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# ASSESSMENT OF COPING AND ADAPTATION STRATEGIES TO CLIMATE CHANGE BY ARABLE FARMERS IN NORTHWESTERN NIGERIA

Tijjani Yahaya Abdullahi[1*], Ameer Abdulazeez[2] Musa Musawa Ahmed[3], Usman Nasiru Usman[4], Uba A.A[5], Shehu S.A[6] and Mohammed A. Ndakuru[7]

[1,4,7]Department of Geography, Federal University, Gashua, Yobe State, Nigeria.
[2]Department of Geography, Federal University, Dutsin-ma, Katsina State, Nigeria.
[3]Department of Geography, Bayero University, Kano, Kano State, Nigeria.
[5,] Department of Forestry Technology Audu Bako College of Agriculture Danbatta, Kano State
[6,] Department of Agricultural Technology Audu Bako College of Agriculture Danbatta, Kano State.

[*]Corresponding Author E-mail: tijjaniyansabo@gmail.com

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***ABSTRACT***

*This study assessed the coping and adaptation strategies employed by arable farmers to cope with the adverse effects of climate change in northwestern Nigeria. Thirty (30) farmers from the four local government areas who were 40 years old and above and had 20 years of farming experience were sampled. A total of 120 respondents were used for the study. The data were subjected to descriptive statistics and presented in tables using percentages. The results revealed that the farmers employed various coping and adaptation strategies. These include crop residue, chemical weed control, use of fertiliser, use of cattle manure, first weeding and second weeding, among others. The significant strategies included using adapted, organic matter and fertiliser, hiring labour for farming, using irrigation, first weeding and second wedding. Conclusively, the agricultural adaptation strategies to climate change in northwestern Nigeria vary owing to the uneven spread of environmental and socio-economic resources. While some of these strategies are age-long practices, their adoption is further reinforced by intensifying ecological stressors. The study recommended that there is a need for the four local farmers' communities to partner with multilateral and international agencies to build the capacities of farmers in relevant areas to strengthen the farmers` ability to develop and implement adaptation strategies and plans that would reduce vulnerability to the impacts of climate changes. Some of these areas include providing financial resources that will increase their ability to adopt crop, water, and soil management strategies in response to the impacts of climate change.*

**Keywords**: Arable Crops, Climate Change, Farmers, Coping, Adaptation Strategies

## INTRODUCTION

Coping responses are the ensemble of short-term responses to potential impacts of climate change that can be successfully applied season-to-season or year-to-year as needed to protect a resource or livelihood, among other things. Some coping strategies (or responses) are explicitly anticipatory, including insurance schemes and emergency preparedness. Adaptive responses refer to how individuals, households, and communities change their productive activities and modify their rules and institutions to minimise risk to their resources and livelihoods (IPCC, 2007).

The resilience of a system, either coping or adaptive responses, or both, will come into play. With a progression of change in climatic conditions, coping mechanisms may sometimes be overwhelmed

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and, by necessity, supplanted by adaptive responses. According to Harris and El-Jasser (2011), the terms adaptation and coping strategies are sometimes used interchangeably to cope with the negative impacts of the perceived change in climate patterns on their farming systems, and most farmers adopted some adaptation strategies and coping practices. In agriculture, adaptation is evolutionary and occurs in the context of climatic, economic, technological, social, and political forces that are difficult to isolate, and most adaptation practices serve multiple purposes (Singh *et al.,* 2003).

Recent studies focus on financial, technical, and institutional criteria to evaluate adaptive capacity (Howell & Hiler, 1975). According to Farauta *et al.* (2012), most researchers have entirely omitted perception. How can individuals adequately adapt to climate change if the perception of current and future climate change is not a reality? Adaptation is an adjustment to a human, ecological or physical system in response to a perceived vulnerability (US Environmental Protection Agency; Eltantawi, 2011). Adaptation strategies became prominent in literature in the 1990s and are often associated with climate change. IPCC (2007) states that adaptation to climate change is an adjustment in natural or human systems in response to actual or expected climatic stimuli and their effects, which moderates harm or exploits beneficial opportunities. Adaptation will be necessary to address the impacts of the warming, which are already unavoidable due to past emissions. Adaptation is also essential because setting limits on emissions will not be enough, or happen soon enough, to avoid all impacts of climate change (IPCC (2007). While planned adaptation could offer a better strategy against climate change, there is a need to identify local strategies for mainstreaming.

