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Economic Impact of Flooding on Plantain Production in Southern Ijaw Local Government Area of Bayelsa State, Nigeria

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ABSTRACT

The study investigated the economic impact of flood on plantain production in Southern Ijaw Local Government Area, Bayelsa State, Nigeria. The specific objectives were to describe the socioeconomic characteristics of the respondents, evaluate the impact of flooding on the income of the farmers, compare the cost and returns associated with plantain production during flooded and non-flooded period, identity factors contributing to flooding, and identify farmers coping strategies during flooding in the study area. Multi-stage random sampling technique was used to select 80 farmers for the study. Primary data collected using questionnaire were analysed using descriptive and inferential statistics. The result showed that the mean age of the farmers was 56 years, majority (79%) of the farmers had no formal education. The result also showed that farmers had an average farm size of 0.82 hectares. The average household size was 6 persons per household, and mean farming experience was 12 years. Logistic regression results of impact of flooding showed that profit was significant ($p<0.05$), farm size and age of the farmer were significant ($P<0.05$) probability level. The farmers have Net Farm Income (NFI) of ₦ 74,617.13/ha, and ₦ 231,575.32/ha for flooded and non-flooded year respectively. The study identified blockage of natural channels, topography of the area, poor drainages, blockage of curvet, closure of dam, prolong rainfall and over flowing rivers as factors contributing to flooding. In addition to that the study also identified farmers' coping strategies in the event of flooding to include opening natural water canals, making canoes to access flooded areas, building wooden platform to keep properties, building wooden platform to live on, diversification to fishing, anticipate early planting next season, early and premature harvesting and exit to other crop ventures with smaller gestation period. The study recommends environmental improvement via unblocking of curvets, unblocking of natural drainages, destroying building on canals, and sand filling of very low lands. Palliatives and other relieve materials should be available to assist flood victims, extension agents should sensitize farmers on the gains of having an insurance policy. Finally, the research institutes and scientific communities should come up with plantain cultivars that will have shorter gestation period and improved flood resilient.

INTRODUCTION

Flood is a natural disaster that occur in myriads of meteorological patterns. United Nations Population Fund (UNPFA, 2013) reiterated that naturally, floods are results of tremendous weather conditions such as prolong rainfalls which are made worse by the activities of human and geographical location of a place. Regions that are liable to flooding are low-lying regions, for

example, Southern parts of Nigeria are more liable to flooding due to the heavy rainfall experienced for a prolonged period of time. Climate change impact is spatially diverse and spread to many geo-political areas at different vulnerability scales (Adeniyi, 2018). This assertion is in sympathy to United Nations Population Fund (UNPFA) that informed that change in climate affect all geographic area at seemingly different magnitude (UNPFA, 2013). Majority of the population of Southern Ijaw Local Government Area of Bayelsa State, are farmers whose primary occupation is crop cultivation, fishing and birds rearing. Over the years, there are series of outcries by the inhabitants that their cultivated crops (cassava, plantain, banana, yam, sweet potato and oil palm) are washed away or under heavy cover with water for months. This has thrown most inhabitants homeless, resulting to by-force harvest, hunger, and food insecurity. For instance, in 2012, 2016, 2020 and 2022 the flood displaced so many people, farm lands were in utter destruction, with many areas totally inaccessible by road. This further worsen the poverty status of the farmers. According to Anarah, Ezeano and Osuofor (2019), flood destroys crops and contribute to great income loss thereby making farmers susceptible to extreme poverty.

Plantain is the second stable immediately behind cassava in Southern Ijaw Local Government area of Bayelsa State (Kainga *et al.,* 2016). Plantain does not tolerate stagnated water and has long gestation period making it the crop which is most adversely affected. Unlike cassava and other root crops which are quickly harvested on noticing the flood, most plantains are usually flowering and are very far from fruiting during this time (Ayawale *et al.*, 2018) . Against this backdrop, the study investigated the economic impact of flooding on the production of plantain among farmers in Southern Ijaw LGA, Bayelsa state, Nigeria. However, the specific objectives were to:

i. describe the socio-economic characteristics of farmers;
ii. ascertain the factors contributing to flooding in the study area;
iii. determine the impact of flooding on plantain profitability ;
iv. compare the costs and return of a flooded and non- flooded year; and
v. to identify copping strategies of farmers during the flood and after the flood.

