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Resource Use Efficiency among Maize Farmers in Lere Local Government Area of Kaduna State, Nigeria

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Authors' contributions

This work was carried out in collaboration among all authors. Authors OSA, RS, UUE and UFY designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Authors OEO, NEO and RA managed the analyses of the study, proof read the article and co-type the manuscript. Authors LG, SO and OO managed the literature searches. All authors read and approved the final manuscript.

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ABSTRACT

This study was carried out to analyzed the resource-use efficiency of maize production in Lere local government area of Kaduna state. Data were collected from a sample of 100 maize farmers selected through multi-stage sampling procedure using questionnaire and data collected were analyzed using simple descriptive statistics, production function and marginal value productivity analysis. The result showed that 82% were in their working age of between 21-50 years, majority of the farmers 53% were married, 91% had formal education, in terms of farming experience, majority (68%) of the respondent had farming experience that is above one year. The linear function gave the best fit with R^2 of 70.2%. Production inputs such as fertilizer and agrochemicals significantly influence maize output in the study area. Maize production in the study area has an increasing return to scale from the sum of elasticity of production (20.439). Land, labour, fertilizer, seed and agrochemicals were underutilized in maize production. Profit could be enhanced by

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increasing the quantity used of land, labour, fertilizer, seed and agrochemicals inputs, as well as their timely supply. It is also recommended that financial support in term of accessibility to credit facilities at low interest rate be given to farmers to allow them increase output and total revenue.

Keywords: Resource use efficiency; production function; maize farmer; elasticity of production; Lere Kaduna; Nigeria.

1. INTRODUCTION

Maize is an important staple food crop grown in all the thirty six states including Abuja the capital city of Nigeria. Maize are grown in some parts of the country throughout the year combining the use of irrigation, cultivation of waterlogged area known as Fadama and rain fed maize production together. Maize is a stable food crop for most sub-Saharan Africans of which Nigeria is inclusive with per capital kg/year of 40 [1]. Maize is consumed boiled or roasted. It serves as mean of livelihood to many Nigerians ranging from the farmers, to marketers to women who sells maize either as boiled or roasted maize. Maize also serves as raw materials to agro–based industries for production of secondary products such as pop- corn and cornflake. Maize also serves as the main energy source for formulation of livestock feed. To achieve food sufficiency in the country there is need to increase the production level of maize since it is the second most popular cereal grown in the northern part of the country. Akande [2], also reported that maize is the second largest cereal crop grown after rice in Nigeria while [3] asserts that it is the third most important cereal crop after sorghum and millet. However in the view of Amos et al. [4], it occupies the third position next to wheat and rice in cereal production within the universe. Undie et al. [5], observed that due to its high feeding value, it serves as a source of carbohydrate to both human especially those living in developing countries and animal feed all over the world. It can be easily be intercropped with legumes. Maize is a staple food crop whose consumption is widespread across the country and among households. Maize can be prepared as pap, *tuwo, pwate*, and *donkunu*, with the cereal cooked, roasted, fried, ground, pounded or crushed form [6]. Maize straw is a cheap source of energy and can be used in home-heating furnaces. Maize can be used as forage, feed for livestock and making silage after fermentation of corn stocks. Maize is used extensively as the main source of calories in animal feeding and feed formulation. According to Khawar et al. [7], maize has a variety of uses. The grain is a rich source of starch, vitamins, proteins and minerals. Maize and other cereals constitute important sources of carbohydrates, proteins, vitamin B and minerals [8].

Resource - use efficiency involves the allocation of the scarce farm inputs efficiently to generate an optimum yield. Resource efficiency in maize therefore refers to a situation where farmers make use of the scarce resources efficiently for the production of maize optimally. Despite the many uses maize can be put to, its production still suffers set back largely due to the fact that it is dominated by small scale farmers who lack the necessary inputs, capital and extension services required to boost their production. The small-scale farmers are also known to be poor resource use efficient because of the lack of ability to allocate the available resources efficiently enough to generate the required output. Small-scale farmers underutilized resources in addition to poor extension services, use of low yielding varieties, inadequate incentives and amenities, which give rise to low output and hence low farm income. Shehu et al. [9], examined resource use efficiency of small-scale maize production in Tafawa-Balewa local government area of Bauchi State. The result showed that 90.17% had formal education; 51.67% were males; 90.17% were between the ages of 21-50. Majority 72.50% were married, majority (86.67%) of the respondent had farming experience that ranged between 5-20 years and 75.00% had no contact with extension agents. The double-log function gave the best fit with adjusted R^{2-} value of 81.16%. Production inputs such as seed, fertilizer, labour affected output significantly. Maize production in the study area has an increasing return to scale from the sum of elasticity of production (1.747). Seed and fertilizer were underutilized in maize production, whereas labour was over used. In a study conducted by Ogunniyi [10] to examine the resource-use efficiency in maize production in Oyo state, Nigeria revealed that farm size, labour cost and cost of seeds have a significant relationship with revenue. The ratio of the MVP of the various resources to the value of their cost indicates that the resources are yet to be efficiently utilized as far as maize production is

