Global Journal of Earth and Environmental Science
Volume 8(3), pages 40-50, August 2023
Article Number: EBF953DA2
ISSN: 2636-6002
https://doi.org/10.31248/GJEES2023.137
https://integrityresjournals.org/journal/GJEES
Full Length Research

Farmers' perception of irrigated rice farming in Madaka Region, Karim Lamido Local Government Area of Taraba State, Nigeria

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Received 11th July 2023; Accepted 19th August 2023

ABSTRACT: Rice production in the Madaka region has benefited from the introduction of irrigation. Nonetheless, irrigation cultivation in the region is not without its difficulties. One difficulty is the cost of installing irrigation systems. The availability of water is another difficulty. The Benue River is a significant source of water for irrigation in the region, but its discharge can fluctuate seasonally. This can make planning irrigation activities problematic for farmers. Despite obstacles, irrigation cultivation is a crucial economic activity in the Madaka region. The study assessed the perceptions of irrigation rice farmers in the Madaka region, along the River Benue floodplain of Karim Lamido LGA of Taraba State, Nigeria. The study sought to assess the source of water supply, timing sequence for planting and harvesting, the level of farmers' experiences and the type of irrigation best practiced to ensure sustainability in the study area. Data were collected from 69 irrigation farmers using structured questionnaires, and personal observation. Descriptive statistics (frequency and percentages) were used to analyse the data. Findings revealed that 66.7% of the respondents were males as against female with 33.3%. Married farmers were generally few (39.1%) less than single farmers, accounting for 52.2%. The study identified lack of capital, access roads, modern irrigation facilities, fertilizer supply as well as lack of education as the significant constraints affecting the farming practice in the study area and recommended, among others, that agricultural extension services should be offered to the farmers on modern way and innovations of irrigation farming. In addition, indigenous farmers should be enlightened to practice dry season farming to boost the availability of rice products during the season.

Keywords: Challenges, farming, floodplain, irrigation, Madaka region, production, rice.

INTRODUCTION

Food security has historically been a global problem, and even presently, the major humanitarian concern is feeding the growing world population in the face of climate change and sustainability boundaries (Foley *et al*., 2011). Irrigation is now a critical component of agriculture; without irrigation, global cereal production would decrease by 20% (Siebert and Doll, 2010), and climate change and population growth will further strengthen the need for it in the future (Neumann *et al.,* 2011). Today, irrigation covers about 24% of the total harvested cropland, accounting for 40% of global cereal yield. This means that irrigation is a major driver of global food production. It is important to note that the percentage of cropland that is irrigated varies greatly by region. For example, in Asia, about 60% of cropland is irrigated, while in Africa, only about 10% of cropland is irrigated (Portmann *et al.,* 2010). Furthermore,

irrigation, as part of human activities in agriculture, offers the opportunity of being independent over the action of natural rainfall, allowing crops to be grown in arid and semi-arid regions (Gleick *et al.,* 2009). However, the studies by Makurira *et al.* (2011) and Nhundu and Mushunje (2010) both found that separating the national agricultural economic sector from irrigation agriculture can lead to negative economic and social consequences.

Makurira *et al*. (2011) studied the impact of irrigation reform in Zimbabwe, which separated the national agricultural economic sector from irrigation agriculture. They found that the reform led to a decrease in food production, as farmers had less access to water. This led to higher food prices, which hurt consumers and producers. Additionally, it led to job losses in the agricultural sector and a slowdown in rural economies. Nhundu and Mushunje (2010) studied the impact of irrigation reform in Malawi, which also separated the national agricultural economic sector from irrigation agriculture. They found that the reform led to a decrease in agricultural productivity, as farmers had less access to water and credit. This led to lower incomes for farmers and increased poverty. Additionally, it led to a decrease in food security, as farmers were less able to cope with droughts and floods. Both of these studies suggest that separating the national agricultural economic sector from irrigation agriculture can have negative economic and social consequences. It can lead to a decrease in food production, higher food prices, job losses, a slowdown in rural economies, and a decrease in agricultural productivity. Additionally, it can lead to increased poverty and decreased food security

“The State of the World's Land and Water Resources for Food and Agriculture” (2015) by the Food and Agriculture Organization of the United Nations (FAO) states that "irrigated agriculture accounts for about 40% of global crop production, but it uses about 70% of all freshwater withdrawn for agricultural use" while "The Future of Irrigation: Taking Stock and Looking Ahead" (2016) by the International Water Management Institute (IWMI) states that "irrigation will be essential for meeting the growing demand for food in the coming decades. However, it is important to manage irrigation water resources sustainably to avoid negative environmental impacts".

