International Journal of Science and Research (IJSR)
ISSN (Online): 2319-7064
Index Copernicus Value (2013): 6.14 | Impact Factor (2014): 5.611

Promotion of Fertilizer Application: A Major Factor to Maintain Food Security and Stability for Smallholders in Togo

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Abstract: ***Agriculture is the engine of economy and social development for many countries in Africa including Togo. Agriculture has large share of employment creation (54%) and contributes significantly to gross domestic product (GDP) about 40% [8]. This study analyzed the factors that are affecting the use of input in Togo's agricultural development, particularly maize. Based on the data collected in 2015, the analysis shows that farm size, gender of the household head, household size and belonging to farm cooperative are significant for all farmers due to their influence to the farmer's choice on input use. It also observed that access to market affected small farmers who are not close to the input market. The evidence from the empirical analysis revealed that the eight independent variables (farm size, farming experience years, age, head of household, duration of education, household size, belonging to farm cooperative, and access to market) contributed up to 76%; 77% and 76% of the systematic variation in the agricultural fertilizers and seeds use in agricultural production. Special attention is needed to help farmers understanding the benefit of using inputs and good practices.***

Keywords*:* Food security, inputs use, smallholder farmer, Agricultural productivity, Togo.

1. Introduction

Agriculture is the engine of economy and social development for many countries in Africa including Togo. Agriculture has large share of employment creation (54%) and contributes significantly to gross domestic product (GDP) about 40% [8], a feature that is common among many developing countries. Agricultural production systems are expected to produce food for a global population which is around 7.12 million [43]. The precondition for the effective performance is also expected to contribute to foreign exchange earnings through increase in export and providing a major market for local industrial sector product and accelerate increase in agricultural output, income and resource [42]. Some agricultural economists believed that each increase cited above can only be achieved with introduction of new technology in traditional agriculture [16]. Technology is at the center of the "advancement of agricultural productivity growth in China" and institutional technical changes accounted for most contributions to the increase of Total Factor Productivity (TFP) of Chinese agriculture [1].

To secure and maintain food security, agricultural systems need to be transformed to increase the productive capacity and stability of smallholder agricultural production. However, there is a question of which technologies and practices are most appropriate to reach smallholder farmers.

As farmers adopt new techniques the productivity rise, which in turn give more productive farmers benefit from an increase in their welfare while farmers who are not productive enough will exit the market to seek success elsewhere [25].

The use of new agricultural technologies and practices has proposed to raise household incomes, slow rural-urban migration, and reduce pressure on natural resources (e.g., [28], [29]). Most research on agricultural intensification has focus on areas with high population densities and/ or market integration such as sub-Saharan Africa and southern Asia [27]. Population densities rise and/or demand for agricultural products increase, the resulting land pressures induce adoption of technological and institutional innovation to intensify land use [4] .

The principle sources of high productivity in modern agriculture are reproducible sources. They consist of particular material inputs and of skills and other capabilities required to use such inputs successfully [36]. Increase productivity need to use mechanization, high yield varieties, which were the basis of the green revolution which began in 1960s promoting application of fertilizers to balance soil pH and provide nutrients and minerals needed by plant to grow well [6]. Increased use of high external inputs sometimes caused farmers to abandon traditional techniques of soil fertility maintenance [2].

The Togolese agriculture is hand caped with the widespread use of basic equipment with very low productivity such as hand hoe, machete, sickle, pick, ax, stick, etc.. less than 1% of sown land apply mechanized and in 2012, 7 tractors were available for one thousand farmers [20].

Togolese agriculture depends on rainfed which impairs productivity and affects farmer‟s access to the banking facilities

Togolese agricultural sector faces several constraints among which are post-harvest losses, lack of credit, high cost and unavailability, timely agricultural inputs, lack of labor to agricultural labor or employee peak, climate variability, the lack of control of water, the low capacity of producer organizations, the high rate of illiteracy, non-remunerative prices for agricultural products, low rates agricultural land, lack of storage facilities, the scarcity and uneven distribution of access to agricultural microcredit and the lack of long-term financing of agriculture [31]. These constraints show that agriculture remains traditional and need more investments to overcome all those problems.

A study carried out on inputs market access in Togo shows that agricultural productivity is low (e.g. for maize production 900kg/ha-1200kg/ha) due to several major constraints including low fertilizer use [18]. This results from the low purchasing power of the majority of farmers and insufficient supply. Fertilizer use by Togolese farmer generally remains dependent on the vagaries of the world market for cotton, coffee and cocoa.

