



## Effectiveness of Fertilizer Use among Arable Farmers in Yola South, North-Eastern Part of Nigeria

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### Authors' contributions

This work was carried out in collaboration among all authors. Author AAS designed the study, performed the statistical analysis, wrote the protocol and the first draft of the manuscripts, managed the analysis and as well as the literature and the final version respectively. All authors read and approved the final manuscript.

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### ABSTRACT

**Aim:** This paper aimed to assess the effectiveness of fertilizer use among arable farmers in Yola South North-eastern part of Nigeria.

**Place and Duration of the Study:** The study was conducted at Yola South LGA of Adamawa State, Nigeria during September, 2019-July, 2020.

**Methodology:** Four (4) areas were selected in the area (Yolde pate, Bole, Mbamaba and Wuro-chekke) where 40 farmers were randomly selected from each farm location totaling to 160 farmers. The data obtained through administered questionnaires were analyzed using simple descriptive statistics and effectiveness Test Value (ETV) method respectively.

**Results:** The result shows that soil type, vegetation cover and soil type were the most indicators of soil fertility among farmers in the area where most farmers used organic fertilizers than the inorganic or combined except at Wuro-chekke farm location. Broadcasting method of fertilizer application was found to be mostly adopted in the area. Similarly, Organic fertilizer was assessed to be highly effective (HE) in all the farm location except at Wuro-chekke while inorganic fertilizer was HE at Bole and the combine used of organic and inorganic fertilizers appeared HE except at Mbamba farm location. Moreover, broadcasting method was HE at Yolde pate and Wuro-chekke

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farm locations while band placing was HE at Bole and spot method found to be moderately effective (ME) except at Mbamba appeared not effective (NE) respectively.

**Conclusion:** Intensive training to the farmers on modern strategies and techniques on fertilizer use through extension services should be conducted and timely provision of fertilizers to the target farmers should be considered by the relevant agencies in Yola area and the environment for the sustainable and profitable food production for the growing population.

*Keywords: Arable; effectiveness; farmers; fertilizer; Nigeria and Yola.*

## 1. INTRODUCTION

Fertilizers are soil amendments that guarantee the minimum percentages of Nitrogen, Phosphate and Potash [1]. The goal of applying fertilizer on plants is to make them grow faster by supplying the elements that are needed in readily available forms [2]. No region of the world has been able to expand agricultural growth rates, and thus tackle hunger, without increasing fertilizer use [3]. Thus, North-eastern part of Nigeria is not exceptional. Fertilizers are of two major types, that is, organic fertilizer made from animal matter, human excreta or vegetable matter and inorganic fertilizer made from synthetic materials [4]. There is evidence that the demand for fertilizers responds more to changes in crop output prices than to changes in fertilizer prices [5]. One way to address the twin problem of low agricultural productivity in sub-sahara Africa is fertilizer use both organic and inorganic, especially in low income countries (particularly North-eastern part of Nigeria) where fertilizer use is lowest [6]. As a result, small scale farmers, who produce the bulk of food in Nigeria, have to embrace fertilizer application in an organic and inorganic form in order to increase yield per unit area of land [7,8]. Thus, the profitability of fertilizer use is the most important factor in determining the demand for fertilizers by farmers [5]. In many sub-Saharan Africa countries, the relationship between food crop prices and fertilizer prices is insufficiently attractive to motivate fertilizer use [5]. This might be attributed to low or poor effectiveness use of fertilizers caused by different factors associated to the use of fertilizers. Farmers will adopt and increase their use of fertilizers only when they perceive that it is in their interest to do so. In Yola farmers actively participated in fertilizer application on farmlands which might not significantly compensate the expected yield of food crops thereby resulted to low or unprofitable farming. Therefore, there is ardent need to assess how fertilizers are been use effectively with respect to types, methods and cropping system by the small scale farmers with the aim of providing

valuable information that will practical solve the existing problem in the area. To this end, this research work saddled to assess the effectiveness of fertilizer use among arable farmers in Yola South, North-eastern part of Nigeria.

## 2. MATERIALS AND METHODS

### 2.1 Study Area

The study area is Yola South Local Government Area of Adamawa State, lies between latitudes 9013' North and 9012' North of the equator and between longitudes 12028' East and 12030' East of the Greenwich Meridian within an area of about 1139.1 square kilometers. The Yola South Local Government Area is bordered in the east by Fufore LGA, in the west by Demsa LGA and in the south by Mayo-Belwa and Fufore LGAs. Yola South Local Government Area has a tropical type of climate marked by distinct dry and raining seasons. The dry season commences in November and ends in April; while the wet season is from May to September. The annual rainfall in the state ranges from 700 mm in the North-west to 1,600 mm in the extreme southern part of Adamawa state [9].

