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Emanating Ecological Challenges Causing Retrogressive Farm Outputs in Birnin-Kudu, Jigawa State

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ABSTRACT

Ecological challenges are described as difficulties or problems arise from the interactions between biotic-biotic, biotic-abiotic or abiotic-abiotic in the environment. It could also be described as the negative impacts of anthropogenic activities on the earth and its compositional natural systems. They can be biotic (i.e relating to living entities, such as plants and animals) or abiotic (i.e. relating to non-living entities, such as climatic conditions) in nature. In this study, a total of six hundred (600) structured questionnaires were administered across various locations in Birnin-Kudu, Jigawa State. The information obtained on the ecological challenges affecting farm outputs revealed that 52.94% of the respondents strongly agreed that plant-pest interaction affects farm output, 41.18% agreed, while only 5.88% disagreed. 63.55% of the respondents strongly agreed that changes in climatic condition affect farm outputs, while 36.47% agreed. 47.06% of the respondents strongly disagreed that the application of pesticides, herbicides and rodenticides cause effect to farm outputs, where 18% of the respondents agreed and strongly agreed that it affect farm outputs while 15.29% disagreed. 69.41% strongly agreed that the flooding affect farm output, where 30.59% agreed.

The study concluded that farmers were practicing varieties of farming food crops activities including Millet, Sorghum, Maize, Sesame, and Rice production. However, interacting ecological challenges including plant-pest interactions, pesticides application, lack of fertilizer, bush burning and flood disaster have negatively affected their livelihood activities, thereby contributing to retrogressive farm output resulting to food insecurity, loss of some good crop breeds, loss of lives, disease outbreak, affect climatic conditions and poverty among farmers in the study area. Consequently, the farmers have expressed the need for the intervention of; government, farmers, non-governmental organizations, gov't/farmers/community, agriculturalist, community leaders, agronomist, foresters, crop production expert and ecologist for contribution towards the improvement of farming activities in the study area.

Keywords; Ecological, Challenges, Retrogressive, and Farm outputs.

INTRODUCTION

Environment comprises of all factors surrounding a living organism, both natural and man-made. It encompasses everything around us, important for sustaining life on Earth. It includes physical aspects such as land, air, and water, along with social, economic, and political dimensions. Organisms, from viruses to humans, rely on the environment for survival, reproduction, and propagation (Ali and Rahman, 2024). Ecological challenges are described as difficulties or problems arise from the interactions between biotic-biotic, biotic-abiotic or abiotic-abiotic in the environment. It could also be described as the negative impacts of anthropogenic activities on the earth and its compositional natural systems (Giving Compass, 2022). They can be biotic (i.e. relating to living entities, such as plants and animals) or abiotic (i.e. relating to non-living entities, such as climatic conditions) in nature. The development of world technical progress, population growth, and irrational use of the Earth's resources led to an ecological catastrophe, which requires an

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immediate solution from the local level to the international one (Kovalenko and Kovalenko, 2018). The main cause of the ecological challenges to be the type of organization of human society (Tavakova, 2016; Kovalenko and Kovalenko, 2018). It is a fact that the ecosystem must find a degree of balance for the continuation of life (Onuoha et al., 2022). Therefore, environmental awareness which described as being aware of our surroundings and understanding how our actions impact the health of the ecosystems in which humans live (Lauwrens, 2021; Fasolya, 2016; Onuoha et al., 2022) will contribute in making effort of finding out the solution to the ecological challenges thereby ensuring healthy ecosystem for improved agricultural farm outputs. Agriculture is one of the pivotal elements of Nigeria's economy. It is the main source of livelihood that provides necessities of life such as employment, food, and income among Nigerians, most especially rural dwellers (Komolafe et al., 2022; Adekola et al., 2023). Several factors were discovered and identified by previous researches as the contributors to the retrogressive farm outputs. Climate changes as one of the ecological challenging factors was classified as one of the top trending situations worldwide affecting environment including agricultural sector. It is been described as the observed increase in Earth's average temperature (Ali and Rahman, 2024).

Scientists predict further temperature rises, leading to rising sea levels, imbalanced climate patterns, and desert expansion. This phenomenon adversely affects human health and agricultural production. Additionally, it affects agricultural productivity through droughts, floods, and pests, ultimately threatening global food security and human well-being (Ali and Rahman, 2024). Flooding remained as the bottleneck in the agriculture in different part of Nigeria. However, it recognized as one of the major challenges to farming-related livelihoods in Sub-Saharan Africa which is the adverse impact of floods (Balgah et al., 2023; Makuza et al., 2023; Adekola et al., 2023). Floods are among the most common and severe weather events in the world (Adekola et al., 2023), contributing to the loss of lives and profitable yield. The occurrence of floods is associated with some other factors which are classified as part of ecological challenges. In adiition, effects of global warming and annual rainfall variability (Adedapo et al., 2020; Tanoue et al., 2021; Adekola et al., 2023) were mentioned as the factors that triggers the occurrence of flood events.