The aim of this paper is to analyze the factors that are affecting the use of input in Togolese agricultural production particularly maize production. To understanding this we will present a brief overview of agricultural productivity and new agricultural technologies use.

2. Literature Review

2.1. Input use in developing countries

2.1.1 Input use studies in developing countries

Green Revolution took place and was successful in Asian countries, where by adoption studies started about four decades ago following the Green Revolution in Asian countries. Since then several studies have been undertaken in Asia and Latin America to assess the rate, intensity, and determinants of adoption.

A review on several empirical studies on the adoption of Green Revolution technologies revealed that the new High Yield Varieties (HYVs) of wheat and rice were adopted at a rapid rate in those areas where they were technically and economically superior to local varieties; and landowners have gained relatively more than tenants and laborers from the adoption of HYVs of wheat and rice [12]. Another study done by the Centro International de Mejoramieto de Maize Y Trigo (CIMMYT) on maize and wheat in six countries (Kenya, Tunisia, Colombia, El-Salvador, Mexico, and Turkey) concluded that the differences in adoption rates among those countries were explained by differences in information acquired, agro-climatic and physical environments, availability of inputs, differences in market opportunities for the crops, and differences in farm size and farmers‟ risk aversion characteristics. A comprehension survey of agricultural technology adoption studies in developing countries by [11] and [10] also found that farm size, risk, human capital, labor availability, access to credit and land tenure systems were the most important factors in influencing farmers‟ decision of technology adoption.
Another study on the diffusion of fertilized grass-legume pastures in Uruguay followed the logistic path during the first years following its introduction. The study considered the number of ranchers borrowing money from the bank for pasture development each year as a proxy for new adopters of improved pastures. The information on borrowers provides a good estimate of total adopters and the rate of new adopters over time. Using panel data, studies by some authors, revealed that learning from own experience and learning from neighbors‟ experience are both important determinants of adoption [12].

2.1.2 Diffusion of input use research in Africa

In Africa, new agricultural technologies have been introduced in the mid-1970s and found success story achieved in Asia but failed in African countries except for hybrid maize in Kenya cited by [12].

The estimation of the interrelationships among technologies already adopted by maize farmers in Swaziland shows that farmers tend to adopt packages rather than individual technology component or practice [33].

A study on peanut research and poverty reduction to show the impacts of variety improvement to control peanut viruses in Uganda showed that sizable research benefits are generated by adopting Rosette-resistant varieties and the benefits accrue in open economy to adopting farmers [37].

Institutional Innovation for agricultural technology adaptation and adoption in the case of Rice in West and Central Africa discovered that by using multi-stakeholder assumed that the ROCARIZ used competitive research grants through multi-stakeholder task forces to generate, adapt, and facilitate the adoption of rice-based technologies and approaches by poor households [36].

2.1.3 Linkage between using agricultural technology and agricultural productivity

From some Policy research issues, the roles of new technology in agriculture, rural infrastructure, and prices in enhancing the process of poverty alleviation are increasingly well understood to the extent that clearer policy guidelines are emanating from research, same cannot be said of the role of rural financial markets in alleviating poverty. In the conventional approach to rural finance, the production side of rural farm households generally provides the rational for rural credit [45].

For the functional structure of Rural Financial Institutions (RFIs) and their System in general, multifunctional RFIs are defined as those that directly and indirectly undertake functions such as farm-level loans (both in cash and kind, and short-and longer-term loans for crops and other enterprises), extension, sales of farm inputs, marketing of farm produce, sale of consumer goods, collection of deposits, other borrowings, and loan recovery [5]. For agricultural growth, intermediate inputs (such as seeds and fertilizer), labor, and operating assets (such as wells, pump sets, and farm implements) are all required and complement each other. Credit makes it possible for farmers to have the inputs they need to realize the full potential of the new technology and hence to repay loans promptly.

The yield increasing advantage of MVs is lower in marginal areas. The observation implies that the more favorable the rice production environments, the greater the yield [15].

Their review from the Asian experience shows that the landless poor and marginal farmers in the unfavored areas benefit, through labor migration, from the new technology adopted in the favored areas. The landless are also rice consumers and benefit from lower prices. They concluded that allocating research resources to the development of high input cereal technology for marginal agricultural areas cannot be justified from the viewpoint of either efficiency or poverty reduction and this conclusion was also supported by [31].

