Nigerian Agricultural Policy Research Journal (NAPReJ) Agricultural Policy Research Network (APRNet)
Vol. 4. Iss. 1. Website:http:// www.aprnetworkng.org ©2018

NAPReJ ISSN 2536-6084 (Print) & ISSN 2545-5745 (Online)

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Structural effects of 2010 - 2015 Fertilizer Policy on farmers' resource use in Nigeria: Evidence from Taraba State

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A R T I C L E I N F O

Key Words

Fertilizer,

Input Policy

Voucher System

Resource use efficiency

ABSTRACT

This study assessed the structural effects of 2010 – 2015 fertilizer policy on crop farmers' resource use in Nigeria. Multi-stage sampling technique was employed to select 120 respondents for the study. Results show that majority (52.50 %) of the household heads were within the age range of 31-50 years with a mean of 50 years. Males dominated the rural household heads in the study area with about 90% while 10% were females. Greater percentages of about 86.67% of the household heads were married while the remaining 13.33% were single, divorced or widowed. Majority (69.17%) of the household heads interviewed were literate with a mean of 8years. Majority (79.17%) of the respondents had farming as their major occupation while those with other occupations including farming were 20.83%. Majority of the respondents (56.67%) fell within the household size of 7-12 persons with a mean of 7 persons per household. Most of the farmers (55%)had about 10-20 years of farming experience, with a mean of 20 years. About 45% of the respondents owned land between 0-2ha in the study area with a mean of 3.14ha. Results on availability and timeliness of fertilizer supply to farmers before and during the policy period showed that government interventions on supply of fertilizer was accepted by farmers to be timely and readily available during the policy period than before the period. The chow test showed that there was a significant structural difference in resource use by farmers in the two periods. Productivity could be improved by expanding the farm size, increasing the quantity of seed, fertilizer use and increasing the level of labour while alternative sources agrochemicals to be employed by farmers in order to boost production.

Introduction

Agriculture is the economic heart of most countries and most likely source of significant economic growth (Department for International Development (DFID), 2003). It has been observed as the major and certain path to economic growth and sustainable development. In the case of Nigeria, agriculture remains the main stay of the economy in spite of the dominant role of the petroleum sector as the major foreign exchange earner (National Economic Empowerment and Development Strategy (NEEDS), 2004). It is the largest non-oil export earner; the largest employer of labour and a key contributor to wealth and poverty alleviation. This is because agriculture provides direct employment to about 75% of the population (National Bureau of Statistics (NBS), 2007).

Although Nigeria's Global Hunger Index (GHI) in 2016 was 25.5, she has remained in the category of countries with serious hunger problems. The GHI ranks countries on a 100-point scale, with 0 being the best score (no hunger) and 100 being the worst, though neither of these extremes is achievable in practice (Grebmer et al., 2008). It is therefore, expected that the agricultural sector must be relied upon in the future to supply more food to a growing and more prosperous population and to be a foreign exchange earner (Nagy &Edun, 2002).

ISSN 2536-6084 (Print) & ISSN 2545-5745 (Online)

Nigeria has a great potential in food and cash crop production, to expand out, increase productivity, become a net exporter and enhance food security (Okolo, 2004). To achieve this, Agriculture in Nigeria needs to embrace science-based technology, improved seed and the use of fertilizer. This is because land expansion is limited without science-based agricultural inputs, leading to the decline of agricultural production (Ayinde, Adewumi&Omotosho, 2009). In this regard, fertilizer is one of the major farm inputs for achieving the green revolution objective in the world. According to Dada (2006), during the Africa Fertilizer Summit, it is generally believed that not less than 50% of incremental crop output in the past five decades is attributable to fertilizer use. Owing to fertilizer use along with other inputs, such as seeds and agro chemicals, many countries of the world with high population densities have been able to achieve relatively, food self-sufficiency in the past decades (World Bank, 2004). Unfortunately, the benefits of green revolution did not accrue significantly to sub-Saharan Africa to any perceptible extent, due to inadequate use of fertilizer and other factors (Federal Government of Nigeria (FGN), 2005). Thus, it is noted that "the rest of the world is fed because of the use of good seed and inorganic fertilizer. This technology has not been used in most of Africa. The only way you can help farmers get access to it is give it away free or subsidize it heavily." Stephen Carr, former World Bank Specialist on Sub-Saharan African Agriculture, quoted in (Dugger, 2007).

Since the establishment of the ministry for agriculture at the federal level in 1967, followed by the creation of the first professional department; Federal Department of Agriculture (FDA), in the ministry in 1970, the promotion of fertilizer and other green revolution technologies has become a deliberate government policy. The institutional policy on fertilizer involved the subsequent establishment of the erstwhile Fertilizer Procurement and Distribution Division (FPDD), which was established in the FDA in an effort to co-ordinate the activities of the states in the importation of fertilizer (Dada, 2006).

Regrettably, Okolo (2004) describes the fertilizer supply in Nigeria as still inadequate. This accounts to some extent for its low usage. Thus, Olomola (2005) opines that there is need to improve the agribusiness market structure and performance because, one major impetus to fertilizer usage is an improvement of the fertilizer market.

The World's population is expected to reach 9.7 billion and Nigeria's population is expected to exceed 300 million people by 2050 as projected by United Nations (UN/DESA, 2015). To keep pace with this population, Nigeria therefore, requires a high-investment/high growth rate policy for the agricultural sector. Investments need to be made in agricultural research, extension, education, transportation and rural infrastructure; all guided by appropriate input and product price and trade policies, which will give rise to a substantial increase in agricultural productivity growth and production. A key element in a high-investment/high growth rate agricultural strategy is an efficiently functioning fertilizer subsector. To function at peak efficiency, the fertilizer subsector requires that complementary inputs such as modern seed and plant protection products are widely used (Nagy & Edun, 2002).