Africa is home to at least one-third of the world’s undernourished population and is the only continent where agricultural productivity per capita has been falling for the past 30 years (Wudil *et al*., 2022). Africa is considered the region with one of the fastest population growth rates in the world and is predicted to reach a population of about 2.5 billion people by 2050 compared to 1.3 billion in 2019 (United Nations, 2019). Population is already outstripping food supply in the Sahel Region (Graves *et al.*, 2019) and increasing many countries' dependence on food imports (D’Odorico *et al.,* 2014); crop production will need to be sustainably increased to prevent population from outpacing food supply (Beltran-Peña *et al*., 2020). Aside from the reliance of African countries on agriculture for food, the agricultural sector also accounts for on average ~19% of their Gross Domestic Product (GDP, with some countries like Sierra Leone relying on agriculture for up to 61% of their GDP) (Beltran-Peña and D’Odorico, 2022) and over 60% of full-time employment—making countries more susceptible to changes in agricultural production capability (ADBG, 2019; World Bank, 2021).

Nevertheless, the smallholder irrigation scheme has been practiced as a rural development model by many developing countries in the past five decades, not only because they have higher returns on investment but also because they are adaptable to the local farming system (World Bank, 2008; Venot *et al.,* 2013). The Global Water Grab: An Analysis of Water Transfers in Agriculture (2017) by the Transnational Institute (TNI) states that "the expansion of irrigated agriculture is leading to a global water grab, as water is transferred from rivers and aquifers in developing countries to irrigate crops in developed countries" (Cotula *et al.,* 2017; Molden *et al*., 2016).

In the face of global climate change and chronic poverty in developing countries, investment in irrigation agriculture is getting renewed attention from the world and regional development bodies (WFP, 2010; UNDP, 2012; Leadership Council of the Sustainable Development Solutions, 2013; NEPAD; 2008). In addition, the recently agreed-upon Sustainable Development Goals (SDGs) aimed to, by 2030, double the agriculture productivity and the income of small scale food producers by ensuring secure and equal access to productive resources, inputs, financial services and markets.

Irrigation is the application of water to land in order to supply crops and other plants with the necessary water needed for growth and development. One of the world's major concerns today is how to improve the quality of life in rural areas and reduce poverty, consequently increasing income, employment generation, and, improving social and economic livelihood. Despite the fact that petroleum sector is the primary of foreign exchange earning in Nigeria, agriculture remains the country’s foundation (Adamu *et al.,* 2013). 'FADAMA', a common phenomenon adopted and established by the World Bank, is a local 'Hausa language' word referring to low-lying swampy area consisting of alluvial deposits and extensive exploitable aquifers (Adesoji *et al.,* 2006; Ahmed, 2006). Girei *et al.* (2013) defined FADAMA as alluvial lowlands formed by erosion and depositional actions of rivers and streams that possess fine-textured and less acidic soils rich in organic matter.

In Nigeria, irrigation based agricultural farming dates back to the colonial era. As the result of the hardships of food insecurity and scarcity, arose the need for continuous cultivation to escape famine, which led to the emphasis on irrigation activities. However, irrigation practices were traditionally done chiefly by small scale farmers known as

FADAMA Farmers, using method and facilities without government assistance or donor organisation assistance (Yahaya, 2002).

In response to the need for irrigated crops cultivation in Nigeria, the government developed three pilot public irrigation schemes in the early 1970s: the Bakolori scheme, the Kano river irrigation scheme, and the Chad Basin scheme (NINCID, 2015). The success of these pilot schemes led to the establishment of 12 River Basin Development Authorities (RBDAs) by the Nigerian government in 1976 (Ngene *et al*., 2021). The RBDAs are responsible for water supply for irrigation and domestic activities, hydroelectric power generation, fisheries projects, navigation improvement, recreation facilities, and flood control. The Federal Ministry of Water Resources oversees all water resources development and management in Nigeria (NINCID, 2015). These efforts have helped to improve food security and economic development in Nigeria. These were the RBDAs established by the government of Nigeria; Upper Benue Basin, Lake Chad Basin, Benin-Owena Basin, Sokoto Rima Basin, Hadejia-Jema'a, river Basin, Lower Benue Basin, Cross River Basin, Ogun-Osun Basin, Anambra-Imo, Niger Basin. All these were given the mandate for water supply for irrigation and domestic activities, hydroelectric power generating, fisheries projects, navigation improvement, recreation facilities and flood control.

Irrigation development in Nigeria began in the late 1980s with the introduction of pumps and tube wells through the Agricultural Development Programmes (ADPs). By 1992, over 80 thousand pumps had been distributed, each irrigating between 0.5-1 hectares. The National FADAMA Development Project (NFDP) of the World Bank built on the ADPs' achievements and distributed 55 thousand pump sets with an equipped area of 1 hectare per pump between 1992 and 1999. By 2004, the cultivated land area equipped for irrigated crop cultivating was around 2931 l7 hectares (FAO, 2005).