Furthermore, reduction in food prices will contribute to the preservation of forest resources because poor farmers who do not own sufficient land clear forests [31]. They suggest and argued that more resources should be allocated to research that generates appropriate technologies for such areas. The development and wide adoption of new and more efficient agroforestry system will both improve the incomes of poor farmers in marginal areas by increasing the efficiency of land use and contributing to partial restoration of forest environments. They finally conclude that if agricultural research ought to reduce poverty in marginal areas by developing new technologies in such areas, then it must focus on the development of appropriate technologies conducive to efficiency of resource use.

The studied carryout in Uganda on Peanut research and Poverty Reduction found that Agricultural research can significantly influence the level and the distribution of income and can reduce poverty in several ways. The results of their study using the poverty indices showed modest reduction in poverty, reflecting the fact that these surplus changes are distributed among a large number of peanut producing households; many of whom are not poor [37]. Technology adoption can lower per-unit cost of production, increase the supply of food, and raise incomes of adopting farmer. The poor also gains disproportionately as consumers from lower food prices, as they spend a high proportion of their income on food [40]. Higher productivity could also create broad-based multiplier effects within the rural community, inducing employment creation in industries related to agricultural production, such as value-added processing, and roadside marketing.

The potential impact of agricultural technology adoption on poverty alleviation strategies in two rural Bangladeshi regions found a robust and positive effect of agricultural technology adoption on farm household well-being and suggesting that there is a large scope for enhancing the role of agricultural technology in „directly" contributing to poverty alleviation [23], [40].

The study of analysis of Micro credit as a veritable tool for poverty reduction among rural farmers in Anambra State in Nigeria showed that the effect of credit on livelihoods can be multidimensional and may not be fully captured by just a single household outcome [24]. However, it takes time before the effect of borrowing on livelihoods is fully materialized. The implications of these findings are that providing the farmers" access to higher amounts of credit will enable them improve their access to information [41]; adopt modern technologies and skills [26]; and achieve enterprise diversification [39]. This development will result to increase in productivity and income of the farmers, and consequently reduction of poverty level [24] .

2.2. Capital, fertilizers, credit market and productivity in Togo

2.2.1 Fertilizers and productivity

State Policy for Development of the fertilizer market in Togo showed that Togolese agricultural production particularly food crops are facing with very efficient traditional practices [3]. Facing the low productivity observed by many researchers among farmer whose incurred food insecurity for population, Togo government have always wanted to see these practices migrate to the adoption of new technology packages in agriculture which mainly characterized by the green revolution years 1977 for Togo, initiated by former President General Gnassingbe Eyadema, Named "Schwartz 1988". This initiative involves the adoption of new technology (improved seeds and chemical inputs) allowed the development of certain crops such as cotton, coffee and cocoa. Unfortunately, food crops did not benefit from this revolution in the same manner as cash crops, due to the smallness of the fertilizer market intended for food crops in Togo.

Indeed, Africa accounts for 3% of global fertilizer market and Togo represents a marginal share of 2% of fertilizer imports either 25 000tons of nutrients in West Africa (11% of the African market). Fertilizer consumption level of food increased after the food crisis, but remains unstable and unsustainable. The same study shows that the use of fertilizers in the different crop group rate varies. In 2010, the use of fertilizer reached 187kg/ha for cotton and 19kg/ha for food crops (maize and rice) as it was observed [18]. In total, 19% of cultivation areas used fertilizers in Togo [43], 25% according to CAGIA [CAGIA: Central Supply and Agricultural Inputs Management of Togo]. These results show that many agricultural area remains to be fertilized if we wants to achieve the objectives of agricultural growth and reach zero hanger in Togo.

Table 1 presents the situation of fertilizer consumption by crop category.

