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Analysis of Variance on Groundnut Production in Bauchi State

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Abstract

This study assesses the application of analysis of variance (ANOVA) on groundnut production in Bauchi State. The study adopted descriptive and correlation research design. Data for the study was collected from Bauchi State Agricultural Development Program (BSADP) for period of four years (2014 – 2017). The data was analysed using descriptive statistics, ANOVA and regression techniques. The result of the analysis reveals that there is no significant difference between the mean production weights of groundnut for the past four years, there is significance difference between the mean production weights of groundnut within the twenty local governments in the State. The study recommends that government should encourage the production of groundnut by providing fertilizers, herbicide and other material needed for its production.

Keywords: *ANOVA, Regression Analysis and descriptive statistics.*

Introduction

Groundnut (*Arachis hypogaea L.*), a species in the family *leguminasea*, is an annual legume. It is known by many local names, including peanut, earthnut, monkey-nut and goobers. The groundnut originated in Latin America and was introduced to African continent from Brazil by the Portuguese in the 16th century (Abalu & Etuk, 2001; Adinya, Enun, & Ijoma, 2010; Hamidu, Kuli, & Mohammed, 2007). The crop is mainly grown for oilseed, food, and animal feed (Pande *et al.*, 2003; Upadhyaya *et al.*, 2006). It is the world's 13th most important food crop, 4th most important source of edible oil and 3rd most important source of vegetable protein (Taru, Kyagya, Mshelia, & Adebayo, 2010).

Groundnut seeds, known as kernels, contain 40-50% fats, 20-50% protein and 10-20 % carbohydrates (Sorrensen *et al.,* 2004). They are a nutritional source of vitamin E and other minerals for human health including niacin, falacin, calcium, phosphorus, magnesium, zinc, iron, riboflavin, thiamine and potassium. Groundnut is useful in the treatment of haemophilia, can cure stomatitis and prevent diarrhoea, and is beneficial for pregnant women, nursing mothers and growing children (Akobundu, 1998). The kernels can be eaten raw, roasted or boiled and the groundnut vines are used as fodder for cattle (Pompeu, 2009). The crop can be used for producing industrial materials, such as oil-cakes and fertilizer. Extracted oil from the kernel is used as culinary oil and other crop extracts are used as animal feeds (Nigam & Lenné, 2006). Almost every part of the crop is used in some way. The multiple uses of the groundnut plant make it an important food and cash crop for domestic consumption and export in many developing and developed countries. Globally, 50% of total groundnut production is used for oil extraction, 37% for confectionery use and 12% for seed (Taru *et al.,* 2010). Groundnut is grown in nearly 100 countries. Globally, it is grown on almost 23.95 million hectares with total production of 36.45 million tons and an average yield of 1,520 kg/acre in 2009 (FAOSTAT, 2011). China, India, Indonesia, Nigeria, Senegal, Sudan, USA and Myanmar are the major groundnut growing countries (Taru *et al.*, 2010; FAOSTAT, 2011). Developing countries in Asia, Africa and South America account for over 97% of world groundnut cultivation and 95% of total production. Production is concentrated in Asia with 50% of global cultivation and 64% of global production. In Africa, groundnut production accounts for 46% of global cultivation and 28% of global production. Between 2000 and 2009, the annual global production increased marginally by 0.4%, the area cultivated by 0.3% and yield by 0.1% (ICRISAT, 2012; Pound & Phiri, 2010). In 2011, Tanzania accounted for 2.9% of the global area for groundnut cultivation and produced 1.7% of global production. The most important growing regions in Tanzania include Mtwara, Tabora, Shinyanga, Kigoma, Dodoma and Mwanza.

While groundnut production is considered a profitable venture (Adinya *et al*., 2010; Taru *et al*., 2010; Taru *et al*., 2008), the total world production of groundnut with shells has not increased much. Global production increased from 35,880,941 tonnes in 2001 to 38,614,053 tonnes in 2011 (FAOSTAT, 2011). Groundnut in African countries, such as Nigeria, is grown at a small-scale level and with less application of modern inputs (Taru *et al*., 2010). For example, during the previous decade, groundnut production in Nigeria has not exceeded 8% of the world output (ITC, 2011).

According to FAOST (2011), groundnut production in Africa in 2011 was 9,435,493 tonnes with Nigeria producing 1, 264kg/acre. Yields in Tanzania are also lower compared with other African countries. For example, in 2011, groundnut yield in shell was 964.7 kg/acre in Tanzania compared with Tanzania producing 651,397 tonnes and 1,724 kg/acre in Guinea-Bissau (FAOSTAT, 2011). Hitherto, the annual yield per hectare in Tanzania has not increased substantially. However, factors associated with low groundnut yields in Bauchi State Nigeria are neither known nor well documented.

Statement of the problem

Available data and experience indicate that Bauchi State is experiencing a sharp decline in the overall production of groundnut. Yields range between 500 and 600 kg/acre compared with a potential yield of 1,000 kg/acre. This declining trend was noted in 2008 data of the Food and Agricultural Organization.