A retrospective review of the Nigerian fertilizer policy reveals an inconsistency of government fertilizer policy over the years. Many policies have been formulated right from the pre-1970 period, the pre-structural adjustment period (1970-1985), the Structural Adjustment Period (SAP) in 1986 and the post structural adjustment period (Bello, 2006). Until 1996, the Federal Government has free monopoly on the distribution of fertilizer in Nigeria. But with effect from 1997, trade in fertilizer has been liberalized and private importers are now free to import and sell fertilizer in the open market.

In this regard and as a contribution to agricultural development in Nigeria and in support of the Transformation Agenda, the Ministry of Agriculture

ISSN 2536-6084 (Print) & ISSN 2545-5745 (Online)

and Rural Development developed and aggressively implemented an Agricultural Transformation Agenda focused on major policy reforms to development of a data base; establish the Growth Enhancement Support Scheme(GESS); introduce electronic wallet system; guarantee leverage; eliminate corruption and reposition the seed and fertilizer sector to better performance, and restore credibility for the sector before Nigerians and the International community. This study therefore was premised on the fact that the problem of fertilizer policy ineffectiveness has been a major challenge to the actors in Nigeria. Hence, there is a need to look at the 2010 – 2015 fertilizer policy to see whether it has made any structural impact on the resource use of the farmers and effectiveness of the policy with respect to the level of fertilizer availability and timeliness of delivery compare to what was obtainable in the past.

Although some studies have been done on the relationship between fertilizer policies and agricultural development in the economy, little is known about the 2010 – 2015 fertilizer policy in Nigeria. Ayinde et al., (2009) studied the effect of fertilizer policy on crop production in Nigeria; Eboh, Ujah and Amaechina (2006) studied how government fertilizer subsidies benefit rural farmers in Nigeria. Nagy and Edun (2002) examined the Nigerian government fertilizer policy and suggested alternative market-friendly policies; Oko (2011) analysed the impact of fertilizer policy on crop production in Nigeria and Liverpool-Tasie, Olaniyan, Salau and Sackey (2010a) worked on a review of fertilizer policy issues in Nigeria. However, limited research has been done, in assessing the structural effects of 2010 – 2015 fertilizer policy on crop farmers' resource use in Nigeria.

2. Contextual Issues

2.1 Nigeria fertilizer policy overview

A historical review of Nigerian fertilizer policy by Nagy and Edun (2002) reveals an inconsistency of government fertilizer policy over the years. Policies kept changing almost year by year (as discussed below) in order to check the problems of availability, leakages and arbitrage. However, none of these policies succeeded. The Federal Government did not follow through on the liberalization process started in 1997 by ensuring that the preconditions for a transition to a privatized fertilizer sector were implemented. The Federal Government withdrew from fertilizer procurement and subsidy policies, leaving the industry stranded.

In spite of the fact that demand and supply factors, such as low farmer incomes and high market prices resulting from limited fertilizer availability have been responsible for low usage of fertilizer in Nigeria, public policy responses to fertilizer related issues have also contributed to the continuing gap in usage. To promote increased use of fertilizer among smallholder farming systems, several policy approaches have been used (Crawford, Jayne, & Kelly, 2005). These include the promotion of state monopoly for fertilizer import and distribution, institution of price controls and subsidies at the fertilizer retail markets, provision of credit to farmers for the purchase of fertilizer, institution of import tariffs, decentralization of procurement and distribution, and deregulation of markets (Liverpool-Tasie et al., 2010). These suggest that frequent changes in fertilizer policies and promotion of a dual fertilizer market (subsidized and free-market) have prevented the required response from the private sector in taking over the role played by the public sector. Despite the repeated changes in policy scenarios for fertilizer at both the federal and state levels over the years, one factor has remained largely constant; the support for fertilizer price subsidy (Liverpool-Tasie et al., 2010). Fertilizer subsidy has been central to the policy direction of Nigeria and may be justified on many grounds such as market failures and equity considerations. In a competitive market, the introductions of subsidies cause distortions leading to economic inefficiency and net welfare losses. However, the absence of a competitive environment in Nigeria and many developing countries provides a rationale for public intervention (Crawford et al., 2005). Crawford et al.,

ISSN 2536-6084 (Print) & ISSN 2545-5745 (Online)

(2005) added that subsidies could be justified on equity grounds as a mechanism for dealing with skewed income distribution. Controversies still surround the continued use of the subsidy policy for equity purposes and its role in reducing farm gate prices while increasing smallholder farmers' effective demand for fertilizer.

Arguably, there are serious and longstanding fertilizer supply problems in Nigeria largely due to low local production and the use of subsidies undoubtedly assisted in the adoption and expansion of maize seed-fertilizertechnology in the 1990s (Smith, Barau, Goldman, &Mareck, 1994). Malawi, for example, transformed from a food aid dependent economy to an exporter after facilitating access to subsidized seeds and fertilizer by smallholder producers through the use of a voucher system (Liverpool-Tasie et al., 2010). On the other hand, the heavy emphasis on price subsidization to the detriment of other approaches, such as complementary actions to improve farmers' fertilizer-use techniques (e.g., extension programs), seeking lower transactions costs (e.g., better regulatory environment), or reduced risk (e.g., fertilizer quality control) has hampered market development in Nigeria (Yanggen et al., 1998).

