# CONSTRAINTS TO INCREASED FOOD PRODUCTION AND DISTRIBUTION IN DUKKU L.G. A. GOMBE STATE, NIGERIA

[1]**Adam Modu Abbas**, [1]**Bala Rabiu Hashidu**, [2]**B.J. Ananya**

[1]Department of Geography, Faculty of Humanities Management and Social Sciences, Federal University of Kashere, Gombe State, Nigeria.
[2]Department of Geography, Nigerian Army University Biu, Borno State, Nigeria.
Email:dradamabbas28@gmail.com, rbhashidu@gmail.com, ananya2007.bj@gmail.com

## ABSTRACT

Agriculture plays a significant role in the process of economic growth and development of Nigeria. It contributes greatly to the provision of food and raw industrial materials. Increased food production and distribution has been a significant challenge in most of the developing countries of the world. In Nigeria, several rural communities in most of the states, Northern Nigeria in particular are faced with this problem. The situation in Dukku Local Government Area of Gombe state is not an exception as food production and distribution in the area has been hampered with a lot of challenges. The study examines the constraints to increased food production and distribution in Dukku L.G.A. A total of 150 copies of questionnaires were administered to purposively sampled population of food crop farmers in six political wards. Systematic sampling technique was employed whereby the first household on every identified street was selected and the interval of ten ($10^{th}$) household was taken to form the $n^{th}$ where the questionnaire was administered. Both primary and secondary source of data were used to collect the data for the research. Chi square ($x^2$) was adopted to test the research hypothesis. The result shows that majority of the farmers in the study area encountered problems in food production and distribution which include: inadequate fertilizer, poor market price, poor transportation system and storage facilities. The study recommended that government should improve the supply of fertilizers and other inputs at a subsidised rates to farmers and establish an extension program in which the farmers will gain knowledge on agriculture as well as improve on the transportation system and market efficiency.

**Keywords:** *Agriculture, Constraints, Distribution, Food and Production.*

## INTRODUCTION

The ultimate aim of agricultural production is to get agricultural products to the consumers in the form that that will be useful to them. Food items including meat, fish, milk and products, eggs and products, fruits, vegetables, cereals, legumes, roots and tubers are some of the common agricultural products. Food has been defined as something good to eat. It could be in liquid, semisolid and solid forms and are necessary to carry out one or more of the life functions of the body in terms of health, growth and normal functions of living organisms (Ricketts, 1983). The greatest world major problem today is how to eliminate hunger and overcome poverty. This challenge is greatest in the developing countries where people starve for lack of adequate food and nourishment and where starvation and poverty go hands in hands. The common strategy adopted has been increasing output of food in tonnage per year through land clearing, improved machinery, better cultivation methods, improved seeds, and improved animal nutrition, breeding and health without considering the quantity and quality of the agricultural products (food) that get to the ultimate consumer (Joseph, 1994, 1996; Omotesho *et. al.,* 1995).

It is also important to note that one of the most basic human needs is food. The struggle to meet these needs ushered in agriculture which implies cultivation of crops and rearing of animals for human utilization. Humanity's longest struggle has being the ever-stopping battle, waged with different weapons and different fronts, adequately to feed itself. Human population has being growing since time immemorial. This exponential growth has put fears about the possible outcome of such increase. Thomas Robert Malthus (1834) is one of such views that voiced out his opinion on his ''Essay on Population'' in 1798. Malthus observed that the period when the number of men surpasses their means of subsistence has long since arrived,'' The result Malthus predicted would be ''misery and vice''. As times went on Malthus was proven wrong by the skyrocketed advancement in science and technology that ushered in many innovations in agriculture. An Indian based Nobel Laureate Amartya Sen in (1994) revealed that the global population had by then grown nearly six times since Malthus first published his essay on population. Food consumption per person had increased, life expectancies lengthened, and standard of living generally increased as a result of ''Green Revolution'' (Bouloung, 2014).World population is projected to continue increasing well into the next century. The question is whether and how global food production

may be increased to provide for the coming population expansion since the said advancement in agricultural technology is concentrated in the developed world? It would be necessary to increase current levels of food production more than proportional to population growth so as to provide most humans with an adequate diet. There are a number of actions that may be taken to help this food expansion, but there are also a number of constraints that make expansion of food output difficult (FAO, 2013).