Flooding as a recognized ecological factor impact negatively on both the living and non-living components of the environment, causing serious damages. For examples, the prominent records of flooding impact on farming as discussed in previous studies include loss of lives, loss of livestock, destruction of properties, damage of crops, and food insecurity (Okeleye et al., 2016; Adekola et al., 2023). The flood disaster was experienced particularly in the 2022 in many places in Nigeria including Birnin-Kudu, Jigawa State and as a result poor farm outputs were experienced. Not only flooding that contributed to the phenomenon but also with the synergy efforts by other ecological challenges which played a vital role. Nigeria at large as of the same year has experienced a series of catastrophic floods due to the influence of climate variability, resulting in the displacement of millions of individuals and incurring financial losses (Agbadaga et al., 2021; Okeleye et al., 2016; Adekola et al., 2023). According to Nemine (2015), the flood disaster has caused huge destruction to more than one and a half million hectares of land, as well as a decrease in food production in areas affected by flooding. According to Agbadaga et al., (2021), the extensive dependence of farmers solely on rainfall is becoming increasingly uncertain due to the adverse effects of climate variability.

The use of synthetic fertilizers has long been a key tool to offset nutrient outputs and thus achieve increased yields (Amanullah et al., 2016; Wang et al., 2020; Liu et al., 2021; Steward, 2022; Krasilnikov et al., 2022). Fertilizer application is believed to have been responsible for at least 50% increase in crop yield in the previous century as stated by (UFERHYC, 2022; Yousaf et al., 2017; Krasilnikov et al., 2022). According to (UFERHYC, 2022), average some cereals yields would decline by 40 percent without nitrogen (N) fertilizer application, while long-term studies confirmed a 40–57 percent yield decline in some without fertilizer application. Yousaf et al., (2017) reported a 19–41% yield increase in rice, and a 61–76% increase in rapeseed with the combined application of NPK fertilizers. However, due to the inappropriate use of mineral fertilizers (i.e., when used in both excess and deficiency), mostly concerning nitrogenous and phosphate, many productive soils have been affected in their ability to function, as shown not only by chemical indicators but also by physical and biological ones. Thus, improper fertilizing technology might have a negative effect on soil health and soil-related ecosystem services (Krasilnikov et al., 2022). Bush burning has been utilized since primitive times and is seen in many traditions as a fundamental component of traditional agricultural practices

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(Afolabi et al., 2024). The evolving life pattern strategies, population growth, urbanization, and agricultural practices exerting pressure on the natural environment indicate that the traditional practice of bush burning is no longer sustainable; nonetheless, efforts to destroy the fertility of the soil, hence it has proven challenging (Aliero, 2004; Afolabi et al., 2024). According to Afolabi et al., (2024) described bush burning typically as the practice of igniting vegetation and other assets at one's disposal. Bush burning, as noted by Hamid et al., (2012), has adversely affected the ecosystem and human health. Pesticides described as a substance used as insecticides, fungicides, herbicides, rodenticides, molluscicides, and nematicides (Bernardez et al., 2015; Tudi et al., 2021). It is generally accepted that pesticides play an important role in agricultural development because they can reduce the losses of agricultural products and improve the affordable yield and quality of food (Aktar et al., 2008; Fenik et al., 2011; Stress Meyer et al., 2017). Because of the need to improve food production and control insect-borne diseases, the development of pesticides increased decades ago. In addition, pesticides are indispensable in agricultural production (Tudi et al., 2021).

They have been used by farmers to control weeds and insects in agricultural cultivation, and remarkable increases in agricultural products have been reported as a result of pesticide use (Bernardez et al., 2015; Lamichhane, 2017). Despite its important to agriculture, the large amounts of remaining pesticides penetrate or reach non-target plants and environmental media (Tudi et al., 2021). As a consequence, pesticide contamination has polluted the environment and caused negative impacts on human health (Bernardez et al., 2015; Hernandez et al., 2013). Knowing its effect based on farmer's perception will generally assist in the provision of proper utilization methods and other safety protocols for better yield and effect reduction. Plants struggle to survive in a harsh environment, facing various challenges throughout their growth stages, including pathogens and insect herbivores (Lee Díaz et al., 2022; Dofuor et al., 2024). Bernays, 1992 revealed that plant-insect interactions have undergone co-evolution for millions of years, leading to intricate and ever-changing interactions that have significantly influenced agroecosystems. Insect pollination improves the quality of the crops, resulting in larger, more uniform, and more flavorful fruits and vegetables (Nicholson and Ricketts, 2019; Dofuor et al., 2024).