The traditionally-grown *Mamboleo* variety of groundnut, which was introduced in the 1960s, has a lower yield compared with improved varieties. As a result, farmers have been forced to abandon it (Bucheyeki *et al*., 2008). Bucheyeki *et al.* (2010) conducted a study to address this problem. Two varieties, *Pendo* and *Johari*, were identified by respondents as high-yielding and possessed preferred traits. Famers identified 10 traits for evaluation of groundnut varieties. These traits were good taste, short cooking time, large seed size, early maturity, high market demand, high yielding, insect-pest resistance, high oil content good peanut butter and disease resistance. Overall farmers' evaluation ranked Pendo and Johari as first and second respectively. These varieties were recommended to farmers in the region so as to improve yield. However, no studies have focused on the socio-economic factors that might be contributing to low yields. Efforts to improve groundnut production also need to address socio-economic constraints in growing areas. Therefore, this study seeks to identify socio-economic factors that contribute to low yields and stagnation of groundnut production in Nigeria with evidence from Bauchi state.

Aim and objectives

The aim of this study was to identify socio-economic factors limiting the groundnut production in the study area. The specific objectives are:

1. To examine whether there is difference between the mean production weight of groundnut for the past four years (2014 – 2017) in Bauchi State

2. To find out whether there is significance difference between the mean areas cultivated for groundnut production within the twenty LGA in Bauchi State.

Research Hypotheses

To achieve the research objectives, the following hypotheses were tested at 0.05 level of significant

Hypothesis One

H_0: There is no significance difference between the mean production weights of groundnut for the past four years in Bauchi State.

H_1: There is significance difference between the mean production weights of groundnut in Bauchi State.

Hypothesis Two

H_0: There is no significant difference between the mean areas cultivated within the Local Government in the State.

H_1: There is significant difference between the mean areas cultivated within the Local Government in the State.

Significance of the Study

The result of this study will be of benefit to the agricultural sector (commercial and peasant farmers), and the nation at large will tap the best out of crop yields, for socio economic development and to meet consumers' needs. It is hoped that through this, farmers would be assisted to make the best out of crops and land, which is available at their disposal to save time, energy, resources and money, at the same time produce an output that is worthwhile and can be used for both present and future use.

Also, this research work will help in educating poor farmers on how to increase yield of groundnut being cultivated and to satisfy the growing demand of groundnut. Lastly, this study will add to the body of existing literatures to the same or related topic.

Literature review

The production of groundnut in Nigeria started around 1912. This was in response to the high world prices. Since then, Nigeria was prominent among world producers. In the fifties and fifties, Nigeria was among the leading exporters of groundnut. It took the lead as the largest producer and exporter of groundnut in the sixties with a production of 500,000 metric tons a year (Purseglove, 1968). Nigeria reached a peak production of 1.6 million metric tons in 1973. But production fell by almost half the 1973 figure, in less than a decade, due to a combination of two important factors. First, the drought of 1974/75 growing season, which brought with it aphid infestation, wiped more than 750,000 hectares of groundnut fields. This brought tremendous loss to both farmers and merchants. Second is the coincidence of oil boom in Nigeria about the same time (Ntare et-al, 2005). The loss from groundnut and the availability of oil money transformed groundnut merchants to government contractors. Government on its part equally shifted its attention from agriculture, as a whole, to the oil industry.

The crushing down of oil prices in the eighties reduced government revenue from oil and forced to adopt stringent measures. One of the prominent measures was the Structural Adjustment Programme which led to the dismantling of commodity marketing boards including groundnut. Since the liberalization, groundnut marketing structures have been dismantled and the private sector has taken over. This left farmers without assured and ready markets and or prices. Farmers adopted different strategies to cope with the situation. One of the strategies was shifting from groundnut to other crops. This had major effect on the production of the crop. But recent evidence showed that groundnut production in Nigeria is picking up again.

The theoretical framework underlying this study borrows insights and empirical contributions from the Farm Household Production Theories, which were cogently re-examined by Mendola (2007). The author pointed out that peasants with access to a piece of land mainly utilize family labour in farm production. According to Ellis (1992), peasants are fundamentally characterized by partial engagement in markets, which are often imperfect or incomplete. On the other hand, Mendola (2007) maintains that, peasants are located in large dominant economic and political systems that can affect production behaviour. Furthermore, Hunt (1991) as cited in Mendola (2007) identified peasant farms as being units for both production and consumption, implying that a proportion of produce is sold to meet their cash requirements and a part is consumed. In this context, Mendola (2007) emphasised that these units involve a variety of market and non-markets tasks, such as agriculture, pastoralism, fishing, crafts, and gathering of fruits, nuts, fuel-wood and water. The author further noted that peasant farmers typically work within developing markets that function sporadically and somewhat disconnectedly across locations and time.

Taylor and Adelman (2003) identified the classic economic models that incorporate household consumption goals into micro-economic models of peasant households' decision-making as 'agricultural-household' models – that is, they identify them as 'consumption and production' units, in both perfect and incomplete market contexts. This means that the typical Cobb-Douglas production function, which assumes constant returns to scale, based on restrictive assumptions of perfect competition in both factor and product markets, and is inadequate to explain reasons for smallholder production behaviour. In this way, Cobb-Douglas production function is equally inadequate to provide answers for the study objectives.