Agriculture plays a significant role in the process of economic growth and development of Nigeria. It contributes greatly to the provision of food and raw industrial materials. Agriculture is the market for the input of the industrial sector, and provides employment opportunities for the people (Clavence, 1979). In the late 1960s, before the diversification of the Nigerian economy to the oil sector, over 60% of the Gross National Products (GNP) was earned from the agricultural sector, whereas over 80% of the labour force of the Nigerian population was employed in the agro-allied industries. Despite its contribution, it is acknowledged that agricultural production cannot be expected to meet the rising level of population demand in Nigeria due to the many problems confronting rural farmers. In the first instance, Nigerian agriculture remains basically inefficient, underutilized and costly (Teriba, 1964; Aribisala, 1983). It is inefficient in the sense that crop yields remain markedly low when compared with other third world countries of Asia and Latin America. It is under-utilized in that only about 45% of the country's 70 million hectares of potential cultivable land are under cultivation (Ibrahim, 2008). Nigeria enjoys good and conducive climate that allows farming to be practiced throughout the year especially in the southern parts of the country. Similarly, in the drier areas of the north, irrigation is intensified to boost grain production. However, the last few decades in Nigeria have witnessed a general decline in the contribution of export crops to Nigeria's Gross Domestic Products (GDP) and foreign exchange earnings (Abumere, 1984).

This has reached the point where Nigeria now imports a substantial proportion of staple foods like rice, beans, millets and wheat to mention a few. On the other hand, there has emerged, within the last few years, tremendous governmental interest in extensive staple food production. Such interest is formalized in the various programmes of the government like the establishment of agricultural development projects, investment in

River Basin Development Programmes, irrigation of dry areas, distribution of fertilizers to peasant farmers and giving other incentives that will boost productivity. Nigeria is involved in the production of various staple foods ranging from cereals, legumes, and vegetables, to root crops and tubers depending on the ecological zones. Thus, the south specializes in the production of root crops, tree crops and mixed grains while the north specializes in the production of grains, cereals and vegetables under irrigation. It was observed that zones of specialization in food crops exist among the different ecological zones in Nigeria, although they are interwoven. The most essential food crops produced locally include cereals, such as sorghum, millet, maize, rice, and wheat; grain legumes as cowpeas, beans, pears and root and tubers such as yam, potatoes, cassava, and coco-yam. Fruits such as grapes, lime, mangoes, oranges as well as vegetables are produced for consumption and in commercial quantities throughout the country. Staple food crops are produced in Nigeria entirely by peasant farmers who use simple implements and hand tools. Holdings of food crops varying in size from 0.45 ha to 3.04 h (Abumere, 1984:245).

Food distribution is a process of transferring or transporting food or drink from one place to another and a very important factor in public nutrition. Where it breaks down, famine, malnutrition or illness can occur. During some periods of Ancient Rome, food distribution occurred with the policy of giving free breads to its citizens under the provision of a common good. The goal of food distribution is not only to connect the producers, such as farmers and fishermen to consumers, but also to allocate the food accordingly. Challenges arise in deciding how the food will be distributed among the people, who have the power of distribution, and what methods should be followed to ensure effective food distribution. The establishment of markets in which producers directly sell their food to consumers is the most traditional method of distribution. However, due to many cases of inefficiency, food is usually transported to a central location and then distributed to outer cities and villages (FAO, 2012). Furthermore, consumers have difficulty purchasing food because of their inability to access markets and/or their inability to afford the costs. On the other end, farmers cannot sell their produce for the similar reasons. Therefore, the main problems with the current distribution system are the lack of markets, the inadequacy of transportation to markets and the inability to afford the costs of production and consumption (Conley, 2012).

In our current system of food distribution, the number of markets and ways to access those markets is inadequate. In Gombe State, particularly in Dukku local government area, as the transportation network and facilities are often very limited. There are few high quality roads or railways to support the transportation of goods and people to the centralized markets. Transportation routes are expensive and almost exclusively require public funding and public maintenance. Poorly maintained roads are a huge problem in many regions, particularly in some parts of Dukku town itself where the poor roads make an area inaccessible and delay any movement of goods. One issue with transportation is the extremely variable geography and climate in each region. Each type of transportation is more effective in certain areas than in others, so solutions must be formed on a local level by critically examining the geography as well as the available resources of the study area. Infrastructure such as markets and transportation routes, unsustainable prices driven by corruption and waste, inefficiency in markets, and poverty could all be contributing factors. Our solutions focus on reducing these factors to create a world in which all have access to food at affordable prices (Dahiru, 2003).

