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# Assessment Of Crops Species That Are Vulnerable To Flooding, in Bade Local Government Area. Yobe State, Nigeria

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## ABSTRACT

This study assesses the crop species that are vulnerable to flooding in Bade Local Government Area with the aim of providing evidence for climate-smart agricultural planning. Using a descriptive survey design, data were collected from 150 farmers across five flood-prone wards through structured questionnaires and analyzed using frequencies and percentages. The findings revealed that rice (26.7%) and pepper (24.7%) were the most severely affected crops, followed by onion (20.1%), millet (16.6%), maize (6.6%), and sorghum (5.3%). The vulnerability of these crops is linked to their cultivation in low-lying floodplains, their physiological sensitivity to prolonged waterlogging, and the coincidence of floods with critical growth stages, particularly between August and September. The destruction of high-demand crops such as rice and pepper reduces household income, exacerbates food insecurity, and increases reliance on external food supplies. The study concludes that identifying flood-sensitive crops is essential for guiding adaptive farming strategies. It recommends the adoption of flood-tolerant crop varieties, adjustment of planting calendars, improved drainage systems, and farmer training on climate-smart agricultural practices. These measures can enhance resilience and support sustainable agricultural production in flood-prone communities of northeastern Nigeria.

**Keywords:** Flooding, Crop species, Agricultural vulnerability, Food security, Bade Local Government, Yobe State, Nigeria

## INTRODUCTION

Flooding is one of the most frequent and destructive natural hazards affecting agriculture in Nigeria, particularly in the semi-arid Northeast where hydrological extremes are common (Adebayo & Oruonye, 2013; Gomma *et al.*, 2019). In Yobe State, where most livelihoods depend on smallholder, rain-fed farming, seasonal floods disrupt cropping systems and undermine food security (HumAngle, 2024). Recent events have displaced communities, destroyed farmlands, and reduced household incomes, underscoring the vulnerability of agricultural production to climate variability.

Bade Local Government Area (LGA), characterized by low relief and seasonally inundated plains, is particularly sensitive to flooding. Reports from 2024 indicate that more than 30,000 agricultural plots were destroyed across Yobe State, with Bade among the most severely affected areas (Daily Trust, 2024). Premium Times (2022) also noted that over 1.4 million people were affected by floods in the state, making it one of the worst flood-hit regions in Nigeria.

The major crops cultivated in Bade Local Government Area include rice, millet, sorghum, maize, groundnut, sesame, and various vegetables. While periodic flooding can improve soil moisture and fertility through silt deposition, it often exceeds the tolerance beginnings of most crops, leading to yield reductions and crop failure (Murtala & Abdulkadir, 2023). Physiological stresses caused by waterlogging such as reduced root respiration, lower photosynthesis, and increased disease incidence make young seedlings particularly vulnerable, while mature plants may survive but record lower yields (Scientifica, 2024). These impacts vary widely among crop species, and even among varieties within a species, complicating adaptation strategies (Frontiers in Sustainable Food Systems, 2024).

One of the major impacts of flooding on agriculture is the destruction of standing crops. When floodwaters submerge farmlands for prolonged periods, crops such as rice, millet, maize, sorghum, and vegetables may rot or fail to mature properly. This results in reduced crop yields and significant financial losses for farmers. In many cases, farmers are forced to abandon their farms entirely due to severe flooding, leading to reduced agricultural output in the affected communities Ayanlade *et al.*, (2018).

Despite the recurrent nature of flooding in Bade, systematic evidence on which crop species are most affected, at what growth stages damage is most severe, and under which flood conditions losses occur remains limited. Much of the available data aggregates impacts across multiple Local Government Areas or states, leaving gaps in understanding at the local level (Premium Times, 2022; HumAngle, 2024). This information gap hinders effective planning by farmers, agricultural extension workers, and policymakers.

Therefore, this study seeks to assess crop species most affected by flooding in Bade Local Government Area, Yobe State, and to characterize the severity and timing of damage across different flood conditions. By documenting species-specific vulnerabilities, the study will provide a foundation for practical recommendations such as adopting flood-tolerant varieties, adjusting sowing calendars, and implementing low-cost flood management strategies like ridging and drainage channels. Ultimately, the findings will contribute to climate-smart agricultural planning in Bade Local Government Area by strengthening local resilience, improving food security, and guiding extension services and input support programs with evidence-based strategies.

