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ECONOMIC ANALYSIS OF THE EFFECTS OF DROUGHT ON MILLET PRODUCTION IN THE DRY LANDS OF KANO STATE

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ABSTRACT

This study examines the relationship between drought and millet yield in the dry land areas of Kano state. The input-output relationship of millet production and farmers coping strategy(s) adopted to cope with the vagary of drought were examine, and the profitability of millet in the study area. Both primary and secondary data were used. Primary data was collected using structured questionnaire administered to 240 randomly sampled millet farmers from purposeful sampled local government areas of kano state as; Ajingi, Danbatta and Gaya local government areas. Rainfall and millet yield data were obtained from The Nigerian Metrological Agency (NIMET) and NEARLS reports from the year 2012 to year 2015, Standardized precipitation index (SPI) was used as drought index using the obtained rainfall data. T-test and descriptive statistics were used to analyze the data. The result showed that there is significant relationship between drought and mille. The research concluded that rainfall, as the primary requirement in millet production is very significant. The study recommended that, Farmers should also be enlightened and encouraged towards optimal utilization of millet farm inputs, and there should be provision of educational facilities and adequate supply of primary inputs such as: seed varieties, chemical fertilizer at subsidized prices. It also recommended that the millet farmers should diversify their sources of income aside agriculture.

Keywords: *Drought on Millet, Production, Dry lands and Kano State*

INTRODUCTION

In the last 40 years, the climate of west African Sahel has shown various changes, especially in terms of rainfall of which inter-annual variability is very high. This has significant consequences for the poor resource farmers, whose income depends mainly on agriculture. The west African Sahel is always known as an area characterized by important interaction between climate variability and key socio-economic sectors such as agriculture and water resources.

Nigeria is divided into six distinct vegetation zones of Coastal Mangrove Swamp Forest, Rain forest, Southern Guinea, Northern Guinea, Sudan and Sahel savannah vegetation zones. The vegetation varies regionally in consonance with the climatic pattern. Drought which is defined as the protracted absence, deficient or poor distribution of precipitation, is one of the anomalies that have plagued the Northern part of Nigeria since the beginning of the 20th century. Drought is as an extended period – a season, a year, or several years– of deficient rainfall relative to the long

term average rainfall for a region. It is the inability of rainfall to meet the Evapo-transpiration demands of crops resulting in general water stress and crop failures. The probability of drought at the on-set and towards the end of the rainy season is usually very high in Northern Nigeria (ICRISAT, 1984; Adeoye, 1986; Tenkouano1997). Dry spells at the beginning of the season usually result in multiple plantings and low or no yields leading to low food security index. In the same vein, end of season drought could bring about water stress at critical periods of need during the reproductive stages of most crops thus resulting in crop failures and shrinking of yields.

Large areas of Northern Nigeria falling within the Sahel and Sudan ecological zones between latitude 9 -14˚N are prone to recurrent droughts in one form or the other (Glantz and Katz, 1977; Apeldoorn, 1981; Adeoye, 1986; Nyong*et al.*, 2007). Infact, the 20th century started in the region with droughts and the resultant famines of 1903 and 1911-1914, respectively (Kolawole, 1987). Other droughts included those of 1919, 1924, 1935, 1951-1954, 1972-1973, 1984-1985, 2007 and 2011 (Apeldoorn, 1978, 1981; Kolawole, 1987; Mortimore, 1989; FME, 2000). Large number of inhabitants of the drought prone areas are smallholder farmers, who depend mostly on the highly variable rainfall for crop cultivation and maintenance of their herds. This paper attempts to look at effects and ways of reducing the risk of drought in Nigeria.

The underlying cause of most drought can be related to changing weather patterns such as low rainfall, reduced clouds cover and greater evaporation rate which are exacerbated by human activities such as deforestation, bush burning, overgrazing and poor cropping methods, which reduced water retention of the soil. The impacts of droughts are mass starvation, famine and cessation of economic activity especially in the area where agriculture is the main- stay of the economy. Drought is the major cause of forced human migration and environmental refugees, deadly conflict over the use of dwindling natural resources, food insecurity and starvation, destruction of critical habitats and loss of biological diversity, socio-economic instability, poverty and climatic variability through reduced carbon sequestration potential.

