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Utilisation of weather forecast information amongst maize farmers in Ido Local Government Area of Oyo State, Nigeria

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ABSTRACT

This study investigated the use of weather forecast information (WFI) as an adaptation measure of climate change among maize farmers in Ido Local Government Area of Oyo State, Nigeria. A multistage sampling procedure was employed to select 120 respondents for this study. A questionnaire survey was used to obtain data, summarized and presented by using tables, frequency counts, percentages and means while Chi-square and Pearson correlation were used to analyze the relationships between variables. Results showed that the mean age, household size, farming experience, average annual income and farm size were 44.9 years, 8 people, 23.2 years, ₦692,583.3 and 5.0 ha respectively. Also, radio (95.8%) and fellow farmers (94.2%) were the key sources by which the respondents accessed weather forecast information. Half (50 %) of the respondents had a favourable perception towards WFI. Also, 55.8% of the respondents had high usage of WFI. However, its usage was impeded by poor agricultural extension service ($\bar{x}$=3.58), inadequate extension training on weather forecast ($\bar{x}$=3.42), lack of assistance in interpreting WFI ($\bar{x}$=3.40), inadequate electric power supply ($\bar{x}$=3.28), inadequate knowledge of WFI ($\bar{x}$=3.16), language barrier ($\bar{x}$=3.05) and untimeliness of WFI ($\bar{x}$=3.04). Statistically, there existed a significant association between the respondents' land ownership and the utilisation of WFI (χ^2=13.218, p<0.01). Pearson correlation result revealed a significant relationship (p<0.01) between maize farmers' perception of WFI and its utilisation. (r=0.445, p<0.01). For improved adaptation to climate change in the study area, the study suggested an improved agricultural extension service to which could be achieved through the provision of climate field schools to improve farmers' comprehension, interpretation, and utilisation of WFI.

Keywords: Utilisation; climate change; forecast; information; weather

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INTRODUCTION

Climate change has been globally recognized as a threat, mostly to the agricultural sector and other sectors of human endeavours. It is one of the major issues that undermine agricultural production and has threatened sustainable development goals one and two in developing countries like Nigeria. Africa is one of the most vulnerable continents to climate change with the strongest economic impacts (Fadina and Barjolle, 2018). Climate change is a reality in Nigeria as elsewhere in the world (Federal Ministry of Environment, 2020). Agriculture is the most exposed sector to climate change impacts because of its over-dependence on rain-fed systems (Antwi-Agyei and Stringer, 2021). Agricultural production depends on climatic factors and so, minor negative changes in climate are capable of prompting damages on the outcomes of agricultural activities (Ofuoku and Obiazi, 2021).

Climate change manifests itself through variations in the mean values of climate indices (temperature and rainfall). Climate change has altered the agricultural calendar, leaving the weather unpredictable and negating the weather predictions potentials of indigenous knowledge and early warning signs. Maize production depends on climate and the nature of soil among others which are regarded as the yield potentials of many areas (Adeagbo *et al.*, 2021). Maize crops survive between 160^{o}C and 190^{o}C and consistently require a specific amount of precipitation (Adeagbo *et al.*, 2021). While farmers are aware of the impacts of climate change on their farming activities (Adebayo *et al.*, 2013), studies (Stringer *et al.*2020; Ojo and Baiyegunhi, 2020; Danson-Abbeam *et al.*, 2021) have shown that rural farmers are adapting to climate change through various measures. Climate change adaptation is especially important in developing countries since these countries are predicted to bear the brunt of the effects of climate change (Omerkhil *et al*., 2020). Considering the vast effects of climate change on arable crops, there is a strong need for rural farmers to complement their indigenous/traditional knowledge of weather forecasts with proven Weather Forecast Information (WFI) for making decisions on the timing of agricultural operations. According to Njoku and Ugbaja (2019) radio and television are the main sources of weather information available to farmers. The most available and reliable source of agricultural information for farmers in Nigeria is an extension under the Agricultural Development Programme organization (Madaki *et al*., 2023). Access to extension service can also provide farmers with quality information on how to best tackle climate change and its effects on their farms (Adeagbo *et al.*, 2021). The constraints to the use of weather forecast information in Nigeria include lack of timely advance information, inappropriate and non-context specific information and undependability of information and widespread illiteracy (Kim *et al*. 2016). One way to minimize the impact of extreme weather is by improving weather forecasting and better communication of weather warnings (Agyeikum *et al*., 2022) but a proven WFI without utilisation is equivalent to a wasted effort and increased level of vulnerability to the effects of climate change.

