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ECONOMICS OF RAIN-FED FOOD CROP PRODUCTION, EXTENSION CHALLENGES AND ADAPTATION STRATEGIES BY WOMEN FARMERS IN EBONYI STATE, NIGERIA

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ABSTRACT

This study was designed to analyse economics of rain-fed food crops production, extension challenges and adaptation strategies by women farmers in Ebonyi State, Nigeria. The specific objectives were to describe the socio-economic characteristics of women farmers in rain-fed farming in Ebonyi State, identify the types of rain-fed food crops grown in the study area, determine the effect of socio-economic factors in the output of rain-fed food crops in the study area, identify rain-fed food crops production adaptation strategies practiced by women farmers in the study area, identify challenges to extension services among women farmers under rain-fed food crops production in the study area. Multi-stage random sampling technique was employed to select 120 women farmers. The primary data was generated through the use of structured questionnaire and oral interview. The data collected were analysed using descriptive statistics such as frequency distribution tables, percentages. Ordinary Least Square(OLS) multiple regression technique was used as an inferential statistical tool to analyse the effect of socio-economic factors in the output of rain-fed food crops in the study area. Socio-economic characteristics of age, marital status and farming experience contributed to a very positive outcome in rain-fed food crops production in the study area. Among the functional forms tried namely the linear, exponential, Cobb-Douglas and semi-log functional forms, only the Cobb-Douglas form gave the best fit and therefore was chosen as the lead equation with a high R^2 value of 0.831. The result of regression revealed that age, level of education, farming experience, farm size, extension contact and use of labour had direct relationships in output of rain-fed food crops. There is need to enhance farmers' access to extension services. Governments should train extension agents as well as the entire staff of extension service on issues of rain-fed food crop production to help them acquire the needed knowledge to enable women farmers adapt to necessary changes needed in rain-fed food crop production.

KEYWORDS: Economics, Rain-fed, Food crops Production, Extension Challenges, Adaptation Strategies

Introduction

Rain-fed agriculture is agriculture that is totally dependent on rain. In the absence of irrigation, rain-fed lands, especially those in the arid and semiarid agro-ecological zones of the world, have been regarded as fragile, marginal, waste, problematical, threatened, low potential or less-favoured lands. The term 'Less favoured Areas'(LFAs) is better as it is relatively free of negative connotations. It accounts for more than 95% of farmed land in poor developing States in Nigeria (FAO STAT,2005). In sub-Saharan Africa, more than 95% of the farmed land is rain-fed, while the corresponding figure is almost 90% for South Asia, about 60% for Africa (FAO STAT,2005). Despite large strides made in improving productivity and environmental conditions in these developing countries, a great number of families in Africa and Asia still face poverty, hunger, food insecurity and malnutrition where rain-fed agriculture is practiced. The common characteristics of rain-fed agriculture especially in tropical and the semi-arid agro ecosystem are low crop yields that are far below

potential yields attainable in the regions, and areas of water losses. For example, cereal yields from rain-fed cultivation are generally around 1tha^{-1} (Rockstrom,2001) as against potential yields of $3\text{--}5\text{tha}^{-1}$ (Barron, 2004) attainable in the region.

The presence of excessive flooding, iron toxicity and lack of water control structures have been bane of lowland swamp rice production in Abakaliki area. Perennial flooding of rice fields in Ikwo area is due to increase of level of water in Cross River; by rainfall in the area. As reported by Ikeme (2009), Nigeria has experienced increasing incidence of diseases, declining agricultural productivity, increasing number of heat waves, unreliable or erratic weather patterns, flooding and declining rainfall.