Adesina and Odekunle (2011) noted that suggested adaptation strategies may be entirely novel to an area or improve what is previously well-known to a community. Therefore, this paper assesses agricultural adaptation strategies to climate change in some selected rural settlements in Northwestern Nigeria and the current adaptation strategies in response to the effects of the climatic variables (rainfall/temperature).

## MATERIALS AND METHODS

### Study Area

Northwestern Nigeria is located between latitudes 12o 00” N and 13o45” N and Longitudes 3o 30” E and 11o 35” E (Figure 1). Its climate is tropical wet and dry, with semi-arid steppe types (Adesina et al., 2011). Agriculture is the predominant economic activity in the study area; the crops produced include millet, sorghum, rice, cowpea, soya beans, wheat, groundnut, maise, cotton, and sesame (Harris & Mohammed, 2003).

The climate of Northwestern Nigeria is tropical wet and dry and semi-arid steppe types coded Aw and Bs by W. Koppen (Eltantawi, 2011). The area from its southern parts (around Latitude $12^0$ N, such as Kano and Gusau) is situated along the ecological zones of dry sub-humid with annual rainfall totals of 800mm - 1000mm, while in its northern part along Sokoto and Katsina (Latitude $13^0$ N) is semi-arid with annual rainfall of range of 600 - 800mm. The extreme northern part is an arid zone with annual rainfall between 400mm and 600mm (Olofin, 1987). The pattern of rainfall in the zone is characterised by unpredictability and unreliability and is highly variable in spatial and temporal dimensions of high inter-annual variability that frequently culminates into dry spells and severe and widespread droughts (Oladipo, 1993; Mortimore & Adams, 1999; Okorie, 2003; Abaje *et al.,* 2013; Abaje, 2023).

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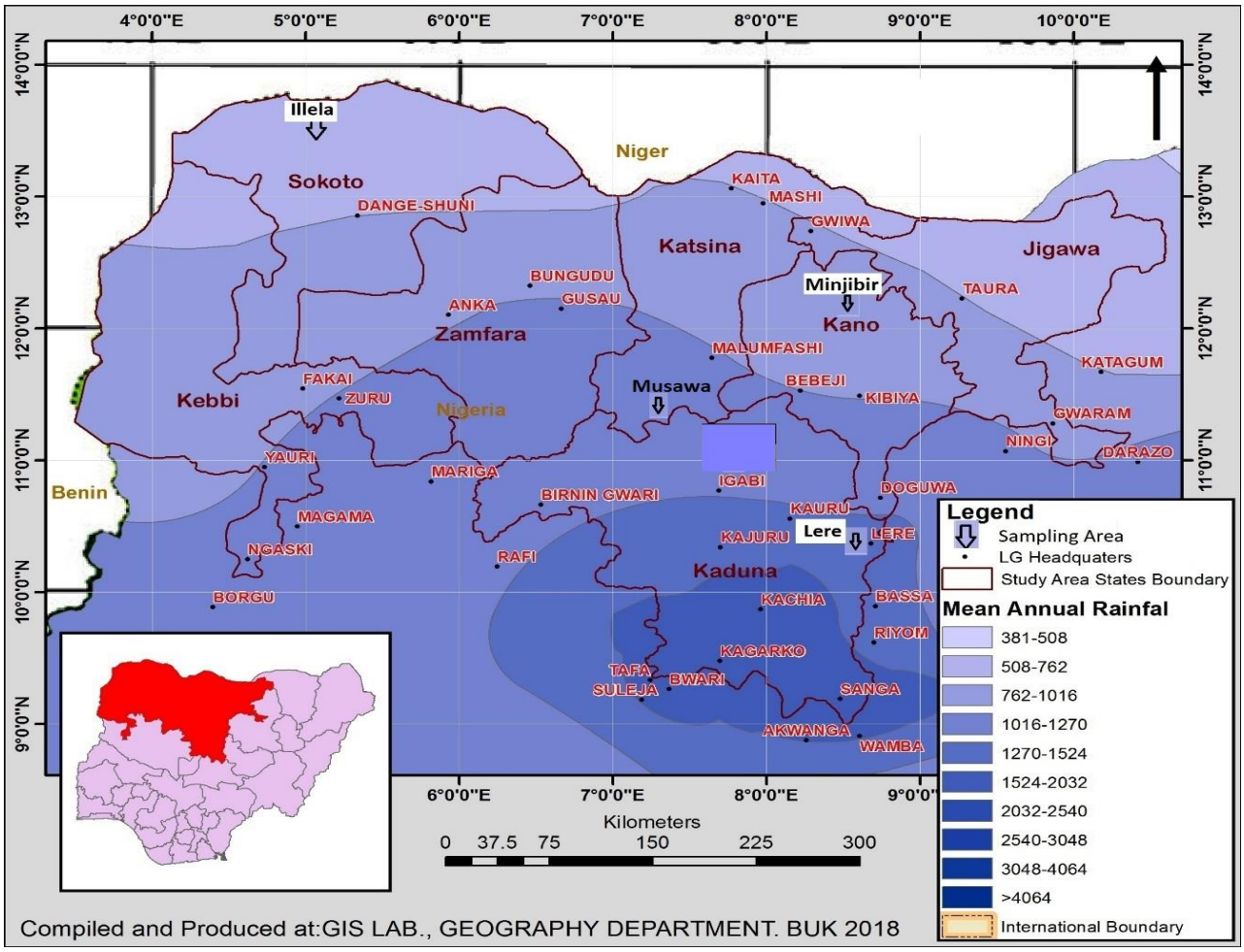