Bucheyeki *et al.* (2008) conducted on-farm evaluation of promising groundnut varieties for adaptation and adoption in Tanzania. The study revealed that *Pendo* (1,444 kg/acre) and *Johari* (1,163 kg/acre) out yielded other varieties. Statistically, the sum of squares for genotypes and environments accounted for the most of the variability in yield, contributing 38% and 33% respectively. *Mamboleo* and *Sawia* varieties showed high genotype and environmental stability. Farmers and researchers ranked *Pendo* and *Johari* as the most preferred genotypes and the best varieties. In another study, Bucheyeki *et al.* (2010) identified drought and low-yielding varieties as the most serious problems in Tabora. The study also revealed that researchers' and farmers' variety selection criteria coincided. Based on the information generated by the study, *Pendo* and *Johari* were recommended.

Wabbi (2002) assessed factors affecting adoption of agricultural technologies in Kumi district, Eastern Uganda. The study revealed that farmers' participation in on-farm trial demonstrations, accessing agricultural knowledge through research, and prior participation in pest management training were associated with increased adoption of most Integrated Pest Management (IPM) practices. The size of a farmer's land holdings did not affect IPM adoption, suggesting that IPM technologies were mostly scale neutral, that is, IPM dissemination may take place regardless of farmer's scale of operation. According to Singh *et al.* (2008), farmers' perceptions of the harmful effects of chemicals did not influence farmers' decisions regarding IPM technology adoption, despite their high knowledge of this issue, suggesting that these farmers did not consider socio-economic, environmental or health impacts as important factors when choosing farming practices. Farmers' managerial capabilities were not important in explaining cowpea IPM technology adoption.

Mugisha *et al.* (2004) in their study on the adoption of IPM groundnut production technologies in Eastern Uganda revealed that adoption was significantly influenced by education, family size, membership of associations, extension visits, access to credit, and household income. A descriptive analysis indicated that lack of seeds, limited information about technologies; costly chemicals, labour intensiveness, and lack of land were reasons for non-adoption.

A study by Kimmins *et al.* (1999) proved that in many Sub-Saharan African (SSA) countries, women were predominantly growing and managing groundnut crops. Therefore, cultivation of the crop had a direct bearing on the overall economic, financial and nutritional status of women and children in the household. According to the authors, other factors that contributed to declining groundnut production were drought, disease epidemics and climatic variability.

Ramadhani *et al*. (2002) noted that despite the importance of groundnut in Tanzania, yields are still low. For the past 10 years, groundnut production has experienced two production patterns with relatively high yields of about 600 and 500 kg/acre. The reasons for low yields in the country are still not well understood. Therefore, the current paper documents an analysis of groundnut production in Nigeria based on evidence from Bauchi State.

The empirical studies reviewed above show that most scholars have concentrated on researching agricultural technology, groundnut diseases, groundnut varieties, and the climatic factors hindering groundnut production as well as the contribution of groundnut to household income for poverty reduction. Research efforts have paid little attention to the socio-economic factors limiting groundnut production among smallholder farmers. This study seeks to reduce this knowledge gap by examining the socio-economic circumstances facing smallholder groundnut farmers in Bauchi State.

Research Design

A research design is a procedural plan that is adopted by the researcher to answer questions validly, objectively, accurately and economically (Kumar, 2011). The study adopted descriptive and correlation research design. This design will be used because it is convenient and reliable and it helps to reach many people in the target population. According to Kothari (2004), descriptive research takes accuracy as a consideration which minimizes bias and maximizes reliability of the evidence collected. The data used for this study was sourced from Bauchi State agricultural Development program (BSADP) for the period of four years. That is, from 2014 – 2017.

Table 1.0: Analysis of Variance (ANOVA)

In one factor experiment, measurement (or observation) are obtained for *X* independent groups of samples, where the number of measurements in each group is *Y*. we speak of *X* treatments, each of which has *Y* repetition or *Y* replications. The result of one factors experiment (one way ANOVA can be presented in table having X rows and Y columns as shown in the table below

Variation	***DF***	***Mean Square***	***F***
Between treatment	*a-1*	$\hat{S}_B^2 = \frac{V_B}{a-1}$	$\frac{\hat{S}_B^2}{\hat{S}_w^2}$ With a -1 and N-1 Degrees of freedom
Within treatment	*a(b-1)*	$\hat{S}_w^2 = \frac{V_w}{N-a}$	
Total	*ab-1*		

Where

$$V = \sum_{j.k}\left(x_{jk} - \bar{x}\right)^2$$

$V_B = \sum_{j.k}(x_{j.} - \bar{x})^2$
$V_W = V - V_B$

Duncan's Multiple Range Test

After the null hypothesis of equality of treatment means has been rejected and we have concluded that at least, one treatment mean is significantly different from others, we conduct a further test to compare the treatment means and observe (or select) the means that contributed to the rejection of the null hypothesis H_0.

A widely used procedure for pair wise comparison of treatment means is the Duncan's multiple range test (DMRT) developed by Duncan in 1955.