At the national level, government at various times have formulated policies and initiated programmes aimed at addressing the food needs of the country. Some of the programmes are: Operation Feed the Nation(OFN), The Green Revolution(GR), National Special Programme on Food Security (NSPFS) and the Presidential Initiatives on Rice and Cassava

Production (Omotor,2009). These programmes are aimed at reducing food insecurity. Generally, problem of food security has been attributed to a number of factors within the system some of which were man-made while others evolve naturally. Today, one of the factors mostly implicated for the current food insecurity woes of the world include extreme weather-induced conditions such as droughts and floods (Adejuwon,2006). Apart from climate change-related factors, there are also other socio-economic, socio-cultural, political, institutional and ecological variables that hamper efforts at attaining maximum food production under rain-fed cultivation. Manyong *et al.* (2005) observed that constant changes in policies and unsustainable implementation of government programmes has been a problem in Nigerian agricultural sector. Small-holder women farmers have adopted one or more adaptation measures based on the financial capacity of the households. The farmers adopt shift of planting season as a form of adaptation to changes in rainfall. According to Apata *et al* (2009), increased awareness and access to extension services are among factors influencing adaptation positively. Among the specific adaptation measures being implemented in Ebonyi State which include agro forestry practices for soil moisture retention and soil erosion control, and water use efficient technologies. Some farmers have adapted through diversification of crops. However, according to Kandji and Verchot (2007), cropping practices alone may not be enough to respond to changes in rainfall, in recognition of this, farmers are embracing non-agricultural activities to broaden their livelihood options and thus improving their adaptation capabilities. Land tenure, user rights and poverty levels influenced the choice of adaptation strategy by farmers. Farmers noted that tree buffer crops against frost have been very suitable and effective in changes in rainfall and even mitigation. This is supported by Lin (2011) who indicated that agro forestry systems also protect crops from extreme storm events in which high rainfall intensity and strong winds can cause landslides, flooding, and premature fruit drop from crop plants.

The practice of organic agriculture is one of the most important measures for adaptation to climate change that affects rain-fed food crops grown by farmers. Organic agriculture according to IFOAM (2007) is a holistic production management system which enhances agro-ecosystem health, utilizing both traditional and scientific knowledge. It prevents nutrient and water loss through high organic matter content and soil covers, thus making soils more resilient to floods, drought and land degradation processes. In organic agriculture, soil fertility is maintained through farm internal inputs (organic manures, legume production, wide crop rotation), rejection of energy demanding synthetic fertilizers and plant protection agents with less or no use of fossil fuel (FAO 2008).

Women are major players in rain-fed food crops production but their activities are constrained by lack of access to available credits from financial institutions. Consequently, women inability to access production capital have decreased their access to land and other production resources and hence constrained income. In several production systems, women provide most of the labour for rice and other food crops production. They are often discouraged from growing more than is needed for family consumption because they are not allowed to control the cash obtained from selling the surplus. Since women frequently lack access to resources, especially credit, they are habitually left out of development projects and extension efforts organized by and for men.

The general objective of the study is to analyse economics of rain-fed food crop production, extension challenges and adaptation strategies by women farmers in Ebonyi State Nigeria.

Specific objectives are to

- (i) describe the socio-economic characteristics of women farmers under rain-fed farming in Ebonyi State.
- (ii) identify the types of rain-fed food crops grown in the study area.
- (iii) determine the effect of socio economic factors in the output of rain-fed food crops in the study area.
- (iv) identify rain-fed food crop production adaptation strategies practiced by women farmers in the study area
- (v) identify challenges to extension services among women farmers under rain-fed food crop production in the study area.