**Figure 1:** Map of the study area showing the sampling site.
**Source:** Fieldwork (2023)

The December to January period is cold with no precipitation. The average night and day temperatures are $15^0$ and $25^{0,}$ respectively (Oladipo, 1993). The weather is hot and dry between February and May during the rainy or hot-dry season. Less than 1% of the annual rainfall is recorded in May. From June to October, the rainy or *Damina* season begins. The ITD has made considerable advances northward, and the areas have widespread rainfall. Over 90% of the annual rainfall is recorded in this season. This is the humid period when surface runoff is available for stream flow and soil moisture is sufficient for plant growth. *Damina* is the crop-growing season when grains and legumes are grown. The Cool Dry Season (*Kaka*) is the harvest season between October and November when rainfall is less than 8% of the annual rainfall. This season is influenced by the north-easterly wind, which brings cool and dusty weather called 'Harmattan" or Hunturu between November and February. The dry air from the north brings no rainfall, but the transported harmattan dust is deposited and replenishes soil nutrients. During this period, the ambient air is arid and cold, dusty during the day and chilly at night (Ahmed, 2006; Liman, Idris and Mohammed, 2014).

**Data Collection**

A total of four farming communities close to the four synoptic stations, Minjibir (Kano), Lere (Kaduna), Musawa (Katsina) and Illella (Sokoto), were selected through purposive sampling

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technique. Consideration was given to a selection of local farming communities close to the synoptic stations on latitudes 12 and 13, as this will provide variations in rainfall, temperature and trends, and historical records of the synoptic stations. Finally, thirty farmers of not less than forty years and twenty years of farming experience were selected using convenience or accidental sampling from the four areas (Minjibir of Kano State, Lere of Kaduna State, Musawa of Katsina State, and Illella of Sokoto States (40 years and above, and 20 years and above of farming experience) were chosen. This added to the total number of one hundred and twenty (120) respondents. Factors considered in the selection of thirty farmers from each of the communities included those respondents who are at least farmers of the age of 40 and above and who also have at least 20 years of farming experience.

**Data Analysis**

These areas are less than 30 km from their nearby (NiMet) synoptic stations. A structured interview schedule was developed to guide the interview's tone on various issues, such as farmers' knowledge or sources of experiences and adaptive/coping strategies to climate change. The interviewees' responses were recorded, refined, and analysed using descriptive statistics such as frequency and percentage. Microsoft Excel (2007) was used for the analysis.

## RESULTS AND DISCUSSION

### Socio-economic Characteristics of Respondents

The socioeconomic profile included age, gender, marital status and other attributes. These are all subsequent. As can be seen from Table 1 majority (66.7%) of the sampled farmers in the study area are within the age bracket of 35-55 years which could be said to be an active age bracket that understands modern adaptive strategies in all the four farming communities, the first middle age group shows that (66.7% in Minjibir, 50% in Lere, 23% in Musawa and 20% in Illella), it further revealed that second middle age group shows that (20.0% in Minjibir, 46.7% in Lere, 23.3% in Musawa and 16.7% in Illella). Age 25-35 years), and age between 25- 35 years are the rare group (13.3% in Minjibir, 00.0% in Lere, 00.0% in Musawa and 33% in Illella).