2.2 State of Fertilizer Quality Regulation in Nigeria

Despite a multifaceted fertilizer quality regulatory process with numerous and diverse participants, fertilizer quality remains a challenge in Nigeria as noted earlier. Fake, adulterated, and misbranded fertilizers, as well as underweight fertilizer bags, are prevalent in the Nigerian market (FGN, 2006; Chude, 2006; Ayoola et al., 2002). Fertilizer quality issues have been identified as another major constraint to fertilizer use in Nigeria and farmers have indicated interest in higher fertilizer use, despite the cost, if they were assured of improved quality (Nagy &Edun, 2002; Chude, 2006).

Numerous fertilizer regulatory activities concurrently exist in Nigeria. The Standards Organization of Nigeria (SON), National Agency for Food and Drug Administration and Control(NAFDAC), Federal Fertilizer Department (FFD) of the Federal Ministry of Agriculture and Rural Development (FMARD), States Ministries of Agriculture (SMAs) and Agricultural Research Institutes under the National University System are key agencies mandated to participate in fertilizer regulation (Nagy & Edun, 2002; Chude, 2006).

Despite these numerous participants charged with fertilizer quality regulation, fertilizer quality issues remain a challenge in Nigeria. The quality challenges occur along the full spectrum of thefertilizer supply chain. Adulteration, which usually involves fertilizer being mixed with productslike sand and crop or weed seeds, is a major problem. Other issues like nutrient deficiency of fertilizer samples subjected to laboratory tests and underweight bags have also been confirmed across the country (Ayoola et al., 2002). In addition to the use of substandard raw materials, nutrient deficiency is largely attributed to poor process control in production plants or poor product mixing in the case of blending plants (Ayoola et al., 2002). Underweight bags, used to increase profit margins, typically occur during multiple levels of re-bagging, often in the absenceof proper scales. Other fertilizer quality issues prevalent in Nigeria include poor quality bags andstorage facilities, inadequate warehouse ventilation, poor product handling and misbranding, misleading or absent labels and false nutrient specifications (Ayoola et al., 2002).

2.3 Improving fertilizer distribution – an example of input vouchers

2.3.1 Role of the Voucher System: As a result of the afore-mentioned bottlenecks, government distribution of subsidized fertilizer in Nigeria is often characterized by cumbersome and expensive administrative processes as well as diversion of the product from the proclaimed beneficiaries.

ISSN 2536-6084 (Print) & ISSN 2545-5745 (Online)

Consequently, limited quantities of inputs often get to farmers long after they are needed (Minot & Benson, 2009). Agricultural input vouchers are therefore seen to be more flexible, enabling holders purchase specific quantities and/or types of inputs from authorized input dealers who agree to accept vouchers as payment. The dealers can then redeem the vouchers from the government or voucher program organizers, often with an agreed margin to cover their expenses and agreed level of profit (Gregory, 2006).

Voucher programmes are seen as an effective way to build private-sector distribution networks when farmers are required to take their vouchers to private input dealers to exchange for fertilizer. Providing guaranteed demand and margins to small input dealers, they accelerate market development (Gregory, 2006). This can be strengthened by capacity building and linkages to initiatives in output marketing, financial services, and market information for dealers (Gregory, 2006). Through well-built exit strategies such as reducing the value of voucher overtime or converting it to a crop production credit that is repaid at harvest, input vouchers can be sustainable programs. Further still, in emergency response situations, vouchers can replace food aid as medium-term support to those affected (Minot & Benson, 2009).By providing access to fertilizer and other inputs at lower cost, vouchers help reduce adoption disincentives due to farmer cash constraints and/or risk aversion and low expectations of returns from investments in inputs (Dorward, Chirwa, Boughton & Kelly, 2007). They increase the probability that farmers will use the technology and benefit from its use by increased agricultural productivity and consequently increased incomes and food security.

In line with these thoughts, agricultural input vouchers are being increasingly employed to address problems associated with agricultural productivity and food security. Malawi has usedinput vouchers in its nationwide fertilizer and seed subsidy programs since 1999. Input vouchers have also been used in various countries such as Afghanistan in 2001, Mozambique in 2002, Zambia in 2003, Tanzania in 2008 and Ghana in 2008 and 2009 (Longley et al., 2003; Gregory 2006; Minot & Benson, 2009).

In Nigeria, the use of vouchers to provide federal and state government subsidized fertilizer has been piloted in several states in 2004 and from 2008 to 2010. The promotion of voucher use in Nigeria stems from the years of wastage and diversion challenges inherent in government's agricultural inputs procurement and distribution. The standard national program purchases fertilizer from importers and then distributes it to state level blenders and agricultural development programs. This national program, however, undermined the development of private sector, commercial sales, and suffers from substantial leakages and non-payments from states to the federal government.

2.3.2: Pilot Trial of the fertilizer voucher system in Nigeria

The International Fertility Development Centre (IFDC) Developing Agricultural Inputs Markets in Nigeria (DAIMINA) pilot project was on the use of fertilizer vouchers in three states in 2004 (Kano, Bauchi and the Federal Capital Territory (FCT)). The objective of the project was to allow farmers to procure fertilizers with a 25% subsidy from private dealers, complementing the government distribution channel and increasing the density of the outlet network (Gregory, 2006). The pilot was expected to demonstrate the potential for a more efficient private sector management system of the state and federal government fertilizer subsidy to targeted beneficiary farmers (Gregory, 2006). A second pilot was done in 2008 (Kano and Bauchi) and another one in 2009 in Kano and Taraba states.