METHODOLOGY

The study was carried out in Southern Ijaw Local Government Area (SILGA) of Bayelsa State. Bayelsa State covers an area of about 21,110 square kilometers with more than three quarters of this area covered by water. Bayelsa State is made of 8 LGAs and Southern Ijaw is one of them. Southern Ijaw Local Government headquarter is in the town of Oporoma in the North of the area at $4°48^{1}$N and $6°04^{1}$E. The area has a coastline of approximately 60 km on the Bight of Benin. The people and their language are known as Izon. It has an area spread of 2,682 km^2 and a population of 319,413 people, National Population Commission (NPC, 2006).

The local government is made up of several towns and villages which include Korokorosei, Igbomotoro, Peremabiri, Opuama, Eniwari, Angiama, Diebu, Ondewari, and Aziama which lie in the heavy tropical rain forest region of Africa where such crops as yam, cassava, cocoyam, rice including plantain grow abundantly (Kainga, 2013).

The predominant occupation of the people in the Local Government Area are fishing, farming, palm oil milling, lumbering, palm wine tapping, local gin making, trading, carving and weaving (Kainga, 2013).

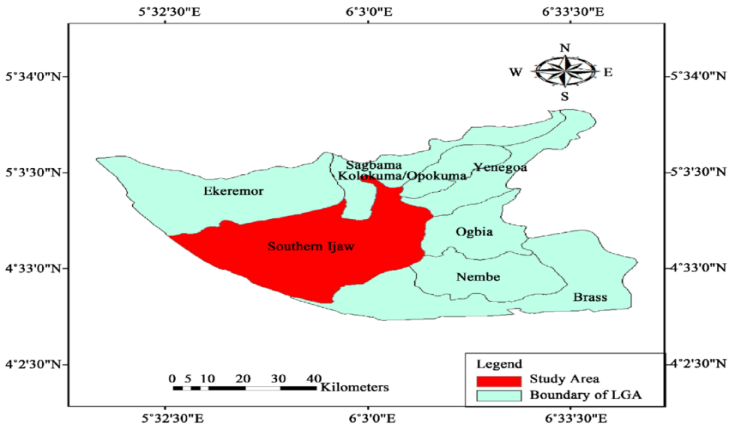


Figure 1: Map of Bayelsa State Showing the Study Area

A multi-stage random sampling technique was used to select respondents for this study. The first stage involved the random selection of 5 villages, from the six clans of the Local Government Area. The villages selected were Peremabiri, Angiama, Ondewari, Amassoma and Aziama. The second stage involved the random selection of 16 plantain farmers from each of the five villages earlier selected making a total of 80 farmers for the study. The sample frame for the study was gotten from Bayelsa State Agricultural Development Programme (BSADP).

Primary data were collected for this study with the aid of questionnaire. Information were collected on; farmers socio-economic characteristics, flood and Production information, and constraints faced by the farmers in plantain production. Data for this study was analyzed using descriptive and inferential statistics. Objective (i), (ii) and (v) were achieved using descriptive statistics such as Frequencies, percentages, means and the four points Likerte type scale. Objective (iii) was achieved using binary logistics regression analysis while objective (iv) was achieved using net farm income analysis.

Model Specification

Net Farm Income

The Net Farm Income (NFI) was employed to achieve objective (iv). It was used to estimate the costs and return of plantain farmers in a flooded and non-flooded year. The formula for net farm income is stated as follows.

$$NFI = TR - TC \quad (1)$$

Where: NFI= net farm income (₦), TR= total revenue (₦), TC= total cost of production (₦)

$$TC = TVC + TFC \quad (2)$$

TVC= total variable cost (₦), TFC= total fixed cost (₦)

Binary Logistic Regression Model

Binary logistic regression model was used to determine the impact of flooding on the profitability of plantain farming in the study area. This was used to achieve objective iii. The model was specified thus

$$P_i = p(Y=1|X_i) = Y = \beta_o + \beta_i X_i \text{ , } i=1, 2, \text{------}, n \quad (3)$$