Dry lands are considered to be areas where annual rainfall is less than the potential moisture losses through evaporation and transpiration. These are mainly areas that are dry for the greater part of the year. According to the world Atlas of desertification (UNEP,1992), dry lands has a ratio of annual average precipitation (p) to potential evaporation and transpiration (PET) of less than 0.65. These areas cover more than 6 billion hectares, or 41.3% of the land surface.

Most of the world's millet area remains under traditional systems. Few farmers apply fertilizer or used improved moisture conservation practices. And that in Sub-Saharan Africa, low rainfall and drought are responsible for insecurity and also constrained the adoption of improved technology. Farmers at the margin of subsistence find it risky to invest in new technology. A growing proportion of farmers however are beginning to adopt new varieties because only a small investment is required to change seed ICRISAT/FAO (1996).

Nigeria is an important millet producing country with an average annual production of 3.4 million tones, about 7.06 metric tons were produced in Nigeria in 2003 (Syngenta Foundation, 2003). The production increased to 4.8 million tons in 2008/2009 cropping seasons (NBS, 2013). It ranks second after India in global millet production. While at the national level it ranks third after maize and sorghum among cereal food crops. It is a staple food throughout the Sahel and in

parts of the Sudan savannah. The crop is therefore very important to the nation's agricultural sector because of their high degree of adaptation to stress environments such as severe drought, poor soil and high temperature are great relief to life in the Sahel (Rai and Kumar, 1994).

The drought prevalence is a characteristic of dry lands and can be defined as periods (1-2 years) where the rainfall is far below the average. Drought preparedness and risk mitigation are essential for proper management of dry land areas. However the FAO (2000) definition of dry land is agro ecological in which they defined those regions classified climatically as arid, semi arid, or dry sub humid, based on the length of the growing period for annual crops.

The dry lands of northern Nigeria fall in the semi arid zone, and have highly seasonal rainfall regimes and a mean rainfall of up to 500mm to 800mm, with an inter annual variability of 25-50 percent. Grazing and cultivation are both vulnerable, and population distribution depends heavily upon water availability (Muharazu, 2014).

Evidence from literature and past studies has revealed that the recent global warming has influenced agricultural productivity leading to declining food production (Kurukuasuriya and Mendelson, 2006; IISD, 2007; Lobell *et al.*,2008).

There is a growing consensus in the scientific literature that in the coming decades the world will witness higher temperatures and changing precipitation levels. The effects of this will lead to low/poor crop yields in many countries (IPCC, 2007; Deressa*et al,* 2008; BNRCC, 2008). This is particularly true in low-income countries, where climate is the primary determinant of agricultural productivity and adaptive capacities are low (SPORE, 2008; Apata*et al*, 2009). Many African countries, which have their economies largely based on weather-sensitive agricultural production systems like Nigeria, are particularly vulnerable to climate change (Dinar *et al*, 2006). This vulnerability has been demonstrated by the devastating effects of the various prolonged droughts that are currently witnessed in some parts of Northern states of Nigeria particularly the more drier areas.

In order to meet the increasing food and non-food needs due to population increase , human now rapidly depleting fertile soils, fossils groundwater, biodiversity, and numerous other non-renewable resources to meet his needs (Abrahamson , 1989;Ehrlich, 1990). This resource depletion was linked with other human pressures on the environment. Possibly the most serious of human impacts is the injection of greenhouse gases into the atmosphere. The reality of the impact of climate change on agricultural development has started showing signs.

Millet is one of the most important crops both in production and consumption in Northern Nigeria where it is mainly produced (Agboola, 1979; CBN, 2002; Abdullahi*et al.*, , 2006). Its production is undermined and yield level is always made uncertain due to occurrence of drought.

Rough estimates suggest that over the next 50 years or so, climate change may likely exert a serious threat to meeting global food needs than other constraints on agricultural systems (IPCC,2007; BNRCC,2008). Specifically, population, income, and economic growth could all affect the severity of climate change impacts in terms of food security, hunger, and nutrition.

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particularly vulnerable to climate change. This vulnerability has been demonstrated by the devastating effects of the various prolonged droughts that are currently witnessed in some parts of Northern States of Nigeria particularly the more drier areas. Food demand in Nigeria has been growing at the rate of 3.5% per annum; food production has been growing at a rate just above 2% per annum in recent years but the annual rate of population growth has been as high as 2.9 percent, thus creating a serious food gap (Baiyegunhi et al., 2010).