2.0 METHODOLOGY.

2.1 STUDY AREA

The study was carried out in Ebonyi State, Nigeria. The State is located in the South East geo-political zone of Nigeria. Ebonyi State lies approximately within latitudes 5° 40' and 6° 45' North of the Equator and longitudes 7° 30' and 8° 30' East of the Greenwich meridian. The State has a population of 2176947 million people made up of 1,064156 males and 1112791 females (NPC,2006). Ebonyi State is bounded on the North by Benue State, on the East by Cross River State, on the West by Enugu State and on the South by Abia State. The State has a total number of thirteen Local Government Areas(LGAs) that are demarcated into three agricultural zones namely: Ebonyi North, Ebonyi Central and Ebonyi South Zones (NPC,2006). It is situated in the derived savannah belt of Nigeria. The prevailing climatic condition in the area is characterized primarily by two seasons which are the rainy and dry seasons. The rainy season is usually from April to October; while the dry season starts from November to February. In Ebonyi State, about 80% of the populace may be engaged in agriculture, growing different types of food crops including cassava, rice, yam, cocoyam, maize, vegetables, fruits (Echiegu,2002). Rice and yam are

predominantly cultivated in Edda. The State also has solid minerals, especially granite stones with few large-scale commercial mining.

Sampling Technique and Sample Size

A five stage random sampling technique was adopted in selecting Agricultural Zones, local government areas, communities, villages and the farmers. In the first stage, two out of the three agricultural zones were randomly selected for the study. In second stage, out of thirteen local government areas in Ebonyi State, three local government areas were randomly selected from each of the chosen agricultural zones (Ebonyi South and Ebonyi Central zones) and this gave a total of six local government areas for the study. In the third stage, two communities were randomly selected from each of the six local government areas and this gave a total of twelve communities. In the fourth stage, two villages were randomly selected from each of the twelve communities and these gave a total of twenty-four villages. In the final stage, a random sampling of five women farmers were taken from the list of farmers in each village and these gave a sample size of one hundred and twenty (120) rain-fed food crop farmers.

Method of Data Collection

Data was collected from primary sources. For the primary data, a semi-structured questionnaire was used to elicit information from the farmers. The questionnaire on the women farmers was used to elicit information regarding their personal and socio-economic characteristics such as age, gender, household size, educational background, farming experience, marital status and agricultural extension staff visitations. Information was also collected on adaptation strategies adopted by the women farmers in

the study area and on challenges faced by the women framers.

Method of Data Analysis

Four functional forms namely linear, exponential, Cobb-Douglas and semi logarithmic were tried and the lead form was selected based on statistical and econometric criteria (high R² value, number of significant variables and agreements of coefficients with a prior expectation on coefficients of age, farming experience, farm size and labour are expected to be positive).

Objective (iii) determine the effect of socio-economic factors in the output of rain-fed food crops in the study area will be achieved using ordinary least square regression analytical method

MODEL SPECIFICATIONS

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

Y= Yield of produced major food crops(kg)

X₁=Age of farmers(years)

X₂=Marital Status (Dummy variable)

X₃=Years of formal education(Years)

X₄=Years of farming experience(Years)

X₅=Total Farm income (₦)

X₆=Number of Extension Visit in a farming season (Dummy variable)

X₇=Farm Size(Ha)

X₈=Labour(man-days)

e_i= Error term

The data collected was subjected to both descriptive and inferential analysis. Objective i, ii, iv and v were analysed using descriptive statistical tools of frequency tables, means and percentages. Objective iii was analysed with Ordinary Least Square(OLS) regression analysis.

Results and Discussion

Table1: Distribution of Respondents According to Their Socio-Economic Characteristics

Age	Frequency	Percentage
27-32	51	42.50
33-38	28	23.33
39-44	26	21.67
45-50	15	12.50
Total	120	100.00
Marital Status		
Single	47	39.17
Married	60	50.00
Widow	10	8.33
Divorcee	3	2.50
Total	120	100.00
Level Of Education		
No Formal Education	14	11.67
Primary School	66	55.00
Secondary School	25	20.83
Tertiary School	15	12.50
Total	120	100.00

Farming Status		
Part Time Farming	57	47.50
Full Time Farming	63	52.50
Total	120	100.00
Household Size		
2-5	53	44.17
6-9	49	40.83
10-13	16	13.33
14-17	2	1.67
Total	120	100.00
Farming Experience		
5-7	14	11.67
8-10	13	10.83
11-13	33	27.50
14-16	60	50.00
Total	120	100.00