The application of the pilot fertilizer voucher programs on fertilizer supplied under the Federal Market Stabilization Program (FMSP) in Nigeria was a response to the challenges of the traditional distribution of subsidized fertilizer in Nigeria(Liverpool-Tasie, et al., 2010). The 2009

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voucher program in Kano and Taraba was a collaborative effort between the federal and state governments, the private sector suppliers and dealers, and IFDC. The program was designed to deliver subsidized fertilizer to 140,000 and 76,000 smallholder farmers in Kano and Taraba states respectively. The pilot program was an attempt to address fertilizer distribution challenges and did not involve or accompany any substantial policy change. Three fertilizer suppliers and over 150 private sector agro-dealers participated in the program. Participating farmers were provided with vouchers, which were redeemable at certified agricultural input dealers within their local government of residence. The value of the voucher was a N2000 (about US$13 in 2009) discount per bag on two bags of nitrogen phosphorous potassium (NPK) and one bag of urea in Kano, and on two bags each of NPK and urea in Taraba. Farmers' vouchers were allocated to match the volume of product requested by states from the federal government through suppliers with specific dealers in the various local government areas (LGAs). This limited farmers' choices on their source of the product. In most cases, there were different certified agricultural input dealers for NPK and urea, which increased the transaction costs associated with redeeming the vouchers.

The voucher program was intended to improve on the traditional fertilizer distribution system characterized by numerous leakages and the late delivery of poor-quality fertilizers to farmers at often close to the market price (Nagy &Edun 2002; IFDC 2010). Thus, an improved system to reduce fertilizer leakages and increase the quantity of subsidized fertilizer that farmers had access to would be expected. Also expected to be seen is a better quality fertilizer being distributed to farmers who participated in the programme on time and at a price significantly lower than the market price.

2.4 The 2010 - 2015 Fertilizer Policy

Building on the successes of the pilot trial of the fertilizer voucher system The Honourable Minister of Agriculture and Rural Development, acting on the authority of the National Council on Agriculture, upon the consideration by the National Fertilizer Development Committee, in wide consultation with the stakeholders' community, and with technical input from the National Fertilizer Technical Committee enacted the policy on fertilizer of the Federal Republic of Nigeria (FMARD,2012).

According to Federal Ministry of Agriculture and Rural Development (2012) the essence of the policy was to address the challenges faced in the fertilizer sub-secor/ The scope for the policy includes:

i. Research & Development

ii. Fertilizer production

iii. Domestic marketing

iv. Quality control

v. Farm use (extension services and education)

vi. International trade (import/export)

vii. Environmental

viii. Governance and institutional

The fertilizer policy as related to these aspects would require technical backup support services in terms of monitoring and evaluation of implementation, as well as periodic review of the policy document. The fertilizer subsector of Nigeria is envisioned as a competitive private input market to develop and disseminate adequate quantity and quality of fertilizer products that are timely available and accessible to the teeming farm population of Nigeria, operating under a supportive public sector, and without undermining the environment.

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2.4.1 Components of 2010 - 2015 Fertilizer Policy

The components of the policy were as follows:

i) Ending Corruption in the Fertilizer Sector

A major target was ending corruption in the fertilizer sector in the Federal Ministry of Agriculture. The Federal Ministry of Agriculture and Rural Development have for decades procured and distributed fertilizers. The government system was corrupt, undermined the private sector, and did not deliver fertilizers to genuine farmers, but to political farmers and the fertilizers were exported. Only 11% of farmers got the government-distributed fertilizers due to corruption and rent seeking (Adesina, 2013). This created a bad image for Nigeria. The corrupt system which has been endemic for over 40 years was totally dismantled by September 2011. Fertilizers and seeds were then sold by the companies directly to farmers, not to government. This eliminated the middle men and rent seekers from the system, while benefitting genuine farmers.

ii) Growth Enhancement Support Scheme (GESS)

The growth enhancement (support) scheme was introduced in May 2012, as a pilot project in 36 states and the Federal Capital territory. It is a Federal Government initiative to actualize the Agricultural Transformation Agenda (ATA). According to the Federal Ministry of Agriculture and Rural Development (2011) about 14 million farmers have registered for the scheme throughout the federation. Inputs have been distributed in three seasonal production cycles to farmers (Adebo, 2014)

Growth Enhancement Support Scheme (GESS) represents a policy and pragmatic shift within the existing Fertilizer Market Stabilization Programme and it puts the resource constrained farmer at its center through the provision of series of incentives to encourage the critical actors in the fertilizer value chain to work together to improve productivity, household food security and income of the farmer. According to Federal Ministry of Agriculture and Rural Development (FMARD), (2016), the goals of Growth Enhancement (Support) Scheme included:

i. Target 5 million farmers in each year for 4 years that will receive GESS in their mobile phone directly totaling 20 million at the end of 4 years.

ii. To provide support directly to farmers to enable them procure agricultural inputs at affordable prices, at the right time and place.

iii. To increase productivity of farmers across the length and breadth of the country through increased use of fertilizer i.e. 50kg/ha from 13kg/ha.

iv. Change the role of Government from direct procurement and distribution of fertilizer to a facilitator of procurement, regulator of fertilizer quality and catalyst of active private sector participation in the fertilizer value chain

iii) The Electronic Wallet (E-wallet) Approach

In order to reach farmers directly with seeds and fertilizers, the Electronic Wallet System was developed. An e-wallet is defined as an efficient and transparent electronic device system that makes use of vouchers for the purchase and distribution of agricultural inputs (Ezeh, 2013, Adesina, 2013). The e-wallet approach is designed for smallholder farmers. The criteria for farmer's participation include: farmers being above 18 years old; have participated in a survey authorized by the government to capture farmers personal detailed information; must own a cell phone with a registered SIM card and have at least sixty naira credit in the cell phone. The fulfilment of these conditions guarantees the issuance of an e-wallet voucher to the farmer. The voucher is used to redeem fertilizers, seeds and other agricultural inputs from agro-dealers at half the cost (Adesina, 2013).