This result is in line with the study of Ikpe (2014) on adaptation strategies to climate variability and change among grain farmers in Goronyo LGA of Sokoto State, which showed that people within the age bracket of 31-50 years are active in farming activities in the area. Kurukuluasiriyya (2003) reported that those over 69 seem less adaptive. However, to some extent, middle-class farmers seem more likely to adopt adaptation strategies. More (2000) found that about 20 per cent of respondents were from the young age group, 68 per cent were from the middle age group, and about 22 per cent belonged to the old age group.

According to Adesina and Forson (1995), age plays a significant role in agricultural practices and coping strategies to change the climate. It is generally agreed that age negatively influences the adoption of new methods. It may be that older farmers are more risk averse and less likely to be flexible than younger farmers and thus have a lesser likelihood of adopting new technologies. Some scientists say that age may positively influence the adoption decision (Mortimore, 1989). It could also be that older farmers have more experience in farming and are better able to assess the characteristics of the study area and the modern adaptive strategies than younger farmers, hence, a higher probability of adopting the approach.

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Table 1: Socio-economics profile of respondents

| VARIABLES | | Minjibir | | Lere | | Musawa | | Illella | | TOTAL | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Freq | % | Freq | % | Freq | % | Freq | % | Freq | % |
| **GENDER** | Male | 27 | 90 | 27 | 90.0 | 27 | 90 | 28 | 93 | 109 | 90.8 |
| | Female | 3 | 10 | 3 | 10.0 | 3 | 10 | 2 | 7 | 11 | 09.2 |
| | **TOTAL** | **30** | **100** | **30** | **100** | **30** | **100** | **30** | | **120** | **100** |
| **AGE GROUPS** | 25 – 35 | 4 | 13.3 | 0 | 00.0 | 0 | 00.0 | 10 | 33.3 | 14 | 11.7 |
| | 35 – 45 | 20 | 66.7 | 15 | 50.0 | 7 | 23.3 | 6 | 20.0 | 48 | 40.0 |
| | 46 – 55 | 6 | 20.0 | 14 | 46.7 | 7 | 23.3 | 5 | 16.7 | 32 | 26.7 |
| | Above 55 | 0 | 00.0 | 1 | 03.3 | 16 | 53.4 | 9 | 30.0 | 26 | 21.6 |
| | **TOTAL** | **30** | **100** | **30** | **100** | **30** | **100** | **30** | **100** | **120** | **100** |
| **OCCUPATION** | Farming | 4 | 13.3 | 22 | 73.3 | 21 | 70.0 | 25 | 83.3 | 72 | 60.0 |
| | Civil servant | 26 | 86.7 | 8 | 26.7 | 9 | 30.0 | 3 | 10.0 | 46 | 38.3 |
| | Trading | 0 | 00.0 | 0 | 00.0 | 0 | 00.0 | 0 | 00.0 | 0 | 00.0 |
| | Others | 0 | 00.0 | 0 | 00.0 | 0 | 00.0 | 2 | 06.7 | 2 | 01.7 |
| | **TOTAL** | **30** | **100** | **30** | **100** | **30** | **100** | **30** | **100** | **120** | **100** |
| **LEVEL OF EDUCATION** | Primary | 0 | 00.0 | 17 | 56.7 | 12 | 40.0 | 17 | 56.7 | 46 | 38.3 |
| | Secondary | 1 | 03.3 | 0 | 00.0 | 8 | 26.7 | 0 | 00.0 | 9 | 07.5 |
| | Certificate | 2 | 06.7 | 4 | 13.3 | 8 | 26.7 | 1 | 03.3 | 15 | 12.5 |
| | Diploma | 7 | 23.3 | 0 | 00.0 | 0 | 00.0 | 3 | 10.0 | 10 | 08.3 |
| | First Degree | 15 | 50.0 | 4 | 13.3 | 2 | 06.6 | 8 | 26.7 | 29 | 24.2 |
| | Masters Degree | 5 | 16.7 | 5 | 16.7 | 0 | 00.0 | 1 | 03.3 | 11 | 09.2 |
| | PhD | 0 | 00.0 | 0 | 00.0 | 0 | 00.0 | 0 | 00.0 | 0 | 00.0 |
| | **TOTAL** | **30** | **100** | **30** | **100** | **30** | **100** | **30** | **100** | **120** | **100** |
| **MARITAL STATUS** | Single | 0 | 00.0 | 0 | 00.0 | 6 | 20.0 | 6 | 20.0 | 12 | 10.0 |
| | Married | 30 | 100 | 30 | 100 | 24 | 80.0 | 24 | 80.0 | 108 | 90,0 |
| | Widowed | 0 | 00.0 | 0 | 00.0 | 0 | 00.0 | 0 | 00.0 | 0 | 00.0 |
| | Separated | 0 | 00.0 | 0 | 00.0 | 0 | 00.0 | 0 | 00.0 | 0 | 00.0 |
| | Others | 0 | 00.0 | 0 | 00.0 | 0 | 00.0 | 0 | 00.0 | 0 | 00.0 |
| | **TOTAL** | **30** | **100** | **30** | **100** | **30** | **100** | **30** | **100** | **120** | **100** |

