

# Effect of irrigation and drought on agricultural productivity in Kwara State, Nigeria

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**Abstract.** This study analyzed the effect of irrigation and drought on agricultural production and estimated their impact on crops production in Kwara state, Nigeria. A total of 80 farmers were randomly selected in the study area. A well structured questionnaire and interview schedules were used for data collection. Data collection was analyzed using descriptive and inferential statistics. Descriptive statistics used include tables and percentages, while the inferential statistics such as logit regression was used to test the hypothesis in relation to the impact of irrigation and drought on agricultural productivity. The study revealed that many of the farmers (40.8%) were between the age ranges of 51-60 years. It showed that 82.5% of the respondents were female and 51.9% of the respondents were Christian. A percentage of 77.5% respondents were married, 31.3% of them had no formal education, and 49.1% of them had family size between 6-10 members. As much as 53.8% of them had farming as their major occupation. The study further revealed that 49.7% of the farmers used ditch irrigation. The result of the logit regression showed that age of the respondents was statistically significant at 1%, sex was significant at 10%, while household size and total area cultivated were statistically significant at 5% levels respectively. While irrigation increases the yield of crops drought reduces the yield of crops, increases food shortage and decreases the cultivated land area available for agricultural production in the study area.

**Key Words:** effect, irrigation, drought, agricultural productivity.

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## Introduction

Irrigated agriculture is one of the most critical human activities sustaining civilization. The current world population of 6.8 billion people is sustained in a large part by irrigated agriculture. Irrigation has been described as a condition necessary for insufficient rainfall and/or poor distribution of rainfall in agriculture producing area (Punial & Pande 1997).

Similarly, Daniel (1990) observed a dry condition due to evaporative demand of the atmosphere which continuously create stress for plants and therefore require water supplements for the period. Irrigation projects are designed to help reduce the dependence of crops growth on precipitation, which to a large extent is uncontrollable by man. Adoption of irrigation in such areas had ensured improved harvest and encouraged crops diversification.

USDA (2010) statistics showed that 17% of cultivated crops land in the United State is irrigated. Yet this acreage produces nearly 50% of total US crop revenues. According to the FAO, the approximate 1,260 million ha under rain fed agriculture, corresponding to 80% of the world's total cultivated land, supply 60% of the world's food: while the 277 million ha under irrigation, the remaining 20% of land under cultivation, contribute the other 40% of the food supplies. On average, irrigated crops yields are 2.3 times higher than those from rain fed ground. These numbers demonstrate that irrigated agriculture will continue to play an important role as a significant contributor to the world's food supply.

According to Food and Agricultural Organization (FAO 1988), irrigation has put smiles in the face of many people in semi- arid and arid regions where crops productivity without irrigation is inevitable. Irrigation system is aimed at increasing and improving agricultural yield, particularly in semi-arid and arid environment. Worlf (1995) observed that irrigation has made higher and more reliable yield possible as crops can be planted more than once in a year within the tropics, apart from bigger and reliable yield as against yearly cultivation, which is often at the mercy of the seasonal rainfall (S. R. R. B. D. A. 1984).

Doberman *et al* (1996) reported that irrigated rice accounted for 75% (363 million tones) overall rice production in Nigeria in 1990, while Vermilion (2004) reported that 40% of world food and 60% of its grains is produced under irrigation and land under irrigation had increased drastically from 94 million hectares in 1950 to 240 million hectares in 2000. This is expected because of the increase in world population and the need to expand agricultural land under the threat of climate

**Table 1.** Nigeria irrigated land 2002-2005

Year	Area irrigated (hectares)
2002	220, 270
2003	220, 270
2004	185, 000
2005	191, 660

Source: CBN Annual Report, 2006.

change. Nigeria has 2.5million hectares of irrigation farmland but just about 220-270 hectares were cultivated in 2002 (Table 1).

The prospect of irrigation agriculture in transforming the dream of attaining the millennium Development Goals to a reality in Nigeria is high (Oriola 2009). The irregular and erratic rainfall distribution over the country mitigation against efficient agriculture would be overcome. Environmental protection in last decade became an important issue in all hydro-technical projects. Also, implementation of irrigation in agriculture has a high priority in the most countries, Ehui *et al* (1990) and Oriola (2009) recommended that 5 days interval irrigation are placed on submerge irrigation on response of rice varieties in North Iran. Global warning and resulting drought is the most important constraint affecting plant production in the Mediterranean Region. Therefore, effective management of scarce water resources is of paramount importance in this region on yield and quality of tomatoes grown in different soilless media in glasshouse (Dittoh 2009).