Source: Field survey,2022

The result from the table reveals that the age range of 27-38 years cumulatively constituted 65.83% of the women farmers. When farmers age is on the increase, they become less active in food production as a result of body weakness and illnesses associated with the increase in age. Nwaru (2004) found out that the abilities of farmers to do manual work decreases with advancement in age. Mafimisebi (2008) noted that majority of small-holder farmers in cassava production in Ondo State fell within the age bracket of 45-50 years. Farmers should be encouraged by providing for them with necessary inputs and financial support that would make them to be productive at the farmers prime age of production. Farmers that are within their productive years should be given maximum support by the government through credit scheme that are readily accessible to the farmers. The table shows that most of the women farmers (61.66%) were married. They possibly had engaged in rain-fed

food crop production to take care of their family needs and ensure food security in their homes. Amongst these married women, widows were (8.33%) and divorcees (3.33%). Women's participation in agricultural activities especially rice cultivation in developing economies is around 90%, and they do this either through rain-fed agriculture or irrigation (FAO,2010). Single women who took part in the rain-fed food crop production in the area constituted 38.33%. These single women farmers could be young school leavers, single mothers or young women taking farming as business or hobby. Also from the table above,52.50% of the women farmers were engaged on full time farming practices. Also rural women in the area were farmers that engaged both in farm and non-farm activities including weaving of clothes, weaving of hair, petty trading, crafts and other domestic chores(FAO,2010).

Table 2: Distribution of Respondents According to The Type of Crop Identified And Cultivated

Type Of Rain-Fed Crop	Frequency	Percentage
Yam	69	57.50
Rice	79	65.83
Cassava	89	74.16
Maize	95	79.16

Multiple responses

Source: Field Survey,2022

The table shows that farmers cultivate more of maize crop. They did so because of maize crop has this dual reason of readily available and unique characteristic of being able to be cultivated twice in every cropping season. Maize was estimated to have the highest output with a total of 5,484,860MT in 2006, an increase of 8.42% over 2005(Etuk et al.,2012).The higher output compared to the other cereals is obvious

because maize is a high-yielding crop. Also the farmers were cultivating cassava readily because of the crop adaptability on wet and arid soils. Cassava is one of the most popular crops grown in almost all States of the country. Southern States are the leading producers compared to the Northern States in terms of both farm size cultivated and output.

Table 3: Socio-Economic Variables On Output of Rain-Fed Food Crops in The Study Area

Variables	Linear	Exponential	Cobb-Douglas+	Semi-Log
Constant	369661.654 (3.190)***	10.884 (19.863)***	11.250 (7.296)***	584438.398 (1.722)*
Age	-9082.355 (-5.419)***	-0.022 (-2.744)***	-1.232 (-3.261)***	-469035.640 (-5.642)***
Marital Status	33740.745 (1.048)	0.148 (.970)	-0.005 (-.037)	-17175.216 (-.566)
Education	-15879.491 (-1.222)	-0.071 (-1.154)	-2.104 (-3.003)***	-372296.382 (-2.414)**
Farm Experience	22882.529 (6.273)***	0.088 (5.121)***	2.743 (7.466)***	580118.288 (7.175)***
Farm Income	0.184 (2.338)**	4.297 (1.158)	0.144 (1.451)	62150.278 (2.837)***
Extension Contact	72498.676 (1.503)	0.857 (3.760)***	0.943 (4.944)***	92655.167 (2.228)**
Farm Size	55689.805 (3.480)***	0.120 (1.580)	0.526 (2.396)**	229153.464 (4.742)***
Labour	-26798.439 (-.572)	0.338 (1.527)	0.368 (1.849)*	23791.643 (.544)
R ²	0.729	0.798	0.831	0.754
F-ratio	37.314***	54.792***	68.081***	42.549***

Source:Field Survey,2021

*** Significant at 1%, **Significant at 5%, *Significant at 10%; + indicates lead equation while figures in parentheses are the t-ratios.