Insects also play a significant role in seed dispersal of many crops (Beckman and Sullivan, 2023). Additionally, insects feed on various plant parts such as roots, stems, leaves, flowers, fruits, pollen, spores, sap, and other plant secretions in a highly diverse manner (Gang were, 2004; Dofuor et al., 2024). Insect-feeding affects crop yield, quality, and growth (Lawrence et al., 2018; Myers and Sarfraz, 2017; Dofuor et al., 2024). The interaction of ecological challenges with agriculture becomes an integral part in our environment today. The situation needs a careful attention for proper decision considering the important of agriculture as a backbone for the survival of especially human on earth. This study aimed at assessing the ecological challenges causing retrogressive farm outputs in Birnin-Kudu, Jigawa State Nigeria. The attempt will ensure in the provision of possible ways of handling and controlling or elimination of ecological challenges affecting agriculture in the study region and beyond. And it will also help authorities in decision making on better agriculture in the State.

MATERIALS AND METHODS

Study Area

The study area Birnin Kudu Local Government is located between Latitudes 11º 20′N to 11º39′ North of the equator and Longitudes 09º 10′E to 09º 40′ East of the Greenwich meridian. It covers area of about 2,073 square Kilometers (Garba et al., 2023). The main elevation of the plain surface of the area is between 400 - 420m above mean sea level. The total annual rainfall received ranges between 500-600mm in the region (Olofin 2008). The area is characterized by a long dry season which lasts on average of 8 months from October to April or May. The mean monthly temperature in the area ranges between 30°C and 35°C. The wet season mean annual temperature is about 25°C and diurnal range of about 10°C to 13°C. Relative humidity ranges from 80% in August to 23% between the month of January and March. The major rivers of the area are River Birnin Kudu, River Masaya and Kiyako (Murtala and Yazid, 2019).

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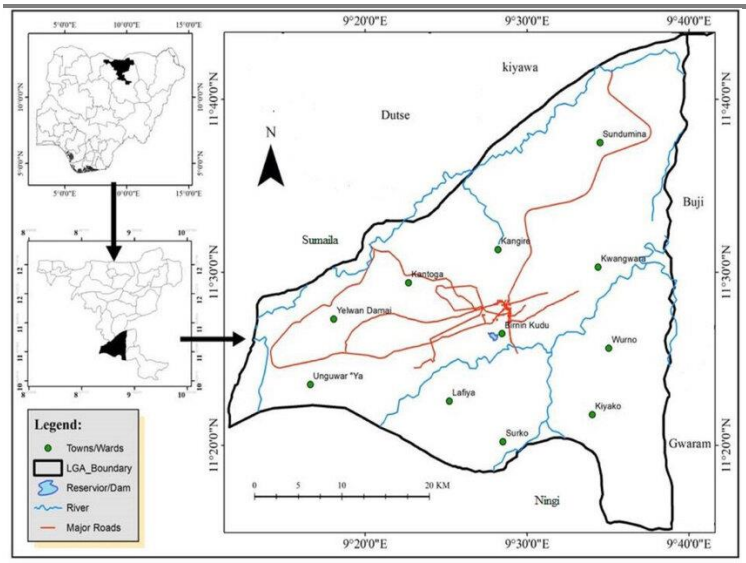

Figure 1: The Study Area (Birnin Kudu LGA), Source; Garba et al., (2023).

Sampling Procedures

The study adopted the methodology of Armah, et al., (2010) and Ibrahim and Tasi'u, (2020) in selecting sample sites. Thus, 12 villages including Birnin Kudu metropolis were purposively chosen out of the across the Birnin Kudu Local Government to form the sample, based on their location effects experienced on their farm outputs based on the ecological challenges caused. The selected areas were Bigidam, Kantoga, Kafin-Gana, Yalwan-damai, Unguwar 'ya, Masaya, Ciyako, Bamaina, Babaldu, Kangire, Sund mina and Birnin-Kudu. These areas are considered the most affected in the study area. A total of 600 respondents were determined as a sample based on Taro Yamane's formula given as:

n=N/1+N(e)^2 …… (i)

Where: n= sample size required, N = number of households (17,000) e = allowable error (%). Substitute numbers in formula: n=17,000÷1+17,000 (0.04) ^2

n=600 ($Rounded$ to the nearest hundred).

Data Collection

A total of 600 questionnaires were administered, field observation and interview questionnaire were utilized in collecting data. All the information obtained from the field observation and interview from the research respondents were recorded in a designed data sheet and later the raw data were entered in to an excel sheet for further analysis.

Data Analysis

The study used statistical techniques in analyzing the data obtained from the research respondents. The statistical techniques involved the use of descriptive statistics. The data collected from the research respondents were represented statistically, using frequency distribution, tables, percentage and figures. The statistical analyses were carried out using the Microsoft Excel soft wares (version 2019).

RESULTS

Socio-demographic profile of the respondents at Birnin-Kudu, Jigawa State.