Cramer and Swanson (1973) is an extensive as comparison of these and other test procedures shows that Duncan's test is superior to Newmankenl's test in detecting true differences between pairs of means.

The standard error of each average is obtained by

$$S_{\bar{y}_{i.}} = \sqrt{\frac{MS_E}{\Upsilon}}$$

Where MS_E is the mean square error and Υ is the number of replicates.

Next the values of $\Upsilon\ \alpha\ (p, f)$; for $p = 2,3, \ldots, t$. Where p is the number of steps apart, α is the level of significance and f is the degree of freedom for error which are obtained from Duncan's table of significant ranges. Hence, the least significant range obtained from $R_p = \Upsilon\ \alpha\ (p, f) S_{\bar{y}_{i.}}$

Then we construct a table of differences in mean, one important property of this table is that its upper diagonal is equal to its lower diagonal, and so by giving either it lower or upper diagonal only, no information is lost. If an observed difference is greater than the corresponding least significant range, we conclude that the pair of means in question is significantly different (Montgomery 2001).

Regression Analysis

In simple linear regression, only a single dependent variables and Y and on independent variables *X* is involved.

In multiple regressions, two or more independent variables are involved. The general model is given by:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2, X_2 + \ldots + \beta_j x_j + \varepsilon \qquad 1.0$$

suppose that data X_{ij} are collected on variable X_j and Y_i are collected on variable Y, than equation (x) can be written as:

$Y = \beta_0 + \beta_1 X_{i1} + \beta_2 X_2 + \ldots + \beta_K X_{2K} + \varepsilon$ i =1,2, 3, ... 2.0

Where Y = Denote the dependent variables

X_j = Denote the regressor variables

β_j = Denotes the regression coefficient

ε = Denote the error term

The model describes a hyper-plane in the K- dimensional space of the regressed variables (X_j). The parameter β_j represents the expected change in response Y per unit change in X_j when all the remaining predictor variables $X_i(i \neq i)$ are holding constant

Matrix Approach to Multiple Regressions

$Y_i = \beta_0 + \beta_1 X_{i2,} + \ldots + \beta_K X_{iK} + E$ the above equation can be represented in the matrix form the matrix form of the equation is

$$Y = \begin{bmatrix} y_1 \\ y_2 \\ \cdot \\ \vdots \\ Y_n \end{bmatrix} \quad x = \begin{bmatrix} 1 & X_{11} & X_{12} & X_{1k} \\ 1 & X_{21} & X_{22} & X_{2k} \\ \cdot & \cdot & \cdot & \cdot \\ \vdots & \vdots & \vdots & \vdots \\ 1 & X_{n1} & X_{n2} & X_{nk} \end{bmatrix} \beta \begin{bmatrix} \beta_1 \\ \beta_1 \\ \cdot \\ \vdots \\ \beta_k \end{bmatrix} \text{ and } \varepsilon = \begin{bmatrix} \varepsilon_1 \\ \varepsilon_2 \\ \cdot \\ \vdots \\ \varepsilon_n \end{bmatrix}$$

$Y = X\beta + \varepsilon$ 3.0

Where

Y = is a vector of observations

X = is an n x p matrix of the levels of the independent variable

β= is a p x 1 vector of regression coefficient

Assumptions of the Error Term

1. E (e) = 0
2. Var (e) = $1\sigma_2$
3. Cov ($e_{ij,} \sigma_j = \begin{bmatrix} \sigma_0 fi \neq i \\ \sigma^2 ifi = j \end{bmatrix}$
4. $e \sim N\ (O, I\sigma^2)$

Estimation of the Parameters Using Matrix Approach

The method of least squares is typically used to estimate the regression coefficients in a multiple linear regression model. We assume that the error term E in the model has $E\,(\varepsilon) = \sigma$ and $V\,(\varepsilon) = \sigma^2$ and that the (ε_j) are uncorrelated random error

We wish to find the vector of least squares estimator $\hat{\beta}$ that minimizes

$L = \varepsilon^2 = \varepsilon'\varepsilon = (Y - X\beta)'(Y - X\beta)$ 4.0

Differentiating with respect to T (*W.R.T*)

$\frac{dL}{d\beta} = -2x'y + 2\hat{\beta}x'x = 0$

$= Y^1Y - Y'X\beta - X'\beta'Y + x'\beta'X\beta$

$= Y'Y - Y'X\beta - X'^1\beta'Y + x'\beta'X\beta$

$= Y'Y - \beta'X'Y - \beta'X'Y + \beta'X'X\beta$

$= Y'Y - 2\beta'X'Y = \beta'X'\beta$

$= (X'X)\hat{\beta} = X'Y$

∴ The least square estimator of β is

$\hat{\beta} = (X'X)^{-1}X'Y$ if and only if $(X'x)^{-1} \neq 0$ 5.0

The fitted regression model is

$\hat{Y} = X\hat{\beta}$

The difference between the actual observation Y_1 and corresponding fitted value $\hat{Y}$ is the residual say, $e_i = y_i - \hat{Y}_i$. The (nx1) vector of residual is denoted by $\varepsilon = Y - \hat{Y}$