The regression estimates of the factors that influenced output of rain-fed food crops of women farmers are shown in Table 2. The four functional forms of the ordinary least square regression model were fitted to the data and the Cobb-Douglas form gave a better fit and was chosen as the lead equation. The criteria for its choice were based on the value of R², the number of significant variables and the signs of the variables. The F-ratio was significant at 1% and the coefficient of multiple determination (R²) was 0.831 indicating that 83.1% of the variations in the output of rain-fed food crops were explained by the independent variables in the model.

Age, education, farming experience, extension contact, farm size and labour were variables that significantly influenced the yield of rain-fed food crops. There was a negative relationship between age of farmers and output of rain-fed food crops at 1% level of significance. This implies that as farmer advances in age, their level of output of crops produced under rain-fed is reduced. As the age of the farmer advances, the farmer becomes less energetic and innovative in farming. There was also a negative relationship between the level of education of the farmers and output of rain-fed food crops at 1% level of significance. This implies that if the farmers are not educated, it will result to a significant reduction in their output of crops. Farmers that are not educated would be less receptive to modern farming practices/techniques and would therefore be less productive and inefficient in resource utilization (Okoye *et al*, 2004, Ajibefun and Aderinola,2004). Educated farmers are expected to be more receptive to improved farming techniques; thereby having them

improving their resource use in rain-fed food crop production. There was a positive relationship between the experience of farmers and output of rain-fed food crops. Onyebinama (2004) said that previous experience in farm business would enable the farmer to set realistic cost and time targets, allocate and utilize resources efficiently and identify production risks. Having long time experience in rain-fed food crop production will encourage women farmers to put in more effort in order to enhance their level of output. It has also been noted that women farmers who practice rain-fed food crop production count a lot more on their farming experience than level of academic attainment for increase in output of their rain-fed food crops.

There was a positive relationship between extension contact and output of crops by the women farmers at 1% level of significance. This implies that women farmers who had extension contacts had better output. Extension contact exposes farmers to relevant skills such field demonstrations that increases output. Through field demonstrations farmers are given information on better varieties of the crops and other resource input that increases yield. Field demonstrations skills can also increase the curiosity and enhance the reasoning abilities of the farmers (Ozor and Nnaji, 2011, Singh and Grover, 2013, Yegbemey *et al*,2014). Furthermore, there was a positive relationship between farm size and output of rain-fed food crops at 5% level of significance. This implies that farmers who had large farm sizes had more output and revenue. According to Onyebinama and Onyejelem (2010), a larger farm size should translate into greater output and higher revenue

generation. There was a positive and significant relationship at 10 percent between labour use of farmers and output of rain-fed food crops. This implies that as labour input increased, output of rain-fed food crops also increased. Female farmers in the

study area were efficient in the use of family labour and perhaps the use of committed people by the women farmers may have culminated to the boost in output of their crops.

Table 4: Food Crop Production Adaptation Strategies Adopted by Women Farmers

Adaptation Strategies	Frequency	Percentage
Use Of Improved Farming Practices And Information From Agricultural Extension Agent	85	70.83
Use Of Improved/Resistant/Species And Farm Chemical	80	66.67
Diversification	75	62.5
Water Conservation Practices	70	58.33
Soil Fertility And Land Policy/Practices	65	54.17

Multiple responses Obtained

About 70.83 percent of the women farmers indicated that use of improved farming practices and information from agricultural extension agent was a major adaptation measure in mitigating the challenges of rain-fed food crop production in the study area. The use of improved farming practices and information from agricultural extension agent involves the change of planting date, making of ridges across slopes in the farm to prevent soil erosion, planting of trees in the farm to serve as wind breaks and shade, avoidance of bush burning and adoption of crop rotation measures to control pest and diseases.