A total of six hundred (600) structured questionnaires were administered across various locations in Birnin-Kudu, Jigawa State. Out of the total number administered, a total of four hundred and twenty-five (425) were retrieved fully filled. The result revealed that males were the only respondents participated in the study 425

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(100%). From the results, age range 25-30years had the highest respondents 214 (50.35%), followed by 35-40years 128 (30.12%), 20-25years 48 (11.29%), 40years above 33 (7.76%) with the least in the age range 15-20years 2 (0.47%). There is a significant different between the respondent's opinion among age ranges ($p<0.05$). Married respondents had the highest percentage of participation 368 (86.59%) as compared with the single respondents 57 (13.41%) respectively. There is a significant different between the respondent's opinion among age ranges ($p<0.05$). Farmers/Businessmen had the highest respondents 194 (45.65%), followed by farmers 88 (20.71%), Businessmen 80 (18.82%), Civil servant 37 (8.715) with the least in others 26 (6.12%). There is a significant different between the respondent's opinion among age ranges ($p<0.05$). Respondents with no certificates had the highest percentage of participation 177 (41.65%), followed by respondents with Secondary certificates 106 (24.94%), Tertiary certificates 78 (18.35%), with the least in respondents with Primary certificates 64 (15.06%) respectively. There is a significant different between the respondent's opinion among age ranges ($p<0.05$). Members of the community with no position had the highest number of respondents 413 (97.18%), followed by political leaders 11 (2.59%), traditional ruler 1 (0.24%) with no respondents from philanthropist. There is a significant different between the respondent's opinion among age ranges ($p<0.05$) (Table 1).

Table 1; Socio-demographic profile of the respondents at Birnin-Kudu, Jigawa State.

Items	**Frequency**	**% P-value**
Sex		
Males	425	100
Females	0	0
Total	**425**	**100**
Age		
15-20years	2	0.47
20-25years	48	11.29
25-30years	214	50.35 <0.05
35-40years	128	30.12
40years above	33	7.76
Total	**425**	**100**
Marital status		
Single	57	13.41
Married	368	86.59 <0.05
Total	**425**	**100**
Occupation		
Farmers	88	20.71
Civil servants	37	8.71
Businessmen	80	18.82 <0.05
Farmer/Businessmen	194	45.65
Others	26	6.12
Total	**425**	**100**
Qualification		
Primary cert.	64	15.06
Secondary cert.	106	24.94
Tertiary	78	18.35 <0.05
None	177	41.65
Total	**425**	**100**
Position in the community		
Member	413	97.18

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Traditional ruler	1	0.24
Political leader	11	2.59 <0.05
Philanthropist	0	0.00
Total	**425**	**100**

Repercussion of ecological challenges on farm outputs

The results on the repercussion of ecological challenges on farm outputs revealed that the majority of the respondents 385 (90.59%) believed that the ecological challenges can cause food insecurity/food shortage while only 9.41% disbelieved. There is no significant association between the respondents who believed and disbelieved ($\chi 2=3.76$; $p>0.05$). 80.24% disbelieved that the ecological challenges can cause land derelicity, while 19.76% believed. There is a significant association between the respondents who believed and disbelieved ($\chi 2=273.60$). 80% of the respondents believed that the ecological challenges can cause loss of some good crop breeds, while 20% disbelieved.

There is a significant association between the respondents who believed and disbelieved ($\chi 2=17.00$). 68.71% believed that the ecological challenges can leads to loss of lives, while 31.29% disbelieved. There is a significant association between the respondents who believed and disbelieved ($\chi 2=41.62$). 62.82% believed that the ecological challenges can leads to disease outbreak while only 37.18% disbelieved. There is a significant association between the respondents who believed and disbelieved ($\chi 2=58.73$). 75.29% believed that the ecological challenges can leads to ineffective ecosystem services while 24.71% disbelieved. There is a significant association between the respondents who believed and disbelieved ($\chi 2=25.94$). 86.35% believed that the ecological challenges can affect climatic conditions while 13.65% disbelieved. There is no significant association between the respondents who believed and disbelieved ($\chi 2=7.91$). (Table 2).

Table 2; Repercussion of ecological challenges on farm outputs.

Items	**YES**	**%**	**NO**	**%**
Ecological challenges can cause food insecurity/food shortage	385	90.59	40	9.41
Ecological challenges can cause land derelicity	84	19.76	341	80.24
Ecological challenges can cause loss of some good crop breeds	340	80	85	20
Ecological challenges can lead to loss of lives	292	68.71	133	31.29
Ecological challenges can lead to disease outbreak	267	62.82	158	37.18
Ecological challenges can lead to ineffective ecosystem services	320	75.29	105	24.71
Ecological challenges can affect climatic conditions	367	86.35	58	13.65

Community's perception on how to eliminate ecological challenges affecting farm outputs

The results on the community's perception on how ecological challenges can be eliminated revealed that 75.53% of the respondents believed that the Supports towards the improvement of agricultural activities are expected from the government, 11.76% believed that it is expected from the synergistic efforts by the government, farmers and community, 8.24% revealed that only farmers should be responsible while 4.47% considered non-governmental organizations to be responsible.