There are three types of irrigation schemes in Nigeria: public irrigation schemes, farmer-owned and operated irrigation schemes, and residual flood plain FADAMA (Takeshima *et al*., 2014). Public irrigation schemes are systems controlled by the government, while farmer-owned and operated irrigation schemes receive assistance from the government in the form of subsidies and training. Residual flood plain FADAMA are purely traditional irrigation practices that originated from the World Bank assisted programmed (WBAP) (Takeshima *et al.,* 2014).

Taraba State has rich watershed resources and enormous irrigation potentials. However, irrigation farming is somewhat alien to the indigenes of the state that are predominantly agrarian. Although, some few Hausa-Fulani practice small-scale irrigation farming along the perennial streams and rivers using shallow irrigation. The Taraba Agricultural Development Project (TADP) had embarked on an irrigation farming sensitisation campaign targeted at rural farmers in the state, hence, the current enthusiasm for irrigation agriculture among the indigenous farmers (Takeshima *et al.,* 2014). The lack of infrastructure and inadequate operation as well as maintenance of existing infrastructure in irrigation were the predominant causes for the low level of productivity in irrigation development in the state. The state had 4856.36 km (485.636 hectares) of FADAMA land as possible potentials for minor scale irrigation. Surface water sources were estimated to irrigate 160,000 hectares through direct pumping. Tube wells and water boreholes constructed on the remaining 3,256.36 hectares were expected to record an average of 67% success (Federal Ministry of Agriculture and Rural Development. (2020).

Madaka village lies on the floodplain of river Benue naturally endowed with a fertile alluvial deposit which extends from Lafia Lamurde down to Ibi. Irrigation practices started in Madaka as a result of the 2012 flood, which destroyed almost all the farms in that particular geographic area. The farmers were left with no alternatives other than to practice irrigation in which they controlled everything; however, because of the achievements in irrigation practices in the area, some farmers launched into irrigation farming without the background knowledge of how to operate an irrigation farming system. Recently, water resource has become a challenge because facilities used in the irrigation practices were misused; these include the tube well machine that irrigates from 0-20 m. This was overused up to even 50 m at a time which affected the efficiency of the machine and caused poor growth of crops and even production when not correctly irrigated.

Irrigation practices in Madaka normally begin in early December when farmers (smallholders) make beds and create a canal after which seeds are then sown before the transplanting period between January and February respectively. However, water is the major challenge in the area because of the inadequacy of the water extracting facilities. As a result, some of the farmers stop their irrigation practices because of financial constraints and lack of irrigation facilities.

Irrigation farming, which has been a significant component of food security and sustainability in most countries of the world, started in Madaka due to the failure and uncertainly of rain-fed agriculture. However, the rain-fed system of agriculture, which has been a yearly practice, does not always yield much productivity for most farmers and has been characterised by many failures such as early ceasing of rainfall, the washing away of fertilisers and soil nutrients by erosion and flood etc.

All the farmers within the locality were affected by the flood, leading to the eroding of farmlands and plants that were cultivated. However, sometimes rainfall stopped earlier than expected during the growing period leading up

to the harvest. As this problem continued, farmers were greatly affected since they depended on rain-fed agriculture to cater for their general needs. Although the government gave relief materials typically to the affected farmers, these could not be sufficient compared to the farmers' produce, which were harvested from their farms. For instance, a farmer could harvest 50-100 bags of maize and rice in a season, but the government would only complement it with 2-3 bags. Sometimes some farmers would not even benefit from the relief materials from the government. Hence, in order to mitigate the impacts of flood disasters, the farmers chose to adopt irrigation farming as a strategy to address the flood-related issues in the region. Additionally, this approach aimed to reduce reliance on rain-fed agriculture for food production.

However, irrigation farming comes with a range of challenges. These include issues like soil infertility, labour, transportation, capital, fertilizer, water management, timing, farmer expertise, and facilities. These challenges collectively hinder the success of crop growth and food production within the realm of irrigation farming. As a result, the practice becomes arduous and financially inaccessible for other farmers who are interested in pursuing it.

Although scholarly works have been carried out on some of the challenges in different countries such as Egypt, Zimbabwe, Malawi and some parts of Nigeria like Kano, Ebonyi, Benue, Jigawa, Niger etc (Nwibo *et al*., 2019; Okereke *et al*., 2017; Okonkwo *et al.,* 2021; Onyeneke *et al*., 2023), yet nothing was done on the challenges of water supply, timing sequence, farmers' experience as well as type of irrigation farming in Madaka area of Karim Lamido Local Government Taraba State. Therefore, this is the gap that the research intends to fill. The study evaluated the activities of irrigation farmers in a bid to examine four (4) challenges associated with irrigation farming along the river Benue floodplain in the Madaka region of Karim Lamido.