Source: Fieldwork, 2023

The gender distribution of respondents in the Table above on climate variability change has recently become necessary because of the social, spatial and economic contexts within which change is perceived and responded to. There is a preponderance of male respondents in all the areas (90% in all the regions except Illella, where 93% of the respondents are male). There is a minor percentage of female respondents in all the regions (10% in all the areas except Illella, and 7% of the respondents are female).

The result agrees with Abaje, Sawa, and Ati's (2014) findings, which show that most respondents were male (87%) while only 13% were female. This is in line with the agreement with other related studies, for example, Ishaya and Abaje (2008) and Adams, Bamidele, Adebola and Kobe (2014) that the agricultural sector and the tedious activities related to climate change adaptation strategies are dominated by males. The dominance of male farmers is not unconnected with the cultural beliefs or practices prevalent in this part of northern Nigeria, which limits women from participating in outdoor activities. The result of this study corresponds with the findings of (Zoelick, 2009; Ikpe 2014 and Bambale 2014), which all revealed that males are the dominant gender involved in farming activities in their respective studies. The figure further shows that about 100% of the farmers are married

(100% in Minjibir, 100% in Lere, 80% in Musawa and 80% in Illella), with only 20% single in Musawa and Illella, respectively. This may not be unconnected with the fact that marriage is an essential aspect of adulthood in most African societies. Thus, individuals who have attained marriageable ages are left alone to fend for themselves outside the comfort of their parents' care (Bambale, 2014). This result is in line with the findings of Abaje et al. (2014) that most respondents (80.6%) are married.

The results show that about half of the respondents in all four stations had primary education, with 38.3% as their highest education attainment. This was followed by 24.2% of respondents who attained first-degree education as their second-highest level of qualification. 12.5% of the respondents are certificated. In contrast, 08.0% of the sampled population had a diploma as their educational attainment. A substantial number of sampled respondents attained a secondary school level of education.

The result shows that a few of the respondents in the study area had attained tertiary education; this may be due to the numerous tertiary institutions in the four sampling sites. Indeed, education is expected to increase one's ability to receive, decode, and understand information relevant to making innovative decisions (Washington, 2001). More so, the literacy and numeracy level of the respondents are also vital factors that may determine the understanding and perception of risks associated with climate variability and change.

This result is very closely related to findings by Abaje *et al*. (2014) in Dustin-Ma LGA of Katsina State. Also, this result is in line with the finding of Ikpe (2014) on adaptation strategies to the effects of climate among grain farmers in Goronyo LGA of Sokoto State, Nigeria, where most of the sampled farmers acquired Quranic education. Formal education is still low among rural households; hence, their awareness of the contemporary effects of climate issues may be low.

The respondents' primary occupations in all four stations revealed that about 60.0 % had farming as their primary occupation, followed by civil service, which had about 38.3%. In contrast, 01.7% engaged in trading and processing as their significant occupations.

Most farmers in the study areas have adopted some adaptation strategies and coping practices. Among these practices, the most commonly adopted strategies were the use of adapted crop varieties such as drought-tolerant crop varieties, crop residue, tied ridging, mono-cropping, mulching, intercropping, ripping, potholing, fallowing, and winter cropping. Other practices included the systematic use of chemical weed control, changes in the cropping system, more labour investment, and rainwater harvesting.

Table 2 indicates that most of the farmers in all four stations in Minjibir, Lere, Musawa and Illella local governments unanimously agreed on the use of the following as an adaptation strategy to climate change against their farming activities: about 75 % of the respondents interviewed used adapted crop residue, while 73.1 % use of chemical weeds control. Tied ridging is used as an adaptation practice; 32.8% of the respondents used this to reduce the effects of climate change; some also practice mono-cropping and other adopted practices mentioned by the farmers.