It is usually necessary to estimate σ^2 to develop and estimator of this parameter, the sum of squares of the residuals will be considered, say,

$SSE = \sum(Y_{i-}\hat{\hat{Y_i}})^2$

$= \sum_{0=1}^{n} e_i^2$

$= e'e$

Substituting $e = Y - \hat{Y} = Y - X\hat{\beta}$

$SSE = (Y - X\hat{\beta})'(Y - X\hat{\beta})$

$= Y'Y\hat{\beta}X'Y - Y'\hat{\beta} + \hat{\beta}X'X\hat{\beta}$

$= Y'Y - 2\widehat{\beta^1}X'Y + \hat{\beta}X'X\hat{\beta}$

Since $X'X\widehat{\beta} = X'Y$ from equation (5.0)

∴ $SSE = Y'Y - 2\widehat{\beta\ } X'Y + \widehat{\beta} X'Y$

$= Y^1 Y - \beta'X'Y$ 6.0

Equation (6.0) is called residual sum of squares and it has *n-p* degrees of freedom

Therefore, an unbiased estimator of σ^2 is given by $\sigma^2 = \frac{SSE}{n-p}$

Properties of Least Square Estimator

Least square method produces an unbiased estimator of the parameter β in linear regression model by

1. Taking expected value of $\hat{\beta}$ and
2. The variance co-variance matrix

$$E(\hat{\beta}) = E[(x'x)^{-'}x'Y]$$
$$= E\ [(x'x)^{-1}x'(X\beta + \varepsilon)]$$
$$= E[(x'x)^{-1}x'x\beta + (x'x)^{-1}x'\varepsilon]$$
$$= E\ (x'x)^{-1}x'x\beta + (x'x)^{-1}x\ E(\varepsilon)$$

Recall E (ε) = 0 and $(x'x)^{-1}x'x = 1$

The test for significance of regression is a test to determine if there is a linear relationship between the response variables *Y* and a subset of the regressed variable $x_1x_2\ ...x_k$ the appropriate hypothesis are

Ho: $\beta_1 = \beta_2 = \ldots\ \beta_K = 0$

Hi: $\beta_l\ \neq 0$

For at least one *j*

Rejection of *Ho* implies that at least one of the regressed variables $X_1X_2\ ...X_N$ contributes significantly to the model

We examine the significance of the model using ANOVA table

Note: R^2 is a measure of the amount of reduction in the variability of *Y* obtained by using the regressed $x_1x_2\ ...x_k$ variables in the model and is given by:

$$R^2 = \frac{SSR}{SST} = 1 - \frac{SSE}{SST}$$

SSR is the sum of square of regression=$\sum\hat{y} - \frac{(\sum y)^2}{n}$

SSE is the sum of square of error=SS_T - SS_R

SST is the total sum of square =$\sum y^2$ - $\frac{(\sum y)^2}{n}$

MS is the mean square.

For the purpose of this research work, the model will be represented by:

$PW=B_0+\beta_1AC+\varepsilon$

Where *: PW: production weight (MT), AC: Area Cultivated, ε: stochastic error term*

Data Presentation and analysis

The data used in this research work is being present in tabular form at the appendix. The table will contain column for years, LGA, production weight (MT) and area cultivated (Hq).

Table 2.0: Summary Statistics

Variables	Minimum	Maximum	Mean
Production Weight (MT)	428.80	55004.84	9307.4370
Area Cultivated (Hq)	432.33	46695.81	8585.75

From table (2.0) above, it can be seen that the minimum production weight over the years is 428.80, maximum production weight is 55004.84 and the average production weight is 9307.4370. The table also reveals that the minimum area cultivated (Hq) is 432.33, maximum area cultivated is 46695.81 and the average area cultivated is 8585.75.

Table 3.0: Production Weight (MT) ANOVA Table for 20 LGAs

	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	4214824801.503	19	221832884.290	3.861	.000
Within Groups	3446997290.464	60	57449954.841		
Total	7661822091.967	79			

Table 3.0 presents the result of analysis of variance of production weight of groundnut in the 20 LGAs in Bauchi State. From the table it can be seen that there is significant difference between the production weight of groundnut in 20 LGA in Bauchi State (p-value = 0000 < 0.05).

Table 4.0: DUNCAN TEST-Production Weight (MT)

LGA	N	Subset for alpha = 0.05			
		1	2	3	4
Katagum	4	2730.5550			
Tafawa Balewa	4	2932.7800			
Kirfi	4	3869.3725			
Zaki	4	4357.8450			
Ningi	4	4992.1050			
Dass	4	5097.4550			
Bogoro	4	5098.9050			
Alkare	4	5165.1050			
Warji	4	5327.5425			
Gamawa	4	5657.2900			

Jamaare	4	5845.7350			
Giade	4	6800.4550	6800.4550		
Ganjuwa	4	9401.6575	9401.6575		
Misau	4	9635.3975	9635.3975		
Itas Gadau	4	10066.9575	10066.9575		
Damdam	4	12815.6250	12815.6250	12815.6250	
Toro	4	13362.2275	13362.2275	13362.2275	
Shira	4		18642.4825	18642.4825	
Darazo	4			22589.9970	22589.9970
Bauchi	4				31759.2500
Sig.		.110	.059	.101	.092
Means for groups in homogeneous subsets are displayed.					
a. Uses Harmonic Mean Sample Size = 4.000.					

