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# Community Participation in Food Security through Vegetable Irrigation in North Eastern Part of Yobe State, Nigeria

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***Abstract***: *This study was carried out to determined community participation in food Security through Vegetable Irrigation in north eastern part of Yobe State, Nigeria. Data for this study was obtained from 361 respondents through the use of a structured questionnaire. The data was analyzed using descriptive statistics (percentage and mean), logit regression model, food security Index and farm budget model. The result from the logit regression model shows that Monthly income, sex and household size were statistically significant at varied levels with food security. The determinants of food security status indicated that probability of a food male-headed household by 1.064 unit will translates to an increase of 1% in the chances of a household remaining secure. Likewise, an increase of 2.4606 in the monthly income will increase progressively and positively the probability of household food security by 1%.the profitability analysis showed the BCR of 1.20 and profitability index of 0.17, respectively. The study recommends that there should adequately provision of credit facilities to small farmers in other to increase their scale of production and improve their food security status. Also, government should give attention to policy that would address family panning in order to reduce the household size to level that household heads can adequately cater for it.*

***Keywords:*** *Vegetable, irrigation, food security, logit regression model, rural community, farm budget*



## INTRODUCTION

The Food and Agricultural Organization, among others have been persistent in expressing these concerns for the global food insecurity over the years. Food security is obtained when all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life (FAO, 2014) The main goal of food security therefore, is for individuals to be able to obtain adequate food needed at all times, and to be able to utilize the food to meet the body's needs. One of the major problems confronting most developing countries today is how to improve the quality of life, reduce the level of poverty and food insecurity (Adamu *et al.,* 2013). Irrigation has been identified to be a key part in optimizing agricultural production for self-sufficiency in food production and poverty reduction in most developing countries in the world (Hassan *et al.,* 2017) Vegetables are leafy

plants with edible succulent stem portions, petioles and leaves (Okunlola, 2009). They are the most important food and income-generating plants such as amaranth, okra, tomatoes, cabbage, sweat pepper, lettuce, garden egg, etc. Vegetables are rich in vitamins and minerals, which are needed for maintaining good health and the prevention of diseases. Also, their importance in human nutrition is so high that a balanced diet must contain 250 - 325g of vegetables and the average human requirement for vegetable is 285 g per person per day (Nwachukwu and Onyenweaku, 2007). Growing and gathering vegetables is an extremely important livelihood activity for women in rural areas, who make up a majority of the rural labour force. Vegetables are major foodstuffs for poor rural women and their families, as they often cannot afford staples such as milk, eggs, and meat. New technologies and approaches must be developed to improve farming practices; which in turn increases the range of commercially viable vegetable varieties that are grown, and will improve nutrition, income, and food security for Nigeria's rural poor (Durodoluwa, 2014). The long dry season experienced by farmers in most parts of North-East, Nigeria form part of the reasons why farmers seem to be shifting towards irrigation schemes. Yet most of the vegetable farmers under current agricultural sector were characterized by smallness of farm size, 0.25 to 1.00 hectares (Echeme and Nwachukwu, 2010). Farmers use local hoes, cutlasses, farm yard manure and the technologies are restricted to tube-wells, wash bores, calabash and motorized pumps. It is against this background that government made frantic efforts to encourage the development of Fadama lands for irrigation purposes by incorporating Fadama farmers' irrigation activities into the National Agricultural Development Programme nation-wide. The Fadama Development Programme which optimizes aspect of modernization process within the irrigation system was introduced to the northern Nigeria since 1984 and has spread to all parts of the northern region. The intervention of the programme is aimed at boosting agricultural production and improving farmers' welfare. There were reports on the impacts of the previous Fadama programmes in Nigeria. For instance, Echeme and Nwachukwu (2010) reported that the success level of Fadama II project delivery was 38.4 percent in Imo State.

Objective of the study

The broad objective of the study is to examine community participation in food security through vegetable Irrigation in the Northern Agricultural Zone of Bauchi State, Nigeria. While the specific objectives include to:

i. Determine socio-economic characteristics of the vegetable farmers in the study area;
ii. Identify various vegetable crop grown and technologies (practices) adopted on vegetable irrigation by the farmers;
iii. Assess the level of adopting technologies on vegetable production;
iv. Evaluate costs and benefits of vegetable production in the area;
v. Examine factors influencing food security status of the vegetable producers and

## MATERIALS AND METHODS

### The Study Area

The study will be conducted in North Eastern Part of Yobe States, Nigeria. It is located between latitudes $12^0$ 30''North and longitudes $13^0$ 18''East. The area covers nine (9) Local Government