### 2.2 Data Collection and Analysis

The study was carried out in four different farm locations Yolde pate, Bole, Mbamba and Wurochekke in Yola South LGA. The areas were chosen due to intensive crop production activities compared to other farm location in the area. The data were sourced and collected from 160 sampled farmers through the use of structured questionnaires administered which comprised various questions pertaining the field parameters, soil fertility indicators, types of fertilizer use, method of application, effectiveness of types and methods of fertilizer applications. The data were analyzed using two statistical tools; Descriptive statistics where percentages and frequencies were computed and the effectiveness test value

was also adopted using 4-point Likert scaling test proposed by [10] expressed as:

$$ETV = \frac{\sum \text{Scale-grade} \times \text{Corresponding Responses}}{\text{Total Number of Questionnaires}}$$

Where: ETV = Effectiveness Test Value and  $\Sigma$ =summation.

The scale-grades were; 1=Not effective (NE); 2=less effective (LE); 3=moderately effective (ME), 4= highly effective (HE). The Effectiveness Test Value (ETV) of < 2.0 was taken as the benchmark, below it any of the conservation techniques was considered as not effective (NE) within a given effectiveness rating (ER).

### 3. RESULTS AND DISCUSSION

#### 3.1 Yolde Pate Farm Location

The area occupies a gentle to moderate slope rejuvenating rill to gully erosion having considerable effects on the arable farmlands dominated with maize and rice as major crops grown over 10- 25 years of farming respectively. Few tress, grasses and shrubs made the vegetation of the area (Table 1). Results on farmers' perception on soil fertility indicators were depicted on Table 2. At Yolde pate farm location it shows that soil type appeared the most indicative indices of fertility status by the majority of the farmers (25%), followed by colour of the soil which received 23% of the respondents, 21% attributed it to vegetative cover, yield responses recorded 19% and only 12% of them conceived

nature of topography as an indicator of soil fertility. Results on the distribution of farmers on the types of fertilizer use were portrayed on Table 3. From the table it shows that most farmers (31%) at Yolde pate farm location patronized organic fertilizers than inorganic fertilizers (29%), while about 23% of them neither uses organic or inorganic. The reason for more adoption of organic fertilizers may be attributed to the high cost of fertilizer beyond the affordable financial capacity of the farmers. This statement corroborated with the recent findings of [12] which shows that at Yolde Pate high cost of fertilizers in the area was perceived to be 23 % of the respondents, 21% as lack of capital and untimely release of fertilizers by the government agencies accounted as 19% of the farmers respectively. Ref. [13] explained that because of high cost of mineral fertilizer coupled with availability problem, there is need for alternative sources. Ref. [7] reported that the intensity of inorganic fertilizer use among Nigerian farmers is low and has dropped due to the prevailing level of poverty. Thus, no region of the world has been able to expand agricultural growth rates, and thus tackle hunger, without increasing fertilizer use. [3]. Result obtained on the distribution of farmers on the method of fertilizer application practiced on their various farm locations were presented on Table 4. At Yolde pate farm location majority of the farmers (30%) had adopted broadcasting method of fertilizer application, followed by band placement (26%), and only 10% of them employed spot application methods. Results on the effectiveness on the types of fertilizer used by the farmers in the study area

**Table 1. Field parameters**

Farm location	C.F experience (years)	Present land use	Vegetative	Major crop grown	Erosion type	Slope type
Mbamba	5-35	Arable farming and animal grazing	Few tress and grasses	Rice, maize and cassava	Gully	Steep
Bole	5-20	Arable farming, animal grazing and Orchards	Tall grasses, trees and shrubs	Maize, groundnut, beans and rice	Rill to gully	Steep
Yoldepate	10-25	Arable farming and animal grazing	Few trees, grasses and shrubs	Maize and rice	Sheet to gully	Gentle to moderate
Wuro-chekke	5-15	Arable farming and irrigation/orchards	Tall grasses and few trees	Rice and cocoyam	Gully	Steep

C.F; Conservation farming; Source: [11]

