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ACCESS AND UTILIZATION OF SEASONAL RAINFALL PREDICTIONS AMONG LOCAL FARMERS IN BILLIRI LOCAL GOVERNMENT, GOMBE STATE, NIGERIA.

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Abstract

Rainfall parameters are very essential for crop growth, but getting access to and utilization of the predicted information by the local farmers often remain a challenge. This study examines the level of accessibility and utilization of annual rainfall prediction among local farmers in Billiri Local Government Area of Gombe State. The study used 2011-2017 Nigerian Meteorological Agency (NiMet) rainfall predictions and ground station rainfall records for same periods and the responses of the local farmers. In order to achieve the objectives of the study, 100 local farmers interviewed using structured interview questions. The respondents were selected using simple random sampling technique from three political wards of the local government area. The study employed Chi-square, correlation and descriptive statistical tools in analyzing the collected data. The findings of study reveal that there is a significant difference between the predicted and observed rainfall attributes. The respondents mostly got the information of annual rainfall prediction from rural square ground for discussions, joints or haunts as against the conventional channels. Only 36% of the respondents have access to rainfall information and were utilizing it in crop production planning. Therefore, the study recommended among others the need for NiMet to provide predicted rainfall information on small scales, improvement in the medium of dissemination of the predicted rainfall information, timely availability of the annual rainfall forecast to the local farmers for farming decisions and increased enlightenment campaign for the local farmers on the significance of rainfall predictions to crop production for general development of the agricultural sector.

Key words: Accessibility, Utilization, Annual Rainfall Prediction, Crop production

1. Introduction

According to Ayoade (2004), water in all its forms plays a vital role in the growth of plants and the production of all crops. It provides the medium by which food and nutrients are carried through the plant. Akash (2015), Oguntoyinbo (1986), Aninash (2000), Ayoade (2002; 2004), Hammer (2001), Cicek, and Turkogu, (2005) have extensively discussed the concept of climate and agriculture. These studies have all confirmed that climatic parameters (i.e. rainfall, sunshine, humidity, temperature, evaporation etc.) are closely interrelated in their influence on crops. However, of all the climatic parameters affecting crop production and yield, moisture is the most important one (Hodder, 1980).

Rainfall is the major source of water, which is essential for plant growth and development in sub Saharan Africa. *It* can be excess, scanty or untimely. The total amount of rainfall in a season is not the criteria but its distribution over a large area is critical. In agriculture, a forecast is useful to the extent that it permits more advantageous ex ante actions, such as altered choice of crop species and cultivars and timing of tillage (Sonka, Mjelde, Lamb, Hollinger & Dixon, 1987) or altered composition or allocation of herds (Julie, Silva, Corene & Matyas, 2014). For

example, a skillful forecast may allow a farmer to diversify less and to match cropping decisions more closely to expected climatic events. A farmer who can anticipate that rainfall is likely to be unusually ample can grow seeds that are sensitive to water availability to improve profits; conversely, a farmer who knows that there is a high probability that rainfall will be unusually low can conserve on inputs, use less water-sensitive inputs, or refrain from application of any unfruitful inputs at all. Forecasts of growing season length or degree-days may be useful in similar ways.

However, forecasts are helpful only if they arrive before planting or stocking decisions are made and if the producer is capable of responding. Some responses, such as changing livestock species, may require resources available only to the most successful producers. A reasonable knowledge of the date of rainfall cessation enables the prediction of the length of the growing or rainy season, which is most useful for the selection of crop varieties, crop matching and cropping sequences (Kowal and Knabe, 1972). Therefore, in order to ensure maximum and sustainable agricultural productivity, as well as efficient water resource management practices, reliable predictions of the monthly and annual precipitation, the cessation dates and the length of the rainy season are all equally very important.