Increased food production and distribution has been a significant challenge in most of the developing countries of the world. In Nigeria several rural communities in most of the States, Northern Nigeria in particular are faced with this problem. The situation in Dukku L.G.A of Gombe state is not an exception as food production and distribution in the area has been hampered with a lot of challenges. Bearing the above scenario in mind, the researchers undertake this study to find out the major constraints that hampered increased food production and distribution in Dukku local government area of Gombe state, Nigeria and to put forward some suggestions that will help in tackling the said challenges for accelerated food production and its distribution.

## Hypothesis
Ho: There is no significant relationship between constraints faced by farmers and food production and distribution in Dukku L.G.A. Gombe state.

## Study Area

Dukku Local government is located between latitude $10^O$ $20'$ $19''$N and $11^O$ $10'$ $14''$N and longitude $10^O$ $30'$ $29''$E and $11^O$ $10'$ $56''$E. It is situated at a distance of about 78km from Gombe, the capital city of Gombe State. Dukku L.G.A is bounded with Bauchi State to the west and north-west, to the north-east by Nafada L.G.A, Funakaye L.G.A to the east and Kwami L.G.A to the south, and finally Akko L.G.A to the south-west. In terms of size, Dukku L.G.A occupies a total land area of about 3,815km$^2$, with a total population of 315,763 (National Population Commission, 2006).
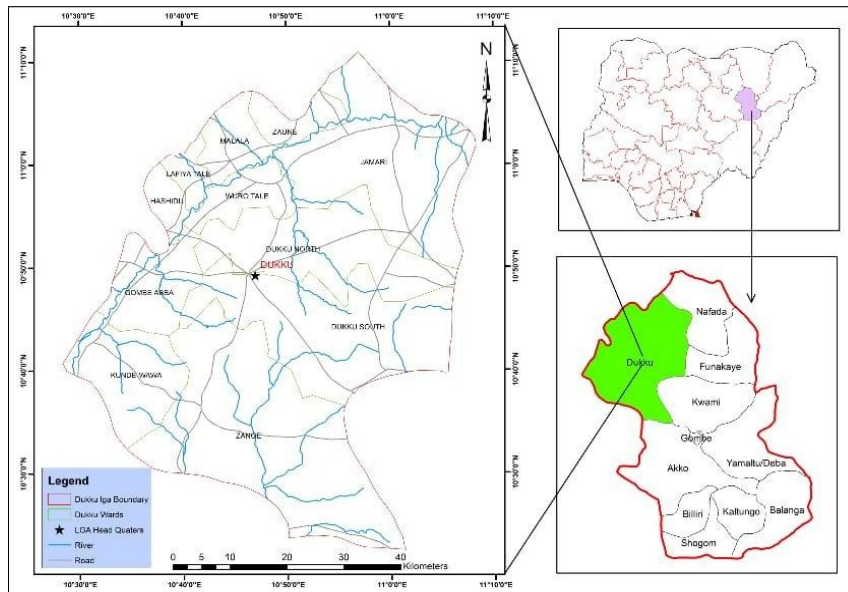


