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Effectiveness of Adaptation Strategies to Climate Variability in Bayelsa State, Nigeria

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ABSTRACT

This paper assessed effectiveness of adaptation strategies to climate variability in Bayelsa State, Nigeria. Purposive random sampling technique was employed to select hundred and twenty (120) respondents across the three agricultural zones of the state. Data collected were analyzed with both descriptive and inferential statistics (ANOVA). The result of the study shows that the effectiveness of adaptation strategies as perceived by farmers: mixed cropping ($\bar{x}$ = 4.1), crop rotation ($\bar{x}$ = 3.8) and postponing of farming periods ($\bar{x}$ = 4.5) were all effective adaptation strategies to climate variability. The study further revealed that mean score on the use of improved genetic resource among cassava, yam and cocoyam by farmers were 4.36 ± 0.07^{a}, 4.33 ± 0.07^{b} and 4.28 ± 0.07^{c}. Furthermore, the use of improved production techniques among cassava yam and cocoyam had 4.29 ± 0.07^{a}, 4.23 ± 0.06^{b} and 4.20 ± 0.06^{a}. Planting of leguminous crops had a mean variation between cassava, yam and cocoyam 4.32 ± 0.06^{a}, 4.32 ± 0.06^{a} and 4.30 ± 0.06^{a}. The Duncan Multiple Range test was used as mean separation technique and it indicated a significant difference (F-ratio 0.006) on the effective use of improved genetic resource among the three arable crops. Hence, it was recommended that farmers should be provided with modern and efficient processing and storage facilities.

Keywords: Effectiveness, adaptation strategies, climate variability and farmers

INTRODUCTION

Adaptation means actions targeted at the vulnerable system in response to actual or expected climate stimuli with the objectives of moderating harm from climate variability or exploiting opportunities (McCarthy *et al.,* 2010). Local adaptive strategies represent those practice and knowledge which local people in various regions have developed over the years, through indigenous knowledge system (IKS) which have enabled them to adapt and mitigate extensively from climate variations (Nyong, 2007).

The local adaptive strategies developed by rural farmers to deal with the changing climatic conditions are; the use of crop rotations, post-pone of planting periods, mixed cropping and/or the integration of bushes or trees; Planting of leguminous crops which they regard as

part of their farming system and are widely planted as food crops; manure and compost are used as fertilizers to maintain soil fertility and the use of local seeds and crops which tolerate extreme conditions, changing seasonal migration and hunting patterns, heat, drought, cold or flooding; Diversification of the production system to reduce the risk of losing the harvest which can happen if just one or two major crops are planted; postponement of the time for planting and sowing of crops when rains are late (FIBL, 2011 and IPCC, 2014).

According to (Smit, B. and Skinner, M.W. 2002; Tiwari *et al.*, 2010; IFAD, 2013) noted that rural farmers have adopted modern strategies such as: irrigation practice; improved genetic resource; improved production and environmental Management (e.g. planting trees); also farm management strategy, such as use of insurance to protect against potential loss; soil and water conservation techniques to improve soil fertility; tree regeneration (though natural regeneration and preservation of species that are at risk of disappearing), and income diversification through income-generating activities.

IPCC TAR, (2001) still asserted that adaptation is the adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities. Adaptation enable communities to live or cope with negative impacts of climate variability for example local farmers now delay the planting in order to reduce crop failure (Kelbessa, 2008). Adaptation is sustainable when the strategies taken to mitigate the prevailing conditions, holistic and service for a reasonable time period (Few, 2006).

METHODOLOGY

The study was carried out in Bayelsa State, Nigeria. Bayelsa State comprises eight Local Government Areas, namely: Brass, Ekeremor, Kolokuma/Opukuma, Nemebe, Sagbama, Southern Ijaw, Ogbia and Yenagoa Local Government Areas. The State is geographically located within latitude 04° 15′ North, 05° 22′ West and 06° 45 East. It shares boundaries with Delta State on the North, River State on the East and the Atlantic Ocean on the West and South. Bayelsa State lies in the heaviest rainfall area in Nigeria, with heavy rain forest and short dry season from November to March (NPC, 2006). Purposive sampling technique was used to selected climate variability prone Local Government Area and twelve communities within these four Local Government Areas of the state. This is because climate variability unfriendly activities are carried-out in these areas by multi-national

companies through emission of gases to the atmosphere.

Purposive sampling technique was used to select one Local Government Area from the three agricultural zones: Nembe, Ogbia and Yenagoa. Communities selected from Nembe local government area: Ogbomabiri, Bassabiri, Adukiri and Igbeta-Ewoama. Communities selected from Ogbia local government area: Oloibiri, Otuoke, Otusega, Oruma. While, communities selected from Yenagoa local government area: Akenfa-Epie, Bessein, Okorama and Tombia.