Table 1 **:** Import and consumption of fertilizers in Togo in the last decade

Total	Use of Inputs	Import and consumption of fertilizers in food crops and for cotton in Togo							
		2000	2005	2006	2007	2008	2009	2010	2011
		Import							
	Tons	**40700**	**32300**	**31200**	**20900**	**23200**	**32400**	**37300**	**54500**
Cotton production	%	86	86	79	64	60	23	20	36
Food Crops production	%	14	14	21	36	40	77	80	54
Elements of fertilizers		**19600**	**15800**	**15000**	**10000**	**11100**	**14900**	**17100**	**25400**
		Consumption							
Total	**Tons**	**31500**	**36200**	**21900**	**19400**	**12400**	**34300**	**36600**	**25600**
Cotton production	%	82	77	53	73	20	27	29	NA
Food Crops production	%	18	23	47	27	80	73	71	25600
Elements of fertilizers	**Tons**	**15200**	**17400**	**10300**	**9200**	**5600**	**15900**	**16900**	**11600**

Source: B. Balique, 2012.

The amount of subsidies given by the State annually, are not reach many farmers in rural areas. The majority of this budget is immobilized in residual stocks for working capital. Since 2008, the subsidy has reached averaged 2.8 billion Currency of the Africa Financial Community Francs (FCFA) and reached 5.2 billion before falling to 600 million FCFA in 2010 [3]. Unfortunately, the mechanism grant does not encourage all farmers. Only the farmers near roads and those who are in contact with the extension service and whose have financial capacity is high benefit from this grant. Only 10% of farmers have contact with them, this number is very low compare to 54% (agriculture population in Togo) small farmers whose livelihoods are marginalized in this grant mechanism [3].

The national cereal balance has been positive due to the support fertilizer policy. In fact, following our investigation on agricultural productivity in Togo, this increase may be due to the increase of cultivation areas but not of increase of yield per hectare. Although there was a slight increase in yield at the corn (6%) with an oscillating around 1.2 tons / ha and 20% increase of cultivation areas [22].

Togolese soils are largely deficient in NPK: 15-15-15 [14]. Despite that Togo has a phosphate deposit in Hahotoè, one of the most abundant on the continent estimated at about 2 billion tons and containing 35% P2O5 reserve are not known by Togolese farmers because of the absence of a straightforward policy of promoting the use of the local mineral resource. The results of some search carryout showed that this NPK: 15-15-15 has economically profitable effect in partially acidulated form or direct application in areas where the soil pH is adequate [14].

2.1.3 Capital and credit markets

Credit markets and capital in rural areas of Togo like of developing countries are recognized to be imperfect in the sense that the interest rate paid by poor people is much higher than the market rate and often they simply afford (e.g. micro-credit/FUCEC in Togo). The reasons for this are the presence of risk and asymmetric information in agriculture. Togo no longer has a national system of credit after the liquidation of the National Fund Credit of Agriculture (CNCA) since 1988. Many Banks in Togo refused to finance food crops farmers in agricultural sector because of the risks associated with climatic hazards. But, the cotton farmers do not face the same difficulties [2]. Because cotton farmers‟ benefits from the system of financing established by the NSCT (New Cotton Company of Togo) to allow its farmers to use new agricultural technologies implemented. The problem of financing the agricultural sector is barrier the adoption of new technologies and the improvement of agricultural productivity. The Togo can also draw on success experiences of other countries in Asia and neighboring countries that succeed to finance their farmers.

Due to the risk of non-repayment, financial institutions prefer to lend to workers and particularly for land owners as they use their property as collateral for loans. Many farmers in Togo are landless, so they cannot have access to credit, owning machine and or accessing fertilizers for agricultural production. They have access to cheaper credit from some OGNs and associations to acquire capital goods for agricultural production. But, this financial market still very narrow for them and many could not access to credit due to the difficulties faces in the repayment. For many moneylender, the rate of repayment remain very higher (2% to 100%) and for some microcredit financial service provider rate of repayment is more than 2%/month during the production season [3].

It is clear that unlike the imperfections in the labor market imperfections on the credit markets and capital have an adverse effect on the efficiency of small farms at a given level of labor. They ensure that the opportunity cost of investing in capital is higher for small homeowners and landowners. For this reason, it is expected that there is a substitution of labor to capital in large farms.

2.1.4 Theory of sharecropping

Sharecropping is very common phenomenon in rural areas of Togo. While the majority of owners of small farms cultivate themselves their property, landowners of lager‟s agricultural areas put their land under contract. There are two types of contracts that are common in Togo: the tenancy for a fixed rent and sharecropping. Lease is to allow a farmer to cultivate the land for his own benefit in exchange for a fixed rent he pays to the owner. Sharecropping, meanwhile, is to share the production with the owner in proportions of land.

