for efficient farm operation. The problem was further complicated by farmers poor access to formal credit sources due to unavailability of collaterals. The finding corroborates Imolehim and Wada (2005) and Kudi (2010) who in their studies on rice production in Nigeria reported dearth of capital as major challenge faced by the producers. The implication is that farmers depend majorly on their scanty personal savings to finance their production activities. Scarcity and high cost of quality improved seeds with a mean rating of 3.68 was viewed by rice farmers as yet another major militating factor to production. The finding supports Okan, Yusuf, Abdulrahman and Suleiman (2016) who reported scarcity and high cost of improved seeds as major constraint to rice production in Ebonyi State, Nigeria. Similarly, Nwike and Ugwumba (2015) rated scarcity of improved seeds as the fourth major constraint to rice production in Aguata Agricultural Zone of Anambra State. The dearth of improved rice seeds often leads farmers to planting saved seeds or borrowed uncertified seeds with consequences of yield reduction. The finding is also consistent with National Agricultural Extension and Research Liaison Services (NAERLS) and Federal Department of Agricultural Extension (FDAE) (2014) who in the agricultural survey report of southeast Nigeria for the year 2013 identified exorbitant cost of improved seeds, fertilizer, agrochemicals and other inputs as serious constraints to enhanced rice production in the area. High cost of seeds, fertilizer and agrochemicals increases total cost of production which in turn reduces farmers' profit.

**Table 6: Constraints to rice production in the study area**

| Constraint | Mean score | Rank | Remark |
|---|---|---|---|
| High cost of labour | 3.79 | 1st | Serious |
| Inadequacy of capital | 3.74 | 2nd | Serious |
| Scarcity and high cost of improved seeds | 3.68 | 3rd | Serious |
| Inadequate mechanization | 3.55 | 4th | Serious |
| Poor technical knowledge | 3.38 | 5th | Serious |
| Flooding of farm land | 3.34 | 6th | Serious |
| Fluctuating product price | 3.20 | 8th | Serious |
| Poor storage facilities | 3.00 | 9th | Serious |
| Non functional irrigation | 2.98 | 10th | Serious |
| Scarcity of arable land | 2.92 | 11th | Serious |
| Poor road network | 2.88 | 12th | Serious |
| Poor demand for rice | 1.74 | 13th | Not Serious |
| Fire outbreak | 1.69 | 14th | Not Serious |

**Source:Field Survey, 2018.**

The next major constraints to rice production in the area were inadequate mechanization with mean score of 3.55. The finding was consistent with (NAERLS) and (FDAE) (2014) who reported low level

of tractorization by rice and other arable crop farmers in the Southeast zone due to dearth of functional tractors and implements. In the absence of tractors and other implements such as threshers, rice farmers resort to the use of manual labour which is often costly and ineffective. Other highly rated constraints to rice production in the area in descending order of seriousness include poor technical knowledge of the farmers, flooding, fluctuating product price, poor storage facility, non functional irrigation, scarcity of land and poor roads. The finding is in consonance with Longtau (2003) who identified major constraining factors to rice production in the country to include inadequate technical knowledge of the farmers arising from poor extension services, low level of mechanization, poor irrigation and other infrastructural facilities, flood menace, low pricing among others. As could also be seen from the result (Table 6) only poor demand for product with mean score of 1.74 and fire outbreak (1.69) were considered by the farmers as not being serious constraint to production. The findings are in line with West African Rice Development Agency (WARDA, 2008) who reported increasing demand for rice among Nigerian consumers in the past few decades.

## CONCLUSION

The study revealed that the cultivation of both improved and local varieties of rice in Anambra Agricultural Zone of Anambra State, Nigeria was common and profitable. Although producers of both types of rice recorded positive gross margin, net farm income and net return on investment, farmers of improved cultivars made higher profit. Various socio-economic factors were also found to determine profit from rice production in the area while a number of factors were identified to be constraining rice production in the area. Addressing these constraints through formulation and implementation of good policies and programmes will enhance production output and net farm income realized by the farmers.

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