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Table 2: Responses on the Adaptation Strategies Adopted by Farmers on Farming Practices in the Four Sampling Stations.

| Adaptation practices | Farmer's response | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Minjibir | | Lere | | Musawa | | Illella | |
| | Freq | % | Freq | % | Freq | % | Freq | % |
| Potholing | 0 | 0.00 | 0 | 0.0 | 4 | 13.3 | 5 | 16.7 |
| Ripping | 0 | 0.00 | 0 | 0.0 | 4 | 13.3 | 1 | 3.3 |
| Crop residues | 16 | 53.3 | 5 | 16.7 | 17 | 56.7 | 12 | 40.0 |
| Chemical weed control | 22 | 73.3 | 7 | 23.3 | 16 | 53.3 | 10 | 33.3 |
| Tied ridging | 2 | 6.7 | 16 | 53.3 | 11 | 36.7 | 10 | 33.3 |
| Ploughing | 0 | 0.0 | 0 | 0.0 | 2 | 6.7 | 9 | 30.0 |
| Using drought-tolerant varieties | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 2 | 6.7 |
| Changing crops | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 1 | 3.3 |
| Mulching | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 1 | 3.3 |
| Intercropping | 2 | 6.7 | 0 | 0.0 | 5 | 16.7 | 0 | 0.0 |
| Mono cropping | 4 | 13.3 | 1 | 3.3 | 2 | 6.67 | 1 | 3.3 |
| Fallowing | 0 | 0.0 | 2 | 6.7 | 1 | 3.3 | 0 | 0.0 |
| Others | 0 | 0.0 | 7 | 23.3 | 2 | 6.7 | 2 | 6.7 |

Source: Fieldwork (2023)

In Minjibir, it is indicated that about 53.3% of the farmers adopted the practices of crop residue as their farming practices, 73.3% adopted the practices of chemical weeds control, 13.3% adopted the practices of mono-cropping, and 6.7% engaged in the practices of tied ridging as their adopted practices.

In Lere, it clearly shows that about 16.7% of the farmers adopted the practices of crop residue as their farming practices, 23.3% adopted the practices of chemical weeds control, 3.3% adopted the practices of mono-cropping, and 53.3% engaged in the practices of tied ridging as their adopted practices.

However, the responses in Musawa and farmers' communities differ. About 56.7% of the farmers adopted the practices of crop residue, 53.3% and 6.67% adopted the practices of chemical weed control and mono-cropping, respectively, while 36.7% engaged themselves in tied ridging.

Farmers in Illella communities adopted 40.0% of crop residue and 3.3% of mono-cropping as their farming practices; other farmers show their responses on the adaptation strategies adopted through the use of 33.3% each of chemical weed control and tied ridging, respectively. This aligns with the findings by Ifeanyi-Obi et al. (2012), who stated that adaptation options/strategies must not be used in isolation. Farmers combine two options where necessary to achieve the desired result.

Table 3 clearly shows that the practices adopted by all the farmers in the four stations are divided into three categories: some adopt them all the time, some adopt them during drought years, and some perform them during good rainfall.

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Table 3: Responses on when to practice the adaptation strategies on farming practices in the four sampling stations

| When to Practices | Farmer's responses | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Minjibir | | Lere | | Musawa | | Illella | |
| | **Freq** | **%** | **Freq** | **%** | **Ferq** | **%** | **Freq** | **%** |
| All the time | 25 | 83.3 | 18 | 60.0 | 17 | 56.7 | 16 | 53.3 |
| During drought years | 5 | 16.7 | 12 | 40.0 | 9 | 30.0 | 6 | 20.0 |
| During good rainfall years | 0 | 0.0 | 0 | 0.0 | 4 | 13.3 | 8 | 26.7 |
| Total | 30 | 100 | 30 | 100 | 30 | 100 | 30 | 100 |

Source: Fieldwork (2023)

In Minjibir, 83.3% of these adopted practices are practised throughout the farming season, and 16.7% are practised during drought. In Lere communities, they perform about 60.0% all the time and 40.0% during drought years. In Musawa, they adopt the practices 56.7% all year, 30.0% during drought years, and 13.3% during good rainfall years. The duration of the practices adopted by the farmers in Illella is within the three seasons: 53.3% all the time, 20.0% during drought years, and 26.7% during good rainfall years.

