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## EFFECTS OF FADAMA III AF SORGHUM PRODUCTION DEVELOPMENT PROGRAMME ON WOMEN AND YOUTHS IN NIGER STATE, NIGERIA

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### Abstract

This study was conducted in Niger state Nigeria to determine the effect of Fadama III AF development programme on women and youth sorghum farmers. A Multi-stage sampling technique was adopted for the sampling procedure. Two local government areas were selected and four villages were randomly selected from both local governments. A total of 78 respondents which included women and youths were selected from the villages which brought the total of the respondents to be 156. Structured questionnaire was used to elicit information from the respondents. The data collected were analyzed through the use of descriptive and inferential statistics such as frequency, percentage, mean, propensity score matching analyzed the effect of Fadama III AF programme on the income, labor, output and area of land cultivated. The ordinary least square regression model was used to analyse the determinants of the income of the beneficiaries and non-beneficiaries. The study revealed that the average income, output and labour used of the beneficiaries increased after the participation of the development program depicting a positive impact on the beneficiaries. The study revealed that the mean age of the beneficiaries and non- beneficiaries were 34years and 37years respectively. The majority of the beneficiaries were females 62.80% and males 37.20% for the non- beneficiaries. The OLS estimates indicated that quantity of seeds at 1%, labour at 5%, farming experience at 5%, number of adopted technologies at 10% and transportation at 1% level of significance respectively were the determinants of income for the beneficiaries while price of sorghum at 1%, farm size at 1% and farming experience at 10% level of significance respectively were the determinants of income for the non- beneficiaries. Therefore it was recommended that the Federal Government, ADP's, non- governmental agency and financing institutions (World Bank) ensure the continuation of the programme and extension to the non-beneficiaries in order to improve the standard of living in the rural area.

**Keywords:** Fadama III AF, Programme, Sorghum, Women, Youths, Farmers

### 1. Introduction

Nigeria is the largest sorghum producer in West Africa accounting for about 71% of the total regional sorghum output (Ogbonna, 2011). Food and Agriculture Organization (FAOSTAT) (2012) Nigeria reported that Nigeria is the third largest world producer after the United States and India. However, 90% of sorghum produced by some countries of the world such as the United States and India is given to animal feed, making Nigeria the world leading country for food grain sorghum production. Sorghum represents 1.6% of the global GDP in 2006 and 5.4% of the agricultural GDP.

making it the 6<sup>th</sup> most important product after cassava, yams, rice, maize and fruits (International Food Policy Research Institute (IFPRI), 2010).

In Nigeria, sorghum is the third cereal in the aspect of production after maize and millet (FAOSTAT, 2012), with more than 4.5 million tons harvested in 2010 representing 25% of the total cereal production (FAOSTAT, 2012). In almost all the North of the country, it is the primary food crop. The majority of domestic production is used for household consumption and fodder. Indeed, producers first use their sorghum to meet household needs, only a small proportion being traded, mostly on the local market (Zalkuwi *et al.*, 2015). Sorghum is primarily eaten in the form of flour or paste. It has a high caloric and nutritional value and is therefore recommended for infants, pregnant and lactating mothers, the elderly and the convalescents (Ogbonna, 2011).

*Fadama* is a Hausa word which implies low-lying and flood plain areas underlined by shallow aquifers and found along Nigeria's river system. *Fadama III* project is a tripartite funded intervention by the World Bank, Federal Government of Nigeria and the participating States. The Federal Government of Nigeria had received additional International Development Association (IDA) credit of USD200 million on June 28, 2013, to scale up impacts on the ground and strengthen the development effectiveness of the well performing Third National *Fadama* Development Project (*Fadama III*) by aligning it more closely with the new Agricultural Transformation Agenda (ATA). Additional financing became disbursement effectiveness by (February 11, 2014) and has commenced operations upon the approval of the eighteen month procurement plan by the World Bank and the annual work plan and budget in April 2014.