Where; p_i=probability of flooding, $(1-p_i)$= probability of non-flooding, Where: Y = Flood (flooded =1, non-flooded = 0), X_1 = profit/losses of the plantain farmer (₦), X_2 = Farming experience (Years spent in plantain farming), X_3 = Level

of education (Years spent in formal education), X_4 = Palliative from the government (₦), X_5 = Age of respondents (Years), X_6 = farm size (hectares), U = error term and β_1- β_5 = Estimated regression parameters

Table 1. Socioeconomic Characteristics of Plantain Farmers

Variable	Frequency	Percentage	Mean
Sex			
Male	14		
Female	64		
Total	78		
Marital Status			
Married	78	100.00	
Single	0	0.00	
Total	78	100.00	
Age (Years)			
< 40	0	0	
41-50	20	25.64	54
51-60	29	37.18	
>60	29	37.18	
Total	78	100.00	
Household size			
1-3	5	6.41	6
4-6	45	57.69	
7-9	28	35.90	
>9	0	0.00	
Total	78	100.00	
Educational level			
No formal education	57	73.08	
Primary school	20	25.64	
Secondary school	0	0.00	
Tertiary	1	1.28	
Farming Experience			
1-5	2	2.56	
6-10	54	69.23	
11-15	7	8.97	
16-20	9	11.54	
>20	6	7.69	
Total	78	100.00	
Association membership	Frequency	Percentage (%)	
Yes	78	100.00	
No	0	0.00	
Total	78	100.00	
Farm Size			
0.1-1.0	47	75.38	
1.1-2.0	32	16.41	
Greater than 2.0	16	8.21	
Total	**78**	**100.00**	

Field Survey, 2024

In other words, the older the farmer the better he/she is able to understand the social, climatic and economic factors affecting farming. Also, younger farmers are likely to adopt new technology faster than the older ones. A greater number of the plantain farmers‟ surveyed fall within the age bracket of 51-60 years. Twenty, representing 25.64% were within the age range of 41-50 years, while 37.18% and 37.18 % were within the age range of 51-60 years and above 60 years respectively. It can be inferred from the above results that, plantain farming in the area is mostly carried out by relatively old adult with mean age of 54 years, implying that the farmers involved in plantain farming in the study area are within the aging population and therefore younger folks should be encouraged to pick up farming in the study area.

The distribution of the respondents based on sex in Table 1 shows that majority (82%) were females while 18% were male. This shows that women are more involved than men in plantain farming in the study area. The result on marital status shows that 100% of the farmers are married. This was expected given their average age of 54 years. This implies that family labour will be handy to enhance production of plantain. Furthermore, results on table 1 also showed an average household size of 6 persons this corroborated the availability of family labour. This also has an implication on plantain consumption and marketable surplus of plantain.

Table 1 also shows that majority (73%) of the respondents do not have formal education, the implication is that production and adaptation decisions are severely affected. Education is a social capital that could help one take a calculated risk, and a well informed decision about production and climate change adaptation.

In addition, 100% of farmers are basically surviving only with farming as their main occupation. This implies that the farmers are serious minded, experienced and concentrated on their farming activities which is their major source of income. The average farming experience of the respondents was 12 years, this implies that the farmers are relatively experienced in plantain farming. Farming experience determines farmers' ability to make good production, farm management and climatic decisions with precision. The farmers also showed 100% involvement in cooperative, this implies that the farmers are willing to share idea, solidify knowledge and pool resources together for their survival. Membership of cooperative could also be a coping strategy for farmers to get back on their feet after the flood. Moreover, the farmers had an average farm size of 0.8 hectares. This result was expected as most of the farmers in the study area have small farm holdings. This also has an implication for decision making and climate change adaptation.