Areas namely Bade, Bursari Geidam, Jakusko, Karasuwa, Nguru, Machina, Yusufari and Machina The climatic condition of the area is that of Sudan savannah. The region has an annual rainfall of 500-600mm, and average annual of 566-400mm.The area has been witnessing a prevailing wind mainly because it is located in Sudan Savannah. The wind which originated from Sahara blows from October-April. According to G.I.C (2006). The main river is the river Yobe and its attributes which draw up the Southern part which pass across down to lake chad. The inhabitant of the area are mostly farmers, which are mainly engage vegetable Production The significant vegetable crops commonly grown in the area are Amaranthus, Tomatoes, Onion, Pepper, Okra, Rosel hot Papper,

**Sampling Techniques and Sample Size**

Multi-stage sampling technique will be used for this study. The first stage will involve a purposive selection of North Eastern Part of Yobe State, based on the concentration of dry-season vegetable growers in the Area. In the second stage, three Local Government Areas (Bade, karusuwa and Nguru LGAs) will be purposively selected from the area. The selection of the LGAs is due large production vegetables in the areas. While in the third stage, three village will be purposively selected from each Local Government Area. Finally, 40 vegetable farmers will be randomly selected from each village, giving a total sample of 360 respondents.

**Method of Data Collection**

The data for the study will be collected from two sources: The secondary data and primary data sources. The secondary data will be generated from the available records of time series statistics on Fadama vegetable production found in Yobe State Fadama Cares Coordinating Office, State Ministries of Agriculture and Yobe State Agricultural Development Programme (YOSADP). The primary data will be collected through the use of a structured questionnaires. The information to be collected are those on socioeconomic characteristics of the respondents; vegetable production; costs and benefits, food security status; constraints affecting vegetable production and causes of food insecurity in the area.

**Methods of Data Analysis**

The data generated will be subjected to statistical tool of analysis such as descriptive and Inferential statistics (logit regression model), food security Index and farm budget model. Descriptive statistics such as frequency, mean and percentages will be used to analyses the socio-economic characteristics, available types of vegetable cultivated, forms of technologies adopted and constraints affecting food security.

**Food Security Index**

The food security index will be used to examine the food security status of vegetable farmers in the study area. The rule stated that a food secure household head (vegetable farmer) is that whose per capita monthly food expenditure fall above or is equal to two-third (2⁄3) of the mean per capita food monthly expenditure of all vegetable farmers in the study sample. On the other hand, a food insecure household is that whose per capita food monthly expenditure falls below two-third of the mean monthly per capita food expenditure (Omonona and Agoi 2007; Oyebanjo, *et al.* 2013). The model is specified as:

where;

$F_i$ = Food security index

PCFEi = per capital monthly food expenditure for the ith vegetable farmer

MPCFEaf = 2⁄3 Mean per capita monthly food expenditure of all vegetable farmers When Fi ≥ 1 = food secure vegetable farmer, Fi ≤ 1 = Food insecure farmer

**Logit Regression Model**

Logit regression model will be used to analyses factors influencing food security status of the vegetable producers. Different researchers employed different methods for the analysis of the data, but many of them adopted logistic regression technique including (Arene and Anyaeji, 2010; Oyebanjo, *et al.* 2013). Since the dependent variable food security is qualitative in nature means dichotomous, it can only take two values either the presence of something or absence, so by pursuing the conventional method of binary response it will either take the value of 1 or zero. This value of 1 means that farmer is food secure and zero means otherwise because this measure of food security in binary manner yields results which have more policy implications (Coleman-Jensen *et al.,* 2011). Logistic regression technique can be used to model the relationship between the dichotomous dependent variable and set of independent variables that are hypothesized to affect the outcome. The logistic regression model characterizing the adoption of farmer food security is given by (Wooldridge, 2010; Oyebanjo *et al.,* 2013; Abdullah *et al.,* 2017).