In spite of many years of agricultural development efforts by past successive governments in Nigeria and international donor agencies and in spite of Millions of dollars committed into such development efforts, agricultural sector appears to have remained undeveloped (Nwaobiala, 2013). This may be as a result of neglect of evaluation on the effectiveness of the programmes on the beneficiaries. There are scanty studies on the impact of *Fadama III* project on farmers' income (Ominikari *et al.*, 2017). There is no evidence of research efforts to measure the impact of *Fadama III* AF on the farmers in Niger State particularly the sorghum farmers. Also, the researchers have in the past commonly used the Heckman's difference - in difference methodology, t-test and chow-test to measure the effect and impact of *Fadama* on the output and income of beneficiaries. The propensity score matching (PSM) method have been rarely used by researchers to measure impact of *Fadama* on the beneficiaries. This study therefore aimed at gauging the effect of *Fadama III* AF sorghum production development on women and youth in Niger State, Nigeria using the PSM approach. The outcome of the study will be a worthy document and provide important feedback that will help relevant stakeholders and government agencies in Nigeria to re-appraise their strategies as well as guide future policy makers towards a more practical and effective approach to development among women and youths. It will also provide basis for further research into the concept of using a more realistic and efficient approach to gauge the impact of the empowerment programmes among women and youths.

## 2. Methodology

The study was conducted in Niger State, Nigeria. It was created April, 1976. The capital of the State is Minna which is located between Longitude 3°30'E and 7°20'E and Latitude 8°22'N. This area was chosen because of its participation in the National *Fadama III* AF development project.

A multistage random sampling technique was adopted in selecting the respondents for this study. The First stage was a purposive selection of two Local Government Areas that has been involved in the empowerment program which is among the highest numbers of *Fadama III* AF women and youth empowerment beneficiaries. The Local Governments were Bosso and Katcha Local Government Areas. The second stage involved the selection of four villages each from the two selected Local Government Areas. A sample size of 50% of the total sample frame of 156 beneficiaries from the eight selected villages which is 78 respondents was used. This sampling process described above was used to determine the sample size of the Non-beneficiaries.

Primary data used for this study were collected using structured questionnaire and interview schedules that were administered by the researcher with the assistance of trained Enumerators. Data

were analyzed using descriptive statistics such as mean and frequency; propensity score matching method and ordinary least square (OLS) regression model.

## 2.1 Propensity Score Matching (PSM) Method

The PSM method was used to determine the effect of *fadania* III AF on the income (₦), labour (man-days), output (kg) and the area of land cultivated (ha) of the women and youth sorghum farmers. The effect of treatment on the beneficiaries was estimated by computing the differences across both groups (beneficiaries and non-beneficiaries). If a project outcome indicator is farmers income, for instance, the average effect of the programme on the beneficiaries is referred to as average treatment effect on the treated (ATE) and is defined as the difference between the expected income earned by programme beneficiaries while participating in the programme and the expected income they would have received if they had not participated in the programme.

$$ATE = \frac{1}{N_1} (Y_1 - Y_0)$$

Where;

ATE = Average of treatment effect on the beneficiaries.

$N_1$  = Number of matches (from regression model)

$Y_1$  = Average annual income (₦), labour (man days), output (kg) and the area of land cultivated (ha) of beneficiaries

$Y_0$  = Average annual income (₦), labour (man days), output (kg) and the area of land cultivated (ha) of non-beneficiaries

The model is specified as:

$$Y_i = \begin{cases} y_i^* & \text{If } y_i^* > 0 \\ 0 & \text{If } y_i^* \leq 0 \end{cases}$$

$$y_i^* = \beta_0 + X\beta_1 + \mu_i, \mu/X \approx N(0, \sigma^2)$$

$$y_i^* = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \dots + \beta_{10} X_{10} + \mu_i \dots$$

Where,

$Y_1$  = dependent variable (propensity scoring index)

$\beta$  = vector of unknown coefficients

$X_1$  = Age (years)

$X_2$  = Sex (1 if male, 0 if otherwise),

$X_3$  = Marital status

$X_4$  = Education (years)

$X_5$  = Farming experience (years)

$X_6$  = Involvement in farming

$X_7$  = Farm size (Ha)

$X_8$  = Quantity of sorghum harvested (Kg)

$X_9$  = Fertilizer (Kg)

$X_{10}$  = Farm distance (km)

$\beta_1 - \beta_{10}$  = Coefficients of variables

$\beta_0$  = Constant

$\mu$  = Error term.