ISSN 2536-6084 (Print) & ISSN 2545-5745 (Online)

Also, for an agro input dealer to participate in the programme, he/she must own a cell phone with a registered SIM card, understand the process of using e wallets, and attend training programmes designed for the project. The agro dealers are required to; conduct honest business and guide against fraud; choose and prepare a location for the business transaction; provide storage facilities and be available at the appropriate time to attend to farmers needs. Other prominent personalities in the scheme are the helpline personnel and redemption supervisors. Each state Agricultural Development Project (ADP) supplied the helpline staffs, and about 3-5 helpline staffs are assigned to each of the Local Government Area. The helpline staff and supervisors connect to the farmers on a daily basis to attend to their needs. The redemption supervisor helps in verifying farmer's identity as well as a farmer's code in the text message received by the farmer, and then compares it with the name and code listed in the farmers register which the supervisor received from the cellulant. The subsidized farm inputs are delivered directly to farmers through their mobile phones. The project was expected to provide direct linkage between the farmers and the government. This will enable the government to disseminate valuable information to the farmers, thus ensuring farmers' progress (Ezeh, 2013).

iv) A Database: A database of 4.5 million farmers was developed, with their full biometric information, to aid in better distribution of subsidized fertilizers and seeds to farmers. The database was meant to be continually updated yearly.

v) Leverage: A total of 30 Billion Naira was leveraged using guarantees, from commercial banks, to finance the seed and fertilizer supply in the country, without spending one Naira from government. It was the first time of achieving this in Nigeria (FMARD, 2016)

3. Research Methods

The study was conducted in Taraba State of Nigeria. The state was chosen because it is one of the pioneer states where the voucher system was introduced in Nigeria, it was safer to work in the area due to insurgency in the north and has a very huge concentration of farmers;

Taraba State, named after "Taraba river" with capital Jalingo is located between latitude 8000' North and longitudes 10030' East with a land area of 54473km2 (21,0322sq.mi) (National Bureau of Statistics, 2008). According to 2006 census figure, Taraba state has the population of 2,300,736 people (National Population Commission(NPC), 2006). It is bounded in the West by Nasarawa state and Benue state, Northwest by Plateau state and Gombe state, Northeast by Adamawa state and Southeast by Cameroun. Taraba state lies largely within the middle of Nigeria and consists of undulating landscape dotted with a few mountainous features which includes the prominent Mambilla Plateau.

The state lies largely within the tropical zone and has a vegetation of low forest in the Southern part and grassland in the Northern part. Rivers Benue, Donga, Taraba, and Ibi are the main rivers in the state. The major occupation of the people of Taraba state is agriculture. Cash crops produced in the state include coffee, tea, groundnuts and cotton. Crops such as maize, rice, sorghum, millet, cassava and yam are also produced in commercial quantities as stated by Canback Global Income Distribution Database (C-GIDD), 2008). In addition, cattle, sheep and goats are reared in large numbers, especially, on the Mambilla Plateau and along the Benue and Taraba valleys. Similarly, the people undertake other livestock production, rabbit breeding and pig farming in fairy large scale. Communities living on the banks of River Benue, River Taraba, River Donga and Ibi engage in fishing all year round. Occupational activities such as pottery, cloth-weaving, dyeing, mat making, carving, embroidery and blacksmithing are also carried out in various parts of the state. Taraba State

ISSN 2536-6084 (Print) & ISSN 2545-5745 (Online)

has a tropical climate marked by dry and rainy season. The rainy season commences early April to October while the dry season commences from October to March. The average rain fall in the area is approximately 1350 mm as well as minimum and maximum air temperatures of 22℃ and 31℃ respectively. The mean soil temperature is 28℃ while relative humidity ranges from 69.0% to 79.0%.

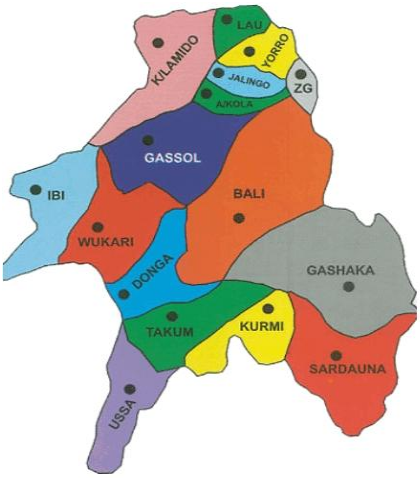

Figure 1. Map of Taraba State, Nigeria
Source: Taraba State Government (no date. Available at Source: www.tarabastate.gov.ng)

A multi-stage sampling technique was used in this study for the purpose of collecting data. In the first stage, three local government areas (LGAs) were randomly selected from among those that participated in the Growth Enhancement (Support) Scheme (GESS), one from each of the three agricultural zones. In the second stage, two (2) communities were chosen from each of the selected LGAs of which twenty (20) homogenous farmers who participated in the programme were randomly selected, giving a total of 120 respondents that were sampled. The sample frame for the sampling was collected from the state Ministry of Agriculture

Questionnaire was used to collect primary data for the study. The questionnaires were administered to the literate households while the researcher interviewed the illiterate households and their responses were recorded accordingly to ensure accuracy of collected data. The data collection instrument was organized in sections to reflect specific objectives of the study.