3. Methodology

3.1. Study Area

The study was carried out in State of Togo Which has the land"s size of 21,925 square meter (56,785 km2) and the population of 7,12 million [43] with an average population density of 253 people per square mile (83hbt/km2 –DESA, 1997) and 110.8hbt/km2 in 2010, [7] and 113.160hbt/km2 [43], with annual growth rate of 2.08 per cent.

The climate is generally tropical with average temperatures ranging from 23 °C (73 °F) on the coast to about 30 °C (86 °F) in the northernmost regions, with a dry climate of a tropical savanna. To the south there are two seasons of rain (the first between April and July and the second between September and November), even though the average rainfall is not very high.

3.2. Data Resource

The data of this study were culled from Ministry of Agriculture of Togo (MAEP-Togo), ICAT [ICAT: Technical Support and Advising Institute of Togo] and field survey. The study was conducted five (5) geopolitical regions namely from southern to northen as follow: Maritime, Plateaux, Centrale, Kara and Savane. A total of 408 smallholder farming households were randomly targeted for this survey where a representative sample was drawn from each region from in 2015 base on the proportionate to size procedure.

3.3. Data Analysis and Model Specification

The study used descriptive analyses such as table, graphs, means and standard deviation to describe distribution of farmers „households according to farm characteristics and productivity. The relationship between agricultural production and production factors is analyzed using OLS and Cobb-Douglas model. It"s hypothesized that increasing the productivity of these factors in rural areas, will contribute to improve agricultural productivity through farmer"s ability to increase their skill and knowledge on how to use production inputs and specially the new technology in agriculture.

3.4. Empirical model and Model Specification

The study use Cobb-Douglas Production function, which takes into account a number of n inputs (production factors) and has variable production elasticity, can be expressed as follow:

$$Y = f(L, La, K, Fert, Sd) \quad (1)$$

Where L is land; La is Labor; K is capital; Fert is Fertilizer, Sd is Seed.

A generalization of the Cobb-Douglas production function that has variables production elasticity and may be specified as follows:

$$logY = \beta_0 + \sum_i^n \beta_i logX_i + \sum_l dlDl + \mu_i \quad (2)$$

Where the dependent variables (quantity of fertilizer use) is Y and independents variables (household characteristics and others factors) are Xi affected input use in the production process. The constant β_0, β_i, μ_i are the parameters to be estimated. Where;

Y= is Quantity of input use (kg)

β_i= measures elasticity,

Xi= Farm size, farming experience, household size, duration of education, access to market and belonging to farm group.

μ_i= Term of error

β_0= indicates the interaction effects between the continuous variables i and j (i, j = 1, 2, ..., n),

dl =is a measure of the effect of the difference between regions or measures the deviation of the mean effect of dummy variable

Dl = Regional dummy

Table 2: Description of variables [The dependent and explanatory variables used here are: Land, labor, machinery, education level of the household head, crop yield, fertilizers, pesticides, soil quality, and climate condition. Besides these, the other explanatory variables refer to dummy gender of the household head, dummy indicating]

Descriptions	*Measurement*	*Expectation sign*
Age	Number of year	+/-
Gender	Male=1 Female=0	+/-
Head of household		+/-
Head education Level	Duration	+/-
Household size		+/-
Farm size	Hectare	+/-
Distance to the nearest market of input/sell	Km	+/-

Table 3: Descriptive variables

Variable	Mean	Std. Dev.	Min	Max
Age	42.375	12.004	21	76
Marital Status	2.04902	0.325	2	5
Primary School	0.2867647	0.453	0	1
Middle School	0.296568	0.457	0	1
High School	0.058823	0.235	0	1
Household Size	7.110294	3.647	1	24
Farming Experiences	5.514706	6.617	0	40
Farm Size	2.068297	4.276	0.24	42.5
Extension Contact	2.073529	4.421	0	48
Maize Seed Cos(FCFA)	40764.12	87844	0	660000
Fertilizer Cost	27500	12313	0	33000
Total Cost	68264.12	9118	0	693000
Total Production/year	2555.82	5606	50	49500

4. Results and Discussion

4.1. Characteristics of household farmer producing maize

ISSN (Online): 2319-7064
Index Copernicus Value (2013): 6.14 | Impact Factor (2014): 5.611

The age, gender and education level of a farmer are important factor used to determine household capabilities in production and the influence on farming experience and ownership of production factor such as land, adoption of agricultural new technology.