**Table 2. Farmers soil fertility indicators (total number of respondents (N) = 40 for each farm location)**

Farm Location	Topography	Color	Soil type	Yield response	Vegetation cover
Yolde pate	5 (12%)	9 (23%)	10 (25%)	8 (19 %)	8 (21%)
Bole	4 (10%)	11 (27 %)	9 (23%)	7 (18)	9 (22)
Mbamba	6 (15%)	8 (20%)	10 (25%)	5 (13%)	11 (27%)
Wuro-chekke	4 (10%)	9 (23%)	11 (27%)	6 (15%)	10 (25%)

Source: Field Survey, (2019)

**Table 3. Distribution of farmers on the types of fertilizer use in the study area**

Farm Location	Organic fertilizer	Inorganic fertilizer	Organic + inorganic fertilizers	None
Yolde pate	12 (31%)	12(29%)	7 (17%)	9 (23%)
Bole	12 (30%)	9(22%)	8 (21%)	11 (27%)
Mbamba	14 (36%)	11(27%)	5 (12%)	10 (25%)
Wuro-chekke	10 (24%)	14(36%)	8 (20%)	8 (20%)

Source: Field Survey, (2019)

**Table 4. Distribution of farmers on the methods of fertilizer application in the study area**

Farm Location	Broadcasting	Band placement	Ring method	Spot application	None
Yolde pate	12(30%)	10 (26%)	6 (14%)	4 (10%)	8 (20%)
Bole	14 (35%)	9 (23%)	5 (13%)	4 (10%)	8 (19%)
Mbamba	12 (31%)	11 (27%)	8 (19%)	3 (8%)	6 (15%)
Wurochekke	15 (37%)	11 (27%)	4 (11%)	3 (8%)	7 (17%)

Source: Field Survey, (2019)

**Table 5. Effectiveness on the types of fertilizer used by the farmers in the study area**

Farm Location	Yolde Pate		Bole		Mbamba		Wurochekke	
Types of fertilizer	ETV	ER	ETV	ER	ETV	ER	ETV	ER
Organic	3.8	HE	3.6	HE	3.9	HE	3.1	ME
Inorganic	2.9	ME	3.5	HE	2.7	ME	2.8	ME
Organic+ inorganic	3.7	HE	3.8	HE	3.0	ME	3.6	HE

Source: Field Survey, (2019). ETV: Effectiveness Test Value. ER: Effectiveness Rating

**Table 6. Effectiveness on the methods of fertilizer application in the study area**

Farm Locations	Yolde Pate		Bole		Mbamba		Wurochekke	
Methods of fertilizer application	ETV	ER	ETV	ER	ETV	ER	ETV	ER
Broadcasting method	3.7	HE	2.8	ME	2.7	ME	3.5	HE
Band placement method	3.8	HE	3.5	HE	3.0	ME	3.6	HE
Ring method	2.8	ME	3.5	HE	2.4	NE	2.9	ME
Spot method	2.9	ME	3.0	ME	2.3	NE	2.4	ME

Source: Field Survey, (2019). ETV: Effectiveness Test Value. ER: Effectiveness Rating

were presented on the Table 5. At Yolde pate farm location organic fertilizers were considered as highly effective (3.8). Hence, Ref. [14] explained that the use of organic fertilizer may go a long way in providing solution to low crop yield. Organic manures check erosion, leaching of nutrients, evaporation losses and remain longer in soil and releases nutrients slowly making it available to plants. [15,16,17]. Similarly, organic

+ inorganic was also highly effective with a rated value of 3.7 and inorganic was perceived as moderately effective (2.9) respectively. The results on the effectiveness on the methods of fertilizer application in the study area were presented on Table 6. At Yolde pate farm location band placement and broadcasting methods were recognized as highly effective with rated values of 3.8 and 3.7 while the moderately effective

methods of fertilizer application was found with spot and ring methods with value of 2.9 and 2.8 respectively.