## 2.2 Ordinary Least Square (OLS) Regression Model

The OLS regression model is specified in implicit and explicit form thus;

Implicit form:

$$Y = f(X_1, X_2, \dots, X_{11})$$

The explicit forms of the regression equation fitted to the data were specified as follows:

Linear:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 X_8 + \beta_9 X_9 + \dots + \beta_{11} X_{11} + \mu$$

Double-log:

$$\ln Y = \ln \beta_0 + \beta_1 \ln X_1 + \beta_2 \ln X_2 + \beta_3 \ln X_3 + \beta_4 \ln X_4 + \beta_5 \ln X_5 + \beta_6 \ln X_6 + \dots + \beta_{11} \ln X_{11} + \mu$$

Exponential:

$$\ln Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 X_8 + \beta_9 X_9 + \dots + \beta_{11} X_{11} + \mu$$

Semi-log:

$$Y = \ln \beta_0 + \beta_1 \ln X_1 + \beta_2 \ln X_2 + \beta_3 \ln X_3 + \beta_4 \ln X_4 + \beta_5 \ln X_5 + \beta_6 \ln X_6 + \dots + \beta_{11} \ln X_{11} + \mu \text{ Where;}$$

Y = Income per production cycle (₦)

X<sub>1</sub> = population density of the plant (kg/m<sup>2</sup>)

X<sub>2</sub> = Quantity of seed used (Kg)

X<sub>3</sub> = Labor (man days)

X<sub>4</sub> = Capital input (depreciation in naira)

X<sub>5</sub> = Farm size (ha)

X<sub>6</sub> = Experience in sorghum farming (years)

X<sub>7</sub> = Adopted technology (number of technologies adopted)

X<sub>8</sub> = Level of education (number of years spent in formal schooling)

X<sub>9</sub> = Price of sorghum per bag (₦)

X<sub>10</sub> = Transportation cost (₦)

X<sub>11</sub> = Amount of credit received in (₦)

β<sub>1</sub> - β<sub>11</sub> = Coefficients of variables

β<sub>0</sub> = Constant

μ = Error term.

### 3. Results and Discussion

#### 3.1 Socio-Economics Statistics of the Respondents

The distribution of the respondents according to their socio-economic characteristics is presented in Table 1. It showed that the mean age of the Sorghum farmers that benefited from the empowerment program was to be 37.35 and that of the non-beneficiaries was 34.18. It was also observed that majority (52.60% and 38.50%) of the sorghum farmers were between the ranges of 31-40 years and the predominant age bracket belong to the productive and economically active age group which portends better future for production in agriculture. This agrees that there's a significant relationship between farmers age and efficiency in agricultural production where younger farmers have the tendency to operate more efficiently than older farmers. 37.20% of the beneficiary respondents were males while that female is 62.80%. The males for the non-beneficiaries were 84.60% and the females were 15.40%. The majority of the respondents for the beneficiaries were single constituting 50% while 48.70% were married and 1.30% were separated. 85.90% were married while 12.80% were single and 1.30% were separated for the non-beneficiaries. The mean of the farm size of the beneficiaries is 1.48 with the range of 0.51 - 1.00 (ha) and 1.28 with the range of 1.51 - 2.00 (ha) for the non-beneficiaries.

#### 3.2 The Effect of Fadama III AF on the Income, Output, Labour and Area of Land Cultivated Respondents

Table 2 showed that the beneficiaries earned extra average income of ₦349,185.90 more than the non-beneficiaries and this implies that the Fadama III AF had a positive effect on the beneficiaries of the empowerment programme. As expected the difference is statistically significant at 1% level given the large and significant level of the project on productive assets of the beneficiaries. Furthermore, the result revealed that the output of the beneficiaries increased with 520.83kg more than the non-beneficiaries which implies a positive effect on the beneficiaries statistically significant at 1% level. This is similar to the findings of Ogbonna and Nwaobiala (2014) who reported that Fadama III had positive impact on the output and income of rural women farmers in Gombe State, Nigeria.