A 4-point Likert type scale (mean score rating) was used to present Government interventions on availability and timeliness of fertilizer supply to farmers before and during the policy period. it was used to enable respondents to specify their levels of agreement or disagreement on a symmetric agree – disagree scale for series of item statements. This were regarded as strongly agree (SA) agree (A) disagree (DA) strongly disagree (SD), with corresponding values of 4, 3, 2, and 1 respectively. The mean score of the respondents based on the 4 – point rating scale were computed as: = 2.50 cut off point. Based on this, any score below 2.50 (MS<2.50) were taken as a weak factor and not considered while those with mean score greater than 2.50 (MS>2.50) were taken as strong factors and considered.This was also used by Oni (2015) to determine the factors influencing farmers' willingness to engage in agro-forestry practice in Ekiti State, Nigeria.

The multiple regression analysis was employed to assess the effect of the fertilizer policy on resource use by farmers during the policy period compared with the past periods. The age, gender, educational level, household size, farm size of respondents and fertilizer cost were used as proxy for fertilizer policy. A similar approach was adopted by Ayinde, Adewumi and Omotosho (2009) in examining the impact of fertilizer policy on crop production in Nigeria.

The implicit function for the regression analysis thus stated:

$Yc = f(X1, X2, X3, X4, X5, X6, e)$

Where: Yc = Farmers Revenue(Naira), X1=Age (Years); X2 = Gender (Dummy: 1=Male; 0= Female); X3 = Educational level (Years spent in school); X4= Household size (Number having the same catering arrangement); X5 = Farm size

ISSN 2536-6084 (Print) & ISSN 2545-5745 (Online)

(Hectares); X6 = Fertilizer cost (Naira), e = error term.

The Chow test was used to test the hypothesis that there is no significant difference between resource use by farmers before and during the policy period. The model is specified as follows

$$F^* = \frac{[\sum e^2_p - (\sum e^2_1 + \sum e^2_2)] / k}{(\sum e^2_1 + \sum e^2_2) / (n_1 + n_2 - 2k)}$$

Where: $\sum e^2_p$ = pooled residual variation of resource use before and during the period, $\sum e^2_1$ = unexpected variation of resource use before the period, $\sum e^2_2$ = unexpected variation of resource use during the period, n_1 = number of observations before the period, n_2 = number of observations during the period, k = number of parameters estimated. The decision rule is: Reject the null hypothesis if the calculated F-value is greater than the F-critical value otherwise accept alternative.

4. Results and discussion

4.1 Socioeconomic Characteristics of Crop Farmers in the Study Area

Table 1 shows the relevant socioeconomic characteristics of crop farmers (respondents) in the study area. Age, gender, marital status, educational level, occupation, household size, farming experience and farm size was discussed in this section.

The results show that majority of the respondents (52.50%) are above 30 years old and thus are more experienced in farming compared to those that are less than 30 years of age (9.17%) who are still learning from their trial and error and have less experience in farming and the use of resources. The mean age of respondents in the study area was 50.08 years. This implies that the study area was dominated by farmers who are still in their most productive years, strong and agile. This agrees with the studies of Ladele (1990) who reported that most of the farmers (59%) in South Western Nigeria fall within this age bracket. Also, Ndukwuet.al, (2010) and Dimeluet.al, (2009) found out that the ability of a farmer to bear risk, be innovative and be able to do manual work decreased with age.

Table 1 Socioeconomic Characteristics of Crop Farmers in the study area

Variables	Percentage
Age	
20-30	9.17
31-40	27.5
41-50	52.5
51-60	7.5
>60	3.33
Gender	
Female	10
Male	90
Marital Status	
Married	86.67
Single	13.33
Educational Level (Years)	
0	30.83
6	38.33
12	20
16	10.84
Occupation	
Farming	79.17
Otherwise	20.83
Household size	
1 - 6	37.5
7 - 12	56.67
13-18	5.83
Farming Experience (years)	
10 -20	55
21-30	31.7
31-40	10
>40	3.3
Farm Size (Ha)	
0-2	45
3 – 5	43.33
6 – 8	10
9 and above	1.67

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Majority (90%) of the farmers were males, this is as a result of the fact that the study area is an agrarian society where farming is measured by the large size of one's land, a requirement which women are not able to meet up with. The reason for the large difference in the percentage above is because farming in itself is quite strenuous considering the largely non mechanised nature in the area and only a few women can withstand the stress. Therefore, it is considered to be more of male job in Taraba State. The female involved do minor jobs like threshing, winnowing, packing and packaging the produce after harvesting has been done.

Majority of the household heads were married (86.67%), while unmarried, divorced and widowed respondents summed together were 13.33%. This agrees with the finding of Ajah (2012) that it is difficult to see rural farmers who are not married because many of them are in polygamous relationships and also the chance to remarry is very high among the rural dwellers in the study area. An implication is that majority of the farmers are likely to make use of family labour for their activities.

The literacy status of the farmers showed that 30.83% had no formal education, 38.33% had primary education, 20% had secondary education, while 10.84% went through the tertiary level of education, which includes holders of B.Sc, HND, OND, NCE and other related certificate. The mean educational level of respondents in the study area was 8 years. It is clearly understandable to anyone that farming does not require certificate before embarking on it in the study area, instead the know-how and skill passed on from generation to generation. The finding implies that literate farmers are in the study area. The implication of this is that the crop farmers are likely to readily adopt new technology and innovation. The knowledge of farmer literacy is good because Nwaru (2005) stated that an educated farmer, other things being equal, allocates farm resources more efficiently. Educated farmers are expected to be more receptive to improved farming techniques, while farmers with low level of education or without education would be less receptive to improved farming techniques (Okoye et al; 2007; Okoye and Onyenweaku, 2007 and Ajibefun and Aderinola, 2004).