However, modern irrigation technology has offered the opportunity to cultivate more land all the year round. So, a model that can adequately propel maximum food productivity, remove hunger from our society, reduce poverty and translate the dream of attaining the high agricultural productivity is presented by MWI (2002).

### Problem Statement

Some 35 years ago precisely in the 70s, Nigeria government gave priority to agriculture. The government introduced the National Food Operation Programme and the Nigerian Agriculture and Cooperative Bank was established to fund agriculture and assist farmers. A number of programmes were put in place such as the farm settlement schemes, the Operation Feed the Nation (O. F. N) and Green Revolution fashioned

in 1976 to revolutionize agricultural sector of Nigeria economy, though declining. Farmers, most especially in the rural areas were taught farming practices and agriculture was made compulsory in all secondary schools to make the programme effective.

In addition, eleven river Basin Development Authorities (R. B. D. A.) were established to facilitate irrigation agriculture as an attempt to expand farmland. As appreciable as all these efforts are not less than 65% of Nigerians are yet food insecure. The World Bank Records (2004) had 325 million people in sub-shara Africa living on less than \$1 per day, there is no doubt that the entire Nigerian farmers are inclusive. Since they live below poverty line, they are plunged into a vicious cycle. The scenario presented above serves as the basis for a pragmatic intervention especially, for irrigation agriculture, which is capable of generating employment and sustain food productivity at the end.

This study therefore aims to analyze the effect of irrigation and drought on agriculture productivity in Kwara State.

The specific objectives are to:

1. Examine the socio-economic characteristics of farmers in the study area.
2. Estimate the impact of irrigation on crop productivity in the study area
3. Estimate the impact of drought on crop productivity in the study area
4. Identify the irrigation method used among the farmers in the study area
5. Identify the problem encountered by the farmers in the use of irrigation.

**Table 3.** Impact of irrigation

Irrigation Impacts	Frequency	Percentage
Decline the crop yield	8	9.9
Increase the crop yield	79	97.5
Stunted crop growth	2	2.5
Food shortage	7	8.6
Food secure	77	95.1
Food price increase	4	4.9
Food price decrease	40	49.4
Others	21	25.9
Impact of drought		
Drought impacts	Frequency	Percentage
Food shortage	40	49.4
Decline in crop yield	61	75.3
Stunted crop growth	76	93.8
Decrease in land area cultivated	15	18.5
Poor quality of crops	34	42
Others	24	4
Irrigation methods applied by the respondents		
Irrigation method	Frequency	Percentage
Ditch irrigation	37	49.7
Terraced irrigation	10	12.3
Drip irrigation	16	20
Sprinkler irrigation	3	3.7
Rotary irrigation	5	6.2
Centre irrigation	9	11.3

Source: Field survey, 2010 \*Multiple Responses

**Table 2.** Socio-economic characteristics of respondents

Characteristics	Frequency	Percentage
Age (year)		
25-40	11	8.4
41-50	32	39.3
51-60	33	40.8
60 above	4	4.8
Total	80	100
Sex		
Male	66	82.5
Female	14	17.5
Total	80	100
Marital status		
Married	62	77.5
Divorced	8	10
Widowed	7	8.8
Single	3	3.7
Total	80	100
Educational level		
Primary	23	28.7
Secondary	21	26.3
Tertiary	11	13.7
No formal education	25	31.3
Total	80	100

Source: Field surveys, 2010

The study hypothesized that, there is no significant relationship between the output and socio-economic characteristics of farmer in the study area.

## Research Methodology

The study began after due approval from the Director and Agricultural officer of Edu Local government area, Pategi, Kwara state where the study was undertaken. All participants involved in the study are farmers. A multi-stage random technique was used to select the farmer. In the first stage, the study area was stratified into 8 cells. The second stage involved random selection of four cells out of the eight cells. The third stage involves random selection of two villages from each cell making a total of 8 villages. The last stage involved random selection of 10 farmers from each village making a total of 80 farmers. This study was carried out in Pategi. It was created from Edu Local Government Area. The population at 1991 census was 45, 494 (22,712 males and 22,782 females). The major towns in the Local government area are: Lade, Kpada, Rogun, Koro, Kusogi and Ariji. The major inhabitants are Nupe people while some are Yoruba and Hausa. Their natural resources are rice, fish, sugar cane, groundnut, millet and melon. It is located approximately on the intersection of latitude 80 441 North and longitude 50 441 East.