concerned in the study area. In another similar study conducted by Awunyo-Vitor et al. [11], in examining the resource use efficiency among maize farmers in Ghana showed that maize farmers in Ghana were inefficient in their use of resources available to them. Fertilizer, herbicide, pesticide, seed, manure and land were underutilized, while labour and capital were over utilized by the farmers. The results further showed that maize farmers in Ghana exhibit increasing returns to scale, indicating that the famers can increase their output by increasing the use of some of the key resources. In a related study by Zongoma et al. [12], conducted to determine efficiency of resource use in maize production among small-scale farmers in Biu local government area of Borno State, Nigeria showed that majority of the respondents (67%) were males and only 36% were females. Majority of the respondents (75%), were youth aged between 21-40 years, while only 3% were above 50 years of age. Semi-log function was the lead equation with R^2 value of 0.81. Fertilizer and quantity of seed has coefficient of 0.426 and 1.336 and were significant at 5% and 1% levels of probability respectively. The result also indicates that size of the farm, labour, fertilizer and seed were excessively utilized with resource efficiency level of 0.01, 0.07, 0.23 and 0.10 respectively. The objective of this study is therefore to measure the resource use efficiency among maize farmers in Lere Local Government Area of Kaduna State.

2. METHODOLOGY

2.1 Study Area

The study was conducted in Lere local government area of Kaduna state. The headquarter is located in Saminaka. The local government area was created in the year 1991 out of the former Saminaka local government area created in 1976. The local government is located between latitude 9^0N and 12^0N and longitude 6^0E and 9^0E of prime meridian. The total land area is about 21,158km^2 and a population of 331,161 as at the 2006 census [13]. It shares boundary with Kano state in the northern part, while in the area towards eastern part it is bounded by Bauchi and Plateau states. In addition to the above mentioned, other important area around Lore local government include the ancient city of Zaria to the north. It is bordered by the commercial town of Kafanchan down south. The study area has many villages among which are Lere, Saminaka, Kayarda, Ungwan-Bawa, Yarkasuwa, Garu, Gure, Dokandanbala, Lazuru among many others. The climate in Lere local government can be divided into three sections, these start with the hot and sunny area beginning from February to early May, followed by the raining season from March to October and then harmathan season, which usually last for about three months. Crops commonly grow in the area include maize, yam, millet, beans, soya beans, tomatoes, onion, sugar cane, rice, groundnut, cucumber, cabbage and potatoes.

2.2 Method of Data Collection

Primary data was used for this study. The primary data was sourced through administering of a well-structured questionnaire and oral interview to the maize farmers. The questionnaire that contained both open- ended and multiple choice questions related to maize farmers socio –economic characteristics, maize output and maize inputs were administered to the farmers by the researchers through physical contact.

2.3 Sampling Procedure

Multi-stage, purposive and random sampling techniques were adopted to select the respondents for the study. In the first stage Lere local government area was selected from the state purposively due to high concentration of maize farmers in the area. In the second stage five villages were also purposively selected which includes; Saminaka, Lere, Ungwa-Bawa, Yarkasuwa and Kayarda. Based on the population and uneven concentration of the maize producers in these villages 50% of identified maize farmers were chosen in each village which resulted into selecting 24 respondents each from Saminaka and Lere while 20 respondents each were selected from Kayarda and Ungwa-Bawa and 12 respondents from Yarkasuwa which gave a total of one hundred (100) respondents that were used for the study.

2.4 Analytical Technique

The following tools of analysis were employed to achieve the stated objectives of the study.

i. Simple descriptive statistics
ii. Production function using multiple regression analysis
iii. Marginal value productivity – marginal factor cost model

2.4.1 Simple descriptive statistics

This involves the use of descriptive statistics such as table, percentage, mean and frequency distribution to describe the socio – economic characteristics of the maize farmers.