**Figure 1: Study Area**
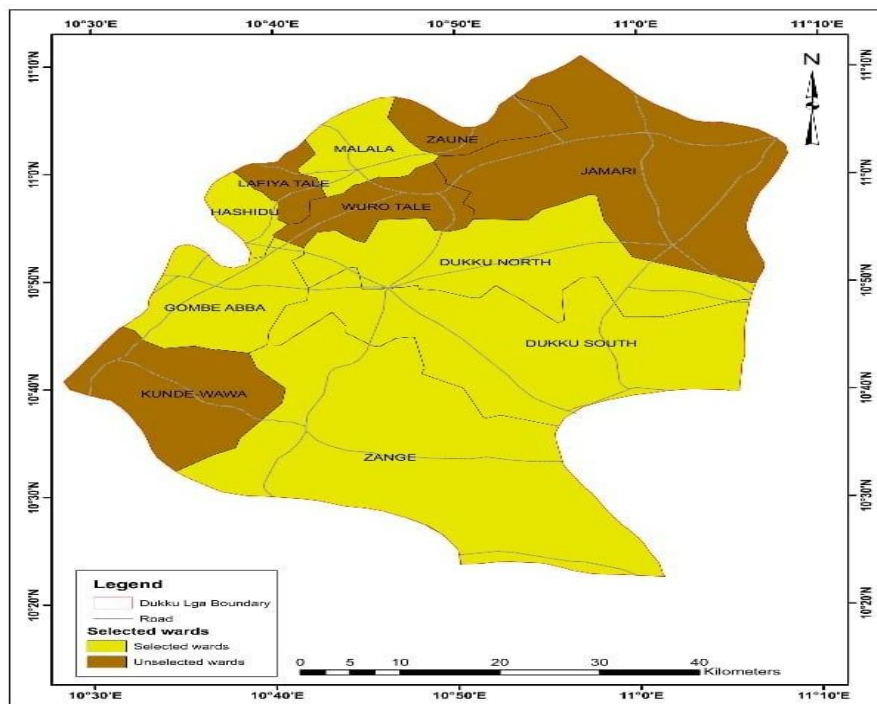**Source: Authors' Work, 2019.**

**Figure 2: Dukku Local Government Area Source: Authors' Work, 2019.**

## MATERIALS AND METHODS

The data for the study was obtained from two main sources: primary and secondary sources. The primary data was collected through the use of a questionnaire, personal interviews and field observation. The secondary information on the other hand was obtained from textbooks, base maps, population figures, published and unpublished articles, information from journals and magazine, previous research work and several internets sources. Systematic sampling technique was adopted to select the households. The first house in each of the neighbourhood identified in a ward was selected in the street, followed by the $10^{th}$, $20^{th}$, $30^{th}$, etc. Where a house was not occupied, the next house in the street automatically became the sample point for consideration. The heads of the households were mostly targeted for the response. The information generated from the respondents was presented in tables and interpreted using statistical tool of simple percentage and analysed qualitatively. Inferential statistical techniques i.e. Chi-square $(x^2)$ was also used to test the research hypothesis postulated using SPSS software. A total

of 150 respondents were drawn from the total number of about 900 households sampled in the study area. The number (150) represents 25% of the total number of the households sampled. Then copies of questionnaires were administered to them. The study is limited to Dukku Local Government Area of Gombe State and based on the six (6) political wards selected. The wards were selected at random out of the eleven (11) wards in the Local Government Area (see Table 1, below).

**Table 1: Sample Size of the Respondents**

| Wards | No. | of | Questionnaire Administered | Percentage (%) |
|---|---|---|---|---|
| 1. | Dukku North | 30 | | 20 |
| 2. | Dukku South | 30 | | 20 |
| 3. | Gombe Abba | 25 | | 17 |
| 4. | Hashidu | 25 | | 17 |
| 5. | Malala | 20 | | 13 |
| 6. | Zange | 20 | | 13 |
| **Total** | **150** | | | **100** |

**Source: Author's Work, 2019.**

## RESULTS AND DISCUSSION
**Constraints to Increased Food Production and Distribution in Dukku Local Government**

In this aspect, the constraints to increased food production and distribution were explored and their effects have been highlighted and explained.

**Table 2: Types of Agricultural practices in the Study Area.**

| Agricultural Type | Frequency | Percentage (%) |
|---|---|---|
| Rain fed | 75 | 50 |
| Irrigated | 59 | 39.3 |
| Both | 16 | 10.7 |
| Total | 150 | 100 |

**Source: Authors' Work, 2019.**

Based on the percentages shown on Table 2, majority of the farmers in the study area engaged in rain fed agriculture (50%), about one-fourth in irrigation agriculture, 10.7% of them engaged in both the rain fed and the irrigation agriculture. Thus, rain fed agriculture, is the most important type of agriculture that is practiced by most of the farmers.

**Table 3: Types of Crops Grown in Rainy Season**

| Type of Crops | Frequency | Percentage (%) |
|---|---|---|
| Maize | 48 | 32 |
| Millet | 21 | 14 |
| G/corn | 3 | 2 |
| Rice | 58 | 38.7 |
| Others | 20 | 13.3 |
| Total | 150 | 100 |

Source: Author's Work, 2019.

Table 3 depicts that 38.7% of the respondents grew rice in rainy season, 32% grew maize, 14% for millet, 2% for Guinea-corn, while 20% grew other crops such as tomatoes, cassava, onions and vegetables. This therefore suggests that many of the farmers in the study area grew rice in the rainy season which is followed by maize. This is perhaps because there were a lot of waterlogged areas around the place

**Tables 4: Crops Grown in Dry Season (Irrigated)**

| Type of Crops | Frequency | Percentage (%) |
|---|---|---|
| Tomato | 16 | 47.3 |
| Onions | 71 | 10.7 |
| Pepper | 24 | 16 |
| Carrot | 11 | 7.3 |
| Others | 28 | 18.7 |
| Total | 150 | 100 |

Source: Authors' Work, 2019.