In Nigeria, millet market has faced supply constrained challenges and the dwindled production has affected its profitability. Production of millet was reduced because of its associated costs including high labour requirement, limited processing facilities, poor marketing infrastructure, among others which have kept the profitability of the crop not know. It is also not known whether there are other factors that may affect the profitability of millet at farmer level. Understanding the contribution of a crop to the households in terms of food and cash is paramount in decision making especially in determining the allocation of household resources.

These various problems of the effect of climate change in the dry lands particularly drought, left many questions unanswered. Consequently, this study attempts to answer the following questions:

i. what are the socio-economic characteristics of millet farmers in the study area?
ii. What is the effect of drought on the productivity of millet farmers?
iii. What is the cost and return associated with millet production?

The main objective of the study is to examine how drought occasionally affects millet farmers' production and yield in the study area. While the specific objectives are to;

i. describe the socio economic characteristics of the millet farmers in the study area,
ii. determine the effect of drought on the productivity of millet farmers.
iii. Determine the cost and return associated with millet production.

Ho: Drought has positive effect on millet yield.

Hi: Drought has negative effect on millet yield.

While considerable attention has been given to the causes of drought in Nigeria (Ojo and Oyebande, 1987; Asue, 1987; Akeh*et al*., 2002) as well as its consequences (Davies, 1987; Enabor, 1987; Fagbemi, 2002) there is inadequate research to empirically measure the relationship between drought and crop production. Most literature paid emphasis on allocating and distributing adequate resources inputs, investment in research and eliminating the bottlenecks to efficient resources utilization at the farm level. Millet in particular is a major crop grown in most drought-affected part of Nigeria, its importance is reflected in the position it occupies as the most dependable source of food for a large number of people in the environment for which it has a special adaptation. Millet is grown as a large subsistence crop in Nigeria and most of it is used for human consumption (Bressani, 1985).

The probability of drought at the on-set and towards the end of the rainy season is usually very high in the northern Nigeria (ICRISAT, 1984; Adeoye, 1986; Tenkouano et al., 1997). Dry spells at the beginning of the season usually results in multiple plantings and low or no yields leading to low food security index. In the same vein, end of season drought brings about water stress at

critical periods of need during the productive stages of most crops thus resulting in crop failure and shrinking of yields. Large areas of Northern Nigeria falling within the Sahel and Sudan ecological zones between latitude 9-14˚N are prone to recurrent drought in one form or the other (Glantz and Katz, 1977; Apeldoorn, 1981; Adeoye,1986; Nyong et al., 2007). In view of this back ground, this study is designed to quantitatively determine the relationship between drought and millet production in some drier areas of Kano state in an attempt to bridge the drought-millet crop production study in Nigeria.

The existing literature also pays no or limited attention to a quantitative analysis of community level data to investigate millet farmers preferred coping strategy(s), perceived barriers, and policy implications in the event of drought to millet production in the study area. This work is also going to take a quantitative analysis of community level data in investigating the millet farmers' adaptation decision to the event of drought.

EMPIRICAL REVIEW OF LITERATURE ON DROUGHT

Generally speaking, drought has a vast effect on mass starvation, famine and cessation of economic activity especially in areas where rain fell agriculture is the main stay of the rural economy. Forced human migration and environmental refugees, deadly conflicts over the use of dwindling natural resources, food insecurity and starvation, destruction of critical habitats and loss of biological diversity, socio- economic instability, poverty and climatic variability through reduced carbon sequestration potential are common knowledge of the causes of drought, (Apeldoom, 1981)

Several research have been conducted on the effect of drought and they have come to terms that drought especially in Africa and with particular reference to Nigeria assert that several challenges such as the widespread poverty, the fact that Nigeria's economy depend on climate-sensitive sectors mainly rain fed agriculture, poor infrastructure, heavy disease burdens, high dependence on and unsustainable exploitation of natural resources, and conflicts are major reasons why drought often harm the Northern region of Nigeria Mortimore *et al.*,(1981)

Other forms of effect of drought was identified in the work of JibrinMJ (1992) such as low or no crop yields resulting in low food security index; mass famine; death of livestock; low groundwater levels resulting in dry wells (which needed to be dug deeper and deeper to obtain water for drinking); drying of lakes and dams; loss of biodiversity and impoverishment of ecosystem; acute shortage of water for domestic use and for livestock; decline in GDP; migration into urban areas; separation of families; and increased indebtedness. Other identifiedcategories of drought effect includes; on agriculture and food security Van Den *et al.*,(1998).