2.4.2 Production function

Production function was used to determine the physical relationship between the inputs and output of maize production using multiple regression analysis. The implicit model is given as:

$$Y= F (X_1, X_2, X_3, X_4, X_5……U)$$

While the explicit models are given as:

Linear production function; $Y=b_0 +b_1X_1+b_2X_2 +b_3X_3+b_4X_4+ b_5 X_5 + U$
Semi-log production function; $Log Y= b_0+b_1X_1+b_2X_2+ b_3X_3+ b_4X_4+ b_5 X_5 +U$
Double-log production function; $Log Y= b_0+b_1logX_1+b_2logX_2+ b_3logX_3+ b_4logX_4+ b_5 logX_5 +U$

Where,

Y= Maize output (kg)
X_1= Land (ha)
X_2= Labour (manday)
X_3= Fertilizer (kg)
X_4= Seed (kg)
X_5 = Agro-chemicals (litre)
b_1- b_5= Regression coefficients to be estimated
b_0= Constant
u= error term

2.4.3 Marginal value productivity – marginal factor cost model

This was adopted to estimate the resource use efficiency as follows:

$$r = MVP/ MFC$$

The values of MVP and MFC will be estimated as follows:

MVP = MPP.PY
MPP = bi.Y
MFC = PXi
Where: r = Efficiency ratio
MVP = Marginal Value Product
MPP = Marginal Physical Production
MFC = Marginal Factor Cost
PXi = (Unit Price of Input X)
y = Arithmetic mean value of output
X = Arithmetic mean value of input considered
Py = Unit price of output
b_1 = Estimated coefficients of independent variables.

Based on the econometric theory, a firm maximizes profits with regard to resource use efficiency when ratio of marginal reform to the opportunity cost is one. The values are interpreted as follows:

If **r is less than 1** = resource was excessively used or over-utilized, hence decreasing quantity use for that resources increases profit.

If **r is greater than 1** – resource is under use or being under-utilized, hence increasing it rate of use will increase profit level.

If **r = 1** it shows the resource is efficiently used, that optimum utilization of resource hence the point of maximization.

2.4.4 Elasticity of production and return to scale

Elasticity of production and returns to scale were calculated by adding up the output elasticity of the various inputs. The formula below was adopted:

$$\text{Return to Scale} = \sum_i \alpha \log Y / \alpha \log X_i = \sum_I \beta_i$$

Where Y is value for output, X_i are values of inputs and β_i is inputs elasticity.

3. RESULTS AND DISCUSSION

3.1 Socio-Economic Characteristics of Respondents in the Study Area

3.1.1 Distribution of the respondents based on age group

Table 1 shows that respondents (38%) are within the age range of between 21-30 years, (27%) of the respondents are within the age range of 31-40 years, (17%) of the respondents are between the range of 41-50 years, (10%) of the respondents are below 21 years, while few (8%) of the respondent are 50 years and above, the result shows that most of the respondents are in their youthful age which makes them active in maize production. The finding in this present study was in agreement with the works of [9] and

[12]. They reported that majority of maize farmers in their study were young and active. Shehu et al. [9], reported that 90.17% of the maize farmers were between 21 -50 years of age while [12] observed that 75% of maize farmers in their study area were between 21 – 40 years.

3.1.2 Distribution of the respondents based on marital status

Table 2 shows (53%) of the respondents are married, (33%) of the respondents are single, (8%) of the respondents are widow, while (6%) of the respondents are divorcee. This implies that majority of the respondents are married people. This shows that the maize farmers may be more stable in their location of production. The result was in conformity with finding of Ogunniyi [10], who observed that 89% of maize farmers in Oyo state, Nigeria were married people.

3.1.3 Distribution of the respondents based on household size

Table 3 shows that majority of the respondents (38%) have household size ranging from 1-5 members, (36%) of the respondents have household size ranging from 6-10 members, (16%) of the respondents have household size that is between 11 – 15 people and 10% of the maize farmers have family members that comprises of 16 people and above. This implies that majority of the farmers have over five household members which signifies that labour can be easily sourced from the family members. Alabi et al. [14], stated that families with high household members are more helpful to their family in terms of agricultural production than families with small household members.