Table 4 shows that almost half of the respondents grew tomatoes in dry season (by irrigation), 10.7% for onions, 16% went for pepper, 7.3% for carrots, while for other unspecified crops goes 20%. This finding therefore reveals that a great number of the farmers (almost 50%) in the study area preferred to cultivate tomatoes than other types of crops cultivable in the area.

**Table 5: Method of Acquiring the Farm Land by the Respondents**

| Method of Acquiring Farm Land | Frequency | Percentage(%) |
|---|---|---|
| Inheritance | 72 | 48 |
| Purchase | 25 | 16.7 |
| Borrow | 27 | 18 |
| Rent | 26 | 17.3 |
| Total | 150 | 100 |

**Source: Authors' Work, 2019.**

The information in Table 5 above shows that almost half of the respondents acquired their farm lands through inheritance, 16.7% of them through purchase, while 17.3% through rent and 18% through borrowing. Thus, the study reveals that majority of the respondents acquired their farm lands through inheritance, especially from their deceased parents.

**Table 6: Farm Size of the Respondents**

| Farm Size | Frequency | Percentage(%) |
|---|---|---|
| 10-50 meters | 23 | 15.3 |
| 50-100 meters | 45 | 30 |
| 1 hectare and above | 82 | 54.7 |
| **Total** | **150** | **100** |

**Source: Authors' Work, 2019.**

The results in Table 6 show that slightly over half (54.4%) of the respondents' sizes of farm lands are one(1) hectare and above, 30% of them were having 50-100 meters farm sizes, 15.3% had 10-50 meters farm sizes. Thus, the results indicate that majority of the respondent cultivated large area of land sizing 1 hectare and above, and this is attributed to the availability of land in the area that allows diversification and intensification of agricultural activities.

**Tables 7: Number of Farms for Each of the Respondents**

| Number of Farms | Frequency | Percentage |
|---|---|---|
| 1-5 | 84 | 56 |
| 5-10 | 35 | 23.3 |
| Above10 | 31 | 20.7 |
| Total | 150 | 100 |

**Source: Authors' Work, 2019.**

The results presented in Table 7 above show that majority (56%) of the respondents had 1-5 farm plots, 23.3% of them managed with 5-10 farm plots, while 20.7 % had more than ten (10) farm lands. This indicates that majority of the respondents cultivated 5-10 different farm lands. This is an indication that there is abundant farm lands in the study area.
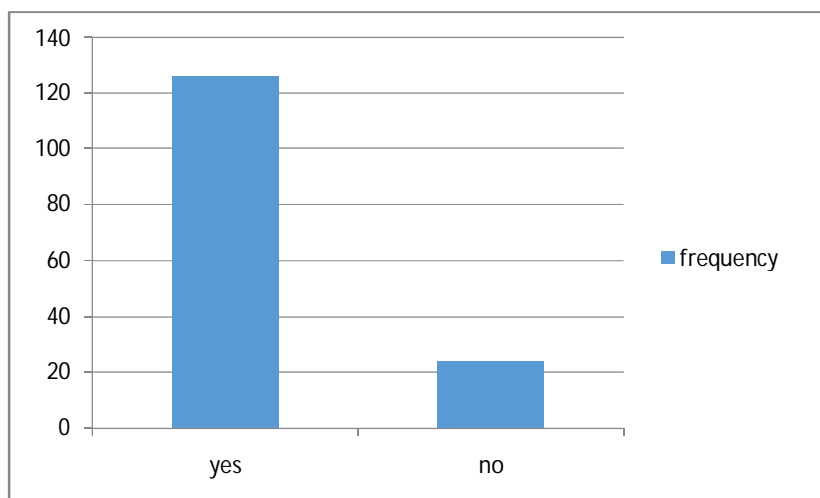