### **Flooding and Agricultural Systems in Nigeria**

Flooding can have both beneficial and detrimental effects on agriculture. While seasonal floods may deposit nutrient-rich silt, excessive and prolonged flooding often destroys crops and reduces soil fertility (FAO, 2017). Flooding has become more frequent and severe in Nigeria due to climate change, rainfall variability, and poor land-use practices. The 2022 flood disaster alone affected millions of people and caused significant agricultural losses (United Nations OCHA, 2022). Studies show that flooding significantly reduces agricultural productivity and threatens rural livelihoods across northern Nigeria (Umar & Gray, 2023).

### **Vulnerability of Crop Species**

The susceptibility of a crop to flood damage depends on its physiological tolerance to waterlogging, planting timing, and field location (Kundzewicz *et al.*, 2014). While some species possess adaptive mechanisms, others face total physiological failure when subjected to excess water.

### **Rice (*Oryza sativa*)**

As a semi-aquatic species, rice is relatively tolerant to flooding; however, this resilience is finite. Prolonged submergence exceeding 7–14 days typically results in severe yield reductions or complete crop failure (FAO, 2017; Mwakyusa *et al.*, 2023). Despite the development of improved flood-tolerant varieties, adoption remains limited in many rural areas. In Nigeria, where rice production is concentrated in the floodplains of Kebbi and Niger States, remote sensing data confirms that extreme flood events significantly damage cultivation (Sanusi & Dries, 2025). Furthermore, water-related shocks have been shown to drastically reduce productivity, directly threatening the livelihoods of farming households (Chete *et al.*, 2025).

### **Cereals: Maize, Millet, and Sorghum**

Unlike rice, maize (*Zea mays*) is highly sensitive to waterlogging, particularly during early growth stages where flooding inhibits root development and nutrient uptake (Ayanlade *et al.*, 2018). Similarly, while millet (*Pennisetum glaucum*) and sorghum (*Sorghum bicolor*) are traditionally drought-tolerant, they are poorly adapted to anaerobic soil conditions. Their root systems are highly susceptible to anaerobic stress, leading to stunted growth and disrupted respiration (Gomma *et al.*, 2019). Evidence from northern Nigeria indicates that sorghum and millet yields decline significantly when inundation occurs during the critical seedling and reproductive stages (Umar & Gray, 2023).

### **Vegetables**

Vegetable crops, specifically pepper (*Capsicum* spp.) and onion (*Allium cepa*), are among the most flood-sensitive species due to their shallow root systems. Excessive moisture creates favorable conditions for soil-borne pathogens, leading to fungal infections and root decay (Murtala & Abdulkadir, 2023). In northern Nigeria, flooding during the bulb formation stage of onions is particularly destructive, often resulting in total yield loss and substantial economic hardship for farmers.

### **Study Area**

Bade Local Government Area is one of the seventeen Local Government Areas in Yobe State, located in the north-eastern part of Nigeria. The Local Government Area was created in 1976 following the nationwide local government reforms aimed at improving grassroots administration. Gashu'a serves as the administrative headquarters of Bade local government area, and functions as the main commercial and socio-economic Centre of the region (National Population Commission, 2006).

Geographically, Bade Local Government Area lies approximately between latitudes 10°00'N and 11°00'N and longitudes 12°00'E and 13°00'E. The area covers an estimated land area of about 3,279 square kilometres. According to the 2006 National Population Census, the local government has a population of approximately 139,782 people, resulting in an estimated population density of about 43 persons per square kilometre (NPC, 2006). The population is largely rural, with most inhabitants engaged in agricultural activities, livestock rearing, fishing, and petty trading.

Bade Local Government Area shares boundaries with several other local government areas within Yobe State. It is bordered by Yusufari Local Government Area to the north, Bursari Local Government Area to the east, and Jakusko Local Government Area to the south. The strategic location of the area within the Komadugu-Yobe River basin makes it an important agricultural zone in the state.