MATERIALS AND METHODS

Study area

Karim-Lamido Local Government Area of Taraba State lies between latitudes 8°40'and 9°30'N of the equator and longitudes 10° 20' to 11° 30' E of the Greenwich Meridian. The geographical area of Karim-Lamido is approximately 6620 square kilometres. The study site is situated at an elevated altitude of approximately 450 metres above mean sea level. This Local Government Area was established in 1976 as one of the initial regions formed from the dissolved Gongola State, situated in the northeastern region of Taraba State, the area is positioned across the River Benue. Karim-Lamido is geographically adjacent to Adamawa State in the east, Plateau State in the northwest, Bauchi and Gombe States in the north, and Lan, Ardo-Kola, Gassol, and Ibbi Local Government Areas in the south (Figure 1).

The area has a tropical continental climate, which is characterized by hot, dry summers and cool, wet winters (Nigerian Meteorological Agency, 2023). Madaka region lies on gently sloping land of the Benue floodplain, about 100 kilometers from the state capital, Jalingo. It is between 305 meters (2000fit) and 610 meters above sea level in the northwest. There are a number of hills and rock outcrops as high as 323 meters in the northern region. These include the Lamurde Dadiya Mountain, Bambuka Mountain, Gwomu Mountain, Zoh Makarau Mountain, Bambur Mountain; these mountains form a fine, interesting tourist site for the town. It is home to a number of ethnic groups, including the Karimjo, Wurkun, Jenjo, and Bambuka. It has a population of 5,000 people (UNDP, 2017). The main economic activities in the village are farming and fishing. The village is also home to a number of small businesses, such as shops, markets, and restaurants.

The maximum temperature in Karim-Lamido ranges between 26 and 30°C, with the highest temperatures being recorded between March and April. The minimum temperature ranges between 15 and 18°C, with the lowest temperatures being recorded in December. Karim-Lamido receives high temperatures all year round, with the highest temperatures being recorded during the dry season. Due to its longitudinal location, Madaka region in Karim-Lamido receives a high amount of insulation compared to other parts of the state. Information about insulation notes that it is one of the single most important climate parameters that are fundamental to understanding the pressure distribution as well as the weather characteristics prevailing in the region. The main annual insolation, otherwise known as the amount of sunshine received, in Karim-Lamido is 2500 hours. The amount of sunshine reduces during July, August, and September months due to increasing cloudiness and also the result of high rainfall (Oruonye, 2012).

The average annual rainfall in Madaka is about 1,200 millimeters (UNDP, 2017). The rainfall duration of Madaka lasts for 1900 days. The onset of rainfall, when an accumulated amount of rainfall is sufficient for growing crops, starts around April 1st. The cessation of rainfall season ends around November 1st. The wettest months are July, August and September, while the driest months are December, January and February.

The Hausa language is predominantly used in the area as a medium of communication for social and economic activities. Although, the major religions of the people of Madaka are Christianity and Islam, there are other pockets of traditional religious affiliations; the people co-exist peacefully with one another.

The study area, Madaka in Karim-Lamido, is agrarian with rich potential for farming, rearing of domestic