Pearl millet

Pearl millet is the sixth most important cereal annually cultivated as rain fed crop in arid and semi-arid areas of Africa and the Indian sub-continent (Khairawal, Rai, Andrew and Harrnarayana, 1999; FAO,2007). It is grown in over 40 countries predominantly in Africa and Asia as a staple food grain and source of feed and fodder, fuel and construction material (FAO,2007). The crop is well adapted to some extent to growing areas characterized by drought, low fertility and high temperatures. It could relatively perform better on soils with high salinity

or low pH values. Because of its tolerance to difficult growing conditions, it can be grown where other cereals such as maize or wheat would not survive. Pearl millet responds well to management inputs, therefore it has high potential of becoming an important component of intensive agriculture especially in arid and semi-arid regions (Izge, 2006). India according to ICRISAT report of (2011), is the largest producer of pearl millet in Asia, both in terms of area and production with an average productivity of 930kg/ha. However, yields of pearl millet have over the years decreased.

Pearl millet breeding in West and Central Africa and indeed in Nigeria has concentrated on the development of open-pollinated varieties. Hybrids in Nigeria and elsewhere are likely to have at least 25-30 % grain yield advantages over OPVs and hence a new herculean and costly initiative have been put in place by individuals and Lake Chad Research Institutes in Maiduguri, Nigeria that has a national pearl millet research mandate to develop hybrids adapted to drier regions. Twenty-five OPVs, developed and released by ICRISAT have been adopted by farmers in nine countries in the West and Central African regions including Nigeria. The most popular varieties like SOSAT-C88 and GB 8735 for example have been released in Nigeria for many years back. Limited seed production and distribution has in addition to research progress been a major bottleneck and has slowed the spread of improved cultivars in the region. Within the last two decades, Nigeria has become increasingly important in the production of pearl millet even with the numerous problems involved in its cultivation. Nigeria has moved from the third to the present second largest producer in the world (Aminu, Ajayi, Ikwelle and Anaso, 1998).

Pearl millet improvement programme in Nigeria is concerned with higher yield for human food and this will likely play a major role in easing the world food shortage as population skyrockets. Izge (2006) reports that the purpose for expanding pearl millet production in Nigeria has actually been deliberate to meet the growing demand for food which incidentally depends on the success of research in pearl millet cultivation and hybrid improvement programmes.

Nigeria uses millions of tones of pearl millet as staple food in many homes, especially among the poor predominant in Northern Nigeria (FAO,2007). It is also used in making a popular fried cake known as "masa". Its flour is also used in preparing "tuwo" a thick binding paste, also referred to as "toh" in northern Africa. It contains 18% protein, rich in vitamin B especially niacin, B6 and folic acid. It is fitted for flat bread especially because it lacks gluten. It is an important food across the Sahel. It is particularly the main staple in a large region of northern Nigeria, Niger, Mali and Burkina Faso. It is often ground into flour, rolled into large balls, parboiled, liquefied into a watery paste using fermented milk and then consumed as a beverage. This beverage called "fura" in Hausa or "tukura" in Marghi language is a popular drink in northern Nigeria and southern Niger.

Pearl millet is well-adapted to regions where many numbers of broilers are produced around the world (Radcliffe et al., 2001). It is equal to or better than typical maize-soybean poultry diets for broiler production and can be fed at up to10% of the ration without grinding (Davis, Dale and Ferreira, 2003; Hidalgo, Davis, Dale and Dozier, 2004), thus reducing feed processing costs. Pearl millet grain is at par or even better than maize in poultry diets (French 1948; Singh and Barsaul (1976; Sharma, Sadagopan and Reddy, 1979). Broilers fed on pearl millet rations were heavier and had better feed conversion rate than those fed on maize (Lloyd, 1964), and mixed

maize and sorghum (Sullivan, Douglas, Bond and Andrews,1990). Kumar, Reddy V., Reddy P. and Reddy R. (1991) studied feed efficiency of laying hens and found increased egg size and better feed conversion when pearl millet was substituted for maize at 60 % by weight. Pearl millet grain contains 27 % to 32 % protein, higher concentration of essential amino acids, twice the extract (fat) and higher gross energy than maize (Ejeta, Hansen and Mertz, 1987; Davis, Dale and Ferreira, 2003).