3.1.4 Distribution of the respondent based on educational qualification

Table 4 shows that (37%) of the farmers had secondary education, (29%) of the respondents had tertiary education, (25%) had primary education and only (9%) had no-formal education. This shows that about 91% of the farmers are educated and possess the ability to read and write. This will enable them to understand new techniques and improvements that may be developed by researchers in maize farming. Shehu et al. [9] and Zongoma et al. [12], reported that 90.17% and 62% of maize farmers in their studies were educated, respectively.

Table 1. Distribution of the respondents based on age range

Age Class	Frequency	Percentage (%)
Below 21	10	10.00
21-30	38	38.00
31-40	27	27.00
41-50	17	17.00
Above 50	8	08.00
Total	100	100.00

Table 2. Distribution of the respondents based on marital status

Marital Status	Frequency	Percentage (%)
Single	33	33.00
Married	53	53.00
Divorcee	6	06.00
Widow	8	08.00
Total	100	100.00

Table 3. Distribution of the respondent based on household size

Household Size	Frequency	Percentage (%)
1 – 5	38	38.00
6 – 10	36	36.00
11 – 15	16	16.00
16 above	10	10.00
Total	100	100.00

Table 4. Distribution of the respondents by their educational qualification

Educational Background	Frequency	Percentage (%)
No – formal education	9	09.00
Primary education	25	25.00
Secondary education	37	37.00
Tertiary education	29	29.00
Total	100	100.00

Table 5. Distribution of the respondents based on source of capital

Source of Capital	Frequency	Percentage (%)
Personal saving	62	62.00
Loan from family	18	18.00
Credit from bank	8	08.00
Money lender	12	12.00
Total	100	100.00

3.1.5 Distribution of the respondents based on sources of capital

Table 5 shows that (62%) of the respondents acquire their capital from personal saving, (18%) of the respondents sourced their capital from family members, (12%) of the respondents sourced their capital from money lender, while (8%) of the respondents sources the capital through bank. This implies that most of the farmers sourced capital through personal saving which implies that they will have ability to manage their finances well if given credit loan. The result obtained with respect to source of capital negates the findings of [10], who reported that 42% of the maize farmers in Oyo state obtained loan from friends and families to start their maize farms while only 26% of the farmers sourced their start – up capital through personal savings.

3.1.6 Distribution of the respondents based on farm size

Table 6 revealed that (32%) of the respondents have farm size of less than one hectare of land, (31%) of the respondents have farm size of one hectare, (17%) of the respondents have three hectares, (14%) of the respondents have two hectares, while only (6%) of the respondents have four hectares and above. The result shows that most of the respondents are small - scale maize farmers. This result consolidates the work of Aaron et al. [15], they reported that maize farmers in Soba local government area of Kaduna state were small-scale producer with a mean farm size of 1.22 hectares. Ogunniyi [10] also reported that maize farmers in Oyo state were small scale farmers with a mean farm size of 2 hectares.

3.1.7 Distribution of the respondents based on their years of experience

Table 7 shows that majority of the respondents (36%) have 1-5 years farming experience in maize production, (32%) of the respondents have less than one years in maize farming experience, (13 %) of the respondents have between 11-15 years of experience in maize farming, (11%) of the respondents have between 6 – 10 years of experience in maize farming while only 8% of the farmers have experience in maize farming that is above 15 years and above. According to Alabi et al. [14] more years of experience in farming enhance efficiency and productivity in business.

Table 6. Distribution of the respondents based on farm size

Farm Size	Frequency	Percentage (%)
Less than one hectare	32	32.00
One hectare	31	31.00
Two hectares	14	14.00
Three hectares	17	17.00
Four hectares and above	6	06.00
Total	100	100.00

Table 7. Distribution of the respondents based on their years of experience

Years of experience	Frequency	Percentage (%)
Less than one year	32	32.00
1-5	36	36.00
6-10	11	11.00
11-15	13	13.00
15 above	8	08.00
Total	100	100.00

Table 8. Estimate of production function of maize in Lere local government area of Kaduna state

Variable	Estimated parameter	Coefficient	Standard error	t-Value	Significant
Constant	X_0	-41256.761	84727.353	-0.441	0.490
Land	X_1	0.108	0.721	0.154	0.800
Labour	X_2	6.456	7.540	0.784	0.370
Fertilizer	X_3	3.276	0.147	16.316	0.000*
Seed	X_4	7.388	14.206	0.452	0.582
Agro-Chemicals	X_5	3.211	11.246	1.401	0.011**
Adjusted R^2 = 0.702					
F Statistics = 69.169					