Agriculture is the dominant economic activity in the area, with the majority of households depending on farming for their livelihood. The agricultural system is largely based on the cultivation of cereal crops such as rice, millet, maize, wheat and sorghum, as well as vegetables including pepper, onions, and tomatoes. Farming activities are mainly concentrated along the fertile Fadama lands located adjacent to the Komadugu-Yobe River. These floodplains provide favorable soil moisture and fertile alluvial soils that support crop production throughout the growing season (Oladimeji, 2014). However, the dependence on floodplain agriculture also makes farming activities highly vulnerable to seasonal flooding and other climate-related hazards.

Climatically, the study area falls within the Sahelian ecological zone of Nigeria, which is characterized by a hot and dry climate influenced predominantly by the tropical continental (cT) air mass originating from the Sahara Desert (Udo, 1978). The climate of the area is generally marked by high temperatures, low

humidity, and limited rainfall. The mean annual rainfall is approximately 500 mm, which is relatively low compared to the southern parts of Nigeria. Rainfall distribution in the area is highly seasonal and variable, with August usually recorded as the wettest month (NEAZDP, 1990).

The rainy season in Bade Local Government Area typically lasts for a short period between June and September, while the rest of the year remains largely dry. The dry season normally extends for about eight months, influenced by the dry north-easterly Harmattan winds from the Sahara Desert. Within the rainy season, the months of July and August are considered the most reliable periods of rainfall, while June and September are often characterized by irregular and less dependable rainfall patterns.

The area also experiences considerable temporal variations in rainfall, which sometimes lead to extreme climatic events such as droughts and floods. Historical records indicate that northern Nigeria experienced severe drought periods between 1969–1973 and 1983–1987, which significantly affected agricultural production and food security in the region (Mortimore, 2009). On the other hand, years with above-average rainfall have resulted in seasonal flooding, particularly along the Komadugu-Yobe floodplains. For example, in recent years such as 2017, 2018, 2019, 2020, 2021 and 2022, unusually high rainfall led to flooding that displaced many residents and destroyed farmlands and infrastructure within the local government area.

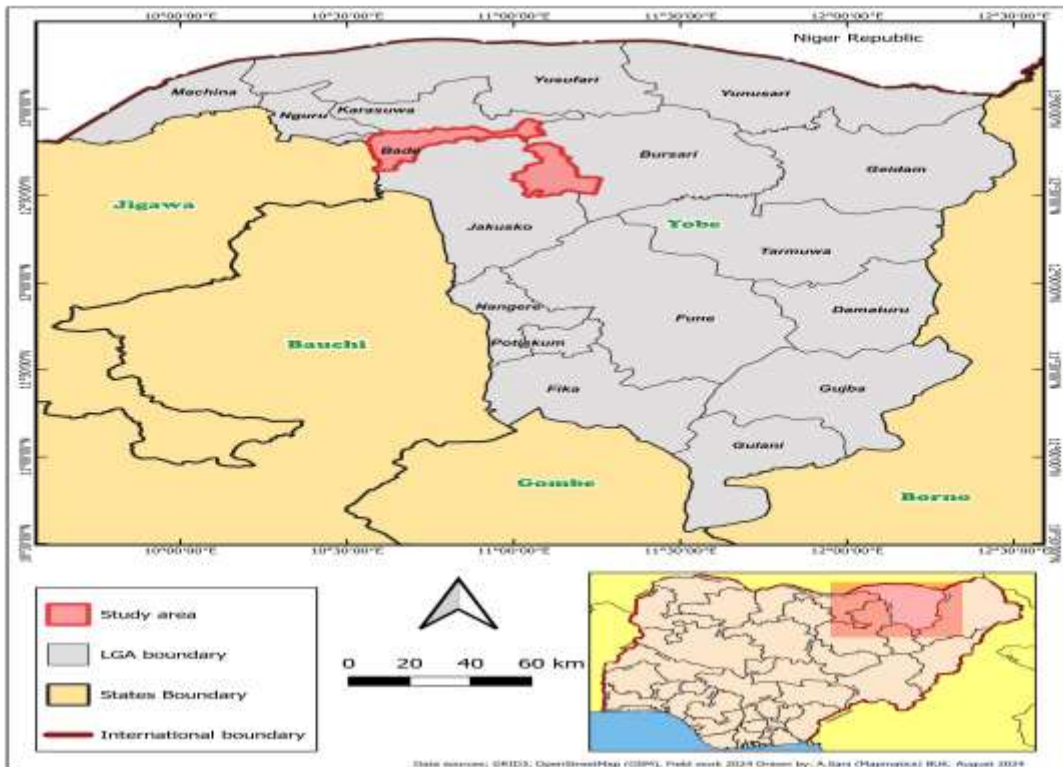


Figure 1 Map of Yobe state showing Bade Local Government Area  
Source: BUK GIS Lab, Geography Department