It is on this premises that this study sought to (a) describe the socio-economic characteristics of maize farmers in the study area; (b) identify their sources of information on weather forecast; (c) ascertain the maize farmers' perception of WFI; (d) determine their utilisation of WFI; and (e) examine the factors constraining the use of WFI. The study hypothesized that: (a) there is no significant association between the respondents' socio-economic characteristics and utilisation of WFI by maize farmers (b) there is no significant relationship between respondents' perception and utilisation of WFI.

METHODOLOGY

Study Area

This study was conducted in Ido Local Government Area (LGA). It is located between latitude 7^{0}30'27.74'N and longitude of 3.43'9.82''E and occupies a total area of 986 km^2. The LGA has a tropical climate with distinct wet and dry seasons. The rainy season starts in April and lasts till October, while the dry season lasts from November to March. The LGA experiences an average annual rainfall of about 1,100 mm, with the highest rainfall occurring in July and August. The temperature in Ido LGA is generally high throughout the year, with an average annual temperature of around 27°C. The hottest months are usually February and March, while the coolest months are December and January. Ido LGA has a varied topography, with the western part of the area characterized by undulating hills and valleys, while the eastern part is mostly flat with gentle slopes. Farming is a major occupation for the people in the LGA, characterized by fertile soil suitable for agriculture, with a mix of sandy and loamy soils. The area is known for production of crops like cassava, maize, yam, and plantain, cocoa, oil palm, rice, and kola-nuts.

Sampling Procedure and Sample Size

A multi-stage sampling procedure was employed for this research. Firstly, the LGA was purposively selected because maize farming is a predominant activity in the study area. Secondly, two wards were randomly selected from the 10 wards in the study area and lastly, simple random sampling technique was used to select 120 respondents from the 173 registered maize farmers using Taro Yamane formula given as:

$$n= N/1+N (e)^{2}$$

Where:
n = sample population
N = grand total of the maize farmer.

Data Collection

Farmers' perception on WFI was measured on a five-point Likert-type scale of Strongly Agree, Agree, Undecided, Disagree, and Strongly Disagree. Constraints were measured on a four-point response scale of Very Severe, Severe, Less Severe, Not Severe, while the respondents' utilisation of WFI was measured on a four-point response scale of Often use, sometimes use, seldom use, never use.

Data Analysis

The mean values for the responses were later analyzed, the higher the mean values the higher the responses of the respondents. Chi Square and Pearson Product Moment Correlation were used to explore the relationship between the hypothesized variables.

RESULTS AND DISCUSSION

Socioeconomic Characteristics of the Respondents

Results show **t**hat more than half (55.8%) of the respondents fall between 26-50 years with a mean age of 44.9 years. This suggests that the responders might be enthusiastic and interested in learning how WFI can be used for adaptation. This age range is lower than what was reported by Ogunwale *et al*. (2020) where approximately half (50.8%) of the respondents fall between 40-49 years. The results show that the majority (74.2%) of the respondents were males, while 25.8% were females. This indicates the dominance of male farmers in maize production in the study area. This study agrees with Azeeze *et al*. (2021) who reported 78.9% of male and female farmers (21.1%). Most (67.5%) of the respondents in this study were married. This finding is similar to Ajiboye (2014) who reported a higher percentage (78.3%) for married farmers. The results further reveal that 38.3% of the respondents had no formal education. However, most (61.7%) of the maize farmers attended one form of educational institution or the other and this could enhance their understanding and positively influence the utilisation of **weather forecast information**. This finding is similar to Ogunwale *et al*. (2020) who reported that 33.3% of their farmers were educated. In addition, the average mean farming experience of the farmers was 23.2 years. This could suggest that the respondents have been adapting to climate change over the years. These findings corroborate that of Ajiboye (2014) who observed a mean of 22.1 years for arable crop farmers in a similar study. Furthermore, the mean household size of the respondents was 8 people; this could imply a large family size and an opportunity for the uptake of labour-intensive adaptation strategies. This study is in agreement with Abidogun *et al*. (2019) who reported a mean of 9 persons for household size in a similar study. On average, the farm size cultivated for maize by the respondents was 5.0 ha. This is an indication that the farmers had access to land. This finding is a higher than Thomas and Sanyaolu (2017) that most (65.8%) of their arable crop respondents cultivated less than two hectares in southwest, Nigeria. The probable reason could be that most of their respondents were subsistent farmers. The study further shows an average annual income of ₦692, 583.3 from maize crops. It can be concluded that the average income earned correlates with the average farm size (5.0 ha) cultivated by the respondents. This could suggest that the respondents were using various adaptation measures of climate change. The finding of this study is in tandem with Adelakun *et al.* (2020) who posits a bit lower average income of ₦625,400. In addition, the majority (81%) of the respondents in this study cultivated maize on rented farmland. This is an indication that WFI could assist with how to make decisions on land use.