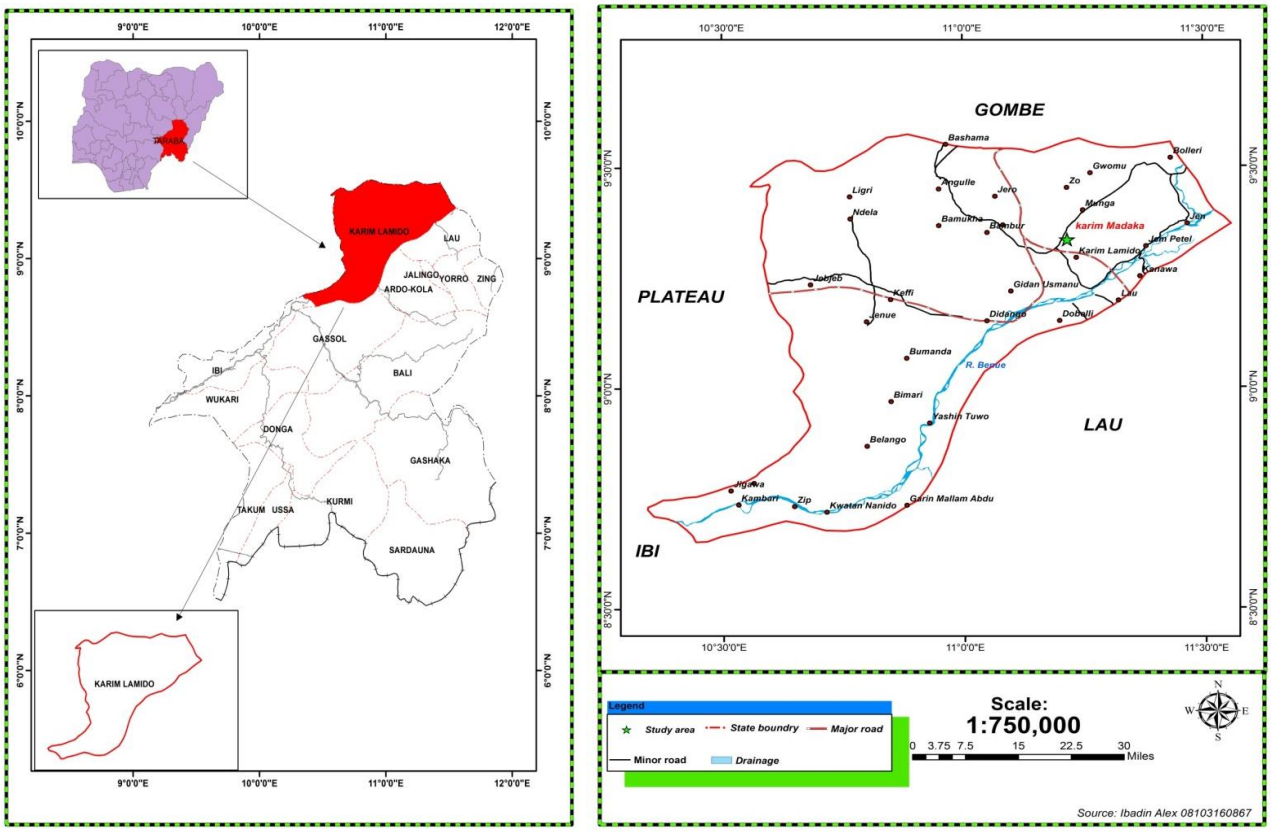

Figure 1. Map of Karim Lamido in Taraba State (Left) and Map of Karim Lamido Showing the Madaka region (Right).

animals like goats, cattle, poultry, etc., vegetables, maize, rice, groundnut, guinea corn etc. is also done at the subsistent level.

Methods

For this study, a survey design was adopted. The primary source of data was through the administration of 90 copies of well-structured questionnaires in line with the study objectives. This study covered Madaka, an irrigation farming community on the river Benue floodplain in Karim-Lamido Local Government area. A total of 90 rice farmers engaged in irrigation were selected for the study. The farmers were interviewed and issued the questionnaires, and out of the 90 copies of questionnaires administered, only 72 were recovered, three of which were invalidated for not being correctly filled; therefore, 69 copies (77%) were analysed. The result of the study was analysed and presented using simple percentage and frequency tables.

RESULTS AND DISCUSSION

Table 1 shows the demographic characteristics of the respondents. The gender characteristics of the irrigation farmers show that 66.7% are male while 33.3% are female. This result implies that males constitute the majority of the irrigation/rice farmers in the Madaka area. The more the number of men engaged in irrigation farming in the Madaka area increases, the more the level of increase in food production in the area because the men do most of the labour by themselves. Furthermore, 52% of irrigation/rice farmers are single, while 39% are married. This implies that the supply of labour from the youthful population is available for more lands to be cultivated to improve food supply and security.

Similarly, of the populations of farmers, 17% are students both of secondary and tertiary institutions, 29% are civil servants. However, 16% of the irrigation/rice farmers in Madaka are self-employed, 4% are still looking for jobs as they engage in irrigation farming, and 20% are full-time farmers who depend on agriculture as a source of livelihood. Therefore, it can be inferred that people with diverse occupations engage in irrigation/rice farming. It is also evident from Table 1 that 80% of the farmers have between one to five years of irrigation farming experience, 16% has six to nine years' irrigation farming experience, while 4% has eleven to fifteen years of farming experience. The result implies that more people have taken up

Table 1. Demographic characteristics of the respondents.

Variables	Frequency	Per cent
Gender		
Male	46	66.7
Female	23	33.3
Total	69	100.0
Marital status		
No response	6	8.7
Single	36	52.2
Married	27	39.1
Total	69	100.0
Occupations		
No response	12	17.4
Students	8	11.6
Civil Servant	20	29.0
Self Employed	11	15.9
Applicant	4	5.8
Farmers	14	20.3
Total	69	100.0
Years in irrigation farming		
1-5 years	55	79.7
6-10 years	11	15.9
11-15 years	3	4.3
Total	69	100.0

Table 2. Sources of Water Supply used for Irrigation in Madaka region.

Variables	Frequency	Per cent
No Response	1	1.4
Reservoir	1	1.4
Hand Pump	15	21.7
Motorise Pump	49	71.0
Others	3	4.3
Total	69	100.0

irrigation/rice farming as an important socio-economic activity that can help them live better lives by ensuring that their food is secured.

There are so many sources of water supply used for irrigation farming, as presented in Table 2. According to the result shown, the sources of water supply used for irrigation farming in the Madaka region are 1.4% of farmers uses reservoir water to irrigate, 21.7% of farmers uses a hand pump to irrigate, 71% of farmers uses motorise pump to irrigate their farms, 4.3% of farmers uses other sources of water supply to irrigate their farms. This study shows

Table 3. The rate of water use for irrigation by farmers in the Madaka region.