Gross margin as a measure of profitability

Gross margin is defined as the difference between the sales revenue for an enterprise and the variable costs directly associated with the enterprise (Rural Solution SA, 2010 cited in Jimmy, 2013). Previous researchers (Adeyemo et al., 2010; Mohammed et al., 2010) calculated gross margin by subtracting the total variable cost from gross revenue. In such studies, gross margin was assumedto be equal to farm net income because fixed costs were not included (Mohammed et al., 2010).Herbert (2005 cited in Jimmy,2013) noted that gross margin is also a useful tool for comparing performance of activities or predict the performances of alternative activities. Gross margins were therefore used in this study as a measure of profitability of finger millet production in a short run. According to Firth (2002), gross margins should only be compared with figures from farms with similar characteristics and production systems. With this reservation in mind, the comparisons can give a useful indication of the production and economic efficiency of an enterprise.

The gross margin does not measure net profit of an enterprise as it only takes variable costs into account. Therefore, it should be clearly stated that the results obtained in the current study are gross margins and not net profits, even though the former is a good measure of enterprise profitability. Ahmad (2004), in studying the factors affecting the profitability and yield of carrot production in two districts of Punjab included a partial budgeting model that was used to determine profitability of carrot growing. This methodology included a gross margin analysis which was used to determine the costs of various inputs and the profitability of carrot cultivation. According to Ahmad (2004) the gross margin was used because of its accuracy in estimating profit.

Baiyegunhi and Fraser (2009) used gross margin analysis to determine the Profitability of Sole Sorghum Production on Small and Large Scale Farms. Empirical results indicated that the farmers were making profits, given the benefits relative to costs involved in sorghum production on both the small and large scale farms. The authors recommended that farmers should access improved technologies on sorghum production through extension services to fully tap the potential of increasing productivity and farm income. Erbaugh et al., (2008 cited in jimmy,2013) found that farm size, production costs, farm location, interaction between production costs and farm gate price as well as the interaction between the varieties used and fertilizer applied were significant in explaining the observed sorghum gross margins. However, contrary to literature farm size was found to negatively influence the gross margins. Their view on the relationship between farm size and gross margins contrast with findings elsewhere such as those by Ibro, (2008) who found positive relationships between gross margins and farm size. The interaction between Production cost and farm gate price was found to be positive and significant while the farm gate price alone was insignificant. The findings also showed that the variety used, tillage

method, and the application of fertilizer were not significant but the interaction between variety used and fertilizer application was significant and positive.

METHODOLOGY

The main source(s) of data for this study is primary and secondary data respectively. Primary data was collected through a field survey of the selected communities using a specially designed questionnaire with the help of trained enumerators. The questionnaire was designed to capture information on the socio-economic characteristics of the millet farmers in the study area which includes, age, educational status, years of experience, gender, marital status, household size, main occupation, farm land sizes and other needs of the households..The secondary data was sourced from Nigeria metrological Agency (NIMET), rainfall data converted to drought with the used of relevant drought indices, data on millet yield for two years (2012 and 2015) was collected from the National Agricultural Extension Research and Liaison services (NAERLS) national report. This data was be used to compare drought and millet yield for five years to determine the effect of the drought on millet production.

The analytical tools to be used in analysing the objectives of this study would include Descriptive and t-test.

Descriptive statistics such as frequency, simple percentage, mean, minimum and maximum, standard error and standard deviation were used in analysing the data to determine the socio economic characteristics of the millet farmers.

The descriptive approach has briefly been explained below:

Arithmetic Mean: this is the set of scores divided by the total number of the observation. Mean is written mathematically as:

X = ∑Xi = X1 X2 X3 +.....................................Xn..(1)

nn

Where;

X = Arithmetic mean

∑ = Summation

X1= Individual observation

I = 1, 2, 3...............................n

Percentage: this was used in the research to determine the population of respondents to a particular response. Percentage is written mathematically as;

Percentage (%) = X × 100.. (2)

T – Test

T – test was also used to compare the years of drought and years of non drought in terms of the millet production. Standardized precipitation drought index was used to covert rainfall data

collected from NEMITE for year 2012 to 2015 respectively. Yield of millet for the two years was collected from the national report of NAERLS for the years 2012 to 2015

Model Specification

$$\frac{\underline{X_A} - \underline{X_B}}{SX^{-}}$$

Where

X_A=Mean of drought

$\overline{X}_B$=Mean of millet yield

$S\underline{X}$=Standard error

Budget technique

Budget technique (net farm income and gross margin) was used to determine the profitability of millet production in the study area. In profitability assessment, there are two types of cost in production; Fixed and Variable costs. Gross Margin is the difference between Gross farm income (GFI) and the total variable cost (TVC). (Olukosi and Enhabor, 1988).