Majority of the respondents (79.17%) depended on farming alone as their major occupation. This is because agriculture is the mainstay of the people living in the rural areas. This implies that most of the respondents are self employed, which enables them to generate income in order to meet the obligations of the family. This is in agreement with the findings of National Economic Empowerment and Development Strategy (2004) that agriculture remains the main stay of the Nigeria economy in spite of the dominant role of the petroleum sector as the major foreign exchange earner. It is the largest non-oil export earner; the largest employer of labour and a key contributor to wealth and poverty alleviation. This is because agriculture provides direct employment to about 75% of the population (National Bureau of Statistics, 2007).

Household size distribution revealed that majority of the respondents (56.67%) fell within the household size of 7-12 persons while 37.50% of them fell within the range of 1-6 persons, per household, implying that majority of the farmers had large household sizes. The mean household size of respondents in the study area was 7 persons. This agrees with the finding of Otitoju and Arene (2010) that majority of the respondents (medium scale soya beans farmers in Benue State Nigeria) had the average family size of about 7 persons. The household size therefore suggests that respondents are likely to enjoy family labour readily. The size of the family will thus inversely influence the amount of hired labour employed in farming.

The farming experience distribution showed that 55% of the respondents had about 10-20 years experience in farming, 31.70% had about 21-30 years experience, 10% had about 31-40 years experience and the remaining 3.3% of the respondents had above 40 years experience in farming. The mean farming experience of crop farmers in the study area was 20years. A farmer's experience in farming determines the rate of his resource use and management strategy. A farmer who has spent many years in farming has more experience in resource use and management than a farmer who has spent less time in farming. This implies that the study area was dominated by experienced farmers. Nwaru, (1993), Dimeluet.al, (2009) and Okoye et.al, (2008) reported that farmers count more on their experience than educational attainment in order to increase their productivity. All things being equal, it is expected that the higher the age of the respondents the higher their experience in farming.

Majority of the respondents 45% owned land between 0-2ha, 43.33% owned between 3-5 ha,

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10% owned between 6-8ha and 1.67% owned more than 9ha. The mean farm size in the study area was 3.14ha. This implies that the area was dominated by small-holder farmers. Small farm size can encourage farmers to intensify agricultural production. Hazarika and Subramanian (1999) were of the opinion that if farm size is small, farmers are able to combine their resources better.

4.2 Government Interventions on Availability and Timeliness of Fertilizer Supply to Farmers Before and During the Policy Period

Table 2. The Mean Rating Scores of Government Interventions on Availability and Timeliness of Fertilizer Supply to Farmers Before and During the Policy Period

Variable	Mean score	Decision
Availability of fertilizer before	2.43	Rejected
Availability of fertilizer during	3.61	Accepted
Timeliness of fertilizer before	2.04	Rejected
Timeliness of fertilizer during	2.53	Accepted

Source: Field Survey, 2016.

From Table 2, the mean score was used and the result showed that during the policy period, government interventions on supply of fertilizer was accepted by farmers to be timely and readily available, but the reverse was the case before the policy period as fertilizer supply was neither timely nor readily available, having scored below the decision mean score of (M-2.5) of a 4-point Likert type rating scale. This agrees with the findings of (Gregory and Bumb 2006; Crawford et al.2003; Morris et al.2007) that identifying the determinants of fertilizer supply usually is a combination of a good policy environment and the following "pillars" of market development: human capital, access to finance, market information and regulatory frameworks that facilitate transactions while protecting actors. Increased fertilizer supply requires policies and institutions that investment risk and transaction cost (Kelly & Crawford, 2007). In order to promote increased use of fertilizer among smallholder farming systems, several policy approaches have been used (Crawford, Jayne, & Kelly, 2005).

4.3 The Effect of the Policy on Farmers Resource Use

Table 3 OLS Regression Analysis on Farmers Resource Use in the Study Area, Before the Policy Period

Variable	Coefficient
Constant	-536033.6
	(-2.38)
Age	-3828.2
	(-0.10)
Gender	-789.1634
	(-0.46)
Educational level	-1255.037
	(-1.40)
Farming experience	9320.663
	(0.54)
Household size	-7624.59
	(-0.49)
Farm size before	81647.73
	(6.86)***
Fertilizer cost before	53606.2
	3.05)***
R2	0.6785
R adjusted	0.6584
F Statistics	0
Residual SS	2.61E+11

Source: Field Survey, 2016. NB: T-values are in parentheses; *** $p < 0.01$

Table 3 shows the result of the OLS Regression analysis on farmers resource use in the study area before the policy period. The R^2 value (0.68) implied that the explanatory variables in the model explained 68 percent total variations in resource use by farmers in the study area. The result showed that two out seven explanatory variables had significant coefficients in the equation and they include; farm size (X_6) and fertilizer cost (X_7).

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Table 4 OLS Regression Analysis on Farmers Resource Use in the Study Area During the Policy Period

Variable	Coefficient
Constant	-598923.1 (-2.35)
Age	-37573.73 (0.82)
Gender	-1526.939 (-0.77)
Edulevel	-1787.873 (-1.71)
Farmexp	2915.603 (0.14)
Hhsize	-1227.983 (-0.07)
Farmsizeduring	90832.11 (6.45) ***
Fertcostduring	73091.60 (3.61)***
R2	0.6736
R adjusted	0.6532
F Statistics	0
Residual SS	3.55E+11

Source: Field Survey (2016). **NB:** Standard errors are in parentheses; *** p < 0.01, implies estimates are significant at 1%.