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There is a significant different between the respondents' views on supports towards the improvement of agricultural activities ($p<0.05$). 51. 29% of the respondents revealed that the enlightens on how farming should be carried out and are expected to be given by agriculturalist, 28.71% believed agriculturalist/community leaders, 18.82% revealed that fellow educated farmers, where 1.18% with the least in term of respondents considered agronomist to be responsible. There is a significant different between the respondents' views on how farming activities should be carried out ($p<0.05$). 445 of the respondents revealed that the best way for controlling pest should be adopted, and it is the duty of agronomist, 38.83% revealed that farmers should be responsible, where 11.76% support agronomist/farmers while 5.41% revealed foresters only.

There is a significant different between the respondents' views on best ways for controlling pest ($p<0.05$). 49.88% of the respondents revealed that the correct time for farm infestation should learn and practice by farmers, 48.47% revealed farm owners, while 1.18% considered crop production expert. There is a significant different between the respondents' views on correct time for farm infestation ($p<0.05$). 60.24% of the respondents revealed that the appropriate use of herbicides, pesticides, and insecticides is responsible by the farmers, where 25.65% considered agriculturalist, 12.94% revealed the state government while 1.18% described agricultural organizations.

There is a significant different between the respondents' views on appropriate use of herbicides, pesticides, and insecticides ($p<0.05$). 48.47% of the respondents revealed that the use of disease resistance varieties and well improved varieties should be expected from farmers, where 41.41% revealed agriculturalist, while 9.65% described agricultural supervisors. There is a significant different between the respondents' views on the use of disease resistance varieties and well improved varieties ($p<0.05$) (Table 3).

Table 3; Community's perception on how to eliminate ecological challenges affecting farm outputs.

Sources of Farming Guidance

Items	**Frequency**	**Percentage (%)**
Government	321	75.53%
Farmers	35	8.24%
Non-governmental organizations	19	4.47%
Government and Farmers	0	0.00%
Gov't/Farmers/Community	50	11.76%

Source of Farming Knowledge

Who Should Enlighten on Farming Practices?	**Frequency**	**Percentage (%)**
Agriculturalist	218	51.29%
Fellow Educated Farmer	80	18.82%
Community Leaders	0	0.00%
Agronomist	5	1.18%
Agriculturalist/Community Leaders	122	28.71%

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Responsibility for Pest Control

Who Should Control Pests?	Frequency	Percentage (%)
Agronomists	187	44.00%
Farmers	165	38.82%
Foresters	23	5.41%
Climatologist	0	0.00%
Agronomist/Farmer	50	11.76%

Learning Correct Timing for Farm Infestation

Who Should Learn and Practice Proper Timing?	Frequency	Percentage (%)
Farm Owner	206	48.47%
Agriculturalist	212	49.88%
Crop Production Expert	5	1.18%
Ecologist	2	0.47%

Responsibility for Proper Use of Chemicals

Who is Responsible for Proper Use of Herbicides, Pesticides, and Insecticides?	Frequency	Percentage (%)
State Government	55	12.94%
Agricultural Organization	5	1.18%
Farmers	256	60.24%
Agriculturalist	109	25.65%

Responsibility for Using Disease-Resistant Varieties

Who Should Use Disease-Resistant and Improved Varieties?	Frequency	Percentage (%)
Farmers	206	48.47%
Agricultural Supervisors	41	9.65%
Farm Engineers	2	0.47%
Agriculturalist	176	41.41%

Ecological challenges affecting farm outputs

The information obtained on the ecological challenges affecting farm outputs revealed that 52.94% of the respondents strongly agreed that plant-pest interaction affects farm output, 41.18% agreed, while only 5.88% disagreed. There is a significant different in responses by the respondents on plant-pest interaction ($p<0.05$). 77.65% of the respondents strongly agreed that the disease outbreak led to retrogressive of farm output, while 22.35% agreed with no respondents with any other choice. There is a significant different in responses by the respondents on diseases outbreak ($p<0.05$). 63.55% of the respondents strongly agreed that changes in climatic condition affect farm outputs, while 36.47% agreed. There is a significant different in responses by the

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respondents on climatic condition ($p<0.05$). 47.06% of the respondents strongly disagreed that the application of pesticides, herbicides and rodenticides cause effect to farm outputs, where 18% of the respondents agreed and strongly agreed that it affect farm outputs while 15.29% disagreed. There is a significant different in responses by the respondents on application of pesticides, herbicides and rodenticides ($p<0.05$). 36.24% of the respondents strongly disagreed that the fertilizer application contributes to the retrogressive of farm output; also 29.28% disagreed, where only 27.53% agreed.