Sources of Accessibility to WFI by the Respondents

The results in Table 2 show that the major sources of accessing WFI were radio (95.8%) and fellow farmers (94.2%). This indicates that these sources were the common means by which the respondents accessed information on WFI. A similar trend of sources of accessibility of WFI was reported by Baffour *et al.* (2022) and Onyeneke *et al*. (2023). Other sources of WFI were extension agents (20%) and television (10.8%). On the contrary, Njoku and Ugbaja, (2019) discovered that their respondents ranked television second for access to WFI. From the results, accessibility to WFI via extension service was grossly inadequate, considering the percentage of the respondents in this category.

Table 1: Socio-economic characteristics of maize farmers (n=120)

Variables	Frequency	Percent	Mean ($\bar{x}$)
Age (years)			
≤25	10	8.3	
26-50	67	55.8	44.9 years
51-75	42	35.0	
>75	1	0..8	
Sex			
Male	89	74.2	
Female	31	25.8	
Marital Status			
Single	15	12.5	
Married	81	67.5	
Separated	6	5.0	
Divorced	5	4.2	
Widowed	13	10.8	
Religion			
Christianity	46	38.3	
Islam	54	45.0	
Traditional	20	16.7	
Educational Level			
No formal Education	46	38.3	
Primary Education	44	36.7	
Secondary Education	23	19.2	
NCE/ND	4	3.3	
HND/B.SC	1	0.8	
MSC.	2	1.7	
Farming Experience (years)			
≤15	42	35.0	
16-30	46	38.3	23.2 years
31-45	24	20.0	
>45	8	6.7	
Household Size			
≤5	35	29.2	
6-10	69	57.5	8 people
11-15	10	8.3	
>15	6	5.0	
Annual Income (₦)			
≤300000	22	18.3	
300001-600000	43	35.8	₦692,583.3k
600001-900000	29	24.2	
900001-1200000	12	10.0	
>1200000	14	11.7	
Farm Size (ha)			
1≤5	80	66.7	5.0ha
5.01-10	30	25.0	
10.01-15	7	5.8	
>15	3	2.5	
Land Ownership			
Owned	25	20.8	
Rented	81	67.5	
Communal	9	7.5	
Joint Ownership	5	4.2	

The result disagrees with Ofuoku and Obiazi (2021) who reported that more than half (57.233%) of their respondents had access to meteorological service information through the extension agents in Delta State, Nigeria. The likely reason could be that the extension service of the Delta State had a strong link with the farmers.

Table 2: Respondents' sources of accessibility to WFI (n=120)

Sources of Information	Frequency	Percent
Radio	115	95.8
Fellow farmers	113	94.2
Community leaders	32	26.7
Agricultural Extension officer	24	20.0
Television	13	10.8
Social media	9	7.5
Non-governmental organization	7	5.8

Respondents' Perception on WFI

The results in Table 3 reveal that the respondents perceived that WFI is location-specific ($\bar{x}$=4.12), WFI is necessary to make decisions on agricultural activities ($\bar{x}$=3.59), WFI is reliable ($\bar{x}$=3.49), WFI is timely ($\bar{x}$=3.37), and WFI is comprehensible ($\bar{x}$=3.35). The implication is that half of the respondents were favourably disposed toward WFI. This is because the respondents scored above the discriminating mean value of 3.00, thereby having a favourable perception of WFI. A study by Ogunkoya *et al.* (2018) found that farmers generally had a positive perception of WFI and believed that it could help them make informed decisions. Thus, such a favourable perception may also likely enhance the possibility of its utilisation for adaptation purposes.

Table 3: Maize farmers' perception on weather forecast information (WFI) (n=120)