Ten respondents were selected from each of the aforementioned communities giving us a sample size of 120 respondents. A five point Likert – types scale of Strongly Agree = 5, Agree = 4, neither disagree nor agree =3, Disagree = 2 and Strongly Disagree =1. A bench mark mean score of 3.0 was taken as a decision rule for acceptance or rejection.

ANOVA was used to test the hypothesis. The choice of ANOVA in this study was justified by the comparison of more than two arable crops.The Duncan Multiple Range Test (DMRT) was used as the separation technique for the mean in this study.

Table 1: Distribution according to the effectiveness of adaptation strategies as perceived by respondents

S/N	Items Effectiveness of adaptation strategies	Scores					Total Score ΣFX	Mean Score X	Remark
		SA 5	A 4	NAD 3	D 2	SD 1			
1	Improved genetic resource	20	10	40	30	20	340	2.8	Reject
2	Improved production techniques	50	20	14	20	16	428	3.6	Accept
3	Planting of leguminous crops	10	30	10	30	40	300	2.5	Reject
4	Mixed cropping	60	30	16	4	10	486	4.1	Accept
5	Crop rotation	50	28	19	16	7	458	3.8	Accept
6	Process/storage facilities	9	17	7	28	59	249	2.1	Reject
7	Postponing farming periods	70	40	8	2		538	4.5	Accept
8	Integrated waste management system	20	19	9	30	42	305	2.5	Reject
Overall mean								3.2	
Total pooled mean (bench mark mean score)								3.0	

Source: Field Survey, 2016. Note: Strongly agree =SA, Agree =A, Neither agree non disagree = NAD, Disagree = D, Strong disagree = SD

THE EFFECTIVENESS OF ADAPTATION STRATEGIES AS PERCEIVED BY RESPONDENTS

The result presented in Table 1. Shows that the effectiveness of adaptation strategies as perceived by farmers in regard to the use of improved genetic resource ($\overline{x}$=2.8). This implies that the use of improved genetic resource was not an effective adaptation strategy that was practiced. Improved production techniques ($\overline{x}$=3.6) was an adaptation strategy to curb the vagaries of climate variability menace and it was effective based on the bench mark mean. Planting of leguminous crops ($\overline{x}$=2.5) was not an effective adaptation strategies to climate variability. While, mixed cropping ($\overline{x}$=4.1) and crop rotation ($\overline{x}$= 3.8) this implies that crop rotation can lead to increased crop diversity. In line with the assertion of (Shailendra *et al.,* 2010), they noted that the impact of crop rotation on species depends on the rotation itself, and the diversity of crops involved in the rotation. For instance, rotations involving non-intensive management practices, such as grass or legumes, intercropping (cover crops), and manure from farm activities (green manure) tends to favour biodiversity and increase productivity. Postponing of farming periods ($\overline{x}$=4.5) were effective adaptation strategies towards climate variability among rural farmers within the study area. Integrated waste management system ($\overline{x}$=2.5) was not an effective adaptation strategies.

Table 2: ANOVA result showing the significance difference in perceived effectiveness of adaptation strategies among three selected arable crops (cassava, yam and cocoyam) in the study area

Adaptation strategies	Cassava	Yam	Cocoyam	F-value
Use of improved genetic resource	4.36 ± 0.07^{a}	4.33 ± 0.07^{b}	4.28 ± 0.07^{c}	0.006
Improved production techniques	4.29 ± 0.07^{a}	4.23 ± 0.06^{b}	4.20 ± 0.07^{c}	0.024
Planting of leguminous crops	4.32 ± 0.06^{a}	4.32 ± 0.06^{a}	4.30 ± 0.06^{a}	0.245
Mixed cropping	4.48 ± 0.06^{a}	4.43 ± 0.06^{b}	4.39 ± 0.06^{c}	0.007
Crop rotation	4.37 ± 0.07^{a}	4.31 ± 0.07^{b}	4.24 ± 0.07^{c}	0.018
Postponing farming periods	4.68 ± 0.05^{a}	4.53 ± 0.05^{b}	4.46 ± 0.05^{c}	0.512
Process/storage facilities	3.63 ± 0.07^{a}	3.71 ± 0.06^{a}	3.75 ± 0.06^{c}	0.792
Integrated waste management system	4.11 ± 0.07^{a}	4.01 ± 0.07^{a}	4.11 ± 0.07^{a}	0.357

Source: Field Survey, 2016. Note: Values are mean ± standard error of means of 5 determinations. Values in each row followed by different superscripts are statistically different at ($P \leq 0.05$). Mean separation was done using Duncan Multiple Range Test (DMRT).

