ISSN: 2230-9926

Available online at http://www.journalijdr.com

IJDR

International Journal of Development Research
Vol. 4, Issue, 5, pp. 1062-1067, May, 2014

International Journal of
DEVELOPMENT RESEARCH

Full Length Research Article

PROXIMATE DETERMINANTS OF SEED DEMAND – A PANACEA FOR FORMULATION OF AGRICULTURAL INPUT POLICY FOR NIGERIA

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ARTICLE INFO

Article History:
Received 05th February, 2014
Received in revised form
09th March, 2014
Accepted 10th April, 2014
Published online 20th May, 2014

Key words:
seed demand;
input market policies;
proximate determinants.

ABSTRACT

The agricultural input market in Nigeria is inefficient, which constitutes a major constraint to achieving national food security. Policies for developing agri-input market must adopt a demand-driven process; thus, this paper aimed at identifying the factors that determine the demand for improved agricultural seed as a basis for the formulation of agri-input policy for Nigeria. Data were obtained from National Bureau of Statistics, and farmer survey covering 300 farmers selected by stratified random sampling from the six geopolitical zones of Nigeria. The proximate determinants and quantitative estimates for selected crops: rice, maize and groundnut; were obtained using statistical "factor analysis" approach. The amounts of total variation in the original number of variables explained by the extracted components were: rice (89.09 percent), maize (56.45 percent) and groundnut (63.44 percent). The multiple regression of the double log form testing the effects of these variables on the demand for rice seeds gave a coefficient of determination indicating that 88.73 percent of the total variation in the demand for rice seed was explained by five key variables representing the principal components for rice, namely: land area cultivated; attitude to price; group membership; credit; and seed availability. It was concluded that policy strategies that strengthen access of farmers to land, credit, association building, availability and affordability of inputs would enhance the performance of the agri input system, particularly the seed sector of the country.

INTRODUCTION

Globally, agricultural development has been linked to the degree of use of the so-called green revolution inputs namely seed, fertilizer and crop protection products. The characteristic low level of agricultural productivity in Sub-Sahara Africa was explained by the wide differential in levels of inputs used relative to Asian Countries and the United States of America (Tsado *et al*, 2010). In cognizance of the importance of good quality seed in raising agricultural productivity, policy measures which member countries are expected to adopt for strengthening the seed system in the ECOWAS sub-region include private sector breeding programmes, compulsory seed certification, and removal of trade barriers on seed across borders. (WASNET, 2006). In Nigeria, the Agricultural Transformation Agenda of the Federal Government; Vision 20-2020; and National Food Security Programme (NFSP) are geared towards ensuring a significant increase in agricultural productivity based on adoption and use of good quality seeds in crop production, among other requisite inputs. The current Frame works for policy intervention in the seed industry in Nigeria comprise the National Agricultural Seed Council (NASC) as the superintending agency, the National Crop Varieties and Livestock Breeds Registration and Release Committee established by law (Decree 33 of 1987) for regulatory activities, the National Agricultural Seed Committee established by the National Agricultural Seed Act No. 72 of 1992, and the National Agricultural Seed Council (NASC) as the superintending agency and sole source of Foundation Seed production in Nigeria, in collaboration with the National Agricultural Research Institutes (NARIs) (FMAWRRD 1987; FMARD 2003). The Seed policy consists in the instruments for the delivery of good quality seed to farmers to achieve increased crop output; through the provision of "price support for the supply of seeds, seedlings and other agricultural inputs such as fertilizers, tractors and implements, livestock vaccines and drugs. So far, about 246 new and improved seed varieties were reported to have been released and registered in Nigeria between 1970 and 2006 to date (PASS, 2007). The marketing of seed involves three

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supply sources, the first being farmers' own seed from previous harvest, which accounts for the largest part of planting materials in Nigeria; suggesting a relative low demand for improved seed from certified sources. The second channel is agency-to-farmers, which is the formal seed sector, involving certification by an accredited body; the agency that sells to farmers such as the farm service centers of State ADPs or the marketing outlets of private seed company. The third channel is the farmer-to-farmer seed diffusion through community based systems, which is used by agricultural development programs and donor agencies to promote adoption of improved seeds. The supply side of the seed system in Nigeria is faced with the problems of lack of clearly defined role between the public and private sector, unfavourable environment for private sector development in the seed sub-sector, absence of quality control mechanisms, and inadequate funding. On the demand side, the major challenges are how to increase and sustain the use of improved seeds; how to achieve agricultural competitiveness through improved seeds, how to assure quality seeds in the market, and how to raise employment in the seed industry. This article opined that a demand-driven approach to policy analysis would promote good policy formulation, rather than the traditional approach emphasizing the supply sources. Thus the purpose was to determine the key issues involved in the formulation of seed policy for Nigeria, from the point of view of the demand side of the seed market. The objectives include an assessment of the levels of seed demand for major crops in Nigeria; an analysis of factors influencing adoption of seed by farmers; and an assessment of farmers' knowledge, attitude and practice of improved seeds.