The farm budget technique model can be specified as:

GM = GFI – TVC

Where;

Net farm income (NFI) = Gross margin (GM) – Total fixed cost (TFC) in Naira

Gross ratio(GR) of the farm; this is a profitability ratio that measures the overall success of the farm. The lower the ratio, the higher the return per naira invested.

Gross ratio (GR) = TFE/GI in Naira

Where;

GR = Gross ratio

TFE = Total farm expenses, and

GFI = Gross farm income

Return on investment (RI); This is defined as gross margin divided by TVC

RI = GM/TVC

Where;

RI = Return on Investment (₦)

GM = Gross Margin (₦)

TVC = Total Variable Cost(₦)

RESULT AND DISCUSSION

Socio Economic Characteristics of the Millet Farmers

Socio economic status is an economics and sociological combined measures of person's working experience and of individuals or family economics and social position in relation to others, based on income, education and occupation. This component presents socio-economic characteristics

of millet farmers. The variables are based on the qualitative and quantitative socio economic variable. The socio economic variables identified in this research include; gender, marital status, level of education, major occupation, age, and household size of the millet farmers. The socio-economic variables are presented in table 2.

Table 2; Socio Economic characteristics of Millet Farmers

Variable	Frequency	Percentage(%)	Minimum	Maximum	Mean	SD
Age						
30-36	18	7.5				
37-43	83	34.6				
44-50	92	38.3				
51-57	30	12.5				
58-64	17	7.1	30	61	46	7.3
		100				
Family Size						
1-10	99	41.2				
11-20	129	53.8				
21-30	6	2.5				
31-40	3	1.2				
41-50	3	1.2	2	50	13	6.5
		100				
Farm Size						
0.1-0.58	32	13.3				
0.59-1.07	57	23.8				
1.08-1.56	38	15.8				
1.57-2.05	75	31.2				
2.06-2.54	38	15.8	0.1	2.5	2.07	2.31
		100				
Gender						
Male	240	100				
Marital Status						
Married	240	100				
Educational Status						
Informal	126	52.5				
Primary Education	55	22.9				
Secondary Education	19	12.1				
Tertiary Education	19	12.1				

Source: Field Survey 2016

Gender

Gender is defined by FAO as "the relations between men and women both perceptual and material. It is a central organizing principle of societies, and often governs the processes of production and reproduction, consumption and distribution" (FAO, 1997). Gender is an important factor as per as family head is concern. Table 2 indicated that millet production in the study area is dominated by male, this can be seen clearly as 100% of the total millet farmer respondents are male non was a female, this is to show that even if there are female millet farmers, they are insignificant which reflect in the fact that is the male gender(head of the family) that shoulder the responsibility of catering for all the need of the family, which is also a reflection of tradition, culture and norms of most societies, which is in consonance with the findings of; M.S.Sadiq, M.T.Yakasai, M.M.Ahmad, T.Y.Lapkene and Mohammed Abubakar (2013), that women are actively engage in farming but only in their husband's farms.

Marital status of the millet farmers

This referred to the fact whether the millet farmer is single or married. Table 2 present marital status of the millet farmers, and it shows that all of the millet farmers responded were married (100%) this shows that married couple shoulder many responsibilities which compels them to participate actively in deferent economic activities specifically farming in the study area, and that people marry at early ages in the study area which is closely related to the findings of; M.S.Sadiq, M.T.Yakasai, M.M.Ahmad, T.Y.Lapkene and Mohammed Abubakar (2013)

Educational status

The level of education of the respondent determines the level at which the head of the household is informed. The result presented in table 2 shows that 22.9% of the millet farmers acquired primary education, the millet farmers that acquired secondary and tertiary education have 21% each and the majority of the respondents which has 52.5 acquired only the Islamic (informal education). This clearly shows that it is the reason why most of the farmers marry at early ages simply because it does not take many years to complete Qur'anic education compared to the formal education. This low level of western education of the farmers makes it difficult for the farmers to acquire modern techniques of coping with drought, which related to the findings of; Barrett C.B, F Aboud, A.A (2002), that formal education may enhance or at least signify latent managerial ability and greater cognitive capacity in the acquisition of new technology which is in contrast with most of the coping strategies adopted by the millet farmers in the study area.