Source: Field survey, 2018
**Significant at 1% level of probability*
***significant at 5% level of probability*

Table 9. Resources use efficiency of the maize farmers in the study area

Variable	MVP	MFC	MVP/MFC (r)
Land (X_1)	21,033.00	2,000.00	10.52
Labour (X_2)	1,257,306.00	24,000.00	52.39
Fertilizer (X_3)	638,001.00	70,000.00	9.11
Seed (X_4)	1, 438,813.00	5,000.00	287.76
Agro – chemicals(X_5)	625,342.25	55,000.00	11.37

Source: Field survey, 2018

3.2 Production Function Analysis

Different functional forms were fitted for the regression analysis; this includes linear, semi-log, and double log functions. The choice of best functional form (lead equation) was based on both statistical and econometric criteria (F-test statistics and R^2 - value) and *apriori* expectation of the sign of the coefficient. Linear regression analysis was the lead equation and is presented in Table 8. The coefficient of multiple determinations (R^2) of 0.702 shows that 70.2% of the variation in the output of maize is accounted for by the variation in the explanatory variables in the model, while the remaining 29.8%was due to error term. The F-value for the equation 69.169 showed that the strength of association between the dependent and independent variables is very high. The coefficient for fertilizer and agro – chemical were significant at 1% and 5 % level of probabilities respectively and both are also positively signed. This implies that a unit increase in either of fertilizer and agro-chemical usage will lead to increase in maize output by 3.276 and 3.211% respectively. The coefficient of land, labour and seed were positively signed which shows they have direct relationship with output of maize in the study area but does not influenced production because they are not significant. This result has similarity with the result of Ogunniyi [10] that also reported linear functional form to be the best- fit, with R^2 - value of 0.827 and F- value of 95.636 higher than those obtained in this present study. The significant value of fertilizer in this study was in agreement with the works of Shehu et al. [9] and Zongoma et al. [12]. They all reported significant value for fertilizer in their various studies.

3.3 Resource Use Efficiency

The result of the resource use efficiency for maize production in Lere local government area is presented in Table 9. The result revealed that the value for resource used efficiency (r) for land is 10.52, labour is 52.39, fertilizer is 9.11, seed is 287.76 and agrochemicals are 11.37. All the values obtained for the input are greater than 1, which shows that land, labour, fertilizer, seed and agrochemical are under utilized for production of maize in the study area. Therefore there is the need for the farmers to increase the use of these resources so that they can be more efficient in maximizing profit in maize production in the study area. This result is in conformity with the work of Awunyo-Vitor et al. [11], they reported that maize farmers in Ghana were under utilizing fertilizer, herbicide, pesticide, seed and land but negate the study of Zongoma et al. [12], that reported that maize farmers in Biu local government area of Borno state, Nigeria were over utilizing the available resources namely farm size, labour, fertilizer and seed in their disposal.

Table 10. Elasticity of maize production and return to scale in the study area

Input Variable	Production Elasticity
Land (X_1)	0.108
Labour(X_2)	6.456
Fertilizer(X_3)	3.276
Seed(X_4)	7.388
Agrochemicals(X_5)	3.211
Return to Scale (RTS)	20.439

3.4 Elasticity of Production and Return to Scale

The estimated elasticity of explanatory variables is presented in Table 10. The return to scale was estimated to be 20.439. The result shows a positive increasing return to scale which implies that maize production in Lere local government area of Kaduna state, Nigeria was in Stage one of production function. This implies that 1 percent increase in the quantity of the variables will result in 20.439 percent increase in maize output. This suggests that resources taken together at present were been underutilized and maize farmers in the study area can therefore increase their maize output by employing the use of more of the resources namely land, labour, fertilizer, seed and agrochemicals in maize production .This finding is in agreement with the results of some studies on resource use efficiency in maize by Ogunniyi [10], Shehu et al. [9] and Awunyo-Vitor et al. [11]. They all reported an increasing return to scale for maize production in their studies with return to scale values of 1.895, 1.747 and 3.327, respectively.