NiMet always encourages farmers all over the country to use weather and climate information throughout the agricultural value chain (NiMet, 2020). It publishes and disseminates seasonal rainfall predictions every year. This is because access to seasonal rainfall forecasts can benefit the local farmers by allowing them to make more informed decisions about their farming practices (Gunda et al, 2017). However, it is unclear whether farmers realize these benefits when crop choices available to farmers have different, variable costs, and return. However, it is possible to adapt to or mitigate the effects of adverse weather if a forecast of the expected weather can be accessed in time (Gadgil, Seshagiri Rao & Narahari, 2002).

A local farmer is a person who grows processes and sales agricultural produce within certain, mostly local area on a smallholding basis. Most of the local farmers cultivate on small plots and often produce for family consumption only by using rudimentary methods. Hence, sometimes they tend to be reluctant in adopting innovations including utilization of rainfall predictions. However, the current challenges and realities the local farmers face in terms of food security are forcing some of them to look for information on rainfall predictions which might be inaccessible to them or not reaching them as at when due. Some might also develop apathy for utilization of the forecast. . The central theme of this paper is to reflect on current experiences of the local farmers in terms of access and utilization of rainfall predictions.

It is against this background that the research aims at assessing the accessibility and utilization of annual rainfall prediction information among local farmers in Billiri L.G.A of Gombe State, Nigeria with a view to answering some questions, The following steps were specifically followed to arrive at the results: validating the accuracy level of Nigerian Meteorological Agency (NiMet) rainfall prediction records, determining the local farmers' sources of rainfall prediction information, examining the impacts of rainfall predictions on agricultural output and examining the level of rainfall forecast

utilization behavior of the farmers in the study area.

2. The Study Area

The study area is located approximately within longitude 9^0 51'53''N and latitude $11^0$13'31''E of the Greenwich meridian. It is located in southern part of Gombe State, It has a total land area of about 737km^2 (285 sq. miles) and has the population of 202,144 at the 2006 census (NIPOST, 2009). It shares border with Kaltungo local government area to the east and Akko local government area to the west (see fig. 1).