There is a significant different in responses by the respondents on fertilizer application ($p<0.05$). 68.25% of the respondents strongly disagreed that the bush burning, clean clearing affect farm output, 25.88% disagreed, while only 5.88% agreed. There is a significant different in responses by the respondents on bush burning ($p<0.05$). 69.41% strongly agreed that the flooding affect farm output, where 30.59% agreed. There is a significant different in responses by the respondents on flooding ($p<0.05$). 44.71% of the respondents strongly disagreed that the regular use of disinfected farm tools causes retrogressive farm output, 29.41% disagreed, while only 18.82% agreed. There is a significant different in responses by the respondents on the use of disinfected farm tools ($p<0.05$). 58.82% of the respondents agreed that the lack of fertilizer lead to the retrogressive farm outputs while 41.18% of the respondents strongly agreed respectively. There is a significant different in responses by the respondents on lack of fertilizer ($p<0.05$) (Table 4).

Table 4; Ecological challenges affecting farm outputs.

Items	Agree (%)	Strongly agree (%)	Disagree (%)	Strongly disagree (%)	Neutral (%)
Plant-pest interaction affects farm output	175(41.18%)	225(52.94%)	25(5.88%)	0(0%)	0(0%)
Diseaseoutbreakledto retrogressive of farm output	95(22.35%)	330(77.65%)	0(0%)	0(0%)	0(0%)
Changes in climatic condition affect farm outputs	155(36.47%)	270(63.53%)	0(0%)	0(0%)	0(0%)
The application of pesticides, herbicides and rodenticides cause effect to farm outputs	80(18.82%)	80(18.82%)	65(15.29%)	200(47.06%)	0(0%)
Thefertilizerapplication contributes to the retrogressive of farm output	117(27.53%)	30(7.06%)	124(29.28%)	154(36.24%)	0(0%)
Bush burning, clean clearing affect farm output	25(5.88%)	0(0%)	110(25.88%)	290(68.24%)	0(0%)
Flooding affect farm output	130(30.59%)	295(69.41%)	0(0%)	0(0%)	0(0%)
The regular use of disinfected farm tools causes retrogressive farm output	80(18.82%)	30(7.06%)	125(29.41%)	190(44.71%)	0(0%)
Lack of fertilizer lead to the retrogressive farm outputs	250(58.82%)	175(41.18%)	0(0%)	0(0%)	0(0%)

Remedies to the ecological challenges affecting farm outputs

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Results on the remedies to the ecological challenges affecting farm outputs revealed that the majority of the respondents (100%) agreed that the proper application of non-problematic fertilizers should be practices, and there is no significant different in responses by the respondents on proper application of non-problematic fertilizers ($p>0.05$). Good agricultural farm practice should be employed when farm preparation and general farm operation, means to avoid flooding should always be maintained. More so, there is no significant different in responses by the respondents on good agricultural farm practice ($p>0.05$). Activities that may result in to climatic changes should be avoided; crops to be planted should be free from any physical defects. There is no significant different in responses by the respondents on activities that may result in to changes in climatic condition ($p>0.05$). On noticed to a particular disease outbreak, an attention of good agriculturalist should be call to give appropriate way out to a problem. There is no significant different in responses by the respondents on the opinion of agricultural professional intervention when disease outbreak scenario occurred ($p>0.05$). Knowledge on farming should be acquired and reacquired as there is always a modification, advancement and evolution in the aspect, and there is no significant different in responses by the respondents on regular knowledge acquisition on agricultural activities ($p>0.05$). Support with cash, improved varieties and other farm equipment should be inquired from government, while for none or partially hazardous pesticide, fungicide, rodenticide and herbicide should be used, only 23.06% were disbelieved where 76.94% believed. There is a significant different in responses by the respondents on this point ($p<0.05$). 84.71% believed that farm tools should always be maintain clean and disinfected in order to avoid any problem while 15.29% disbelieved (Table 5).

Table 5; Remedies to the ecological challenges affecting farm outputs.

Items	TRUE	%	FALSE	%
Proper application of non-problematic fertilizers should be practices	425	100.00	0	0.00
None or partially hazardous pesticide, fungicide, rodenticide and herbicide should be use	327	76.94	98	23.06
Good agricultural farm practice should be employed when farm preparation and general farm operation	425	100.00	0	0.00
Means to avoid flooding should always be maintained	425	100.00	0	0.00
Activities that may result in to climatic changes should be avoided	425	100.00	0	0.00
Crops to be planted should be free from any physical defects	425	100.00	0	0.00
On noticed to a particular disease outbreak, an attention of good agriculturalist should be call to give appropriate way out to a problem	425	100.00	0	0.00
Farm tools should always be maintained clean and disinfected in order to avoid any problem	360	84.71	65	15.29
Knowledge on farming should be acquired and reacquired as there is always a modification, advancement and evolution in the aspect	425	100.00	0	0.00
Support with cash, improved varieties and other farm equipment should be inquired from government	425	100.00	0	0.00

DISCUSSION

Ecological challenges significantly contributed in a greater extent to the retrogressive farm outputs in this investigation which are associated with some other important conditions. More so, in this study, the respondents participated in providing the needed information were males and this is because farming activities

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in the study area are known for males alone. This is also part of the culture of most people in Nigeria, especially the Northern region of the country. Our findings agreed with some previous studies by Komolafe, (2021) which revealed that the study demonstrate the majority of individuals involved in agricultural activities in the study area are male, thus demonstrating the prevalence of male involvement in agricultural activities in rural Nigeria and Afolabi et al., (2024) which revealed that 62.0% of respondents were male and 38.0% were female, suggesting a greater male participation in arable crop farming within the study area. This male predominance has often been ascribed to the labour-intensive nature of farming, which relies heavily on manual labour. The research indicates that the majority of responders were male.