Table 1. Socio-Economic Characteristics of the Sorghum Farmers

| Variables                 | Beneficiaries |            | Non-beneficiaries |            | Pooled |            |
|---------------------------|---------------|------------|-------------------|------------|--------|------------|
|                           | Frequency     | Percentage | Frequency         | Percentage | Total  | Percentage |
| <b>Age(years)</b>         |               |            |                   |            |        |            |
| 21-30 years               | 17            | 21.8       | 3                 | 3.8        | 20     | 25.60      |
| 31-40 years               | 41            | 52.6       | 30                | 38.5       | 71     | 91.10      |
| 41-50 years               | 16            | 20.5       | 27                | 34.6       | 43     | 55.10      |
| 51-60 years               | 3             | 3.8        | 18                | 23.1       | 21     | 24.80      |
| Greater than 60 years     | 1             | 1.3        | -                 | -          | 1      | 1.30       |
| Total                     | 78            | 100        | 78                | 100        | 156    | 100.00     |
| Mean                      | 37.35         |            | 34.18             |            |        | 35.76      |
| <b>Sex of Respondents</b> |               |            |                   |            |        |            |
| Female                    | 49            | 62.8       | 12                | 15.4       | 61     | 39.10      |
| Male                      | 29            | 37.2       | 66                | 84.6       | 95     | 60.90      |
| Total                     | 78            | 100        | 78                | 100        | 156    | 100.00     |
| <b>Marital status</b>     |               |            |                   |            |        |            |
| Single                    | 39            | 50         | 10                | 12.8       | 49     | 31.41      |
| Married                   | 38            | 48.7       | 67                | 85.9       | 105    | 67.31      |
| Separated                 | 1             | 1.3        | 1                 | 1.3        | 2      | 1.28       |
| Total                     | 78            | 100        | 78                | 100        | 156    | 100.00     |
| <b>Farm size</b>          |               |            |                   |            |        |            |
| 0.01-0.50                 | 3             | 3.8        | 15                | 19.2       | 18     | 11.54      |
| 0.51-1.00                 | 37            | 47.4       | 13                | 16.7       | 50     | 32.05      |
| 1.00-1.50                 | 16            | 20.5       | 8                 | 10.3       | 24     | 15.38      |
| 1.51-2.00                 | 14            | 17.9       | 31                | 39.7       | 45     | 28.85      |
| 2.01-2.50                 | 5             | 6.4        | 11                | 14.7       | 16     | 10.26      |
| Greater than 2.50         | 3             | 3.8        | -                 | -          | 3      | 1.92       |
| Mean                      | 1.28          |            | 1.48              |            | 1.38   |            |
| Total                     | 78            | 100        | 78                | 100        | 156    | 100.00     |

Source: Field survey, 2018

Table 2. Estimated Effect of *Fadama* III AF on the Income, Output, Labour and Area of Land Cultivated Respondents (Nearest Neighbor Matching as the Lead Method)

| Matching method           | Outcome indicator            | ATT        | t-value   |
|---------------------------|------------------------------|------------|-----------|
| Nearest neighbor matching | Income                       | 349,185.90 | 5.279***  |
|                           | Area of land cultivated (ha) | -0.76      | 1.194     |
|                           | Labor used (man days)        | -152.25    | 2.605***  |
|                           | Output                       | 520.84     | 6.097***  |
| Radius matching           | Income                       | 357,032.50 | 7.95***   |
|                           | Area of land cultivated (ha) | -0.59      | 0.981     |
|                           | Labor used (man days)        | -143.66    | 4.258***  |
|                           | Output                       | 570.72     | 5.856***  |
| Kernel matching           | Income                       | 353,919.50 | 9.861***  |
|                           | Area of land cultivated (ha) | -0.72      | 2.462**   |
|                           | Labor used (man days)        | -150.55    | 2.659***  |
|                           | Output                       | 527.80     | 4.801***  |
| Stratification method     | Income                       | 352,352.10 | 16.490*** |
|                           | Area of land cultivated (ha) | -0.128     | 0.280     |
|                           | Labor used (man days)        | -110.563   | 5.364***  |
|                           | Output                       | 610.51     | 8.474***  |

Source: Field survey, 2018

Note: \* Significant at 10% probability level, \*\* Significant at 5% level, \*\*\* Significant at 1% level.

The labour used in (man days) increased by 152.248 more than the non-beneficiaries also signifying positive effect on the beneficiaries of the program and was statistically significant at 1% level. Contrarily, it was found that the difference in the area of land cultivated by the beneficiaries and non-beneficiaries was not significant.

### 3.3 The Determinants of Income of Fadama II AF Beneficiaries and non-beneficiaries in Sorghum Production in Niger State

The OLS regression estimates of the determinants of income of *Fadama II AF* beneficiaries in sorghum production in Niger State are presented Table 3. The exponential functional form was chosen as the lead equation based on the number of significant variables. The result revealed that the F-value of 13.13 was statistically significant at 1% level of probability. This implies that the whole model was significant, that is, there was a significant relationship between the dependent variable and the independent variables included in the model.