**Figure 3: Problems Encountered During Food Production and Distribution**
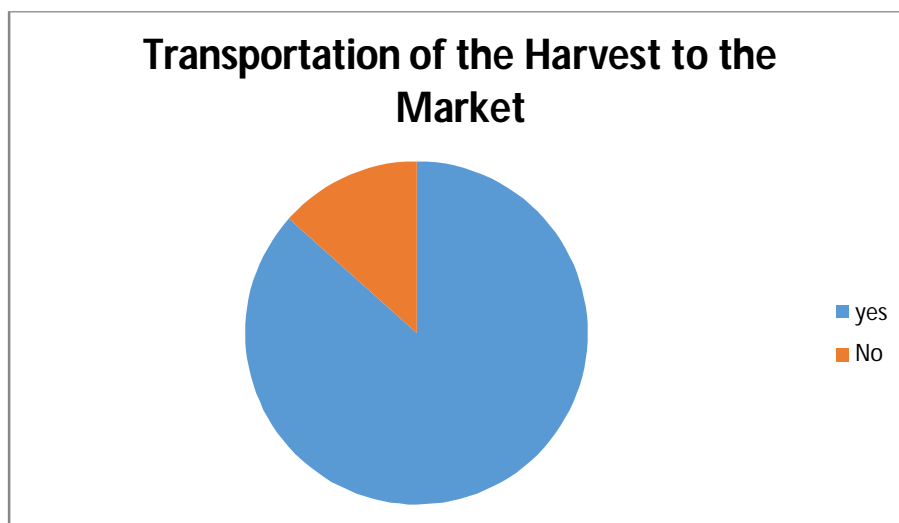**Source: Authors' Work, 2019.**

Fig 3 above indicates that 84% (majority) of the respondents encountered problems in food production and distribution, while only 16% of them did not come across any problem during both food production and distribution in the area under study.

**Table 8: Causes of the Problems Encountered in Food Production and Distribution**

| Problems Encountered | Frequency | Percentage (%) |
|---|---|---|
| Inadequate fertilizer | 64 | 42.7 |
| Lack of access to market | 27 | 18 |
| Lack if insecticide & herbicide | 20 | 13.3 |
| Pest and diseases | 39 | 26 |
| Total | 150 | 100 |

**Source: Authors' Work, 2019.**

Table 8 above shows that many (42.7%) of the respondents indicated that they were ,facing challenges of inadequate fertilizer, 18% of them indicated lack of access to market, while13.3% cried of lack of insecticides and herbicides and 26% of them encountered problem of pests and diseases.



**Fig 4: Transportation of the Harvest to the Market.**
**Source: Authors' Work, 2019.**

From the perception of the respondents on figure 4 shows that 86.7% of the respondents transported their harvest to the market, while13.3% of the respondents don't transport their harvest to the market.

**Table 9: Distance of the Respondents' Farms to the Market**

| Distance | Frequency | Percentage |
|---|---|---|
| 1-4 km | 11 | 7.3 |
| 4-10km | 10 | 6.7 |
| 11-20km | 29 | 19.3 |
| Above 30 km | 54 | 36 |
| Others | 46 | 30.7 |
| Total | 150 | 100 |

**Source: Authors' Work, 2019**

Table 9 above shows that 7.8% of the respondents were 1-4Km away from the market. Distance, 6.7% of the respondents had 4-10 km. 19.3% of the respondents had 11-20 km. 36% of the respondents had above 30 km which transported their harvest into the market in Kano Metropolis, while 30% of the respondents are others that transported their harvest outside the state.

**Table 10: Means of Transferring Produce from the Farm to the Market**

| Means | Frequency | Percentage |
|---|---|---|
| By cart | 16 | 10.7 |
| Truck(pick up) | 106 | |
| | | 70.7 |
| Animals | 20 | |
| | | 13.3 |
| By head | 8 | 5.3 |
| Total | 150 | 100 |

**Source: Authors' Work, 2019.**

Table 10 above indicates that almost three-quarters of the respondents transfered their farm produce to the market by truck (pick up), slightly above one-tenth of the respondents conveyed the produce by cart, 5.3% by head, while 13.3% by animals.

**Table 11: Time Spent to Transport Harvest to the Market**

| Time Spent | Frequency | Percentage |
|---|---|---|
| Less than 5 hours | 117 | 78 |
| 13 hours | 14 | 9.3 |
| 1 day | 7 | 4.7 |
| 3 days | 6 | 4 |
| Others | 6 | 4 |
| Total | 150 | 100 |

**Source: Authors' Work, 2019.**

Table 11 above shows that slightly over three-quarter of the respondents transported their harvests to the market in less than 5 hours, 9.4% of the respondents in 13 hours, 4.7% in one(1) day, 4% in three(3) days, 4% in non specified other periods.

**Table 12: Condition of the Road**

| Condition of the Road | Frequency | Percentage |
|---|---|---|
| Poor | 26 | 17.3 |
| Good | 12 | 8 |
| Fairly good | 103 | 68.7 |
| Very good | 9 | 6 |
| Terrible | 0 | 0 |
| Total | 150 | 100 |

**Source: Authors' Work, 2019.**

Table 12 above indicates that majority (68.7%) of the respondents indicated that the condition of the road in the study area was fairly good, 17.3% indicated poor, 8% of them said the road condition is good, 6% of them said it is very good, while none said it is terrible.