Perception Statements on WFI	SA	A	U	D	SD	Mean ($\bar{x}$)
It is reliable	25(20.8)	55(45.8)	9(7.5)	16(13.3)	15(12.5)	3.49
It is timely	26(21.7)	45(37.5)	14(11.7)	17(14.2)	18(15.0)	3.37
It is comprehensible	26(21.7)	43(35.8)	19(15.8)	11(9.2)	21(17.5)	3.35
It is location specific	52(43.3)	50(41.7)	5(4.2)	7(5.8)	6(5.0)	4.12
For deciding on agricultural operations	20(16.7)	52(43.3)	26(21.7)	14(11.7)	8(6.7)	3.52
It is not readily available	5(4.2)	35(29.2)	17(14.2)	28(23.3)	35(29.2)	2.56
It is not accessible	4(3.3)	20(16.7)	16(13.3)	26(21.7)	54(45.0)	2.12
It is complex and difficult to apply	10(8.3)	33(27.5)	38(31.7)	16(13.3)	23(19.2)	2.93
It is misleading	8(6.7)	26(21.7)	31(25.8)	25(20.8)	30(25.0)	2.64
For decision on agricultural activities	12(10.0)	18(15.0)	21(17.5)	32(26.7)	37(30.8)	2.47

SA = Strongly agree, A = Agree, U + Undecided, D = Disagree, SD = Strongly disagree

Categorization of Respondents' Perception of WFI

The result in Table 4 reveals the respondents' categorization of maize farmers' perception of WFI. The findings show that half (50%) of the respondents had a favourable perception of WFI, and the other half (50%) had unfavourable perception of WFI. It can be deduced from this finding that only the farmers that had a favourable perception of WFI will consider its uses.

Table 4: Categorization of farmers' perception on weather forecast information (WFI) (n=120)

Perception	Categorization	Frequency	Percentage (%)
Favorable perception	10-30	60	50
Unfavorable perception	31-60	60	50

Utilisation of WFI by the Respondents

Results in Table 5 revealed the most frequently utilised WFI by the respondents. The Findings revealed that WFI was mainly utilised to make decisions on planting ($\bar{x}$=3.22), land preparation ($\bar{x}$=2.84), and seed preservation ($\bar{x}$=2.71). Furthermore, the Table shows that more than half (55.8%) of the respondents scored above the mean value of 2.50, thereby having a fair usage of WFI (WFI). This might be attributed to their average level of perception towards WFI, because a positive perception could translate to an increase in the use of weather forecast information (WFI). This finding is inconsistent with Njoku and Ugbaja (2019) who reported that 63% of the respondents had low utilisation of WFI.

Table 5: Utilisation of weather forecast information by the respondents (n=120)

Activities	Often use	Sometimes use	Seldom use	Never use	Mean ($\bar{x}$)
Planting	63(52.5)	33(27.5)	11(9.2)	13(10.8)	3.22
Land preparation	32(26.7)	52(43.3)	21(17.5)	15(12.5)	2.84
Seed preservation	27(22.5)	47(39.2)	30(25.0)	16(13.3)	2.71
Harvesting	21(17.5)	35(29.2)	34(28.3)	30(25.0)	2.39
Processing	18(15.0)	19(15.8)	32(26.7)	51(42.5)	2.03

Discriminating mean= 2.50

Constraints to the Utilisation of WFI

Results in Table 6 revealed the constraints encountered by the respondents in the utilisation of WFI. Poor agricultural extension service ($\bar{x}$=3.58) and inadequate extension training on weather forecast ($\bar{x}$=3.42) ranked as the major constraints to the respondents' usage of WFI. This implies that the extension agent-farmer link is weak. This study is in tandem with Njoku and Ugbaja (2019) and Gbadebo (2022) who reported as low as 13.3% and 18% respectively for farmers-extension contact in similar studies. However, Thomas and Sanyaolu (2019) reported that half (50%) of their respondents always had contact with extension agents on climate information services under the Oyo State Agricultural Development Programme (OYSADEP). In addition, lack of assistance in interpreting WFI ($\bar{x}$=3.40) was among the major constraints. This is an indication that WFI is technical and may require an interpreter for farmers' comprehension and use. This finding is buttressed by Agyekum *et al*. (2021) and Ofuoku and Obiazi (2021) that meteorological information could be too technical. In addition, inadequate electric power supply ($\bar{x}$=3.28) could have hindered the farmers from accessing WFI through television. Also, inadequate knowledge of WFI interpretation ($\bar{x}$=3.16) and language barrier ($\bar{x}$=3.05) were among the constraints, this is so because not all the respondents are well and formally educated. In addition, the respondents added that WFI was untimely ($\bar{x}$=3.04). This is an indication that WFI does not fit with agricultural activities in most cases. This finding is in agreement with Ofuoku and Obiazi (2021) who ranked the timing constraint highest in their study.