The Duncan multiple range test was used to separate the means of the production weight of groundnut within the 20 LGA. The result indicates that the 3 LGAs (Bauchi, Darazo and Shira) have the highest production weight which was followed by Toro, Dambam, Itas Gadau which was followed by Giade, Ganjuwa and Misau; followed by Katagum, Tafawa Balewa, Kirfi, Zaki, Ningi, Dass, Bogoro, Alkare, Warji and Jama'are has the least production weight.

Table 5.0: Area Cultivated (Hq) ANOVA Table

	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	2170376880.299	19	114230362.121	2.042	.019
Within Groups	3355746588.160	60	55929109.803		
Total	5526123468.459	79			

Source: Researcher's computation Using SPSS

Table 5.0 indicates that there is significant difference between the mean of areas cultivated (Hq) (p-value = 0.019 < 0.05).

Table 6.0: Duncan Multiple Comparison -Area Cultivated (Hq)

LGA	N	Subset for alpha = 0.05				
		1	2	3	4	5
Tafawa Balewa	4	2025.1925				

Kirfi	4	2643.8100				
Dass	4	3153.1200	3153.1200			
Alkare	4	3932.5600	3932.5600			
Zaki	4	3945.1300	3945.1300			
Katagum	4	4060.0225	4060.0225			
Warji	4	4199.6075	4199.6075			
Ningi	4	5161.4613	5161.4613	5161.4613		
Misau	4	5686.5050	5686.5050	5686.5050	5686.5050	
Giade	4	7598.7500	7598.7500	7598.7500	7598.7500	7598.7500
Ganjuwa	4	7727.7210	7727.7210	7727.7210	7727.7210	7727.7210
Gamawa	4	9487.4575	9487.4575	9487.4575	9487.4575	9487.4575
Itas Gadau	4	10388.6525	10388.6525	10388.6525	10388.6525	10388.6525
Bogoro	4	10462.1425	10462.1425	10462.1425	10462.1425	10462.1425
Damdam	4	10819.8575	10819.8575	10819.8575	10819.8575	10819.8575
Toro	4	11030.9145	11030.9145	11030.9145	11030.9145	11030.9145
Jamaare	4		15796.7400	15796.7400	15796.7400	15796.7400
Darazo	4			17023.5565	17023.5565	17023.5565
Shira	4				18130.6300	18130.6300
Bauchi	4					18441.1700

Sig.		.169	.053	.064	.052	.091
Means for groups in homogeneous subsets are displayed.						
a. Uses Harmonic Mean Sample Size = 4.000.						

Table 6.0 indicates that Bauchi, Shira and Darazo cultivated highest area for land for groundnut production which was followed by Jama'are, Toro, Dambam, Bogoro, Itas Gadau, Gamawa, Ganjuwa, Giade, Misau and Ningi followed by Warji, Katagum, Zaki, Alkare and Dass. Kirfi and Tafawa Balewa cultivated a small land area for groundnut production.

Table 7.0: Coefficients of Regression Analysis

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	3336.221	1285.569		2.595	.011
	Area Cultivated (Hq)	.695	.108	.591	6.465	.000
a. Dependent Variable: Production Weight (MT)						

R = 0.591, R-square = 0.349, Adjusted R-square = 0.341, p =-value = 0.000

Table 7.0 presents the result of the regression analysis of production weight and area cultivated. The result show that there is positive and significant effect of area cultivated for groundnut production and the production weight of groundnut (p-value = 0.000 < 0.05). the R-value of 0.591 indicate positive correlation coefficient which implies that the higher the area cultivated, the higher the production weight and vice-versa. The adjusted R-square of 0341 indicates that 34.1% of the variation in the dependent variable (production weight) has been explained by the independent variable (area cultivated). The value B = 0.695 indicates that 1 unit change in area cultivated will cause 0.695 changes in the production weight.

DISCUSSION OF RESULT

The study focuses on the analysis of variance on groundnut production in Bauchi State. The result of the findings reveals that statistically, there are significant differences between the weights of groundnut production (MT) in the twenty local governments in Bauchi State. The study also reveals that. The Duncan multiple range tests reveal that Bauchi Local Government, Darazo Local government and Shira Local Government has the largest weight of groundnut production in the State. This was followed by Toro, Dambam, Itas Gadau which was followed by Giade, Ganjuwa and Misau; followed by Katagum, Tafawa Balewa, Kirfi, Zaki, Ningi, Dass, Bogoro, Alkare, Warji and Jama'are has the least groundnut production weight.

The result of the findings also reveals that there is statistically significant difference between the mean of areas cultivated (Hq) p-value = 0.019 < 0.05. The Duncan Multiple range was used to separate the differences in the mean area of land cultivated. The result reveals that Bauchi, Shira and Darazo cultivate highest area for land for groundnut production in Bauchi State. This implies that the higher the land area the higher the weights of groundnut production.