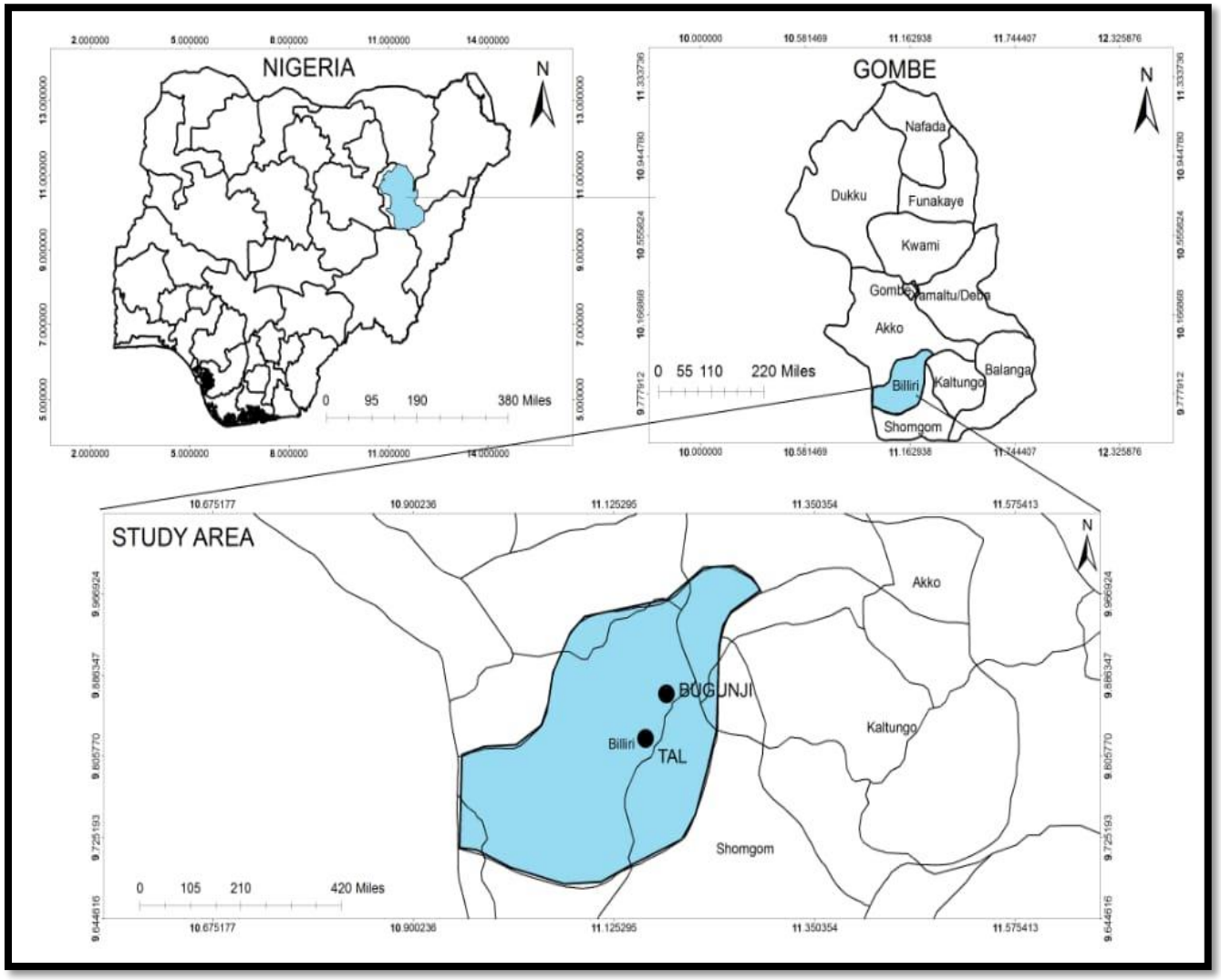

Figure 1: The Study Area - Billiri LGA
Source: GIS and Remote Sensing Laboratory, Geography Department, GSU, Gombe (2019)

The topography of the study area is predominately (61.72%) plain land. The highest point in Billiri is 882m above sea level and the major drainage channel is River Panda and its two main tributaries are River Chabbal and River Gada-Uku (Lasale) having some little streams (Mayomi et al, 2018).

The climate of the study area belongs to the Koppen's Aw climate with two distinct seasons, rainy and dry or summer and winter seasons. The rains start around April/May and end around October/November and it has an average annual rainfall and temperature of 904 mm and 25.4 ^{0}C respectively (Mayomi et al, 2018).

The people of Billiri LGA are predominantly Tangale, Waja, Tula and Pero-chonge. The major economic activities are agriculture and small-scale businesses. To be specific, agriculture is the major economic activity in the area. Irrigation farming is also practiced in some specific locations. The major crops produced are maize, guinea corn, millet, rice and soya beans. A cattle rearing is also practiced with low proportion of people who are engaged. The concentration of agricultural production and administrative functions `has attracted a number of small-scale businesses ranging from furniture making, mechanic services, trading of all sorts with the establishment of m. This activity has also attracted some banks in to the area. These include Unity bank and Tangale Micro Finance Bank.

3. Methodology

Three types of data from three different sources were used for this study as shown in Table 1:

Table 1: Types and Sources of Data

S/N	Data Required	Source
1,	Rainfall Data (Amount & length)	UBRDA Dadin Kowa
2.	Rainfall Prediction Records(Amount, Length, Onset & Cessation)	NiMet
3.	Respondents' Responses	Field Social Forms(Questionnaires)

The data used for this study are past monthly rainfall records, prediction records and responses from selected respondents. The instruments used for collecting the data are questionnaire, interview schedule and personal observation. Reconnaissance survey was carried out to get acquainted with the study area. This provided an opportunity for mapping out effective strategies for data collection. It also aided in the questionnaire design and pilot survey. 'The sample size of the study was determined using the total population of local farmers in the study area in which 100 questionnaires were distributed in three (3) areas as follows: 40 questionnaires were administered to Banganji, followed by Tal with 30 questionnaires and Billiri with 30 questionnaires. A simple random sampling technique was used in the selection of the respondents and descriptive statistics such as tables, frequency distribution, percentages and charts as well as chi-square were used as the analytical tools.