4. CONCLUSION AND RECOMMENDATIONS

In conclusion the study revealed that there is strong relationship between the independent and dependent variables with high value of F – statistics and that 72.2% of the variations in the output of maize production in the study area is accounted for by the explanatory variables in the model with fertilizer and agrochemical usage having great influence on maize output in the study area being significant at 1% and 5% probability levels respectively which indicates that the higher the usage of both fertilizer and agrochemicals the higher the output of maize in the study area. However the farmers are found to be inefficient in the use of other resources such as land, labour and seed. The result also showed that all the resources specified in this study were underutilized and that maize production in the study area is in stage one of production function with return to scale value of 20.439. The study therefore suggest that loan facilities should be provided to maize farmers from the commercial bank or government with single digit interest rate to increase their capital base which in turn will boost maize production in the study area because availability of fund will increase the ability of farmers to purchase hybrid maize seeds, pay for farm labour adequately and acquire good fertile land. The farmers should also be encouraged to form a co-operative society that will enable them have access to loan from the various financial sectors. Farmers should also be advised to increase the use of resources such as land, labour, fertilizer, seed and agrochemicals so that they can be more efficient in utilizing these resources and maximize profit in their maize farming.

CONSENT

As per international standard or university standard, respondents' written consent has been collected and preserved by the author(s).

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. FAO. FAOSTAT Food Agriculture Organization, Rome; 2003. Available:http//:faostat.fao.org/default.htm m. Accessed August, 28th, 2020
2. Akande SO. Comparative cost and returns in maize production in Nigeria. Nigerian Institute of Social and Economic Researc (NISER) Individual Research project Report, Ibadan; 1994.
3. Ojo SO. Factor productivity in maize production in Ondo state Nigeria. Applied Tropical Agriculture. 2000;15(1): 57-65.
4. Amos RN, Jens BA, Symon M. On farm evaluation of yield and economic benefits of short term maize legume intercropping systems under conservation agriculture in Malawi. Field Crop Research. 2012;132: 149-157.
5. Undie UL, Uwah DF, Attoe EE. Effect of intercropping and crop arrangement on yield and productivity of late season maize/soybean mixtures in the humid environment of South Southern Nigeria. Journal of Agricultural Science. 2012;4(4): 37-50. Available:http:dx.doi.org/10.5539/jas.v4n4p 37.
6. Abdulrahaman AA, Kolawole OM. Traditional preparations and uses of maize in Nigeria. Ethnobotanical Leaflets. 2006; 10:219-227.
7. Khawar J. Zahid A, Muhammad F. Maize: Cereal with a variety of uses. DAWN – Business. Available:http://wwwdawn.com/2007/03/12/ ebr5.htm. Accessed August 28th, 2020
8. Iken JE, Amusa NA, Obatobu VO. Nutrient composition and weight evaluation of small newly developed maize varieties in Nigeria. Journal of Food Technology, Africa (Kenya). 2002;7:25-35.
9. Shehu U, Ibrahim AI, Hassan T, Bello M. Analysis of resource use efficiency in small-scale maize production in Tafawa-Balewa local government of Bauchi state Nigeria. IOSR Journal of Agriculture and Veterinary Science (IOSR-JAVS). e-ISSN: 2319-2380, p-ISSN:2319-2372. 2017; 10(1):59-65. DOI:10.9790/2380-1001015965 Available:www.iosrjournals.org.
10. Ogunniyi LT. Resource-use efficiency in maize production in Oyo state, Nigeria. Journal of Sustainable Development. 2017;1(2):12-19.
11. Awunyo Vitor D, Wongnaa AC, Aidoo R. Resource use efficiency among maize farmers in Ghana. Agriculture and Food Security. 2016;5:28. DOI:10.1186/s40066-016-0076-2
12. Zongoma BA, Bulama YM, Shettima BG, Umar ASS. Resource use efficiency in maize production among small-scale farmers in Biu local government area, Borno state Nigeria. Journal of Resources Development and Management. 2015; 10:2422–8397. Available:www.iiste.org.
13. NPC. National Population Commission, Federal Office Office of Statisitics. Census; 2006.
14. Alabi J, Musa D, Filein W. Seed systems in Sub-Sahara Africa: issues and options. The World Bank Discussion Paper 266: The World Bank, Washington D.C USA; 2005.
15. Aaron JA. Olukotun O., Momodu GG. Economic analysis of maize production among small scale farmers in Soba local government area of Kaduna state, Nigeria. Proceedings of African Regional Conference on Sustainable Development. Held at Calabar, Nigeria. 2012;7(1):141–146.

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