## METHODOLOGY

A descriptive survey research design was adopted for this study in order to assess crop species affected by flooding in Bade Local Government Area. Three wards, Usur-Dawayo, Dagona, and Sugum/Tagali wards were purposively selected due to their high exposure to seasonal flooding.

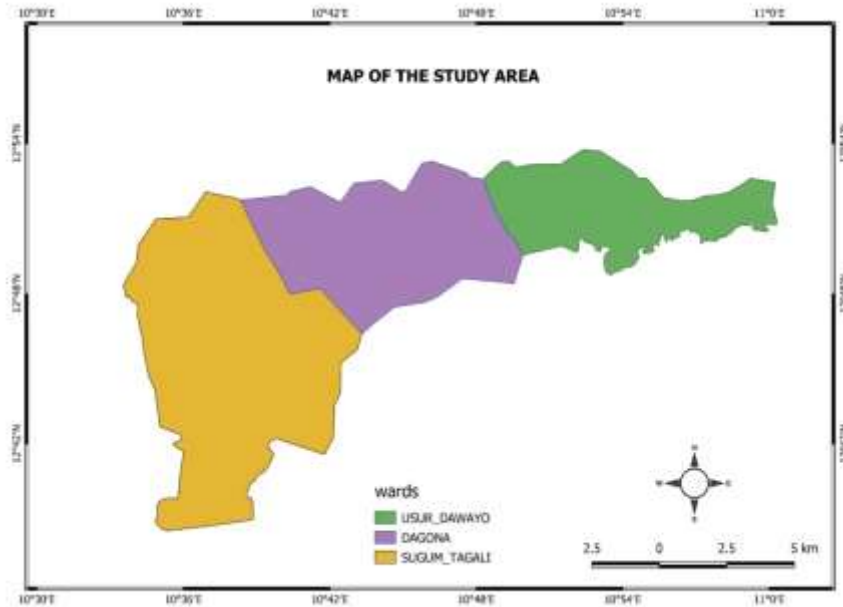


Figure.2: Map of Usur-Dawayo, Dagona and Sugum-Tagali wards; the study Area  
 Source: G I S Lab, Umar Suleiman College Of Education Gashua

A total of 150 farmers were selected using purposive and convenience sampling techniques. Data were collected through structured questionnaires, which captured information on crop types cultivated, the extent of flood damage experienced, and seasonal patterns of flooding. The collected data were analyzed using descriptive statistical techniques, specificad percentages, in order to determine the crop species most affected by flooding in the study area. The results were presented in tables and graphical forms for clearer interpretation.

## RESULTS AND DISCUSSION

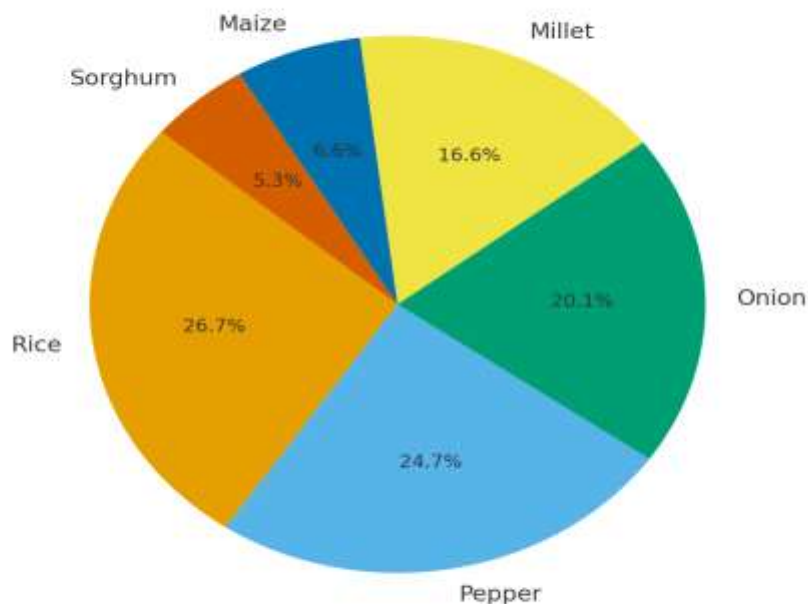
Table 1: Distribution of Crop Species Affected by Flooding in Bade Local Government Area