Conceptual framework

The conceptual framework for this paper is consistent with other agricultural development theories (Olaide *et al*., 1975) as well as the market equilibrium theories (Lipsey and Lancaster, 1956). The high input pay-off model assumes that farmers are efficient allocators of resources and also respond to economic stimuli, but operate under immense technical and economic inhibitions; hence, proposed the need for support in terms of improved seeds and other technical inputs, as well as remunerative output prices, which forms the basis for price intervention policies. Also, the market failure theory holds that market for agri inputs fails in certain respects that the market is unable to correct for them on its own; thus creating the need for market intervention policies. The agricultural seed policy process consists of two sides, supply and demand. The supply side actors comprises policy authorities - policymakers, policy service providers, policy analysts and consultants, among others - whose activities govern the outcomes of government actions and inactions in the seed market.

The demand side actors comprise the policy stakeholders - farmers, seed producers, seed marketers, among others - whom the outcomes of government actions and inactions in the seed system are directly or indirectly incident upon. Both sets of stakeholders meet in the marketplace for agricultural seeds to determine the outcomes of public policy interventions, depending on the balance of powers exerted from either side on certain issues affecting the industry. Without a common reference point for actors on both sides, a gap exists in the policy marketplace for seed, which accounts significantly for the overall performance of the seed industry. Hence, a demand-driven seed industry for the country would require a determination of the demand level and the factors influencing the demand for agricultural seeds; to achieve a more efficient seed industry in Nigeria generally and for the benefit of the stakeholder community particularly.

Data Collection and Analysis

The estimation of seed demand for major crops in the country was based on land area (in hectares) under each crop obtained from National Bureau of Statistics database, combined with survey data on seed rate (kilogram/hectare) collected through the farmer survey. The farmer survey involved the use of structured questionnaire to collect data from 300 farmers selected by stratified and multi-staged random sampling from the six geo-political zones of Nigeria. A focus group discussion was also conducted from each zone using the hypothetical "problem tree" as previously applied (Ayoola 2004) to diagnose issues relating to agricultural seed market according to their respective causes, effects and consequences among farmers. The analysis of seed demand was conducted in terms of its proximate determinants and quantitative estimates for selected crops. A proximate analysis implies the recognition of the presence of inexactitudes limiting the drawing of hard inferences and conclusions in certain instances (Ayoola, 2001). Seed demand depends on several variables, reduced to a manageable number or proximate determinants representing the original set without losing much information, through statistical "factor analysis" approach, The field data collected on rice, maize and groundnut were subjected to factor analysis of 15 variables using principal component method. The principal components were constructed using the linear combinations of the dependent variables (Eboh, 2009) as follows:

$P = a_1X_1 + a_2X_2 + \ldots\ldots + aiXi$ ----------equation1

Where i = 1, 2, 3, ……15

X_1 = land area (in hectares)
X_2 = group membership (yes/no)
X_3 = access to credit (yes/no)
X_4 = knowledge level (high/low/none)
X_5= attitude to price (strongly agree/agree/disagree/strongly disagree)
X_6 = seed availability (always, sometimes, not available)
X_7 = seed affordability (price affordable, not affordable)
X_8 = gender (male/female)
X_9 = family size (number)
X_{10}= educational status (formal/informal/none)
X_{11}= experience (in years)
X_{12}= age (in years)
X_{13}= seed accessibility (average distance in kilometers to source of agricultural seed)
X_{14}= access to other productive inputs - fertilizer (amount spent in ₦)
X_{15}= seed rate (kilogram/hectare)

The functional form of the multiple regression function is

$Y = \beta o + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \beta_5X_5 + \beta_6X_6 + e_1$
----------equation2

Where j = 1, 2, 3, ……15

X_1 = land area (in hectares)
X_2= attitude to price (strongly agree/agree/disagree/strongly disagree)
X_3 = group membership (yes/no)
X_4 = access to credit (yes/no)

X_5 = seed availability (always, sometimes, not available)
X_6= access to other productive inputs - fertilizer (amount spent in ₦)

RESULTS AND DISCUSSION

The results revealed the status of the knowledge, attitude and practice of farmers about improved agricultural seeds; the nature as well as the determinants of the demand for agricultural seeds.

Knowledge, Attitude and Practice of farmers

The results on table 1 showed that about 67 percent of farmers generally had a good knowledge of seed and its difference from grain; with the South West, North East and North West indicating 96.7 percent, 91.4 percent and 89.3 percent respectively (figures 1 and 2).

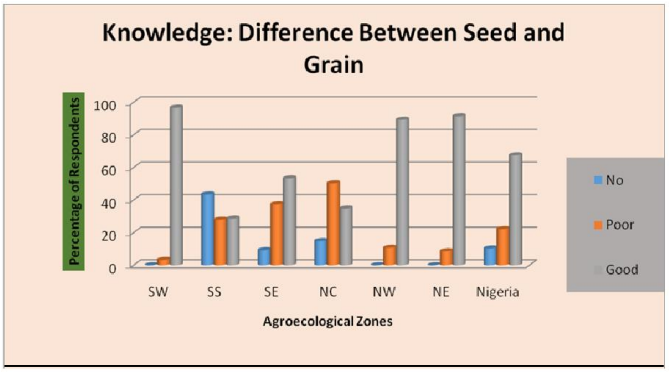

Figure 1.