Table 3. Determinants of the Income of the Beneficiaries in Sorghum Production (Exponential as the Lead Function)

| Variables                         | Linear Coefficients   | Exponential Coefficients | Double log Coefficients | Semi-Log Coefficients |
|-----------------------------------|-----------------------|--------------------------|-------------------------|-----------------------|
| Constant                          | 555009.60<br>(2.04**) | 13.32<br>(28.***)        | 0.14<br>(0.03)          | -7542335<br>(-2.64**) |
| Seed (kg)                         | 15737.49<br>(4.95***) | 0.03<br>(5.16***)        | 0.01<br>(0.12)          | 13354.01<br>(0.35)    |
| Labour (man-day)                  | 704.82<br>(2.12**)    | -0.01<br>(-2.40**)       | 0.11<br>(1.57)          | 67062.12<br>(1.47)    |
| Capital input (₦)                 | -1.60<br>(-0.43)      | -4.68<br>(-0.75)         | -0.03<br>(-0.33)        | -10013.56<br>(-0.21)  |
| Farm size (ha)                    | 50446.97<br>(1.96*)   | 0.06<br>(1.41)           | 0.28<br>(4.65***)       | 166509<br>(4.50***)   |
| Farming experience (years)        | -3833.51<br>(-1.46)   | 0.01<br>(2.14**)         | -0.02<br>(-0.69)        | -4790.53<br>(-0.24)   |
| Adopted Technology (number)       | -7198.30<br>(-1.49)   | 0.02<br>(1.89*)          | -0.02<br>(-0.36)        | -6128.95<br>(-0.18)   |
| Education (years spent in school) | -211.01<br>(-0.15)    | 0.01<br>(0.06)           | -0.01<br>(-0.05)        | -150.72<br>(-0.06)    |
| Price of sorghum (₦)              | 19.76<br>(0.92)       | 0.01<br>(1.08)           | 1.35<br>(0.01)          | 830344.6<br>(2.65**)  |
| Transportation (₦)                | 54.00<br>(2.38**)     | 0.01<br>(2.68***)        | 0.01<br>(2.94***)       | 6027.54<br>(2.04**)   |
| Credit (₦)                        | 0.17<br>(0.41)        | 3.08<br>(0.44)           | -0.00<br>(-0.11)        | -490.44<br>(-0.16)    |
| R <sup>2</sup>                    | 0.6693                | 0.6621                   | 0.4800                  | 0.4600                |
| R <sup>2</sup> Adjusted           | 0.6199                | 0.6117                   | 0.4024                  | 0.3794                |
| F Value                           | 13.56***              | 13.13***                 | 6.18***                 | 5.71***               |

Source: Field survey, 2018

Note: values in parenthesis are t-values. \*Significant at 10% probability level, \*\* Significant at 5% level, \*\*\* Significant at 1% level.

It also shows that the coefficient of multiple determination (R-squared) was 0.6621. This implies that 66.21% variation in the income of the sorghum farmers was explained by the explanatory variables included in the model, while the remaining 33.79% not explained is as a result of variables not included in the model as well as factors beyond the farmers' control. The estimated coefficients of seed (0.03), farming experience (0.01), number of adopted technologies (0.02) and transportation cost (0.01) were positive and statistically significant at 1%, 5%, 10% and 1% level of probability

respectively. This implies that for a unit increase in each of these variables holding other variables constant will lead to increase in the income of the beneficiary sorghumfarmers by 3.00%, 1.00%, 3.00 and 1.00% for seed, farming experience, number of adopted technologies and transportation cost respectively. Conversely, the estimated coefficients of labour (-0.01) was negative and statistically significant at 5% level of probability indicating that a unit increase in the use of labour holding other variables constant will lead to decrease in income of the beneficiary sorghumfarmers by 1.00%. Summarily, seed, labour, farming experience, number of adopted technologies and transportation were the significant determinants of income of *Fadama* II AF beneficiaries in sorghum production in Niger State.