4.1.1 Household age and gender

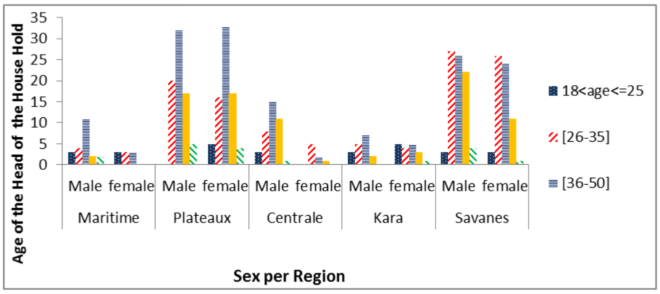

Figure 1: Age per gender

Result in Figure 1 shows the age and gender of the household for every region. It can be observed that a total of 408 respondents‟ responded whereby 57% of the respondents are male and 42% are female. Also, 36% of most of households farmers living in Plateaux rural areas, this finding is similar to the one found during the national survey in 2013 [20]. This region contributes a lot on food production in Togo. Most of the household head are male; this means that most of the decision is taken by them in production crop system.

The same Figure 1, shows that the age of the majority of farmers lies between 35 and 50 year old represented by 45%. With low number (almost quarter (27%)) of the farmer‟s age between 18 and 35 years, this is the group of youth which has energy and expected to boost production.

4.1.2 Farmer's Education Level

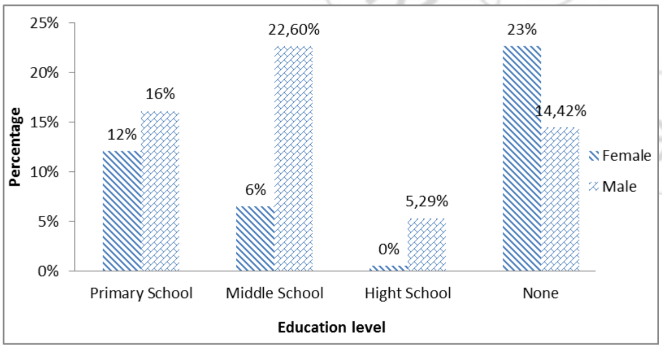

Figure 2: Education level of the households

Result in Figure 2 represents respondents‟ responses on education level of households.

In order to see capabilities and knowledge of the household to adopt agricultural new technology, education is used to measure the effect. The Figure 2 shows that 28% of household have primary school level, 28,6% have middle school level and only 6% have high school level, while minimum of 0.25% have university and adult education. It was surprising to see that more than one third of the population (37%) has never been to school. This shows that there is so much population with very low level education or no education. This indicated that agriculture has never attracted educated people which are reported by many African countries. This result can explain why farmers have not been able to adapt agricultural new technology like machines, fertilizers and new variety seed to improve their agricultural productivity. Even for those who are using they don‟t know proper application of fertilizer application and many of them don‟t know how to do good agricultural practice in their farm [13].

4.1.3 Household cultivation areas and Land Ownership

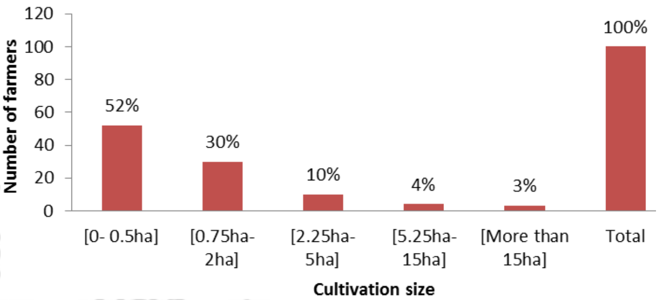

Figure 3: Cultivation areas

The result in Figure 3 shows that the farmers own the areas size from 0 - 0.5 hectares are small scale farmers and middle scale farmers owning the land between 0.75 – 2 hectares.