Farm size before the policy period was positively significant at P<0.01. This showed that an increase in farm size caused an eventual increase in farmers' revenue by N81. 647.73. This supports the finding by European Commission Agriculture and Rural Development (2011) that income per worker increases with farm size. On the average, the income per worker of the largest farms was more than those with smallest farms. This is largely explained by differences in farm structure.

Cost of fertilizer before the policy period was positively significant at P<0.01. This showed that an increase in the cost of fertilizer (cost of a bag) caused an increase in farmers' revenue by N53, 606.20. This implied that cost of fertilizer had a direct relationship with farmers' revenue in the study area. This finding is not surprising giving that increase in the cost of fertilizer used by the farmer is an indication of n increase in the quantity of fertilizer used in larger hectares and thus, increased output; the value of which is revenue. This agrees with the findings of William et al., (2011) that fertilizer use, as expected, significantly increases the gross margin per hectare planted. The study found that a 50kg bag of fertilizer tends to raise an additional ZMK45, 000 to 70,000 in net revenue over and above the cost of fertilizer.

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R2	0.6736
R adjusted	0.6532
F Statistics	0
Residual SS	3.55E+11

Source: Field Survey, 2016. Standard errors are in parentheses; *** = p < 0.01.

Table 4 shows the result of the OLS Regression analysis on farmers resource use in the study area during the policy period. The lead equation is the semi-log functional form.
The R^2value (0.6736) showed that the explanatory variables in the model explained 67 percent total variations in revenue of farmers in the study area. The result showed that the explanatory variables (farm size during the policy period (X_6) and

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fertilizer cost during the policy period(X_7) had significant coefficients in the equation.

Farm size during the policy period was positively significant at P<0.01. A unit (ha) increase in farm size leads to ₦90. 832.11 increase in farm revenue. Thus, the larger the farmers' farm size, the more efficiently are their resource utilization and hence, greater farmers' revenue. This supports the finding of Tijani (2007) and Abubakar (2004) that annual income of a farmer determines his ability to purchase improved farm inputs such as fertilizer, hired labour improved seed, chemicals and other improved technology, which may bring about increase in productivity and subsequently leads to higher farm revenue.

Cost of fertilizer during the policy period was positively significant at P<0.01 and a unit increase (50kg bag) in fertilizer use increased the revenue of the farmers by ₦73,091.60.. The OLS regression analysis indicated that an increase in the cost of fertilizer caused an increase in farmers' revenue by ₦73,091.60. This could be as a result of government intervention through subsidy granted and other related factors. This implied that farmers may have increased usage of fertiliser resulting in increasing cost due to availability, timely delivery and subsidisation as earlier discussed

The result of the two OLS regression analysis show that there was an increase in revenue by ₦9,184.38 (17.13% increase) per unit increase in farm size during the policy period and an increase in revenue of the farmers by ₦19, 489.40 (24% increase) for every unit increase in fertilizer bag usedduring the policy period. These findings are in resonance to the observation made by Roth and Abbot (1990) in their analysis of agricultural input subsidy reforms in Burkina Faso. They opined that net revenue (including subsidy cost transferred) to farmers would increase by 30% over and above the situation without the subsidy**.** This implied that farmers had more revenue during the policy period than before the policy period.

In order to verify that the differences in revenue as indicated above was not just by chance and if the policy actually had an impact on farmers resource use in the study area a chow test was performed (Table 5).This was to test for a structural difference in the resource use by farmers before and during the policy period, which translated intothe farmers' revenue. It was used to test the hypothesis that there is no significant difference between farmers resource use before and during the policy period.

Table 5 Chow test of structural effect of fertilizer use on farmers' resource use before and during the policy period

ep2	1.3225E+24
e1^2	6.80323E+22
e2^2	1.25727E+23
K	7
n1	120
n2	120
Fcal*	188.0797845
Ftab	35.63
Numerator	1.61249E+23
Denominator	8.57342E+20

Source: Field Survey, 2016.

Results shows that the F-tabulated value of *F* (35.63) was less than the F-calculated value of *F* (188.08), it implied that there was a significant difference between resource use in the two periods (before and during the policy period) in terms of revenue generated across the two periods and hence, there was a structural change in farmers' resource use in the study area. Hence, the hypothesis which states that there is no significant difference between farmers' resource use before and during the policy period, was rejected. Therefore, the policy had made significant impact on farmers resource use in the study area.

Conclusion

This study has among other things obtained scientific evidence on the structural effects of 2010 – 2015 fertilizer policy on farmers' resource use in Nigeria. The study showed that there was improvement in the timeliness and availability of fertilizer to the farmers during the policy period and there was statistically significant difference in the structure of farmers' resource use during the policy period (Growth Enhancement Support Scheme) and before the policy period. It implied that the policy has had a significant impact on agricultural output in the areas where it was implemented. Although, with a slight improvement on past policies, the results showed that a lot needs to be done, in terms of fertilizer policy formulation and implementation, to revive the dwindling agricultural output contribution to national income and farmers' livelihood.

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In view of the findings from this study, the follow recommendations are made:

i. The Federal Government of Nigeria should continue to develop the private sector fertilizer market and delivery system and support activities that decrease the transactions cost of the delivery system, sustain and increase fertilizer availability and timeliness of delivery in order to improve agricultural productivity of the farmers.

ii. There is also need for the stakeholders in agriculture (policy makers, policy analysts, extension personnel, researchers and farmers themselves) to come together and agree on workable methods of fertilizer distribution in Nigeria. This will go a long way in reducing the complexities of un-timeliness, unavailability, diversion and high cost of fertilizer in the country.

iii. Productivity could be improved by expanding the farm size, increasing the quantity of seed, fertilizer use and increasing the level of labour while alternative sources of agrochemicals to be employed by farmers in other to boost production.

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