Age range could never be a determinant factor for an individual to engage in farming activities in most areas. Furthermore, there is no specific age range in which one can attain in order to engage in to farming activities; but this varied with locations and culture of the people in a given society in Nigeria. In this study, males of the age range 15-20years were participated in the process of obtaining information regarding ecological challenges that cause retrogressive in farm outputs but due to a little experience they had on the system, they couldn't provide or explain certain situation associated with the farming activity. Therefore, the age range 25-30years had the highest responses regarding the situation. This is because of the long-term experience they had on the system. The finding was similar to that of Adekola et al., (2023) which revealed that the average age of the respondents with highest respondents was 38.6 years. This implies that most of farmers in the study area are in their youthful age. Also, Afolabi et al., (2024) stated in a similar study that 40.0% of respondents were above 35 years of age, followed by 24.0% aged 21-25 years, 20.0% aged 31-35 years, and 16.0% aged 26-30 years. This suggests that the farmers remained within their active age range, consistent with Socolow et al., (2011), who reported that younger farmers tend to possess greater knowledge of optimal practices and are often more inclined to accept risks and adapt to improved farming techniques due to their extended planning horizons.

Majority of the respondents were married individuals (86.59%) contributed with needed information on the ecological challenges affecting farm outputs in a greater extent than singles (13.41%). This is because of the fact that married individuals have many responsibilities (such as family and other relatives), making it vital to engage in to farming system for long time which makes them able to acquired much experience of various situations associated with farming activities; of which they can give account on the time of need. Unlike the single which are mostly participated in the farming act to assist their parents particularly on subsistence farming. This agrees the findings of Adekola et al., (2023) which disclosed that the majority of respondents (85.0%) were married and this implies that farmers in the study area have household responsibilities.

It is also in consistent with the findings by Afolabi et al., (2024) which stated that 5.0% of the respondents are single, 71.0% are married, 11.0% are divorced, and 13.0% are widowed, demonstrating that the majority of respondents are married. Married individuals were more engaged in agriculture and may obtain assistance from their wives in doing various farm duties. Farmers/Business individuals account for 45.65% of the total respondents. The reason why majority of the farmers are businessmen was supported by many of the respondents during interview as farming remain as an occupation of raining season to them while other business activities are considered during other seasons. Despite the advancement and other development in education sector across the world, majority of the people who are living in rural settings have less interest in western education. Hence, in this study, respondents with no certificate had the highest percentage. 90.57% of the community people in the study area confirmed that ecological challenges cause serious food insecurity/food shortage. The findings are similar to that of Afolabi et al., (2024) which revealed that 40.0% of respondents possessed no formal education, further supported that respondents' attainment of education suggests their lack of options for promptly grasping new agricultural techniques due to their previous educational deficiencies. Plant-pest interaction, climate change significantly affects the farm output thereby assuring food shortage/insecurity. Other ecological factors have led to an increase in pest breeding, affecting animals and food crops, causing undernourishment and food insecurity due to the evolution of different pest species (Dauda, 2023). In addition, our findings are consistent to other previous study which revealed that climate change in Nigeria has caused variations in rainfall and sunshine patterns, particularly in the northern region, where agriculture is the main economic activity.

These changes have affected crop planting and harvesting seasons, leading to crop scarcity and unavailability, increasing food prices, and severe food insecurity (Dauda, 2023). Also, larger percentage (80.24%) of the

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community people disbelieved that these ecological challenges have no effort to set land in to derelicity. This is because they had no record of land in to derelicity as the results of ecological challenges. 80% of the population revealed and assured that these ecological challenges significantly cause loss of some good crop breeds, thereby affecting the diverse varieties available. Ecological challenges also lead to loss of lives as revealed by the majority of the respondents (68.71%) in the study area. This is because of the food insecurity and shortage caused by the challenges could directly leads to loss of lives as there no sufficient food to which people dependent for their survival.

This finding was supported by previous evaluation which stated that lack of ensuring food security is tantamount to political instability, hunger, malnourishment, and reliance of food importation and its adverse effects on trade deficits (Havas and Salman, 2011; Enilolobo et al., 2022). 62.82% of the population disclosed that these challenges lead to diseases outbreak, affecting ecosystem services and climate change at large. Majority of the respondents (47.06%) opined that the application of pesticides has no effect on yield and production of farm outputs. This because most of the farmers have better idea on pesticides application that they can apply a quantity that wouldn't cause any harm. This was in line with the previous findings by Ali and Rahman, (2024) which revealed that transitioning away from the excessive use of pesticides towards sustainable agricultural practices is key to addressing environmental issues.