Also 66.67 percent of women farmers indicated that use of improved, resistant species of crops and farm chemicals were a major adaptation measure in mitigating the challenges of rain-fed food crop production in the study area. The farm practices that are associated with the use of improved, resistant

species of crops and farm chemicals were making use improved varieties of rain-fed food crops, use of drought resistant varieties of rain-fed food crops, use of pesticide to control pest and use of herbicides to reduce the high rate of weed infestation.

About 62.5 percent of the women farmers involved themselves in farm diversification which entails intercropping of crops in rain-fed cultivation, combination of rain-fed food crops with livestock production to increase income, joining of cooperative society and indulging in other income generating activities. This implied that farm diversification is an important adaptation measure to rain-fed food crop production challenges.

Other crop production adaptation strategies practiced by the women farmers were water conservation practice, soil fertility and land policy practices

Table 5: Food Crop Extension Challenges to Women Farmers in Rain-Fed Food Crop Production in The Study Area

Constraints	Frequency	Percentage
Pest And Diseases	90	75.00
High Cost Of Inputs	85	70.83
Small Farm Holdings	80	66.66
Poor Supporting Infrastructure	75	62.50
Lack Of Improved Varieties	70	58.33
Low Technological Utilization	65	54.16

Multiple responses Obtained

Source: Field survey,2021

About 75.00 percent of the women farmers stated that their crops were attacked by pest and diseases. This is a reflective of the major problem of rain-fed food cropping. Also 70.83 percent of the women farmers indicated high input cost was a constraint to rain-fed food crop production in the study area. The high cost of chemicals like fertilizer, pesticides and herbicides are usually out of reach in respect to resource poor farmers and this affects their output considerably

(Egwuda 2001). Furthermore,66.66 percent of the women farmers also indicated that small farm holdings was a major constraint to increase in rain-fed food crop farming in the study area. The practice of fragmented farm holdings militates against large scale production of rain-fed food crops and directly results to lower output (Akinola, 2010). Incidentally, 62.50 percent of the farmers indicated that poor infrastructure was a challenge to rain-fed food crop

production in the study area. The nature and location of the farms of the women farmers make it imperative that good feeder roads, proper processing and storage facilities be provided for the women farmers to enhance their output. These facilities were almost not in existent in the study area. This contributed to the low output of the women farmers (Adewuyi and Okunmadewa,2001). Also lack of improved varieties and low technological utilization experienced by the farmers contributed to a reduction in output of rain-fed food crop production in the study area.

Conclusion

Socio-economic characteristics of age, marital status and farming experience were factors that had direct relationship to output in rain-fed food crop farming. The regression results highlights that age and education had a negative relationship to output of rain-fed food crops while extension contact, farm size and labour had a positive relationship in respect to output of rain-fed food crops. Furthermore, pest and disease attack were the major problems that affected rain-fed food crops production and also some other factors like high cost of inputs, small farm holdings, poor supporting infrastructure and lack of improved varieties of crops affected the output of rain-fed food crops. Government should enact policies that will encourage farmers to increase their use of critical resources such as land and labour to maximize output and also provide them with the technical ability to solve the challenges they experience in their farms which can achieved through the introduction of credits, subsidies and grants to the farmers. Farmers are advised to cultivate more of cereal and cassava crops on the basis of the amount of output produced. We advocate more extension contacts between farmers and extension agents for proper and efficient dissemination of improved production technologies and techniques in practice of rain-fed food crop production. Extension agents as well as the entire staff of extension service needs to be trained on issues rain-fed food crop production to help them acquire the needed knowledge and be able to help farmers adapt to necessary changes needed in rain-fed food crop production. Government should encourage farmers to practice farm diversification which will serve as an adaptation measure to rain-fed food crop production challenges. Farmers are advised to protect their crops from the menace of pest and diseases through the use of disease resistant varieties of rain-fed food crops.

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