**Table 13: Damages of Farm Produce before or after Transporting to the Market**

| Damages | Frequency | Percentage |
|---|---|---|
| Yes | 127 | 84.7 |
| No | 23 | 15.3 |
| Total | 150 | 100 |

**Source: Authors' Work, 2019.**

Table 13 indicates that majority (84.7%) of the of the respondents recorded damages on farm produce before or after transporting to the market, while only 15.3% of them did not record any.

**Table 14: CausesOf Farm Produce Damages According to the Respondents**

| Cause of the Problem | Frequency | Percentage |
|---|---|---|
| Road condition | 25 | 16.6 |
| Poor storage facilities | 100 | 66.7 |
| Lack of immediate buyers(customers) | 15 | 10 |
| Others (specify) | 1 0 | 6.7 |
| Total | 150 | 100 |

Source: Authors' Work, 2019.

Table 14 above indicates that majority (66.7%) of the respondents indicated poor storage facilities as the problem they encountered, 16.6% indicated poor road condition while, 10% went for lack of immediate buyers (customers) as a problem and other unspecified reasons were 6.7%.

**Table 15: Other Problems Encountered in Food Distribution**

| Problems Encountered | Frequency | Percentage |
|---|---|---|
| Case of arm robbery | 27 | 18 |
| Extortion by security personal on road | 57 | 38 |
| High tax by government | 23 | 15.3 |
| Poor basket and sacks for packing | 18 | 12 |
| Lack of support from government | 25 | 16.7 |
| Total | 150 | 100 |

**Source: Authors' Work, 2019.**

Table 15 above indicates that many (38%) of the respondents encountered the problem of extortion by security personal on road as their other problems of food distribution, 16.7% accounted for lack of support from the government, 18% indicated the case of armed robbery, 15.3% went for high tax by government as a problem while, 12% indicated poorly knitted baskets and sacks for packing as their problem.
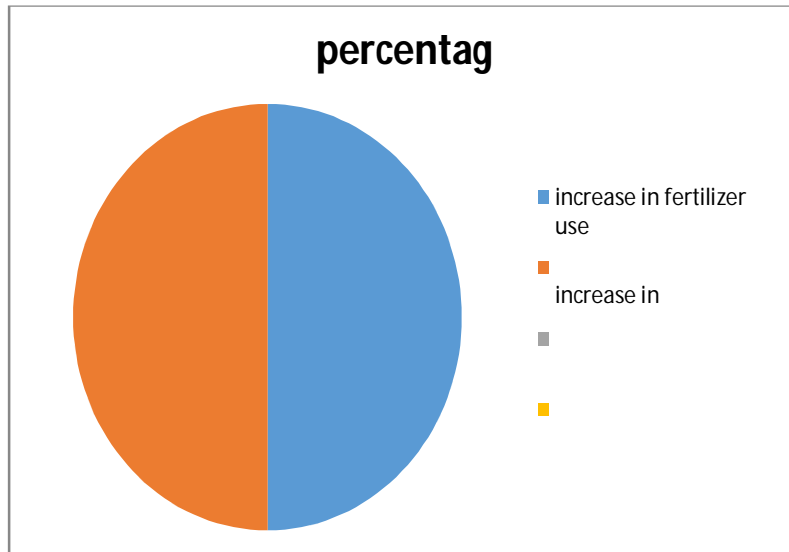
**Fig. 5: Personal Effort of Farmers to Improve Food Production and Distribution**
Source: Authors' Work, 2019.

Figure 5 above indicates that exactly half of the farmers accounted for increase in fertilizer and another half accounted for the increase in transportation facilities as the major effort that they are making to improve food production and distribution in the study area.
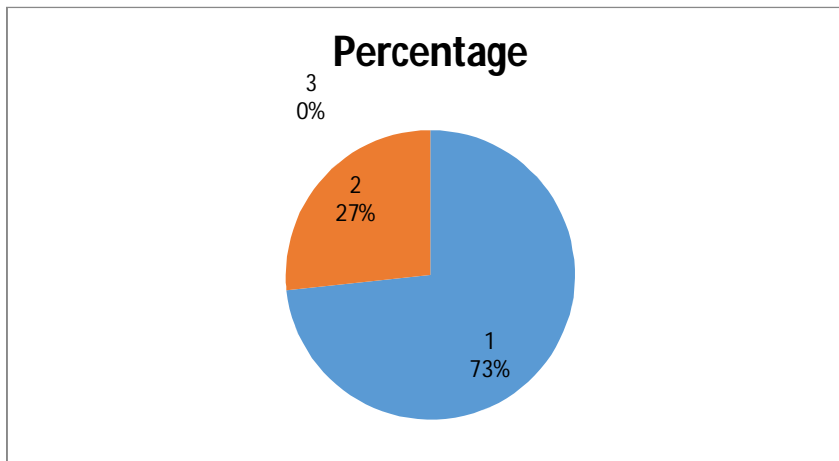