### Data Collection and Analysis

The researcher collected data from the sampled farmers with the aid of structured interview scheduled. There were two major variables in the study, that is the dependent and independent variables. The dependent variable is the total farm output in kilogram, while the independent variables are Age, total cost fertilizer (Naira), years of experience, level of education, cost of chemical used (Naira) and farm size in hectares.

The coefficient of multiple determinations (R<sup>2</sup>) was obtained as a measure of goodness of fit. This is the percentage of total variation of dependent variable (Y) explained by the variation in the independent variable (X1- X5). The equation with the high R<sup>2</sup> value explained the variation better and was regarded a better fit. The regression coefficient for the various input used were tested using the test to determine the inputs to which output is highly responsive only those variables whose variable computed t-values were significant at 1%, 5% or 10% were taken to have significantly influenced variation output.

## Result and Discussion

The study revealed that majority of the respondents are still in their productive age: 51-60 years, (40.8%) while 4.8% were above 60 years; it shown that majority of the farmers were male (82.5%) while 17.5% were female and majority of the respondents are Christians (51.9%), only 2.5% were traditionalist by religion. It showed further that 77.5% of the respondents were married and only 3.7% were single. The respondents were purely illiterate without any formal education (31.3%) while only 13.8% had tertiary education (Table 2).

**Table 4.** Problems encountered in the use of irrigation

Problems encountered	Frequency	Percentage
Maintenance	77	95.1
Water availability	40	49.1
Scarcity of irrigation materials	21	25.1
Others	30	37

Source: Field survey, 2010 \*Multiple Responses

The study revealed further a multiple response of the respondents on the impact of irrigation on their agricultural production (Table 3). That 97.5% experienced an increased in their crop yield, 49.5% also claimed that irrigation reduced the food price in the study while 95.1% claimed of the food scarcity. It further showed that 2.5%, 8.6% and 4.9% claimed that irrigation reduced the started growth of their crop, reduced their food shortage and increased food process respectively. The difference in the variation of those impacts could be attributed to level of farm soil fertility.

As it shown in Table 3 there were multiple response on the impact of drought as revealed in the study that 49.4% claimed drought increase the food shortage, 75.3% claimed that irrigation decline their crop yield, 93.8% also claimed drought increase the stunted growth of their crop while 18.5%, 42.0% and 29.6% of the respondents also claimed that drought reduced their land area cultivated, increase the quality of their crops respectively. Variation of the impact of the drought may be attributed to individual's formal level of understanding.

However, the study revealed that the method of irrigation adopted by the respondents as 49.7% used ditch irrigation, 12.3% used terraced irrigation, 20% used drip irrigation while 37%, 6.2% and 11.3% used sprinkler, rotary and centre irrigation respectively. Variation of the impact of the drought may be attributed to individual's formal level of understanding (Table 3).

The study exemplified the problems encountered by the respondents in the use of irrigation as maintenance problem being 95.16%, water availability 49.1% and 25.1% were due to irrigation materials. The variation encountered not withstanding indicated that maintenance problem is effective on the study area (Table 4).

The study showed that age of the respondent is statistically significant at 1% with a coefficient value of 37.86 with a positive sign. Sex is also significant at 10% with a negative sign, which implies if there is any increase gender, there would be great reduction in the output of the farmer. It further showed that household size is statistically significant at 5% with a value of 189.5 with a positive sign while total land area also significant at 5% with a value of 14.4. Household size has the highest coefficient which implies that it existed as the most important factor that greatly determined the output of the farmers in the study area (Table 5).

**Table 5.** Logit regression analysis

Variable	Coefficients	Standard Error	T- ratio
Age	37.86	9.647	3.925***
Sex	-39.69	24.41	-1.626*
Marital Status	-1.166	0.872	-1.338
Household size	189.5	82.36	2.302**
Primary occupation	76.23	126.2	0.604
Total land area	14.4	65.42	2.221**

Log Likelihood= 65.08

Dependent variable = Total farmland

\*\*\* Significant at 1% \*\* Significant at 5% \*significant at 10%

## Conclusion and Recommendation

Several lessons can be drawn from this study. Firstly, irrigation has a tremendous positive effect on the agricultural production as remedy to drought. Provision of irrigation materials with adequate maintenance at subsidized rate is important for the success of the different methods employed by the participants.

The age, sex, household size and total land area had a greater impact on the agricultural production in Pategi, Local Government Area of Kwara State. It concludes that irrigation increase crop yield while drought reduce crop yield, increase food shortage and decrease their land area cultivated for agricultural production.

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