With regards to fertilizer application on whether it has any negative contribution to poor harvest, the majority of the respondents (36.24%) believed that fertilizer application has no negative effect on crop yield while 58.82% believed that lack of sufficient fertilizer in farming system could result to poor yield. The finding is inconsistent to that of Wan et al., (2021) revealed that chemical fertilizer has been excessively used for the high yield of plant around the world, especially in China; this has deteriorated the citrus orchard soil environment. And Pradip et al., (2020) also which revealed that he use of agriculture fertilizer is a major factor for the degradation of soil quality, soil erosion, salinity and general loss of fertility of agricultural land as well as the loss of the production of the quality crop. Moreover, to resolve this conflict, the use of organic fertilizer provides a promising solution (Krasilnikov et al., 2022).

Bush burning activities was regarded as helpful in farming system in the study area. This is because 68.24% of the respondents believed that it has no impact on crop yield. This finding corroborates that of Afolabi et al., (2024) which revealed that a significant proportion of the respondents noted that bush burning diminishes soil and plant productivity and ultimately, the act of burning promotes insect infestation on crops. It is also in consisted with that of Jamala, (2012), who discovered that farmers asserted bush burning results in diminished pasture for livestock, destruction of wildlife habitats, a decrease in soil fertility, an increase in soil erosion, and the destruction of soil microorganisms.

Conversely, the findings from Ambe et al., (2015) and Aluko et al., (2019) highlighted the necessity of raising awareness due to the detrimental impacts of bush burning (Afolabi et al., 2024). Majority of the respondents (69.41%) revealed that flooding affect crop yield in the study area. Larger percentage of the loss in term of yield was as result of flood disaster experienced in the study area. This finding was supported by previous study by Dauda, (2023) which stated that rising sea levels and heavy rainfall caused flooding in Nigeria, across different regions, particularly Northern regions. This leads to species loss, uncultivable farmlands, and disruption of agricultural activities, affecting agricultural produce. In an attempt to obtain information of how these ecological challenges can be eliminated so as improved farm output can be produced; the community people disclosed their perceptions towards that, where 75.53% revealed that support towards the improvement of agricultural activities must be responsible by the government of the state.

This is because, the majority of the community people believe that it is only the government in position with authority and full potentials to ensure support in a greater extent with necessary required farming aids such as provision of abundance varieties, farming tools, fertilizer, pesticides and herbicides including other activities such as water ways maintenance and improvement which would significantly assist in the eradication or elimination of these ecological challenges. This finding was in line with that of Bolarin et al., (2021) which revealed that as a result of ongoing similar situations, the government is typically left to manage the consequences of subsequent shocks. On the other hand, a considerable number of people in that community

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opined that support toward the improvement of agricultural activities should be responsible by the synergistic effort by the government, farmers and other category of people in the community.

Enlightens on how proper farming system should be done were believed by the 51.29% of the population as a responsibility of agriculturalists. This because of their indulges and experience in the agricultural field. The best way for pest control should be adopted in agricultural system in that community a good practicing measure against effects by some ecological challenges, and it is solely responsible by agronomist as confirmed by 44% of the population, where 38.82% considered farmers. Correct time for farm infestation against other ecological challenges should be learn and practice by agriculturalist as revealed by 49.88%, where 48.47% revealed that farm owner should be a right individual to learn and practice farm infestation at a right time. Highlights on the appropriate use of herbicides, pesticides and insecticides are responsible by farmers as confirmed by 60.24% of the respondents, where 25.65% believed agriculturalist. The use of disease resistant varieties should be responsible by farmers as revealed by 48.47% of the respondents. This is because; at the end of the process, it's the farmer that would harvest profit or loss. Hence it is in good position to know how much the important of using disease resistant varieties.

CONCLUSION AND RECOMMENDATIONS

The study concluded that farmers were practicing varieties of farming food crops activities including Millet, Sorghum, Maize, Sesame, and Rice production. However, interacting ecological challenges including plant-pest interactions, pesticides application, lack of fertilizer, bush burning and flood disaster have negatively affected their livelihood activities, thereby contributing to retrogressive farm output resulting to food insecurity, loss of some good crop breeds, loss of lives, disease outbreak, affect climatic conditions and poverty among farmers in the study area. Consequently, the farmers have expressed the need for the intervention of; government, farmers, non-governmentalorganizations,gov't/farmers/community, agriculturalist, community leaders, agronomist, foresters, crop production expert and ecologist for contribution towards the improvement of farming activities in the study area. Factors that significantly influenced the impact of ecological challenges experienced by the farmers were farmers' marital status, educational status, age, and years of experience in farming. Therefore, farmers should intensify effort in the searching more knowledge on how to tackle these ecological challenges while government and other agents from various agricultural agencies should assist farmers with necessary needs that would greatly enhance the farming activities and ensures profitable yield.

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