Variables	Frequency	Percent
Daily Usage	55	79.7
Weekly Usage	5	7.2
Any other time	9	13.0
Total	69	100.0

that motorise pump is the primary source of water used for irrigation farming in the Madaka region. The implication of these results in the area indicates that farmers who pump water from the same sources will have a challenge. This is because the more frequent others use their pump, especially farmers with large farms, the more other person's wells or sources of water get dried or become less productive with a moderate or low yield which further indicates farmers who do not irrigate their farms frequently affects their crops in the field when the need arises.

The information in Table 3 shows the rate of water use for irrigation by farmers in the Madaka region. From Table 3, it is seen that 79.7% of the farmers use their sources of water supply daily, 7.2% of the farmers use their sources of water supply weekly, 13.0% of the farmers use their sources of water supply neither daily nor weekly but any other time. This implies that irrigation farmers in the Madaka region irrigate their farms daily. This means that as farmers continue to irrigate their farms daily coupled with good soil and seed quality, there will be high crop yield leading to a bumper harvest in the region, especially rice, which needs water up to 100 mm under it to give a high yield and to be free from weed and handpicking of the weeds.

Figure 2 shows the productivity of the sources of water supply used by the irrigation farmers. From this figure, it is seen that 50.7% of the water supply sources have high yield, 42.0% sources of water supply are moderately yielding in which 7.2% of the water sources have low yield. The result implies that the source of water supply in the Madaka region is productive because of its high yield. Harnessing water for irrigation is the critical factor in irrigation farming; since the source of the water supply in the Madaka region is productive, farmers will not struggle to pump out water, and at such more farmers will engage themselves in irrigation farming in the area as the result of the abundant source of water supply. This result agreed with Ngene *et al*. (2021), which observed that though the country's water potential for irrigation is high but due to many reasons, the country's capacity to support agriculture through the development of irrigation has been weak. According to the UNDP (2006), the country cannot assure its food self-sufficiency even with an abundant surface water supply. However, if the country uses all its efforts to collect all available water resources for crop

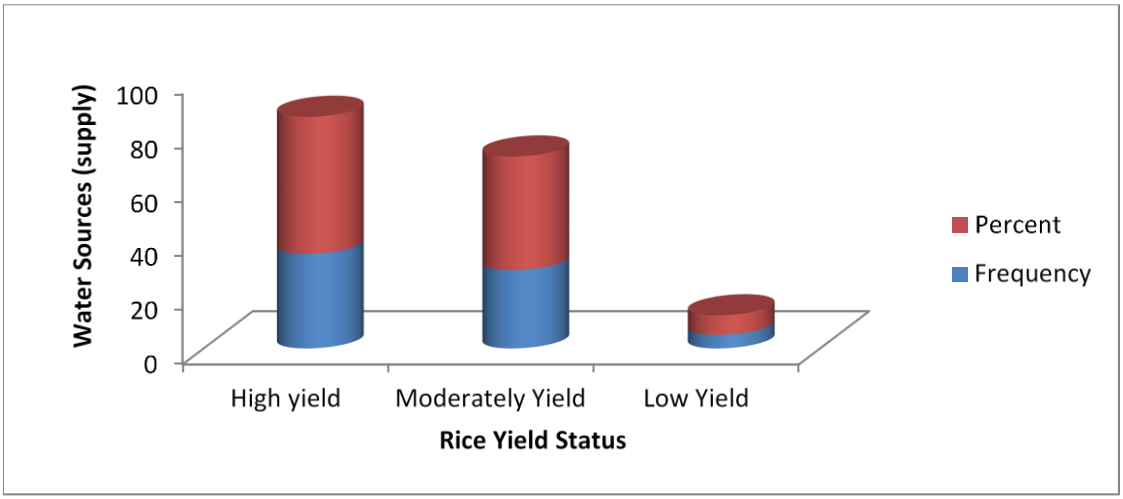

Figure 2. The productivity of the water sources for irrigation farming in Madaka region.

production, there is a possibility that the country can cover its food deficit and can also export some crops like oil crops and cereals.

Table 4 shows the number of years farmers in Madaka have been using irrigation farming to cultivate their crops with a specific focus on rice. From this table, it is seen that 79.7% of the respondents have 1-5 years of irrigation farming experience in the Madaka region, 15.9% have 6-10 years of irrigation farming experience, while 4.3% of the respondents are between have 11-15 years of irrigation farming experience in Madaka region. This result implies that most of the irrigation farmers in the Madaka region have few years of farming experience, which means in the next five years to come, the productivity of the irrigation farmers in the Madaka region will increase such that there will be the availability of food both for consumption and commercial purposes in the area under study.

Table 5 show the significant period of the year for irrigation farming practice in the Madaka region. From Table 5, 29% of farmers start irrigation farming practices in November-December. This period is immediately after the rainy season in the area. Similarly, 50.7% of farmers start irrigation farming practices from December – January; this period is the core dry season period in the area. Other farmers constituting 20.3%, starts their irrigation farming practices from January – February during the harmattan period where the air is cool, dry and dusty in the northern part of Nigeria.