Age of the millet farmer

Table 2 reveal that the minimum age is 30 years and the maximum is 61 years, farmers that are within the age range of 30-36 covered 7.5% , which is 18 of the total millet farmer respondents in the study area, the result also reveal that the farmers that are within the age range of 37-43 years are 83 (34.6%) of the total millet farmer respondent and, 2 (38.3%) of the millet farmer respondents are within the age range of 44-50, 30 (12.5%) of the millet farmers are within the age range of 51-57, and the remaining 7.1 % are within the age ranges of 58-64.This show that most of the millet farmers in most community are young still strong and active for farming activities. This is related to the definition of FAO (2008) that those that are within the age ranges of (19-49) are economically productive in a population.

House hold size

Table 2 reveals that those that have family members from 1-10 are 40.4%, while those with family size of between 11-20 are 54.6% between 21-30 (2.5%), and between 31- 40 (1.3%), and those that have family size range of 41-50 are also 3 (1.2%). This shows that those that have 11-20 are the majority and produce more because of high needs of the family members and they even incurs low cost in production because the more the family size, the less the cost of production because family labour is by far cheaper than hired labour. Family size to a greater extent determines the level of millet productivity of the farmers, and also their capacity to adopt better coping strategies, and this is also related to the findings of ; Kehinde (2011) who posited that large house hold size increases the farmer's tendency to adopt new technology.

Farm Size

Table 2 also revealed that millet farmers that have the farm sizes of between 0.1-0.58 ha are 32(13.3%) of the total 240 millet farmer respondents, 57(23.8%) out of the total millet respondent has farm that has the size of between 0.59-1.07/ha, (15.8%) which is 38 of the total farmer respondents owned farms that are within the sizes of 1.08-1.56, and also 75 (31.2%) of the total millet farmer respondents have the farm size ranges of between 1.57-2.05 ha, the remaining 38(15.8%) of the millet farmer respondents have farm size of between 2.06-2.54ha. The result shows that about 100% of the total millet farmer respondent are small farmer holders who produce mainly for sale and consumption.

Table4 Relationship between Drought and Milled Production

Year	2012	2013	Total	2013	2014	Total	2014	2015	Total
Total rainfall (mm)	1774.7	923.2		923.2	1376		1376	899.3	
SPI Drought index (A)	1.96	-0.47	1.49	-0.47	0.82	0.35	0.82	-0.54	0.28
Millet yield (B) tonn/ha	128.43	69.07	197.5	69.07	95	164.07	95	100	195
X (A-B)	126.47	68.6	195.07	68.6	-94.18	25.58	-94.18	100.54	6.36
X2	15994.66	4705.9	20700.62	4705.9	8869.8	13575.8	8869.8	10108.3	18978.2
T-calculated	2.9958			0.9893			1.4547		
T-tabulated	0.4986			0.3365			0.4265		

Source; NIMATE AND NEARLS

Decision rule;

T cal> t tab significant

T cal< t tab not significant

SPI(Standardized Precipitation Index);

The higher the index, the lower the drought level

The lower the index, the higher the drought level

Test of hypothesis

Ho: There significant relationship between drought and millet yield.

Hi: There is no significant relationship between drought and millet yield.

From the result in table 4, for the years 2012/2013, t-calculated (2.9958) is greater than t-tabulated (0.4986), and in the years 2013/2014, t-calculated (0.9893) is greater than the t-tabulated (0.3365). So also in the years 2014/2015, t-calculated (1.4547) is greater than the t-tabulated(0.4265). Based on the decision rule, if t calculated > t tabulated, it is significant indicate a significant relationship between drought and millet yield, that is a change in the drought leads to change in millet yield which is seen in all the set of years 2012/2013, 2013/2014, and 2014/2015 are all significant because t-calculated > t-tabulated in all the set of years. Null hypothesis (Hi) is accepted and alternative hypothesis (Hi) is rejected as the table presented the drought indices in year 2012 was higher indicating increase in wetness and correspondingly high millet relative yield contrary to year 2013 where the SPI indices was low indicating decrease in wetness and decrease in millet yield from 128.43 to 69.0 tonnes. Drought indices in the year 2013 was lower indicating a decrease in wetness and corresponding lower millet yield relative to the year2014 with higher drought indices indicating increase in wetness and increase in millet yield from 69.07 tonnes in 2013 to 95 tonnes in the year 2014. But in the years 2014/2015, even though the result shows significant relationship between the drought and millet yield, the drought indices decrease in the year 2015 but with a bid increase in the millet yield from 95 tonnes in 2014 to 100 tonnes in the year 2015. This may be caused by factors like, rainfall variation and or insects in the year 2014. This is related to the finding of; Teklu T. *et.al* (1991), that as rainfall increases, millet production increases as well.