Crop Species	Frequency (No. of Farmers Affected)	Percentage (%)
Rice	40	26.7
Pepper	37	24.7
Onion	30	20.1
Millet	25	16.6
Maize	10	6.6
Sorghum	8	5.3
Total	150	100%

Source: Data Analysis 2026

**Graphical Representation of Flood-Affected Crops**

Proportion of Flood-Affected Crops in Bade LGA



**DISCUSSION OF THE FINDINGS**

The results presented in Table 1 show that rice (26.7%) and pepper (24.7%) are the most flood-affected crops in Bade Local Government Area. Onion accounted for 20.1% of reported crop losses, followed by millet (16.6%). Maize (6.6%) and sorghum (5.3%) were reported as the least affected crops among the respondents. These findings suggest that crops commonly cultivated in low-lying Fadama floodplains, particularly rice and vegetables, are highly vulnerable to seasonal flooding. The high vulnerability of pepper and onion may be attributed to their low tolerance to waterlogging, which often leads to root rot and fungal infections. This result is consistent with Murtala & Abdulkadir (2023), who noted that rice farms in floodplains of Jigawa State experienced the highest damage due to prolonged water submersion. Rice, although a semi-aquatic crop, suffers significant yield losses when floods persist beyond its tolerance threshold. Similarly, vegetables such as pepper are extremely sensitive to waterlogging, often resulting in fungal infections and root decay (FAO, 2017).

Onion (20.1%) and millet (16.6%) also recorded substantial flood damage. This aligns with Gomma *et al.*, (2019), who found that farmers in Yobe reported high levels of onion and millet losses during the 2018 flood season. Millet and sorghum are generally drought-tolerant crops, but their susceptibility to flooding during early growth stages highlights the dual vulnerability of crops in semi-arid environments to both droughts and floods (Frontiers in Sustainable Food Systems, 2024). Maize (6.6%) and sorghum (5.3%) were the least affected crops, which corroborates earlier studies indicating that these cereals can withstand short-term flooding better than vegetables (Scientifica, 2024). However, both crops still experience significant yield reductions when flooding coincides with critical reproductive stages. .

The implications for food security in Bade Local Government Area are profound. The loss of high-demand crops such as rice, pepper, and onion reduces household income and exacerbates food shortages. Similar findings were reported in Taraba and Borno States, where flood-affected communities recorded increased food imports and heightened vulnerability to poverty (Adebayo & Oruonye, 2013; Daily Trust, 2024). Thus, identifying flood-vulnerable crops is critical for climate-smart agricultural planning in northern Nigeria.

## CONCLUSION

This study identified rice, pepper, and onion as the crop species most vulnerable to flooding in Bade Local Government Area. Their vulnerability is largely associated with their cultivation in low-lying floodplain areas and their limited tolerance to prolonged waterlogging. The findings highlight the significant threat that flooding poses to agricultural productivity and food security in the region. Understanding the crop species most affected by flooding is therefore essential for developing effective adaptation strategies and climate-smart agricultural policies aimed at improving resilience among smallholder farmers in flood-prone areas.

## RECOMMENDATIONS

To reduce the impacts of flooding on agricultural production in Bade Local Government Area, several measures are recommended.

1. Farmers should be encouraged to adopt flood-tolerant crop varieties, particularly improved rice varieties capable of surviving prolonged submergence.
2. Farmers should change planting calendars to avoid peak flood periods this may help reduce crop losses.
3. The government should construct of drainage channels near farmlands this can help divert excess water and prevent prolonged waterlogging.
4. Farmers should also be encouraged to practice crop modification by combining flood-tolerant crops with traditional varieties in order to reduce risk. Finally, and also agricultural extension services should intensify training programs on climate-smart agricultural practices to help farmers adapt to increasing flood risks.

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