### 3.2 Bole Farm Location

The riverine area is sited on steeply (of about 20-22%) slope gradient with well rejuvenated rill to gully erosion having considerable devastation on farmlands. The vegetation is characterized by tall grasses, tall trees and shrubs dominated with arable farming with about 5-20 years conservation experience mostly maize, groundnut and cowpea along the hilly areas while rice is cultivated at swampy syncline (Table 1). Conversely, most farmers (27%) at Bole farm location considered soil colour as major indicator of soil fertility, 23% perceived it to soil type and vegetative cover received about 22% of the farmers' perceptions (Table 2). Similarly, at Bole farm location 30% of the farmers adopted organic fertilizers, followed by 27% who used nothing on their farm, 22% employed the use of inorganic fertilizers and the use of both organic and inorganic fertilizers perceived by 21% of the farmers than any other farm location in the area (Table 3). The low use of inorganic fertilizers in the farm location might be connected to lack of capital, untimely release and its unavailability as it was revealed by [12] that about 20% of the arable farmers at Bole farm location considered as lack of capital, 19% as high cost while untimely release was assessed as 18%. The released fertilizers by the government were targeted to government officials, businessmen and traditional leaders than the small-scale farmers. Ref. [18] also explained that the beneficiaries are supposed to be poor farmers but some fertilizer leaks out to others and elites may capture much of the benefit. The trend remained the same at Bole farm location where 35% of the farmers agreed to have adopted broadcasting method of fertilizer application, 23% band placement and 13% employed ring method respectively (Table 4). The rate of effectiveness for all the fertilizers were rated as high at Bole farm location with rated value of 3.8 organic + inorganic. This is in line with the assertion of [19] that there was significantly improved leave area with the combined use of organic and inorganic fertilizers than sole use of each sources. Similarly, 3.6 value of organic and 3.5 inorganic fertilizers were rated as highly effective respectively (Table 5). Bole farm location band placement and ring were perceived to be highly effective (3.5) and moderately effective was rated

3.0 value with spot method and 2.8 value with broadcasting method (Table 6).

### 3.3 Mbamba Farm Location

The area is located at the eastern part of Yola south LGA characterized by few tall trees and grasses. The farmers engaged dominantly in arable farming where rice and maize been the major crop grown for about 5-35 years conservation experience (Table 1). Most farmers (27%) had assessed vegetative cover as main soil fertility indicator at Mbamba farm location, and then 25% linked it to soil type, while soil colour perceived 20% and topography recorded 15% respectively (Table 2). Likewise at Mbamba farm location 36% of the farmers used organic fertilizers, while 27% of them employed inorganic fertilizer and 25% adopted none of the fertilizers (Table 3). The highly adoption of organic fertilizer might be linked to the availability of organic manures in the area having high numbers of herdsmen settled in the area. Thus, Ref. [12] revealed that at Mbamba farm location 65% of the respondent agreed that the organic fertilizers were readily available and 35% as not readily available. As for the low use of inorganic fertilizers high cost, lack of capital and unavailability of credit were among the major factors also as revealed by [12] respectively. Furthermore, at Mbamba farm location 31% of them practiced broadcasting method, 27% band placement, ring method attracted 19% while 15% adopted none and only 8% used spot method of application (Table 4). At Mbamba farm location organic fertilizers were highly effective (3.9) among the arable farmers. Thus, organic manures check erosion, leaching of nutrients, evaporation losses and remain longer in soil and releases nutrients slowly making it available to plants [17,13]. The use of organic + inorganic and inorganic fertilizers were moderately effective with a rated value of 3.0 and 2.7 correspondingly (Table 5). The moderate effectiveness of inorganic fertilizers may be due to the rapid released and excessive leaching of the synthetic nutrients in the soil system. Thus, according to Ref. [20] expressed that the imbalanced use of inorganic fertilizer without application of farmyard manure (FYM) as well as knowing the requirements of crops and fertility status of soil causes deterioration in soil structure and depletion of soil fertility. In addition, Ref. [21] argued that inorganic fertilizer may increase yield in the short term but may be both uneconomical and environmentally unsound. Conversely, ring and spot methods of fertilizer application were

found not effective at Mbamba while band placement and broadcasting methods were moderately effective with rated value of 3.70 and 2.7 correspondingly (Table 6).

### 3.4 Wuro-Chekke Farm Location

The flood plain area is situated along river Benue basin at western part of the study area dominated with tall grasses and few trees, practicing arable farming, irrigation and orchards farming. The area has noticeable rill to gully erosion with notable steep topography having sediments and depositional materials spread over the low lying adjacent areas. Rice and cocoyam were the major crops grown in the area for over 5-15 years conservation farming experience (Table 1). At Wuro-chekke farm location soil type remained the major indicator (27%) of fertility status in the area, vegetative cover conceived with about 25% of the respondents while 23% had attributed it to colour of the soil and only 4% recognized nature of topography as an indicator correspondingly (Table 2). Conversely, 36% of the farmers used inorganic fertilizers on their farm, 24% adopted the use of organic fertilizer and the use of both organic + inorganic fertilizers received 20% as well as none used of fertilizer (20%) at Wuro-chekke farm location respectively (Table 3). The reasons behind the increased use of inorganic fertilizer over the organic fertilizer were expressed in the recent findings of [12] found that majority of the farmers (80%) at Wuro-chekke farm location perceived organic fertilizers not readily available and only 20% of them as readily available and 81% of the farmers recognized the readily availability of inorganic fertilizers and 19% not readily available correspondingly. Despite the availability of inorganic fertilizers in the area still remain unaffordable to the small-scale farmers that are considered as target beneficiaries. Hence, Ref. [22] asserted that among the problems hampering arable crop yield is availability and affordability of inorganic fertilizers. The availability and the cost of fertilizers to resource-poor farmers constrain the use of fertilizers to a large extent [23]. At Wuro-chekke farm location broadcasting method was adopted by most of the farmers (37%), then 27% employed the use of inorganic fertilizers, ring method 11% and only 8% had used spot application correspondingly (Table 4). Conversely, the use of organic and inorganic fertilizers was moderately effective with rated values of 3.1 and 2.8. According to Ref. [13] to increase crop yield, farmers do rely on the