**Fig 6: Support from the Government to Improve Food Production and Distribution**
**Source: Authors' Work, 2019.**

Figure 6 above indicates that majority (73%) of the of the respondents indicated that they were not receiving any support from the government while, 27% of the respondents said they received.

### Testing of the Research Hypothesis
From the introduction part of this research work, the researcher set out a hypothesis to guide the conduct of the research. This section tested the hypothesis earlier formulated.

### Step One: The Hypothesis
Ho: There is no significant relationship between constraints faced by the farmers and food production and distribution in the Study Area.
Question 7 of the questionnaire is chosen for the hypothesis testing.

### Test of Homogeneity of Proportion
Is another chi-square test, sample is selected from several different populations. This kind of test is used to determine whether the proportions of element that have a common property are the same.

**Table 16: Test of Homogeneity Proportion**

| Options | Kosawa | Dan Hassan | Sarkin Kura | Gun Dutse | Karfi | Total |
|---------|--------|------------|-------------|-----------|-------|-------|
| Yes | 24 | 25 | 28 | 29 | 20 | 126 |
| No | 6 | 5 | 2 | 1 | 10 | 24 |
| Total | 30 | 30 | 30 | 30 | 30 | 150 |

### Step Two: Calculation of Level of Significance and Degree of Freedom
X=5%=0.5 D.F= (r-1) (c-1)
= (2-1) (5-1)
= 1x4= 4

Therefore, $X^2$ critical values at 0.5 level of significant is 9.49

### Step Three: Decision Rule (Rule of Thumb)
The decision rule is that if the calculated chi-square is less than the tabulated, the Ho: will be accepted, while if the calculated $x^2$ is greater than the critical tabulated value, the Ho: is rejected.

**Step Four: Test Statistics**

rowsuℕ × coluℕnsuℕ  Grand total
_____

| O | E | O-E | $(O-E)^2$ | $\dfrac{(O-E)^2}{E}$ |
|---|---|---|---|---|
| 24 | 25.2 | -1.2 | 1.44 | 0.0571 |
| 25 | 25.2 | -0.2 | 0.04 | 1.5873 |
| 28 | 25.2 | 2.8 | 7.84 | 0.3111 |
| 29 | 25.2 | 3.8 | 14.44 | 0.5730 |
| 20 | 25.2 | -5.2 | 27.04 | 1.0730 |
| 6 | 4.8 | 1.2 | 1.44 | 0.3 |
| 5 | 4.8 | 0.2 | 0.04 | 8.3333 |
| 2 | 4.8 | -2.8 | 7.84 | 1.6333 |
| 1 | 4.8 | -3.8 | 14.44 | 3.0083 |
| 10 | 4.8 | 5.2 | 27.04 | 2.6333 |
| Total | | | | 19.50 |

**Step Five: Interpretation**

Since the tabulated chi $(x^2)$ is less than the calculated chi $(x^2)$, which is (9.49< 19.50) the Ho (null hypothesis) is hereby rejected and therefore conclude that there is significant evidence of association between constraints faced by the farmers and food production and distribution in the study area Chi square was chose as a statistical technique because; the degree of association between was demanded. Furthermore, the nature of the  data which was collected on the ratio scale permits the choice of the above used.

**CONCLUSION**

The survey reported in this study had identified that the constraints to increased food productivity in the Study area can be quantified and scaled. The inadequate fertilizer use, problems of high cost of human labour, high cost of transportation to the market and lack of funds and access to credit facilities are the major constraints to increased food production and distribution in the study area. Other significant identified constraints are, high yielding seeds, high cost of crop damages resulting from poor storage facilities and poor sales of food stuff due to price fluctuation. All these reduce the incentives that can encourage local farmers to increase productivity in the subsequent farming seasons. Consequently, in order to improve

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