This $[P_i/(1 – P_i)]$ is simply the odds ratio in favor of food security (Fi) i.e. the ratio of the probability that the farmer is food secure to the probability that it is not food secure. The subscript 'i' shows the observation in the data. βo is the intercept of the model, while X1, X2, X3. . . Xn are the explanatory variables. It is important to note that the estimated coefficients do not directly affect the change in corresponding explanatory variables on the probability of the outcome. Rather, the coefficients reflect the effect of individual explanatory variables on its log of odds. The positive coefficient shows that the odds ratio will increase as the explanatory variables increases, and conversely, the odds ratio will decrease as the explanatory variables decreases. Explicitly, this model will be specified as:

$$F_i = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 X_8 + \beta_9 X_9 + \mu_i \quad \ldots (3)$$

where;

$F_i$ = 1 if household head is food secure, 0 otherwise $\beta_o$ = Vector of parameters $\mu_i$ = Random error

X1 = Quantity of vegetable produced (kg)

X2 = Monthly income (Naira)

X3 = Age (years)

X4 = Sex (Male =1, Female = 0)

X5 = Level of education (years)

X6 = Farm size (Hectares)

X7 = Farming experience (years)

X8 = Household size (number of individuals)

X9 = Membership of cooperative (Member =1, 0 otherwise)

**Farm Budgeting Model**

Farm budget model will be used to evaluate costs and benefits of vegetable production where total costs and returns will be estimated. The total cost incurred during the production period is obtained by multiplying the various input resources by their unit market prices, while returns (revenue) refers to the sum of outputs multiplied by their unit price which is also known as the gross income (GI) (Olukosi and Erhabor, 2005).

The model is specified as:

NFI = GI − TC . . . (4)

where;

NFI = Net Farm Income (₦)

GI = Gross income of vegetable production

TC = Total costs (variable + fixed costs) of vegetable production

$$D = \frac{P - S}{N} \quad \ldots (5)$$

where,

D = Depreciation of fixed assets

P = Price of the assets

S = Salvage value

N = Number of years

**RECUTS AND DISCUSSION**

**Socio Economics Characteristics of The Respondents**

The result of the socio economics characteristics of the respondents in Table 1 revealed that 1.9% of the respondents were within age group of ≤ = 20,15.2%within the age of 21 – 30, while 32% of the respondents are within the age of 31- 40. This implies that, farmers were within the active age of production and innovation (Yunusa,1999). Similarly, Isa et -al (2010) reported that younger farmers are more receptive to new ideas than the old ones. The result further revealed that,31% are within the age of 41- 50, while 16.3% are within the age of 51-60, while 11% f the respondents are from ≥ 60. The result indicate that majority of respondents 95% are male .The dominance of

males over their female counterparts may be due to fact that most farming activities require more strength which most females may not be able to provide; this corroborate the finding by Ahmed et-al (2015).A larger proportion 88.4% of the respondents were married ,implying that most of the respondents were married and responsible to cater for their households and had a clean knowledge of wellbeing, the statement is in line with finding by Ayoade and Adeola(2012). The result also shows that majority of the respondents 44% has a household size between 6-10 persons. This implies that most respondents had enough people at home to employ labour on their farm. The above is in line with the findings by Ezeibe et al (2015). The result indicates that 53% of the respondents had informal education (i.e. Adult and Quranic education), while the remaining 27% had secondary education,14% had tertiary education and 6.4% had primary education. The level of education affects the type of decision farmer take in agricultural production and determine the level of opportunity. Furthermore, the result shows that 98% of the respondents in the study area were farmers, while 1.7% were civil servant ,1 % were either business men or women. The result also shows that majority of respondents 27% has four (4) children's, while 22.4% has less than two (2) childrens,25% of the respondents has 6 persons, while 17% has eight 8childrens ,9% has greater or equal to 9 children. Also 39% of the respondents has greater or equal to 12 years of farming experience. This implies that most of the respondents had enough experience in vegetable framing, which may positively influence their production, increase their income and improve their food security status. The above corroborates the findings by Ambia et al (2012)

**Table: 1 Shows The Socio-Economic Characteristics of Respondents(N=361)**

| Variable | Frequency | Percentage | Mean |
|---|---|---|---|
| **Age (years)** | | | |
| ≤ = 20 | 7 | 1.9 | |
| 21 - 30 | 55 | 15.2 | 42 |
| 31- 40 | 118 | 32.7 | |
| 41- 50 | 111 | 30.7 | |
| 51- 60 | 59 | 16.3 | |
| ≥ = 61 | 11 | 11 | |
| **Sex** | | | |
| Female | 19 | 5.26 | |
| Male | 342 | 94.76 | |
| Marital status | | | |
| Single | 42 | 11.63 | |
| Married | 319 | 88.37 | |
| **Household Size** | | | |
| < = 5 | 90 | 24.9 | |
| 6 - 10 | 157 | 43.5 | |
| 11 - 15 | 78 | 21.6 | |