Factors Contributing to Flooding

The results on Table 2 shows the factors contributing to flooding in the study area. Location of the land ($\bar{x}$ = 4.00), topography of the State ($\bar{x}$ = 4.00), dumping of refuse in culverts ($\bar{x}$ = 3.94), dam spillage/failure ($\bar{x}$ = 3.92), blockage of natural water channels ($\bar{x}$ = 3.88) among others were adjudged to be factors contributing to the flooding in the study area because they have means which were higher than 2.5 which was the bench mark for this study. These results were expected. Bayelsa state has a topography that makes it liable to flooding unlike other states because of its characteristic lowlands and swamps, more often when there is an over flow from the two major rivers in Nigeria, River Benue and River Niger, the over flow is usually drained to the Atlantic ocean through the tributaries in the Niger Delta thus resulting to a corresponding flooding of the surrounding lowlands of which Southern Ijaw is one of them. In additional to that, dumping of refuses in culverts and gutters makes it difficult for rain water to drain to the appropriate water channel thus resulting to avoidable flood in surrounding low lands. Blockage of natural water canals is also a challenge, sometimes houses and roads are built on water channels thus stopping the natural flow of water to tributaries, this also contribute to a great extent the severity of flood incidence. Furthermore, unavailability of infrastructure was not agreed to be contributing to the flooding. This was not

expected because infrastructure such as bridges, culverts, gutters and other underground water channels if available will reduce the occurrence and impact of flood to a great extent. The implication of this is that farmers in the study area are not fully aware of the importance of infrastructure in climate change mitigation and adaptation.

Table 2: Mean rating of factors contributing to flooding

Factors contributing to flooding that affects plantain production	SA	A	D	SD	Sum of scores	Mean	Decision	Rank
Location of the farm	78	0	0	0	312	4.00	Agree	1st
Topography of the State	78	0	0	0	312	4.00	Agree	1st
Mobility for extension agent	0	76	2	0	232	2.97	Agree	9th
Unavailability of infrastructure	0	1	77	0	157	2.01	Disagree	11th
Mismatch between extension approaches and farmers' needs	43	35	0	0	277	3.55	Agree	6th
Blockage of natural channels	69	9	0	0	303	3.88	Agree	5th
Dam spillage/Failure	44	33	0	0	302	3.92	Agree	4th
Deforestation	75	15	3	0	300	2.91	Agree	10th
Prolonged rainfall	0	4	68	0	221	3.07	Agree	8th
Overflowing rivers	65	4	1	0	221	3.16	Agree	7th
Soil moisture	0	17	57	0	230	3.11	Agree	8th
Dumping of refuge in culvert	45	29	4	0	307	3.94	Agree	3rd

Field Survey, 2024, SA=4, A=3, D= 2, SD =1, Mean =2.5

Results on Table 3 show the logistic regression of the impact of flooding on the profit of the farmers, the result showed a pseudo R square value of O.461 which indicates that 46% of the independent variable can be explained by the dependent variables. From the result, the coefficient of profit/losses was significant at one percent probability level. This implies that there is a higher odds for plantain farmers to make less profits or incur more losses in a flooded year than it is in a non-flooded year. This result was expected because plantain farmers harvest plantain that are not matured yet, pay higher labour cost to harvest and transport plantains in other to avoid total loss in the wake of the flood.

The coefficient for farm size was also significant at 5% probability level, this implies that the larger the farm the more likely the impact of the flood. This was expected because farmers with larger farms are more severely hit by the flood, this is because the investment is more and so also are the losses incurred. Furthermore, the result showed that age of the farmers was positive and significant at five percent probability level, this implies that as the age of the farmers increases the impact of the flood on the farms increases. This was not expected because older farmers have better experience to mitigate flood disaster than younger farmers. Probably, in this case older farmers may not have the physical strength to adjust to early harvesting and processing of plantain to other slowly perishable products like plantain flour and plantain chips.