Table 6: Constraints to the utilisation of weather forecast information (WFI)

Constraints to usage of WFI	Very severe	Severe	Less severe	Not severe	Mean ($\bar{x}$)
Poor agricultural extension service	77(64.2)	37(30.8)	5(4.2)	1(0.8)	3.58
Inadequate extension training on WFI	57(47.5)	56(46.7)	7(5.8)	0(0.0)	3.42
Lack of assistance in interpreting WFI	63(52.5)	45(37.5)	9(7.5)	3(2.5)	3.40
Inadequate access to WFI	53(44.2)	54(45.0)	11(9.2)	2(1.7)	3.32
Inadequate power supply/electricity	47(39.2)	62(51.9)	9(7.5)	2(1.7)	3.28
Inadequate knowledge of WFI	35(29.2)	69(57.5)	16(13.3)	0(0.0)	3.16
Language barrier	50(41.7)	37(30.8)	22(18.3)	11(9.2)	3.05
Untimeliness of WFI	28(23.3)	74(61.7)	13(10.8)	5(4.2)	3.04
Reluctance to adopt WFI	19(15.8)	39(32.5)	48(40.0)	14(11.7)	2.53

Association between the Farmers' Socioeconomic Characteristics and Utilisation of WFI

Findings of the study reveal a statistically significant association ($p<0.05$) between the respondents' land ownership and their utilisation of weather forecast information (χ^2=13.218, p=0.010). This indicates that a farmer tends to utilise WFI as long as he has access to land. In addition, the study reveals no significant association ($p>0.05$) between sex, marital status and religion and usage of WFI. This implies that any of these variables may not influence the respondents' utilisation of weather forecast information. This result is consistent with Baffour *et al*. (2022) and Onyeneke *et al*. (2023) that marital status and religion were not statistically significantly associated with accessibility to and utilisation of climate information service (Table 7).

Table 7: Test of relationship between the farmers' socio-economic characteristics and the utilisation of weather forecast information.

Socio-economic characteristics	Chi Square (χ^2)	Df	p-value	Decisions
Sex	3.274	1	0.070	NS
Marital Status	2.910	4	0.573	NS
Religion	1.037	2	0.595	NS
Land ownership	13.218	4	0.010	S

Relationship between the Farmers' Socioeconomic Characteristics and the Utilisation of WFI

Pearson Product Moment Correlation (PPMC) analysis results revealed no significant relationship (p>0.05) between age (r=-0.001, p=0.992), years of experience (r=-0.070, p=0.445), farm size (r=-0.11, p=0.195), household size (r=-0.153, p=0.095), average annual income (r=-0.097, p=0.291) and the farmers' utilisation of weather forecast information. It could be inferred that the household size, age, income, and years of experience of the respondents had a weak and negative relationship with the utilisation of weather forecast information. This finding is consistent with Abegunrin *et al.* (2021) and Alliagbor *et al.* (2021) who reported that household size and farming experience were not statistically significant with the use of weather forecast information. However, Singh *et al.* (2016) and Thomas and Sanyaolu (2017) reported that education, farm size, family size age, and income were significantly related to the use of WFI (Table 8).

Table 8: Test of relationship between the farmers' socio-economic characteristics and the utilisation of weather forecast information

Respondents' Socio-economic characteristics	r- value	p-value	Decision
Age	-0.001	0.992	NS
Farming experience	-0.070	0.445	NS
Household size	-0.153	0.095	NS
Annual Income	-0.097	0.291	NS
Farm size	-0.119	0.195	NS

Source: Field Survey, 2022

Association between the Respondents' Perception of Weather Forecast Information and Utilisation of WFI

Results of Pearson Product Moment Correlation (PPMC) analysis revealed a statistically significant association (p<0.01) between farmers' perception of weather forecast information (WFI) and the utilisation of weather forecast information (r=0.445**, p=0.000). This indicates that respondents' perception could directly influence their ability to use WFI. In addition, a moderate relationship existed between farmers' perception and the use of weather forecast information (WFI)) (Evans, 1996).

Table 9: Test of relationship between the maize farmers' perception of weather forecast information (WFI) and the utilisation of weather forecast information

Variables	r-value	p-value	Decision
Perception on weather forecast information (WFI)	0.445**	0.000	S

CONCLUSION

The inability of rural farmers to utilize WFI effectively for adaptation had rendered them vulnerable to the risks associated with climate change. The emergence of WFI aims to enhance and supplement the conventional methods of adaptation that have been made unreliable by climate change. This study aimed at assessing maize farmers' utilisation of weather forecast information in Ido LGA of Oyo State. The study found out that half of the respondents had a favourable disposition toward the use of WFI and thus utilized it mostly for planting, land preparation and seed preservation. However, its utilization was hindered by poor agricultural extension service. In view of this, the government should improve the activities of agricultural extension agents for better delivery of WFIs to the rural farmers.

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