| | | |
|---|---|---|
| 16 - 20 | 15 | 4.2 |
| ≥ = 21 | 21 | 5.8 |
| **Educational Status** | | |
| Qur'anic education | 191 | 52.91 |
| Primary education | 23 | 6.37 |
| Secondary education | 98 | 27.15 |
| Tertiary education | 49 | 13.5 |
| **Occupational Status** | | |
| Farmer | 352 | 97.51 |
| Business | 3 | 0.83 |
| Civil servant | 6 | 1.66 |
| **Number of Children** | | |
| ≤ = 2 | 81 | 22.4 |
| 3 - 4 | 98 | 27.1 |
| 5 - 6 | 90 | 24.9 |
| 7 - 8 | 60 | 16.6 |
| ≥ = 9 | 32 | 8.9 |
| **Years of Farming Experience** | | |
| < = 5 | 22 | 6.1 |
| 6 - 10 | 82 | 22.7 |
| 11 - 15 | 61 | 16.9 |
| 16 - 20 | 55 | 15.2 |
| ≥ = 21 | 141 | 39.1 |

Source: Field Survey (2024)

## Food Security Status of Households

Analysis of the determinants of food security using logistic regression model (Table 2) showed that three regressors; income, sex and household size affect significantly the probability of household food security in Yobe State. Detail analysis revealed that household food security increases consistently and positively with sex (male = 1) and increased in monthly income at 1 and 5% respectively. This implies that the probability of a male-headed household by 1.064 unit will translates to an increase of 1% in the chances of a household remaining food secure. Likewise, an increase of 2.46e-06 in the monthly income will increase progressively and positively the probability of household food security by 1%. On the contrary, the probability of household food security (food secure) decreases with increase in increase in household size by -0.235 units. Similar finding was reported which indicate that age, household size and income have significant effects on the food security status of households. The fact that these factors are statistically significant implies a high degree of vulnerability which could be related to the resource base and economic viability of the households (Saaka, 2016). It is important to note that the type of marriage relationship (monogamous or polygamous) has an effect on whether a household is food secure or not (Owoo, 2018).

**Table 2: Distribution of vegetable farmers based on food security status**

| Variables | Food secure | Food insecure | Pool |
|---|---|---|---|
| Food security line (₦ cal) | | | 18,000 |
| Households | 216 | 145 | 361 |
| Percentage | 59.84 | 40.16 | 100 |
| Mean household size | 8 | 12 | 9 |
| MPFE (₦) | 26748.48 | 9185.21 | 19639.58 |
| MPFE/adult/day | 3,343.56 | 734.56 | 2,182.17 |
| Head count | 0.59 | 0.41 | |
| Surplus | 1.04 | | |
| Shortfall | 0.46 | | |

Source: Field survey (2024).

**Logistic regression model**

Analysis of the determinants of food security using logistic regression model (Table 3) showed that three regressors; income, sex and household size affect significantly the probability of household food security in Yobe State. Monthly income had a positive and significant correlation with food security (p = 0.000, which is less than 0.05). This implies that the likelihood of monthly income increases food security of the household by a factor 0.0024 if monthly income increases by one naira. The coefficient of sex (1.064) is also positive and significant at 5% (p=0.048). This implies that the likelihood of a household being food secure increases by a factor of 1.06 if a head of household is male.Household size had a negative and significant relationship with food security (p = 0.000, which is less than 0.05). This implies that the likelihood of a household being food secure decreases by a factor of 0.24 if household size increases by one member. The results are akin to those of studies carried out by Sekhampu (2013) and Mupaso et al., (2024), which showed that a larger household size reduces the likelihood of being food secure. According to their reports, a larger family size normally has a higher demand for food.The pseudo R2 value of 0.1937 suggests that the model explains 19 per cent of the variation in the dependent variable (food security).These correspond with the findings which show that age, household size and income have significant effects on the food security status of households. The fact that these factors are statistically significant implies a high degree of vulnerability which could be related to the resource base and economic viability of the households (Saaka, 2016). On the contrary, the probability of household food security (food secure) decreases with increase in increase in household size by -0.235 units.