This study shows that most of the farmers in the Madaka region start their irrigation farming practices during the cool, dry season months, especially the harmattan period, because of the early planting of crops such as rice. It was observed that irrigation farmers who start planting early would have a bountiful harvest at the end of the farming season, particularly rice which takes four months to mature and be harvested in the region. According to the Food and Agriculture Organization of the United Nations (FAO, 2015), the average growing time for rice is 120 days. However, there are some varieties of rice that can mature in as little as 90 days, and others that can take up to 180 days. The growing time of rice also depends on the climate. In warmer climates, rice can mature more quickly than in cooler climates. Finally, the growing conditions can also affect the growing time of rice. If the rice is not properly irrigated or fertilized, it may take longer to mature. Farmers also enjoy a good supply of labour in the time of harvest because there will be enough manpower to do the work at a short period of time, and transportation of goods produced from the farm to the home or market will be easy because of the absence of the rain which usually affects

Table 4. Numbers of years farmers have been using irrigation farming to cultivate in Madaka region.

Variables	Frequency	Per cent
1-5 years	55	79.7
6-10 years	11	15.9
11-15 years	3	4.3
Total	69	100.0

Table 5. The period of the year of starting irrigation farming practices in the Madaka region.

Period for starting irrigation farming	Frequency	Per cent
November-December	20	29.0
December-January	35	50.7
January-February	14	20.3
Total	69	100.0

and makes the farm roads deplorable as they plan for the next season's rain-fed agriculture.

The information in Table 6 represents the period of starting irrigation practices in the Madaka region. From Table 6, 94.2% responded that irrigation in the Madaka region is carried out during the dry season, 1.4% of the respondents practice irrigation farming during the rainy season, while 2.9% of the respondents responded that irrigation in the Madaka region is practised both in the dry and in raining season. This result implies that the dry season is favourable for irrigation farming in the Madaka region, starting from December to January (Table 5). From this result, it can be said that the River Benue floodplain, which extends to the Madaka region with an excellent alluvial fertile soil because of sedimentation by flooding events with water retaining ability during the dry season, facilitates the irrigation practices in the Madaka region.

The results in Table 7 show that the time of planting affects the harvesting time of rice in the Madaka region. From this table, it is seen that 60.9% of the respondents agree that the planting period affects the harvesting time in Madaka, while 31.9% of the respondents do not agree that the planting period in Madaka affects the harvesting time in the Madaka region. The result implies that farmers who have good timing and planning for the early cultivation of their crop turn out to have a bumper harvest and sometimes harvest two times in a particular place in a year because as they harvest early, especially rice, the leftover will shoot again if the place is still having water and can grow the rice to maturity such that it can be harvested again. Put differently, those farmers who plant early are always free from the cases of rainfall affecting harvest, free from the poor road network, and can sell the byproducts, i.e. the chaff and the grasses, to the Fulani herdsmen vice versa who use them as foliage for their herds. Therefore, if measures are not taken to construct a good road network in the area, food production in that area will be affected seriously such that whenever it is raining intensively, and for a long period of time, crops produced on the farm cannot be transported out of site and because of the lack of storage facilities in the area, the crops will get spoilt.

Table 8 shows the farming practice in the Madaka region before irrigation farming in the area. From this table, it is seen that 4.3% of the respondents did not respond to the questionnaire, mean well 7.2% were practicing manual farming practice before the inception of irrigation in the area, 73.9% of the respondents were engaged in rain-fed agriculture before irrigation farming in Madaka region, while 10.1% of the respondents were engaged in both dry season and rain-fed agriculture, 1.4% were engaged in spraying system farming. In comparison, 2.9% of the respondents were engaged in subsistence farming before introducing irrigation farming in the region. This implies that farmers in the Madaka region have been faced with low harvest and food challenges because of the failure in rain-fed agriculture, which is characterized by flood disasters, a short period of rainfall, rainfall uncertainty which affects the crops in the field and cause low harvest and food shortage in the area. This result agrees with Hailemariam (2016) works, which stated that the Ethiopian's population increases averagely 3% per year. To feed this rapidly increasing population as a country, rain-fed irrigation alone cannot be a solution. Rather intervention of irrigation agriculture can be a solution for the country having colossal water potential for irrigation. Many developing countries cannot meet their food consumption using rain-fed agriculture. The reason many of them integrated irrigation agriculture in the economy to feed their rapidly increasing population.

If the soil moisture cannot supply enough moisture to the plant, the plant cannot grow, or if it grows, it cannot yield the expected production. Therefore, irrigation is needed at any time when the moisture of the soil is not capable of supporting plant growth while the water is available.

Table 6. Period of Irrigation Farming Practices in the Madaka region.

Period	Frequency	Per cent
No response	1	1.4
Dry Season	65	94.2
Raining Season	1	1.4
Both Season	2	2.9
Total	69	100.0

Table 7. Timing of planting period affects the harvesting time of rice in Madaka region.