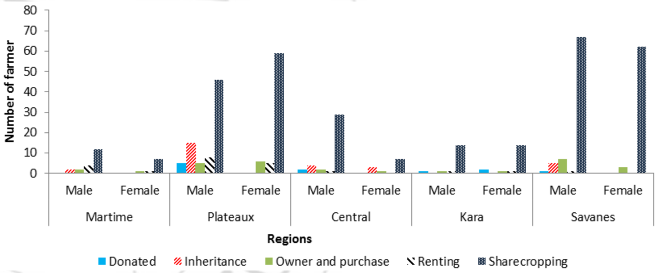

Figure 4: Land Ownership

Regarding access to land, the majority of farmers are likely to share their production with the land owner who gave them land for cropping. Figure 4 shows that sharecropping system is held by 76%, followed by inheritance 9%, land owner with land 7% and renting land were only 5%. This situation shows difficulty that farmer has in obtaining bank loans or micro finance to buy the necessary inputs. It is therefore, necessary to revisit the land reform to empower farmers and easy access to bank credit.

4.1.4 Use of fertilizers

Results of the fertilizers, seeds improvement, machinery used and other problems link to erosion, credit and livestock alimentation in the study areas are in the following part of this paper.

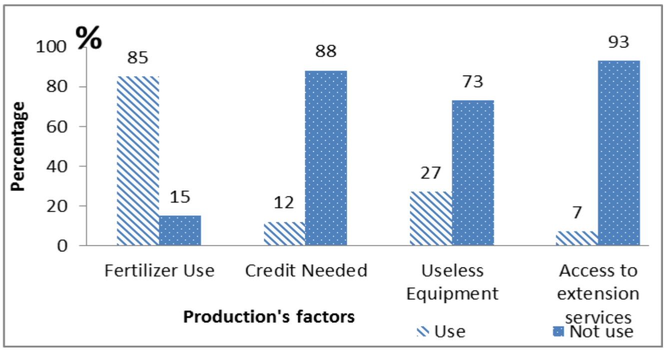

Figure 5: Production"s factors

Figure 5 shows that many farmer do not have access to extension services. Only 7% of the farmers have access to extension and 27% of farmers have adequate facilities for their agricultural activities. Almost 88% of farmers need credit for agriculture production, which paralyzes the financing of activities related to the production, material goods, and even for commercial. However, yields remain low, following the misapplication of these inputs. Not all farmers are able to adopt technology due to the small number of extension workers they have, and the fact that it comprises many measures that require a high level of knowledge from farmers [9].

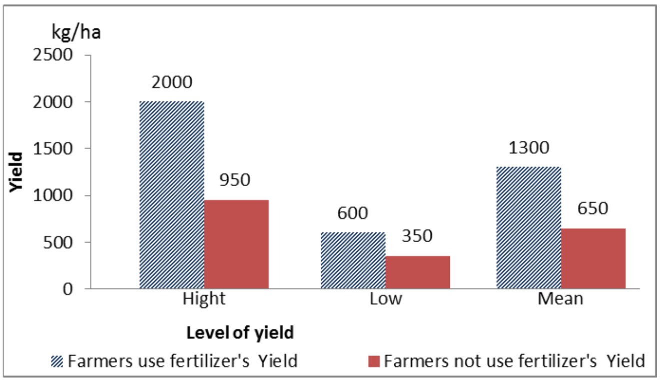

Figure 6: Households" Yield based on fertilizer use or not

Figure 6 shows that among those who use fertilizers, there are farmers who manage to get good performance to 2000kg/ha. But, farmers who get poor performance (e.g. 600kg/ha) are certainly those who improperly apply fertilizers or are victims of climatic hazard.

Beside those who use agricultural inputs, the study found that there are farmers who don"t use agricultural inputs. The yield is still very low among these farmers. It is therefore, advises that farmers" awareness for application of improved seeds and use of agricultural inputs is necessary. The tools used by most of the farmers are traditional local hand tools.

4.2. Reasons for low adoption in new agricultural technology by farmers

Table 4: Result from Cobb-Douglas Model to determinants of factors affected input use in maize production