use of inorganic fertilizers, which are costly and more effective when combined with the organic manures respectively. Moreover, the use of both organic + inorganic fertilizers was highly effective (3.6) among the small scale farmers at Wuro-chekke farm location (Table 5). This finding is in conformity with the result of [13] who found out that combined application of organic and inorganic fertilizers result in high crop growth rate than sole application. Band placement and broadcasting methods were considered highly effective (3.6 and 3.5) while ring and spot methods were recorded moderately effective among the farmers at Wuro-chekke farm location (Table 6).

## 4. CONCLUSION

An increase in agricultural food production required increase in fertilizer use among small scale farmers most especially in Sub-Saharan countries and particularly in the north-eastern Nigeria where the weathered soils is characterized by low inherent fertility, low organic matter and undergoes degradation due to continuous cropping, deforestation, poor management among others. However, fertilizer use among the small scale farmers in Yola South is apparent despite its high cost and unavailability but the rate of production still remained low and unprofitable which might be attributed to poor use, method and management of the fertilizers resulted to low or ineffective. Thus, findings from this research revealed that organic fertilizers were mostly adopted by the farmer than the inorganic fertilizers which might be connected to unavailability and high cost coupled with low income of the farmers. Similarly, broadcasting method of application was adopted by majority of the farmers in the area because it is easy, simple and less time consumption, even though, the applied fertilizers using this method are susceptible to leaching and volatilization. Conversely, band placement method was revealed as the most effective due to the fact that it creates high nutrient concentration gradient more close to the root rhizosphere of the plants. In addition, organic and the combine use of both organic and inorganic fertilizers were considered as most effective in all the farm location in the study area due to the long term mineralization process and nutrients balance in the soil system. The need for an increase in agricultural research most especially in fertilizer technology should be intensified to provide substantial information on the effectiveness use of fertilizer in the study area. Based on the findings obtained from this

research work, to actualize the dream of adequate food production for the growing population in the area, it is therefore, recommended that;

- An intensive research and training should be geared towards the small scale farmers on new fertilizer techniques and its strategic management;
- Government should adopt the low price fertilizer campaign that is affordable by the farmers and timely released of the fertilizers to the target farmers should be considered amicably and;
- The small scale farmers should consider adhesively the adoption of effective techniques of fertilizer use on their farmlands for profitable farming.

## CONSENT

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

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## COMPETING INTERESTS

Authors have declared that no competing interests exist.