Table 3 Binary Logistic of the Impact of Flooding on the Profitability of Plantain

Variables	Odds Ratio	Std. error	Z	Marginal Effect
Sex	1.011	0.031	0.23	0.009
Age	1.132	0.123	2.48**	-0.413
Marital status	0.922	0.809	1.06	0.056
Profit/losses	2.961	0.067	2.931***	0.863
Education	0.084	0.313	1241	0.567
Experience	0.842	0.081	-1.23	-0.670
Farm size	0.826	0.019	2.014**	0.509
Palliatives	2.012	0.066	1.06	0.001
Number of farmers	78			
Wald Chi 2 (8)	26.92			
Prob>Chi 2	0.003**			
Pseudo R^2	0.461			
Constant	1.99**			

Field Survey, 2024, ***and ** significant at 1% and 5% respectively

Costs and Returns of Plantain in a Flooded and Non-Flooded Year

Table 4 shows the costs and return of plantain farmers in a flooded and non-flooded year, the result shows that labour constituted 55% of the cost of production in a flooded year as compared to 48% in a non-flooded year. This result was expected because in a flooded year the plantain farmers hurriedly harvested their plantain to avoid destruction by flood this however mounts pressure on labour thus making cost of labour to increase. Furthermore, the total variable cost during the flooded year was much more than that of the non-flooded year, this explains that there was a general upsurge in the prices of goods and services in the flooded year. In addition to that, the net farm income for the non-flooded year (₦ 231, 575.32) was far more than the net farm income of the flooded year (₦ 74,613.4). This suggests that plantain farmers made much more profits when there is no incidence of flood.

Table 5 reveals that there is a significant difference between the profit plantain farmers make during a flooded year and a non-flood year. This was corroborated with a t value of 2.422 which was significant at 5 percent level. This was expected, although the ravaging flood comes with significant revenue losses for the farmers it does not totally erode their profits. In the study area the flood starts in late September and ends in November/Decembers. Most plantain farmers rush to harvest bunches before the floods comes by so doing pre matured bunches are also harvested to avoid destruction, this has its implication. Most times, the weight of the rushed harvest is usually carried by labourers and processors who are paid to harvest and process plantain to other more durable products like plantain chips and flour. The labour cost for harvesting and processing becomes unusually competitive. In addition to that, the processors are usually overburdened with the task so as to avert further deterioration. The aftermath of this is the poor quality and surplus of plantain product during and immediately after this period and thereafter a corresponding shortage and total dependence on plantain brought from other places. The implication of this is that farmers in the study area experience a reduction in profit as a result of the flood and thereafter become food insecure.

Table 4. Costs and return of plantain farmers in a flooded and non-flooded year per hectare

Variables	**Flooded year Average Amount in production period (₦)**	**Percentage (% of TVC)**	**Non flooded year Average Amount in Production period (₦)**	**Percentage (% of TVC)**
Average farm size	0.82		0.82	
Variable cost				
Cost of Suckers	81,025.64	40.91	84,487.18	44.70
Transportation	7,000.50	3.54	13,000.95	6.88
Labour	110,023.40	55.55	91,500.65	48.42
AT A. Total variable cost(TVC)	198,049.54	100	188,988.78	100
B. Total Revenue (TR)	304,166.67	-	437,564.10	-
Fixed cost				
Wheel barrow	18,000.00		11,000.00	
Cutlass	3,500.00		2,000.00	
Rent	10,000.00		4,000.00	
C. Total fixed Cost	31,500.00		17,000.00	
D Total cost (A+C)	229,549.54		205,988.78	
E. Gross Margin(B-A)	106,117.13	-	248,575.32	-
F Net farm income (B-D)			231,575.32	
ROI (F/B)	74,617.13			

Field Survey, 2024

Table 5: T- test comparing the profitability of plantain farmers in a flooded and non-flooded year

Item	Mean	Standard Error	Standard Deviation
Net Farm Income flood year	74,613	0.4672390	1.27391
Farm Income in a non-flood year	231,533.99	0.1673421	1.169222
Combined effect	3.122	0.0427617	1.22021
Difference	113,499.99	0.1922145	
t-statistics 2.122**			
P-value 0.0035			
degrees of freedom = 76			
95% Confidence interval of the difference is (-0.014 - 0.116)			