4. Results and Discussion

4.1 Background Characteristics of Respondents

The background demographic and socio-economic characteristics of the respondents, access, awareness and utilization of rainfall predictions are presented in tabular forms and discussed as follows. Table 2 depicts the socio-economic and demographic characteristics of the respondents. Table 2 reveals that males constitute more than half of the farmers in the study area, while females constitute only about one-third.

Gender			Age			Education			Marital Status			Livelihood Option			Tribe		
Category	**No.**	**%**	**Category**	**No.**	**%**	**Category**	**No.**	**%**	**Category**	**No.**	**%**	**Category**	**No.**	**%**	**Category**	**No.**	**%**
Male	68	68	18-24	3	3	Primary	16	16	Single	32	32	Farmer	55	55	Tangale	58	58
Female	32	32	25-35	40	40	Secondary	33	33	Married	58	58	Civil Servant	26	26	Waja	8	8
			36-45	37	37	Tertiary	36	36	Divorce	5	5	Trading	14	14	Tula	10	10
			46-55	18	18	Others	15	15	Widow	5	5	Animal husbandry	2	2	Dadiya	5	5
			>56	2	2										Hausa	9	9
															Fulani	8	8

Table 2: Socio-economic Characteristics of the Respondents (N=100)
Source: Fieldwork, 2020.

This contradicts the figures of the Federal Ministry of Agriculture. This may not be unconnected with culture of Muslims of northern Nigeria that mostly limits the female's responsibility to their households. Therefore, this study concludes that males constitute larger proportion of the farming population of the study area.The respondents within the age brackets of 18-24, 25-35, 36- 45, 46-55 and 56 years and above were 3%, 40%, 37% 18% and 2% respectively. This implies that greater proportion of the age distribution falls between age brackets of 25-35 and 36-45 years which are the majorly the working population (see Table 2).

As further shown in Table 2, about one-sixth of the respondents attended primary school, one-third had secondary education, and little above one-third were graduates of tertiary institutions and only another one-sixth (15%) acquired informal education.

Table 2 further demonstrates that 32% of the total respondents are single, more than half of them are married, 5% are divorce and the remaining 4% are divorce. The greater proportions of the farming population in the study area are married. Therefore, the study observed that married people are engage more in farming activities.

Regarding livelihood option, Table 2 shows that 55% of the respondents are farmers while, civil servant constitutes 23%, trading has 14% while animal husbandry has only 2%.most of the respondent are local farmers which has the higher proportion from the total number of the respondent.

On the basis of tribes, the leading tribal group in the study area as indicated in Table 2 is Tangale which constitutes over half of the population and the least is Dadiya. That shows the study area is predominantly a Tangale community.

4.2: Perception of Respondents on changes in Rainfall Pattern

Table 3 shows the perception of the respondents on changes in rainfall pattern and almost all (97%)of them noticed that, while 3% of them did not notice any rainfall pattern changes. 52%, 3%, 6%, 3%, 3% and 2% of them observed decrease, increase in amount of rainfall, early onset of rainfall, late onset, early cessation and late cessation respectively. From the information obtained from the respondents, it is clear that the higher proportion observed decrease for rainfall, which in turn affects local farmers' output.

Table 3: Perception of Respondents on Rainfall Changes Pattern

Rainfall Pattern Change	Option	F	%
Changes in Rainfall Pattern	Yes	97	97
	No	3	3
Nature of Changes:			
	Decrease in amount	52	52
	Increase in amount of rainfall	3	3
	Early onset	6	6
	Late onset	35	35
	Early cessation	3	3
	Late cessation	2	2
	Decrease in growing season	0	0

Source: Authors' Work, 2020

4.3: Respondents' Awareness, Source and Utilization of Rainfall Prediction /Information

Table 5 below shows the awareness, sources and utilization or application of rainfall prediction/information by the respondents. It depicts almost all (99%) of the respondents were aware of the rainfall prediction and more than of them indicated that union organizations are main source of the information. In addition to this almost half the make use of the information