Summary

The study focused on the analysis of groundnut production in Bauchi State for the past four years. The study was divided into five chapters. The chapter one covers the background to the study, statement of the problem, research objectives, and research hypothesis, significant of the study, scope of the study and operational definition of terms. The chapter two covers review of literature both the conceptual and empirical review. The chapter three covers the methodology of the study. The chapter four covers the data presentation, analysis and interpretation. The chapter five gives the summary, conclusion and recommendations. The study reveals the following findings:

i. There is a significance difference between the mean productions weights of groundnut for the past four years.
ii. Bauchi, Shira and Darazo have the highest mean production weights of groundnut.
iii. The study reveals also that Tafawa Balewa has the least mean weight production.
iv. Bauchi, Shira and Darazo have the largest cultivation area for groundnut production.

Conclusion

The study analysed groundnut production in Bauchi State. From the result of the findings it was concluded that smaller production weight of groundnut production in some of the local government in Bauchi State is due to small area of land cultivated for groundnut production purpose.

Recommendations

Based on the result of the analysis from this study, the following recommendations were made:

- ✓ Government should encourage the production of groundnut by providing fertilizers, herbicide and other material needed for its production
- ✓ Farmers in the Local government such as Tafawa Balewa should be encouraged to increase the area cultivated for groundnut production.
- ✓ Farmers should be educated about the use of herbicide as this will enable cultivation of large vast of land for groundnut production.
- ✓ Loans should be provided to farmers with minimal interest as this will enable farmers to obtain and cultivate a large vast of land for groundnut production.

Reference

Abalu, G. O.I., & Etuk, E. G. (2001). Traditional versus improved groundnut production practices: Some further evidences from Northern Nigeria. *Experimental Agriculture, 22*(1), 33-38.

Akobundu, E. (1998). *Farm-household analysis of policies affecting groundnut production in Senegal.* Thesis submitted to the Faculty of the Virginia Polytechnic Institute and State University in partial fulfilment of the requirements for the degree of Master of Science in Agricultural and Applied Economics, Virginia.

Adinya, I. B., Enun, E. E., & Ijoma, J. U. (2010). Exploring profitability potentials in groundnut (*Arachis Hypogaea*) production through agroforestry practices: A case study in Nigeria. *Journal of Animal and Plant Sciences*, *20*(2), 123-131.

Bucheyeki, T. L., Shenkalwa, M. E, Mapunda, T., & Matata, W. L. (2008). On-farm evaluation of promising groundnut varieties for adaptation and adoption in Tanzania. *African Journal of Agricultural Research, 3*(8), 531-536.

Bucheyeki, T. L., Shenkalwa, M. E, Mapunda, T., & Matata, W. L. (2010). The groundnut client oriented research in Tabora, Tanzania. *African Journal of Agricultural Research, 5*(5), 356-362.

Ellis, P. E. (1992). Evaluation of production, multiplication and distribution systems of improved groundnut germplasm in Nigeria. A TCP/RAF/7 823 (A) Report.

FAOSTAT. (2011). FAO Statistics Division 2013. Retrieved from http://faostat.fao.org/site/567/DesktopDefault.aspx?PageID=567#ancor [Site visited on 27/01/2013].

Hamidu, B. M., Kuli, S. G., & Mohammed, I. (2007). Profitability analysis of groundnut (Arachis hypogae L.) – Processing among women entrepreneurs in Bauchi Metropolis. *Management Network Journal, 3*(6), 389-395.

International Trade Centre (ITC) (2011). Exporting Groundnut. *International Trade Forum Magazine*.

Kothari, C. R. (2004). *Research Methodology: Methods & Techniques.* 2nd Edition, New Delhi, New Age International Ltd, Publishers.

Kimmins, F. M., Deom, C. M., Subrahmanyam, P., Chiyembekeza, M., & van der Merwe P. J. A. (1999). *Groundnut Rossete: A virus affecting groundnut production in Sub-Saharan Africa.* The American Phatophalogical Society.

Kumar, R. (2011). *Research Methodology: A step by step guide for beginners.* 3rd Edition, Los Angeles, SAGE Publications Ltd.

Mendola, F. (2007). Market prospects for Groundnut in West Africa (Eng/Fr). CFC Technical Paper No. 39 PO Box 74656, 1070 BR Amsterdam. The Netherlands: Common Fund for Commodities; and Patancheru, India: International Crops Research Institute for the Semi-Arid Tropics. 252

Mugisha, J., Ogwal, R., Ekere, O. W., & Ekiyar, V. (2004). Adoption of IPM groundnut production technologies in Eastern Uganda. *African Crop Science Journal*, *12*(4), 383-391.

Nigam, S. N. and Lenné, J. M. (1996). Groundnut in ICRISAT Programmes. *Grain Legumes, 14,* 25-27.

Nweze, N. J. (1997). Agricultural Production Economics: An Introductory Text AP Express Publishers Limited, Nigeria.