Independent variable	Dependents Variables					
	NPK:15-15-15		Seed		Urea	
	For All Farmers	For farmers with farm size less than 1.5ha	For All Farmers	For farmers with farm size less than 1.5ha	For All Farmers	For farmers with farm size less than 1.5ha
	Coefficients					
Farm size	0.1796***	1.2986***	0.1771***	1.2277***	0.1798***	1.271***
Farming experience years	0.0056	-0.0061	0.00658	-0.0021	0.0053	-0.005
Age			-0.0018	0.00169*	-0.00178	0.0004
Head of household	0.4891***	0.0870***	0.4628***	0.0635*	0.4668***	.05637*
Duration of education	-0.0049	0.0014	-0.0084	-0.00221	-0.0032	0.0045*
Household size	-0.02146***	0.0005	-0.023***	-0.00475	-0.0199***	0.0009
Belonging to farm group	0.22682***	-0.0003	.2197***	0.01182	0.2162***	-0.00858
Access to market	0.004	0.0062***	0.0028	0.0061***	0.00237	0.00428**
Maritime	0.1238	-0.0155	0.13243	0.03465	0.105829	-0.01776
Plateaux	-0.6276***	-0.0976*	-0.599***	-0.0714	-0.6143***	-0.1018*
Centrale	0.0521	-0.0551	0.0752	-0.0226	0.0562	-0.056
Savanah	-0.4449***	-0.0147	-0.414***	0.0029	-0.4147***	0.01146
_cons	4.9145***	3.9938***	3.398943***	2.4096***	4.2635***	3.2756***
Number of observation	384	287	386	289	386	289
F(11, 275)	67.48	227.79	61.25	174.07	60.82	203.08
Prob > F	0	0	0	0	0	0
R-squared	0.7606	0.8765	0.7669	0.8619	0.7624	0.8808
Root MSE	0 .54696	0 .20688	0 .52826	0.21051	0.53966	0.19746

Note: *** Significant at P<0.01; **Significant at P<0.05; * Significant at P<0.10;

At all farmers level

Table 4 from Cobb-Douglas regression shows that for the use of NPK: 15-15-15, Seed and Urea the coefficients of farm

size, head of household and farm cooperative membership have positive sign and statistical significant at p<0.01 level of probability. This implies that increase in farm size, gender of the head of household and farm cooperative membership have positive influence on the input use by 17%, 48% and 22% for NPK: 15-15-15; 17%, 46% and 21% for Seed and 17%, 47% 22% for Urea. And in addition learning from neighbors" experience is important determinants of adoption [12]. The head household"s gender affects positively the choice of fertilizer use. The household size has negative sign and statistically significant at p<0.01 level of probability. This means that the number of person living in the household influence the choice of using fertilizer or not.
The results for regional dummy variable show that the NPK: 15-15-15, seed and Urea use"s coefficient are negative and statistically significant at p< 0.01 level of probability. This implies that in Plateaux and Savanah regions farmers are not using fertilizer in good way, which affected their output negatively. This finding imply that, a unit increase of NPK: 15-15-15, Seed and Urea use, decrease the production by 63% and 41% for NPK: 15-15-15, 59% and 41% for Seed and 61% and 41% for Urea respectively for Plateaux and Savanah" regions. The law of minimum is required to allow crop growing. Balanced nutrition is needed to obtain maximum yield and avoid shortages of nutrients.

The evidence from the analysis using adjusted R-square revealed that the eight independent variables contributed up to 76%; 77% and 76% percent of the systematic variation in the agricultural fertilizers and seeds use in agricultural production respectively for NPK:15-15-15, Seed and Urea.

5. Conclusion and Recommendations

This study focused on the factors affecting inputs application in rural areas in Togo. The econometric evidence obtained from the study showed that the overall contribution of the eight independent variables (farm size, farming experience years, age, head of household, duration of education, household size, belonging to farm cooperative, and access to market) on the input use of major agricultural commodities (e.g. maize) were very significant in the model specified.

It was also observed that Access to market was significant for small farmers. This implies that, the less the distance between the inputs market and farmers, the more the use is.

In the study of [9], he explains that small land size of the household, ineffective infrastructure facilities and limited capacity of extension workers are main drivers that led to low agricultural technology use

There is no doubt that agriculture would be one of the key routes to Togo"s development in the future if the government and private sectors give more attention on it. Agricultural development will provide opportunity to majority and boost the export of agricultural produce as a result will increase economy of individual and the nation at large.

Therefore, to ensure increase in agricultural input use, the country should adequate supply and distribution inputs evenly and timely in every cropping season, as well as ensuring availability of credits to rural farmers.

6. Future Scope

This study recommends future research to focus on how to allowed farmer access to training and better understanding of how to use fertilizers. This could be done with more implication of extension"s agent. Attract the attention of policy makers on the strategy to liberalize the inputs market by encouraging the private sector implication.

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