Table 3 revealed that most respondents reported having used more than one type of coping strategy. This decision implies that a single strategy was inadequate to adapt to the impact of climate change, as a combination of several strategies was likely to be more effective than a single strategy.

Table 4: Responses on the Coping Strategies Adopted by Farmers in the Four Sampling Stations

| Copping practices | Farmer's response | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Minjibir | | Lere | | Musawa | | Illella | |
| | Freq | % | Freq | % | Freq | % | Freq | % |
| Use of fertiliser | 14 | 46.7 | 17 | 56.7 | 15 | 50.0 | 30 | 100 |
| Use of cattle manure | 13 | 43.3 | 16 | 53.3 | 16 | 53.0 | 29 | 96.7 |
| Hire of labour for farming activities | 7 | 23.3 | 2 | 6.7 | 8 | 26.7 | 12 | 40.0 |
| Use of irrigation | 1 | 3.33 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 |
| Purchase of improved seed | 2 | 6.7 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 |
| First weeding | 24 | 80.0 | 13 | 43.3 | 14 | 46.7 | 7 | 23.3 |
| Second weeding | 22 | 73.3 | 13 | 43.3 | 14 | 46.7 | 0 | 0.0 |
| Others | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 |

Source: Fieldwork (2023)

Most respondents reported using more than one type of coping strategy. This decision implies that a single plan is inadequate for adapting to the impact of climate change, as a combination of several methods is likely to be more effective than a single strategy. Minjibir farmers communities' response to the coping farming practice in the following ways-46.7% performed used fertiliser, 43.3% used cattle manure, 23.3% hired labour for farming activities, 3.33% used irrigation, 6.7% purchased improved seed, 80.0% first weeding, 73.3% second weeding and 0.00% engages for other coping strategies.

Lere farmers' communities' response on the coping farming practice in the following ways: 56.7%

used fertiliser, 53.3% used cattle manure, 6.7% hired labour for farming activities, 43.3% first weeded, 43.3% second weeded, and 0.00% engaged in other coping strategies. The adaptation strategies adopted in different regions depend on their level of economic development technology, financial capacity, institutional support and traditions. Therefore, each region tends to adopt the most similar adaptation strategies.

In Musawa, farmer's communities responded to the coping farming practice through their coping strategies: 50.0% used fertiliser, 53.0% used cattle manure, 26.0% hired labour for farming activities, 46.7% first weeding, and 46.7% second weeding. This result is in line with the study of Ikpe (2014) on adaptation strategies to climate variability and change among grain farmers in Goronyo LGA of Sokoto State, which showed that people within the age bracket of 31-50 years are active in farming activities in the area. Sorhang and Kristiansen (2011) reported that those over 69 years old seem to be less adaptive. However, to some extent, middle-class farmers seem more likely to adopt adaptation strategies. More (2000) found that about 20 per cent of respondents were from the young age group, 68 per cent were from the middle age group, and about 22 per cent belonged to the old age group.

According to Adesina and Forson (1995), age plays a significant role in agricultural practices and coping strategies to change the climate. It is generally agreed that age negatively influences the adoption of new methods. Older farmers may be more risk-averse and less likely to be flexible than younger farmers, and thus, they are less likely to adopt new technologies.

## CONCLUSION AND RECOMMENDATIONS

The findings revealed that the four (4) sampled communities had several coping strategies in response to the effects of climate change. The results showed that the farmers employed various coping and adaptation strategies. These include crop residue, chemical weed control, use of fertiliser, use of cattle manure, first weeding and second weeding, among others. The significant strategies included the use of adapted organic matter and fertiliser, the hiring of labour for farming, the use of irrigation, first weeding, and second wedding. Conclusively, the agricultural adaptation strategies to climate change in northwestern Nigeria vary owing to the uneven spread of environmental and socio-economic resources. While some of these strategies are age-long practices, their adoption is further reinforced by intensifying ecological stressors. The study recommended that there is a need for the four local farmers' communities to partner with multilateral and international agencies to build the capacities of farmers in relevant areas to strengthen the farmers` ability to develop and implement adaptation strategies and plans that would reduce vulnerability to the impacts of climate changes. Some of these areas include providing financial resources that will increase their ability to adopt crop, water, and soil management strategies in response to the impacts of climate change.

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