Table 2 shows the result of ANOVA on the perceived effectiveness of adaptation strategies on three arable crops. The result shows that the mean score on the use of improved genetic resource among cassava, yam and cocoyam by farmers in the study area were 4.36, 4.33 and 4.28 respectively. The Duncan multiple range tests used as mean separation technique show that there is a significant difference (F-ratio 0.006) in the effectiveness of using the adaptation strategy (improved genetic resource) among the three arable crop farmers. The result shows that cassava farmers adopted the improved genetic resource among the three farmers group whereas cocoyam farmers adopted the least use genetically improved varieties. This implies that the use of improved genetic resource was effectively utilized by the three arable crop farmers in the study area. The effective use of improved genetic resource among the three arable crop farmers considered maybe due to the factor that the three arable crop farmers face the same climate variability or operate in the same environment and therefore are exposed to the same climatic hazards.

Table 2 shows the result on the perceived effectiveness of adaptation strategy 'improved production technique' among cassava, yam and cocoyam farmers in the study area to curb the negative impact of climate variability. The mean score of the three arable crops were 4.29, 4.23 and 4.20 respectively. The Duncan multiple range test used as mean separation technique show that there is a significant difference (F-ratio 0.024) in the effectiveness of using improved production techniques among the three arable crop farmers.

Table 2 Further shows the result of ANOVA on the perceived effectiveness of adaptation strategies on three arable crops. The result shows that the mean score on the use of leguminous crops among three arable crops as an effective adaptation strategy by cassava, yam and cocoyam farmers were 4.32, 4.32 and 4.30 respectively. The Duncan multiple range test used as mean separation technique show that there is a significant difference (F-ratio 0.245) in the effectiveness of using leguminous crop by farmers.

Table 2 shows that the perceived effectiveness of adaptation strategy on three arable crops cassava, yam and cocoyam. The result show that the mean score (4.48, 4.43 and 4.39) on the use of mixed cropping among the three arable crop farmers. The Duncan multiple range tests used as mean separation technique show that there is a significant difference (F- ratio 0.007) in the effectiveness of using mixed cropping by farmers.

Table 2 further show that the perceived effectiveness of adaptation

strategy on the three arable crops cassava, yam and cocoyam. The result shows that the mean score on the use of crop rotation among the three arable crops as an effective adaptation strategy by cassava, yam cocoyam farmers were 4.37, 4.31 and 4.24 respectively. The Duncan multiple range test used as mean separation technique show that there is a significant difference (F- ratio 0.018) in the effectiveness of using crop rotation by farmers.

Table 2 show the result of ANOVA on the perceived effectiveness of adaptation strategies on three arable crops. The result shows that the mean score on postponing farming periods among cassava, yam and cocoyam by farmers in the study area were 4.68, 4.53 and 4.46 respectively. The Duncan multiple range test used as mean separation technique show that there is a significant difference (F-ratio 0 .512) in the effectiveness of using the adaptation strategy (postponing farming periods) among the three arable crop farmers.

The ANOVA result on the perceived effectiveness of adaptation strategy on three arable crops. The result show that the mean score on the usage of processing/storage facilities among the three arable crop cassava, yam and cocoyam farmers in the study area were 3.63, 3.71 and 3.75 respectively. The Duncan multiple range test used as mean separation technique show that there is a significant difference (F-ratio 0.792) in the effectiveness of using adaptation strategy (processing/storage facilities) among the three arable crop famers.

Finally, Table 2 shows the result of ANOVA on the perceived effectiveness of adaptation strategies on three arable crops. The result that the mean score on the use of integrated waste management system used among the three arable crop cassava, yam and cocoyam were 4.11, 4.01 and 4.11 respectively. The Duncan multiple range tests used as mean separation technique show that there is no significant difference (F-ratio 0.357) in the effectiveness of using integrated waste management system among the three arable crop farmers.

CONCLUSION

The study concluded that the effectiveness of adaptation strategies to climate variability as perceived by farmers in regard to the use of improved genetic resource ($\bar{x}$ = 2.8), planting of leguminous crops ($\bar{x}$ = 2.5), integrated waste management system ($\bar{x}$ = 2.5) were not effective adaptation strategies to climate variability because they were below the 3.0 bench mark mean score. While, mixed cropping ($\bar{x}$ = 4.1), crop rotation ($\bar{x}$ = 3.8), postponing of farming periods ($\bar{x}$ = 4.5) were effective adaptation strategies towards climate variability among rural farmers.

The ANOVA result on the perceived effectiveness of adaptation strategies on three arable crops (yam, cocoyam and cassava).The mean score on the use of improved genetic resource among cassava, yam and cocoyam by farmers were 4.33, 4.28 and 4.36 respectively. The Duncan multiple range test used as mean separation technique show that there is no significant difference (F-ratio .250). Hence, the study recommended that farmers should be provided with modern and efficient processing and storage facilities

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