**Table 4. Determinants of the Income of the Non-Beneficiaries in Sorghum Production (Double-Log as the Lead Equation)**

| Variables                         | Linear Coefficients     | Exponential Coefficients | Double log Coefficients | Semi-Log Coefficients |
|-----------------------------------|-------------------------|--------------------------|-------------------------|-----------------------|
| Constant                          | -284867.5<br>(-4.02***) | 8.92<br>(20.35***)       | -3.57<br>(-0.90)        | -2494673<br>(-0.74)   |
| Seed (kg)                         | -728.84<br>(-0.22)      | -0.01<br>(-0.02)         | -0.08<br>(-0.95)        | -11056.12<br>(-0.74)  |
| Labour (man-day)                  | -107.16<br>(-1.55)      | -0.01<br>(-0.08)         | -0.02<br>(-0.36)        | -11046.39<br>(-1.12)  |
| Capital input (N)                 | -0.13<br>(-0.14)        | -6.13<br>(-1.08)         | -0.01<br>(-0.02)        | 9171.16<br>(0.64)     |
| Farm size (ha)                    | 111227.8<br>(6.52***)   | 0.70<br>(6.59***)        | 0.93<br>(7.40***)       | 139176.3<br>(6.42***) |
| Farming experience (years)        | 646.44<br>(0.83)        | 0.01<br>(1.68*)          | 0.15<br>(1.79*)         | 11161.06<br>(0.78)    |
| Adopted Technology (number)       | -1150.54<br>(-0.59)     | 0.01<br>(0.20)           | 0.01<br>(0.36)          | -1141.84<br>(-1.01)   |
| Education (years spent in school) | -582.46<br>(-0.66)      | -0.01<br>(-0.54)         | -0.01<br>(-0.27)        | -357.19<br>(-0.30)    |
| Price of sorghum (N)              | 32.33<br>(5.06***)      | 0.01<br>(5.52***)        | 0.07<br>(3.99***)       | 28580.89<br>(3.86***) |
| Transportation (N)                | -2.46<br>(-0.22)        | 0.01<br>(-0.22)          | -0.01<br>(-1.60)        | -1064.69<br>(-1.34)   |
| R <sup>2</sup>                    | 0.76                    | 0.78                     | 0.78                    | 0.74                  |
| R <sup>2</sup> Adjusted           | 0.73                    | 0.75                     | 0.76                    | 0.71                  |
| F Value                           | 24.57                   | 26.56                    | 27.59                   | 21.80                 |

Source: Field survey, 2018

Note: values in parenthesis are t-values. \*Significant at 10% probability level, \*\* Significant at 5% level, \*\*\* Significant at 1% level.

For the *Fadama* II AF non-beneficiaries in sorghum production in Niger State, the OLS regression estimates of the determinants of income are presented in Table 4. The double-log functional form was chosen as the lead equation based on the F-value, R-squared value and the number of significant variables. The result revealed that the F-value of 27.59 was statistically significant at 1% level of probability. This implies that the whole model was significant, that is, there was a significant relationship between the dependent variable and the independent variables included in the model. The estimated coefficient of multiple determination (R-squared) was 0.78 which implies that 78% variation in the income of the sorghumfarmers was explained by the explanatory variables included in the model, while the remaining 22% not explained is as a result of variables not included in the model as well as factors beyond the farmers' control. Since the double-log function was the chosen equation, the estimated coefficients are the direct elasticities of the variables. The estimated elasticities of farm size (0.93), farming experience (0.15) and price of sorghum (0.07) were positive and statistically significant at 1%, 10% and 1% level of probability respectively. This implies that for 1% increase in

each of these variables holding other variables constant will lead to increase in the income of the non-beneficiary sorghumfarmers by 93.00%, 15.00% and 7.00% for farm size, farming experience and price of sorghum respectively. In essence, farm size, farming experience and price of sorghum were the significant determinants of income of *Fadama II* AF non-beneficiaries in sorghum production in Niger State.

#### 4. Conclusion and Recommendations

##### 4.1 Conclusion

Considering the empirical results obtained from this study, it can be concluded that *Fadama III* AF had a positive impact on the lives of the beneficiaries with the implications that income, output and labour used had a positive impact on the beneficiaries. Quantity of seeds, labour, farming experience, number of adopted technologies and transportation were the determinants of income for the beneficiaries while price of sorghum, farm size and farming experience were the determinants of income for the non-beneficiaries.

##### 4.2 Recommendations

Based on the results of the study, the following recommendations were hereby proffered:

- i. The *Fadama III* AF had a positive impact in the lives of the beneficiaries increasing their income and output. Therefore, the Federal Government, ADP, non-governmental agencies and financing institutions (World Bank) should ensure the continuation of the programme and extension to the non-beneficiaries in order to improve the standard of living in the rural area.
- ii. The Federal Government and non-governmental agencies in collaboration with the farmers' cooperative societies should formulate policies and programmes that will encourage youths' participation in sorghum production in the rural areas.
- iii. The Ministry of agriculture, non-governmental agencies, research institute and financial institutions (CBN) should enhance access to credit, infrastructure facilities such as storage facilities to preserve the farm produce and also provide of drought resistance seed.

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