Author's Computation

Table 5 reveals that there is a significant difference between the profit plantain farmers make during a flooded year and a non-flood year. This was corroborated with a t value of 2.422 which was significant at 5 percent level. This was expected, although the ravaging flood comes with significant revenue losses for the farmers, in some cases total revenue lost while in other cases partial remove lost. In the case of partial it does not totally erode their income. In the study area the flood starts in late September and ends in November/Decembers. Plantain farmers who have bunches already rush to harvest before the floods comes by so doing pre matured bunches are also harvested to avoid destruction, this has its implication. Most times, the weight of the rushed harvest

is usually carried by labourers and processors who are paid to harvest and process plantain to other more durable products like plantain chips and flour. The labour cost for harvesting and processing becomes unusually competitive. In addition to that, the processors are usually overburdened with the task so as to avert further deterioration. The aftermath of this is the poor quality and surplus of plantain product during and immediately after this period and thereafter a corresponding shortage and total dependence on plantain brought from other places. The implication of this is that farmers in the study area experience a reduction income as a result of the flood and thereafter become food insecure.

Farmers Coping Strategies during Flood

The results on table 6 shows that the farmers build high wooden platforms ($\bar{x}$ = 3.98) above the water body where they secure their properties, they also build high wooden platforms where they live ($\bar{x}$ = 3.20), open natural water outlets to reduce water accumulation ($\bar{x}$ = 3.93), they build up canoes so that they can access flooded areas easily ($\bar{x}$ = 3.88) , they harvest their crops as soon as they are convinced that the flood is coming ($\bar{x}$ = 3.25) they further planned to adjust their time of planting in the next planting season ($\bar{x}$ =3.25) . Due to the flood, and a subsequent lost in source of livelihood, farmers' diversity into captured fisheries. These were adjudged to be coping strategies of farmers because there have means which were higher than 2.5. On the other hand the farmers did not agree that insuring their farms was a good coping strategies for them this is because insuring of farms have a mean lower that 2.5 which was the agreed cut off point. Their negative perception about insurance was expected because by their level of education they don't have full knowledge of the working of insurance policy.

Table 6: Farmers' Coping Strategies During Flood

Farmers coping strategies during the flood	SA	A	D	SD	Sum of scores	Mean	Decision	Rank
Adjustment in planting season	20	58	0	0	254	3.25	Agree	4th
Harvesting early before the flood comes	20	58	0	0	254	3.25	Agree	4th
Making canoes to access flooded areas	69	9	0	0	303	3.88	Agree	3rd
Opening natural water canals	73	5	0	0	307	3.93	Agree	2nd
Diversify to fishing during flood	16	62	0	0	246	3.16	Agree	6th
Build high wooden platforms to secure properties	77	1	0	0	311	3.98	Agree	1st
Build high wooden platforms to live	18	60	0	0	250	3.20	Agree	5th
Run to other high lands like roads and camps	20	50	8		234	3.00	Agree	7th
Exit to other crop ventures with shorter gestation period	20	47	11	0	246	3.16	Agree	6th
Insuring of farms	15	15	38	10	156	2.00	Disagree	8th

Field Survey, 2024; SA=4, A=3, D= 2, SD =1, Mean =2.5

CONCLUSION AND RECOMMENDATIONS

The study concluded that flooding is a serious problem to the livelihood of plantain farmers in the study area, it affects their productivity vis-à-vis the profitability of the plantain venture. Farmers incur more cost during a flooded year than a non- flooded year. They make more profit during non-flooded year than the flooded year. The study also concluded that there were man-made factors that contributed to the flooding in the study area. Plantain farmers try to cope with the flooding

situations by building high wooden structures to safe guard their properties and also for them to stay, many also diversify into fishing during the flood.

Based on the findings of this study, the following recommendations are made:

i. Flooding is a natural disaster which is further worsen by man-made factors, attention should be paid to unblocking of curvets, unblocking of natural drainages, destroying building on canals, and sand filling of very low lands. These will reduce the menace
ii. Farmers are usually devastated during floods because of the livelihood lost, the government and other stakeholders should provide palliatives and other relieve materials to assist flood victims
iii. The government and other stakeholders including extension agents should sensitize farmers on the gains of having an insurance policy.
iv. The research institute and scientific communities should come up with plantain cultivars that will have shorter gestation period and improved flood resilient.

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