## REFERENCES

1. Adrian C, David W, Carl W, Jean R, Dan G. Organicfertilizer. Available:<http://www.ext.colostate.edu/mg/gardennotes/234.html> Retrieved 15 September, 2014.
2. Aderinoye-Abdulwahab SA, Salami ST. Assessment of organic fertilizer usage by vegetable farmers in Asa local government area of Kwara State, Nigeria. *Agrosearch*. 2017;17(1):101–114 Available:<https://dx.doi.org/10.4314/agrosh.v17i1.8101>
3. Africa Fertilizer Summit. African union special summit of the heads of state and government. Abuja, Nigeria. 13 June 2006.
4. Abuja Declaration on Fertilizer For African Revolution; 2009.
5. Heinrich D, Manfred D, Ralf V, Martin ET, Reinhold G, Gunter S. Fertilizers, 2 Types in ullmann's encyclopedia of industrial chemistry, Wiley-VCH, Weinheim; 2009.
6. FAO Fertilizer use by crop. Fertilizer and Plant Nutrition Bulletin 17; 2006. ISBN 978-92-5-105592-2
7. Andersson E. Turning waste into value: Using human urine to enrich soils for sustainable food production in Uganda. *Journal of Cleaner Production*. 2015;96: 290–298. Available:<https://doi.org/10.1016/j.jclepro.2014.01.070>
8. IFPRI. A review of literature on agricultural productivity, social capital and food security in Nigeria. International Food Policy Research Institute (IFPRI), NSSP Working Paper 21; 2011.
9. FAO. Status and challenges of soil management in Nigeria. Food Agriculture Organisation (FAO); 2013. Available:[http://www.fao.org/fileadmin/user\\_upload/GSP/docs/WS\\_managing](http://www.fao.org/fileadmin/user_upload/GSP/docs/WS_managing)
10. Adebayo AA. Climate i (sunshine, temperature, evaporation and relative humidity). In Adebayo AA, Tukur AL, editors. Adamawa State in Maps. Department of Geography, Federal University of Technology, Yola, Nigeria. 1999;26.
11. Asika NM. Research methodology in the behavioral sciences. Longman Nigeria. Living soils/ Status\_Soil\_Management\_ Nigeria\_Ojuola; 1991.
12. Sadiq AA, Shuwa AS. An appraisal of substantive soil and water conservation techniques adopted on different farm locations in Yola South LGA, Adamawa State, Nigeria. *International Journal of Scientific Research Engineering & Technology (IJSRET)*. 2019;8(3): 164-173. ISSN: 2278–0882.
13. Maryam A, Sadiq AA. An evaluation of fertilizer use intensity among arable farmers in Yola South LGA, Adamawa State, Nigeria. *African Journal of Agriculture and Food Science*. 2020;3(2): 48-63. ISSN: 2689-5331
14. Sadiq AA. Effects of nitrogen fertilizer with and without cowdung on maize growth (*Zea mays* L.) and some selected soil chemical properties in a pot experiment.

- International Journal of Food and Agricultural Research. 2018;14(1&2):36-50.  
ISSN: 0189 - 7136.
14. Tunku P. Comparative effects of inorganic and organic fertilizers on the performance of okra (*Abelmoschus esculentus* (L.) MOENCH). In Jibrin JM., Hussaini MA, Auwalu BM, Essiet EU, Muhammad IR, Mohammed SG, Daneji MI, Garba Y, Pantami SA. (eds); Agricultural Transformation in a Deregulated Economy: Prospects and Challenges. Proceeding of the 46<sup>th</sup> Annual Conference of the Agricultural Society of Nigeria at Convocation Arena New Campus, BUK, Kano, Nigeria, November 5<sup>th</sup> – 9<sup>th</sup>. 2012; 890-891.
  15. Malival PL. Agronomy at a Glance. Agrotech Publishing Academy, Udaipur. 2001;3-15.
  16. FAO. Fertilizer use by crops in Pakistan. 2004;4–24. In Pakistan Journal of Life and Social Sciences. 2009;7(2):108 – 111.
  17. Das PC. Manures and fertilizers. (2<sup>nd</sup> Ed.). Kalyani Publishers, New Delhi. 2005;75–76.
  18. Eric WC, Jayne TS, Valerie AK. Alternative approaches for promoting fertilizer use in Africa. Agriculture and Rural Development Discussion Paper 22. The International Bank for Reconstruction and Development / The World Bank. 1818 H Street, NW Washington, DC 20433. 2006;1-88.  
Available:www.worldbank.org/rural
  19. Amujoyegbe BJ, Opabode JT, Olayinka A. Effect of organic and inorganic fertilizer on yield and chlorophyll content of maize (*Zea mays* L.) and *Sorghum bicolor* (L.) (Moench). African Journal of Biotechnology. 2007;6(16):1869–1873.
  20. Shah STH, Zamir MS, Waseem M, Asghar A, Tahir M, Waleed BK. Growth and yield response of maize (*Zea mays* L.) to organic and inorganic sources of nitrogen. Pakistan Journal of Life Social Science. 2009;7(2):108–111.
  21. Shiyam JO, Binang WB. Effect of poultry manure and plant population on productivity of fluted pumpkin (*Telfairia occidentalis* hook f.) in Calabar, Nigeria. Journal of Organic Systems. 2013;8(2):29-35.
  22. Druilhe Z, Barreiro-Hurlé J. Fertilizer subsidies in sub-Saharan Africa. ESA Working paper No. 12-04. Rome, FAO; 2012.
  23. Fasina OO. Determinants of perceived effectiveness of organic fertilizer used by farmers in Oyo State, Nigeria. Agricultura Tropica et Subtropica. 2013;46(1):23-28.

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