Table 4: Awareness, Source and Utilization of Rainfall Prediction/Information

Variable/Option		F	%
Awareness of Rainfall Prediction	Yes	99	99
	No	1	1
Source of Rainfall Prediction/Information:	Extension workers	39	39
	Unions /associations	59	59
	Media	2	2
Using the Rainfall prediction Information in	Yes	48	48
Cropping Production calendar	No	52	52
Application of R/fall prediction/information:	Types of crops to plant	16	16
	Varieties of crops	10	10
	Planting date	9	9
	Reducing Risk	20	20
	Others	2	2
	Improving yields	13	13
	Reducing cost	4	4

Source: Authors' Work, 2020

Table 4 shows that almost all (99%) of the respondents were aware of the rainfall prediction information and more than half of them said they got the information from unions/associations. Again, more than half of them said they used the information in cropping production calendar and all of them agreed that they applied the information in various ways.

Table 5: Onset of Rainfall (Expected and Observed)

	ONS expected	ONS observed	DF	Remark
2011	150	141	-9	Early
2012	161	129	-32	Early
2013	141	154	13	Late
2014	144	118	-26	Early
2015	171	141	-30	Early
2016	139	141	2	Late
2017	149	150	1	Late

Source: Authors' Work, 2020

Table 5 the onset of the rainfall both the expected and observed is not corresponding, from 2011 – 2015 the onset is early compared to the expected onset predicted. 2016 and 2017 the reverse is the case because the onset arrives lately. This implies that when the

local farmers utilized the predicted information it would affect their agricultural output.

Table 6: Cessation Days of Rainfall (2011- 2017)

CES expected		CES observed	DF	Remark
2011	304	281	-23	Early
2012	301	251	-50	Early
2013	309	276	-33	Early
2014	304	229	-75	Early
2015	305	241	-64	Early
2016	290	260	-30	Early
2017	297	280	-17	Early

Source: Authors' Work, 2020

Cessation days are usually early based on Table 6 and this usually affects the agricultural production of the local farmers. Most of the local farmers do not have the information on the cessation dates. 2011 prediction of the rainfall cessation was shorten by -23, - 50, -33 -75,-64 and -30 days based on the predicted and observed for 2011, 2012, 2013, 2014 2015, 2016 and 2017 respectively.

Table 7: Expected and Observed Length of Growing Season

Year	LGS expected (Days)	LGS observed(Days)	DF (Days)	Remark
2011	150	165	15	Longer
2012	120	135	15	Longer
2013	140	155	15	Longer
2014	161	171	10	Longer
2015	120	130	10	Longer
2016	155	175	20	Longer
2017	150	175	25	Longer

Source: Authors' Work, 2020

The expected and observed length of growing season was fluctuating from 2011 to 2015 and from 2016 to 2017 the observed length of the growing season is stable (see Table 7). Using Chi-square statistics, the calculated value is 13 while the table value is 11.07. Since the calculated value is more than the table value therefore null hypothesis is rejected 0.05 significant levels thereby, there is a significance differences between the expected length of growing season and the observed growing season at 0.05 significant levels.

5. Conclusion

Lack of access of rainfall prediction information plays a vital role in lack of good agricultural production or outputs annually to the local farmers. Most of the local farmers are aware that rainfall attributes are predicted annually but the problem they encountered is the ability for them to have access to the predicted rainfall information. It is also observed that the prediction of the seasonal rainfall forecast and the observed rainfall attribute from the ground station is not corresponding; there is little variation in the data. Most of the local famers utilize the information in planning for their planting.

6. Recommendations

NIMET predicted rainfall at regional scale that have large scale variability within the region and it has effect in the application of the predictions in small scale and crop production planning, thus a need for a NIMET To provide predicted information at a small spatial scale The present method of dissemination of this rainfall prediction information is grossly in adequate and in affective, thus a need for expanding and improving the medium of communicating the predicted information to local farmers.The study suggests that there should be increase campaign to local farmers on significance of rainfall prediction information on crop production planning for general development of the agricultural sector.

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