**Table 3: Regression Analysis**

| Fss | Coeff. | Std. Err. | Z | P>\|z\| | [95% conf. interval] | |
|---|---|---|---|---|---|---|
| Yield | 0.0006045 | 0.004479 | 0.13 | 0.893 | -0.0081742 | 0.0093833 |
| Monthly income | 2.46e-06 | 5.50e-07 | 4.48 | 0.000*** | 1.39e-06 | 3.54e-06 |
| Age | -0.0018841 | 0.0198982 | -0.10 | 0.924 | -0.0407076 | 0.0369393 |
| Sex | 1.063906 | 0.536853 | 1.98 | 0.048** | 0.0116944 | 2.116118 |
| Education | -0.1334935 | 0.1111491 | -1.20 | 0.230 | -0.3513417 | 0.0843547 |
| Farm size | 0.0262658 | 0.0836283 | 0.31 | 0.753 | -0.1376426 | 0.1901743 |
| Experience | 0.0272732 | 0.0184296 | 1.48 | 0.139 | -0.0088482 | 0.0633946 |
| Household size | -0.2355154 | 0.0376484 | -6.26 | 0.000*** | -0.3093049 | -0.1617259 |
| Constant | 0.7530267 | 0.8444364 | 0.89 | 0.373 | -0.9020382 | 2.408092 |
| LR chi 2(8) | 94.06 | | | | | |
| Prob>chi 2 | 0.0000 | | | | | |
| Log likelihood | -195.76514 | | | | | |
| Pseudo $R^2$ | 0.1937 | | | | | |

Source: Field Survey (2024)

**Profitability Analysis**

Table 4 summaries of the profitability indices of vegetable production. Results showed that the total cost of producing vegetable stood at N109,754.93/ha of which variable cost constituted 79.95% and fixed cost accounted for the remaining 29.05%. in spite of the huge cost incurred, a net return and a gross margin of N132,300 and N44,545.07 were realized. Equally, the financial health of vegetable enterprise showed the BCR of 1.20 and profitability index of 0.17, respectively. The implication of BCR of 1.20 entails that for every one Naira invested, a gain of N17.00 naira would be obtained. Similar finding as indicated by the benefit-cost ratio of 1.33, which indicates that every ₦1.00 invested in the business will generate an additional ₦33.00 in revenue. This confirms other research that found BCR values of more than 1.00 (Akegbejo-Samsons and Adeoye, 2012; Adebayo and Daramola, 2013; Tunde et al., 2015; Alawode et al., 2016). This demonstrated the viability and profitability of vegetable production. This could explain why more people are venturing into the enterprise because it has proven to be sustainably profitable in the study area. This result corroborates with the findings of Adebayo and Daramola (2013) and Ajagbe (2019).

Table 4: **Net Farm Income Analysis**

| Items | Cost | % |
|---|---|---|
| **(A) Variable cost** | | |
| i. Cost of seeds | 5,359.56 | 4.88 |
| ii. Cost of fertilizer | 3,8136.09 | 34.75 |
| iii. Cost of herbicide | 5,873.14 | 5.35 |
| iv. Cost of insecticide | 4,629.36 | 4.22 |
| v. Cost of labour | 15,000.00 | 13.67 |
| viii Cost of Irrigation | 18,756.78 | 17.09 |
| **(B) Total Variable Costs (TVC)** | **87,754.93** | **79.95** |
| **(C) Fixed Cost** | | |
| Rent on land | 15,000 | 13.67 |
| Depreciation of farm tools | 7,000.00 | 6.38 |
| **(D)Total Fixed Cost (TFC)** | **22,000** | **29.05** |
| **(E) Total Cost (TC=TVC+TFC)** | **109,754.93** | |
| **(F) Returns** | | |
| Vegetable sales | 132,300 | |
| **(G)Total Returns** | **132,300** | |
| **(H) Gross Margin (TR-TVC)** | **44,545.07** | |
| **(I) Net farm income (TR-TC)** | **22,545.07** | |
| Benefit cost ratio = G/E | 1.20 | |
| Profitability index = NFI/TR | 0.17 | |

Source: Field Survey (2024)

## CONCLUSION AND RECOMMENDATION

The understanding of community participation in food security through vegetable irrigation farming, especially among participants in the study area, is a step towards ensuring food security. This study found that monthly income was found to be more food secure, as the income increase the provision of participants to be more food secured. the study further shows that sex of the participants been male head of household increase and become food secured. The household size been negative but also significant which showed that a larger household size reduces the likelihood of being food secure. As a larger family size normally has a higher demand for food. implying that increasing household size enhanced the chances of reducing food security status of the participants This finding consolidates the outcome of Omotesho et al., (2006) who obtained a negative sign for household size in a similar study in Kwara State. This study recommends that programs and policies designed to create job opportunities be targeted at the most participants (women and youths) as this would help reduce their dependency and increase their food security status, as the vegetable production is a worthwhile and profitable enterprise in the study area. Moreover, there should be provision and proper monitoring of credit facilities to small farmers as this would go a long way in increasing their scale of operations while improving their food security status. Adequate attention and priority should be given by the government to policy measures directed towards family planning to reduce household size to a level the ho.

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