Cost and Returns associated with Millet Production

Millet farming may not be for the purpose of only satisfying the household food needs and subsistence. The farmers may be interested in selling their output to raise income. Thus, the farmers like any other entrepreneurs need to know the profitability of their production activities.

Table 6: Cost and Returns associated with Millet Production

Cost items	Quantity/ha	Unit price(₦)/ha	Cost (₦)/ha	% of total cost
Variable cost				
Seeds (kg)	24kg	88	1,760	2.36
Fertilizer NPK (kg)	58kg	310.35	18,000	24.15
Organic fertilizer manure(kg)	2310.8	5.794	13,389	17.95
Cost of material inputs			33,149	44.46
Labour input (m/d)				
Land preparation	9	250	2,250	3.02
Planting	9	250	2,250	3.02
First weeding	25	500	12,500	16.77
Second weeding	25	500	12,500	16.77

Harvesting	15	350	5,250	7.04
Fertilizer application	9	250	2,250	3.02
Transportation		4,400	4,400	5.90
Total labour input			41,400	55.54
Total variable cost			74,549	
Returns				
Gross farm income (GFI)	1050kg	88	92,400	
Gross margin (GM)			17,851	
Return on naira invested (RI)			0.23	
Gross ratio (GR)			0.80	

Source: field survey, 2016.

Table 6 gives the analysis of the cost incurred on variable inputs like seeds, fertilizer, labour and transportation cost. The production factors were valued at the prevailing market price at the period under consideration, (2015/2016 farming seasons) respectively. The average rate of labour prevailing in the study area in the year 2016 was between, ₦ 250, ₦ 350 and ₦ 500 per man-day, depending on the farm operation. While millet yield was valued at the average price that the millet farmers received at lowest

Labour cost account for about 55.54% which was ₦41,400 of the total cost of production, covering the cost of farm clearing, planting, first weeding, second weeding and harvesting, and also cost of transportation. Total cost accounted for ₦74,549. On the average, it cost ₦74,549 to cultivate one hectare of millet farm. Gross margin (GM) is ₦ 17,851 which indicate that millet farming is not much profitable which may be due to lack of mechanization and or subsistence nature of most of the millet farmers. Gross ratio (GR) of the millet production is 0.80 equally indicated that millet production even though not highly profitable, but is relatively profitable. This result agreed with the findings of Ogaji (2010), who stated that the lower the Gross ratio, the higher the profitability of the farm enterprise and vice versa. Given the magnitude of this ratio, it can be adjudged that millet production at farm level is relatively a profitable venture in the study area. The average rate of return (defined as the gross margin per hectare divided by total cost of production per hectare and multiply by 100) was found to be 23 per cent, implying that small scale millet farmers in the study area realize a profit of about ₦ 0.23 for every one Naira invested, which is 23 kobo for every 100 kobo invested.

CONCLUSION

Many African countries, which have their economies largely based on weather-sensitive agricultural production systems like Nigeria, are particularly vulnerable to climate change (Dinar *et al*, 2006). This vulnerability has been demonstrated by the devastating effects of the various prolonged droughts that are currently witnessed in some parts of northern region particularly the more drier ones.

The study concluded that drought play a very important role in the production of millet, because t-calculated is greater than t-tabulated, drought, as the number one primary requirements has

significant impact of change in millet yield. The study however concluded that most millet farmers have working experience of many years which makes it easier for the farmers to device different means such as improved seeds, early weeding, thinning etc to cope with the drought incidence. It has also been concluded that most of the millet farmers are male and married shouldering responsibilities of catering for all the family needs. **RECOMMENDATIONS**
Based on the findings of this research, the following policy recommendations are made;

1. There should be provision of improved rural infrastructure specifically good road network to facilitate easy access to market for the millet product and sources of millet inputs such as seeds, and fertilizer for the millet farmers in the study area.
2. There is also the need to improve technology such as: moisture conservation practices, fertilizer, high yield, drought tolerant, and early maturing millet seeds varieties, through the establishment of farm service and seeds supply centres in strategic places of the study area so as to alleviate to greater extent the effect of drought on the millet yield and boost millet production in the study area.

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