Variables	Frequency	Percentage
No response	5	7.2
Yes	42	60.9
No	22	31.9
Total	69	100.0

Table 8. The farming practice in Madaka region before irrigation farming.

Farming practices	Frequency	Percentage
No response	3	4.3
Manual practice	5	7.2
Rainfed agriculture	51	73.9
Rainfed agriculture and dry season farming	7	10.1
Spraying system	1	1.4
Subsistence farming	2	2.9
Total	69	100.0

Applying water to the crop is important to avoid crop production failure due to moisture stress and increased crop production.

The information in Table 9 indicates how the level of education of farmers affects the irrigation farming experience in the Madaka region. From this table, it is seen that 4.3% of the farmers did not respond to the question, 63.8% of the respondents agreed that their level of education affects irrigation farming experience in the Madaka region, while 31.9% of the respondents do not agree that their educational level affects their farming experience. This result implies that farmers with formal education do not just use any seeds and traditional farming methods to cultivate. They also know how to irrigate crops in the field, apply fertilizers and chemicals, and use modern ways of farming. This helps them to produce different varieties of seeds and high crop yields in the area.

If the government can educate farmers in the area about irrigation farming and provide them with loans, they will use that knowledge to produce more agricultural products, particularly rice, in large quantities that can be sold locally and even exported to meet the demands of food insecurity in the country. This is in line with the findings of Nagy and Edun (2002), who reported that poor farmers do not benefit from fertilizer subsidies provided by the Nigerian government. The World Development Report (WDR, 2008) also supports this finding, stating that input services such as credit and extension services are supposed to help farmers improve agricultural production.

Table 10 shows the types of irrigation systems currently in use in the Madaka region. This table shows that 11.6% of the respondents did not respond to the question. From this table, 50.7% uses surface irrigation system type to cultivate in Madaka region, 2.9% of the respondents use sprinkler irrigation system type to cultivate, 14.5% respondents use drip irrigation system type to cultivate in Madaka, 17.4% of the respondents use manual irrigation method to cultivate. In comparison, only 2.9% of the respondents use another irrigation system to cultivate in the Madaka region. This implies that surface irrigation is the significant type of irrigation system currently in use in the Madaka region because it is easy to irrigate plants or crops with water using pipes from a very far distance to the farm located at a particular point in time. Unlike other types of irrigation systems, farmers can irrigate crops at their own best and convenience such that all crops receive water equally.

The data presented in Table 11 contains the efficiency of the irrigation type currently in use in the Madaka region. From this table, it is seen that 4.3% of the respondents did not respond to the question; 78.3% of the respondents agreed that the type of irrigation currently in use in the Madaka region is efficient, while 17.4% of the respondents do not agree with this option that the irrigation type currently in use which is surface irrigation in Madaka is efficient. This result implies t hat there will be large food production in the Madaka region because of the efficiency of the surface irrigation where the farmer had been once controlling every process of farming by themselves such that nothing can be deficient or higher than expected to increase food production in the area and country at large.

Table 9. The level of education of farmer's effects on irrigation farming experience in Madaka region.

Variables	Frequency	Percentage
No Response	3	4.3
Yes	44	63.8
No	22	31.9
Total	69	100.0

Table 10. The types of irrigation currently in use in the Madaka region.

Variables	Frequency	Per cent
No response	8	11.6
Surface irrigation	35	50.7
Sprinkler irrigation	2	2.9
Drip Irrigation	10	14.5
Manual Irrigation	12	17.4
Others	2	2.9
Total	69	100.0

Table 11. The efficiency of the irrigation type currently in use in Madaka region.

Variables	Frequency	Percentage
No response	3	4.3
Yes	54	78.3
No	12	17.4
Total	69	100.0

Conclusion

Small-scale irrigation has the potential to contribute to improved food security and higher rural incomes in sub-Saharan Africa. However, a combination of factors has hampered its development. This study analysed the challenges of irrigation farming in Madaka along the River Benue floodplain in Karim Lamido LGA Taraba State. In general, the study found that the lack of capital, lack of access road, and lack of modern irrigation facilities have a significant effect on irrigation farming, such as difficulty in transporting produce from the farms to the stores and market places, especially when there is late harvest.

Recommendations

Based on the results and findings, the study recommends that government should establish a water distribution centre to harness the river Benue which is close to the Madaka region, by establishing self-managed schemes to supply water to farmers using hydro flow pumps through tube wells and also supply them with the pump to irrigate at their convenience. Also, the agricultural extension services should be offered to the farmers on modern way and innovations of irrigation farming, and finally, the indigenous farmers should be enlightened to practice irrigation farming continually to boost the availability of food production during the dry season and to augment the challenges of food insecurity post by rain-fed agriculture in the county.

CONFLICTS OF INTEREST

The authors declare that they have no conflict of interest.

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