Pande, S., Bandyopadhyay, R., Blümmel, M., Narayana Rao, J., Thomas, D., & Navi, S. S. (2003). Disease management factors influencing yield and quality of sorghum and groundnut crop residues. *Field Crops Research*, *84*(1-2), 89-103.

Pompeu, A. S. (2009). Groundnut production, utilization, research problems and further research needs in Brazil. In *Proceedings of the International Workshop on Groundnut. ICRISAT Center, Patancheru, India, 13-17 October 1980* (pp. 244-246). International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), Patancheru, A.P., India.

Ramadhani, T., Otsyina, R., & Franzel, S. (2002). Improving household income and reducing deforestation using rotational woodlots in Tabora District, Tanzania. *Agriculture Ecosystem and Environment, 89* (3), 229-239.

Singh, A., Vasishtb, A. K., Kumara, R., & Dasc, D. K. (2008). Adoption of integrated pest management practices in paddy and cotton: A case study in Haryana and Punjab. *Agricultural Economics Research Review, 21,* 221-226.

Sorrensen, R., Butts, C., Lamb, M., & Rowland, D. (2004).Five years of subsurface drip irrigation on Peanut. *UGA/CPES Research and Extension Bulletin,* No. 2004.

Taru,V. B., Kyagya, I. Z., Mshelia, S. I., & Adebayo, E. F. (2008). Economic efficiency of resource use in groundnut production in Adamawa State of Nigeria. *World Journal of Agricultural Sciences, 4*(S), 896-900.

Wabbi J. B. (2002). *Assessing factors affecting adoption of agricultural technologies: The case of integrated pest management (IPM) in Kumi District, Eastern Uganda*. Thesis submitted to the faculty of the Virginia Polytechnic Institute and State University in partial fulfilment of the requirements for the degree of Master of Science in Agricultural and Applied Economics, Blacksburg, Virginia.

APPENDIX A
DATA PRESENTATION

Year	LGA	Area Cultivated (Hq)	Production Weight (MT)	Year	Production Weight (MT)	Area Cultivated (Hq)
2014	Katagum	4977.23	7605.78	2015	5078.81	7761.00
2014	Zaki	7950.83	6808.18	2015	8113.09	6947.13
2014	Misau	14050.94	1251.60	2015	14337.69	13113.88
2014	Jama'are	3671.11	4601.89	2015	3746.03	46695.81
2014	Bauchi	32981.09	31666.01	2015	33654.17	32312.25
2014	Bogoro	713.14	559.13	2015	728.80	570.54
2014	Toro	20222.66	14314.04	2015	20635.37	14606.17
2014	Giade	9050.44	9611.91	2015	9235.14	9808.07
2014	Alkaleri	3913.58	3142.86	2015	3993.45	3207.00
2014	Dass	920.03	801.41	2015	938.81	817.77
2014	Kirfi	3195.48	2911.10	2015	3260.69	2970.51
2014	T/Balewa	924.22	753.82	2015	943.08	769.20
2014	Darazo	5242.58	8706.74	2015	5349.57	8884.43
2014	Ganjuwa	13171.11	11309.03	2015	13439.91	11539.83
2014	Ningi	5159.98	7592.88	2015	5265.29	7747.84
2014	Warji	2565.63	3626.91	2015	2617.99	3700.93
2014	Itas-gadau	4286.37	5743.95	2015	4373.85	5861.17
2014	Shira	22499.92	20938.82	2015	22959.10	21366.14
2014	Dambam	18431.88	16132.31	2015	18808.04	16461.54
2014	Gamawa	7727.53	14337.47	2015	7728.99	14630.07
2016	Katagum	428.80	432.33	2017	437.38	440.98
2016	Zaki	676.96	1002.58	2017	690.50	1022.63
2016	Misau	5026.22	4148.78	2017	5126.74	4231.76
2016	Jama'are	7903.86	5885.77	2017	8061.94	6003.49
2016	Bauchi	5396.90	4844.76	2017	55004.84	4941.66
2016	Bogoro	9383.01	20157.87	2017	9570.67	20561.03
2016	Toro	6233.11	7526.46	2017	6357.77	7676.99
2016	Giade	4413.98	5433.18	2017	4502.26	5541.84

2016	Alkaleri	6313.56	4643.75	2017	6439.83	4736.63
2016	Dass	9173.75	5442.29	2017	9357.23	5551.01
2016	Kirfi	4466.00	2323.58	2017	4555.32	2370.05
2016	T/Balewa	4883.08	3256.31	2017	4980.74	3321.44
2016	Darazo	39489.03	25001.96	2017	40278.81	25501.10
2016	Ganjuwa	5443.37	3991.10	2017	5552.24	4070.92
2016	Ningi	4724.33	2626.30	2017	4818.82	2678.83
2016	Warji	7983.44	4391.38	2017	8143.11	5079.21
2016	Itas-gadau	15647.33	14826.48	2017	15960.28	15123.01
2016	Shira	14411.34	14958.74	2017	14699.57	15258.82
2016	Dambam	6941.87	5289.89	2017	7080.71	5395.69
2016	Gamawa	3550.81	4446.68	2017	3621.83	4535.61

Source: Bauchi State Agricultural Development Program