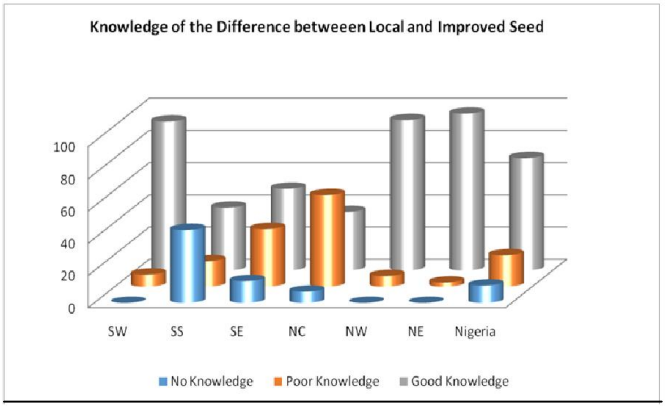

Figure 2.

A similar result was obtained in respect of farmers' knowledge about seed subsidy policy and difference between local and improved seed varieties, whereby 61.7 percent and 69.95 percent of respondents demonstrated their knowledge in each case. These results implied that the low demand for improved agricultural seeds in Nigeria might not be attributed to lack of knowledge about improved seed and seed policy by the majority of farmers. Most of the farmers were of the opinion that improved seeds were not readily available and too expensive, except in the North East (Figures 3 and 4). Specifically, 62.5 percent and 75.5 percent of farmers respectively disagreed with the notion that improved seeds generally failed to deliver or posed greater problems to farmers; while 63.3 percent agreed that improved seeds required higher doses of fertilizers (Table 2). Table 3 showed an average distance of about 18 kilometer to the seed market, while Ayoola *et al*. (2010) reported a normative target of 15 kilometer radius desired to buy improved seed in the market.

Table 3 also showed that 70 percent and 66 percent of farmers respectively, have good access to extension service and belonged to farmers' groups; indicating that extension service institutions and farmer groups could be effective in targeting farmers with improved seed policies.

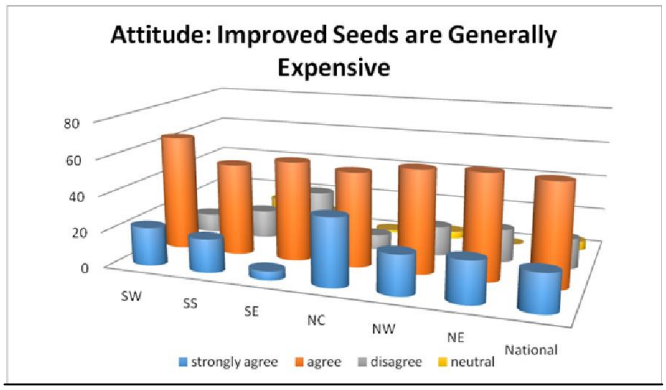

Figure 3.

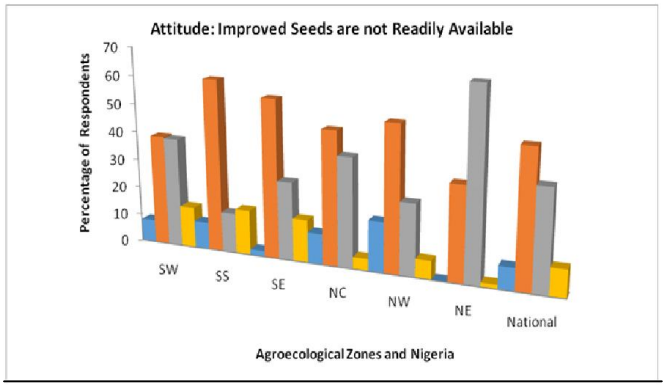

Figure 4.

The Nature and Determinants of Seed Demand

Although timely availability of good quality seeds at affordable price holds the key to an efficient seed market; figure 5 shows that the situation of limited availability of improved seed and limited demand for improved seeds prevailed in the market, which was attributed to the traditional practice of using own seed saved from previous harvests by the vast majority of farmers. The consequences were that most farmers recycle impure seeds from previous harvest, resulting into low crop yield, low output and low income. Makinde (2006) reported similar situation of limited availability of improved seeds and opined that foundation seed enterprises would promote the supply of improved agricultural seed in Nigeria. Kugbei et al. (1997) also recommended that building partnerships within the seed systems of other African Countries, specifically Zimbabwe, would promote a demand driven improved agricultural seed system in the country. The nature of seed demand is a complementary type in the sense that its use along with other productivity enhancing inputs such as fertilizers would enhance its ability to deliver the expected productivity increase. It is also a derived type of demand because it is demanded for the production of crops other than for its direct consumption; implying that for the use of improved seeds to expand, the demand for the crop outputs must first expand. Table 4 shows the estimated demand for seed in respect of major crops namely: rice, maize, sorghum/guinea corn, millet, groundnut, cotton, and beans.

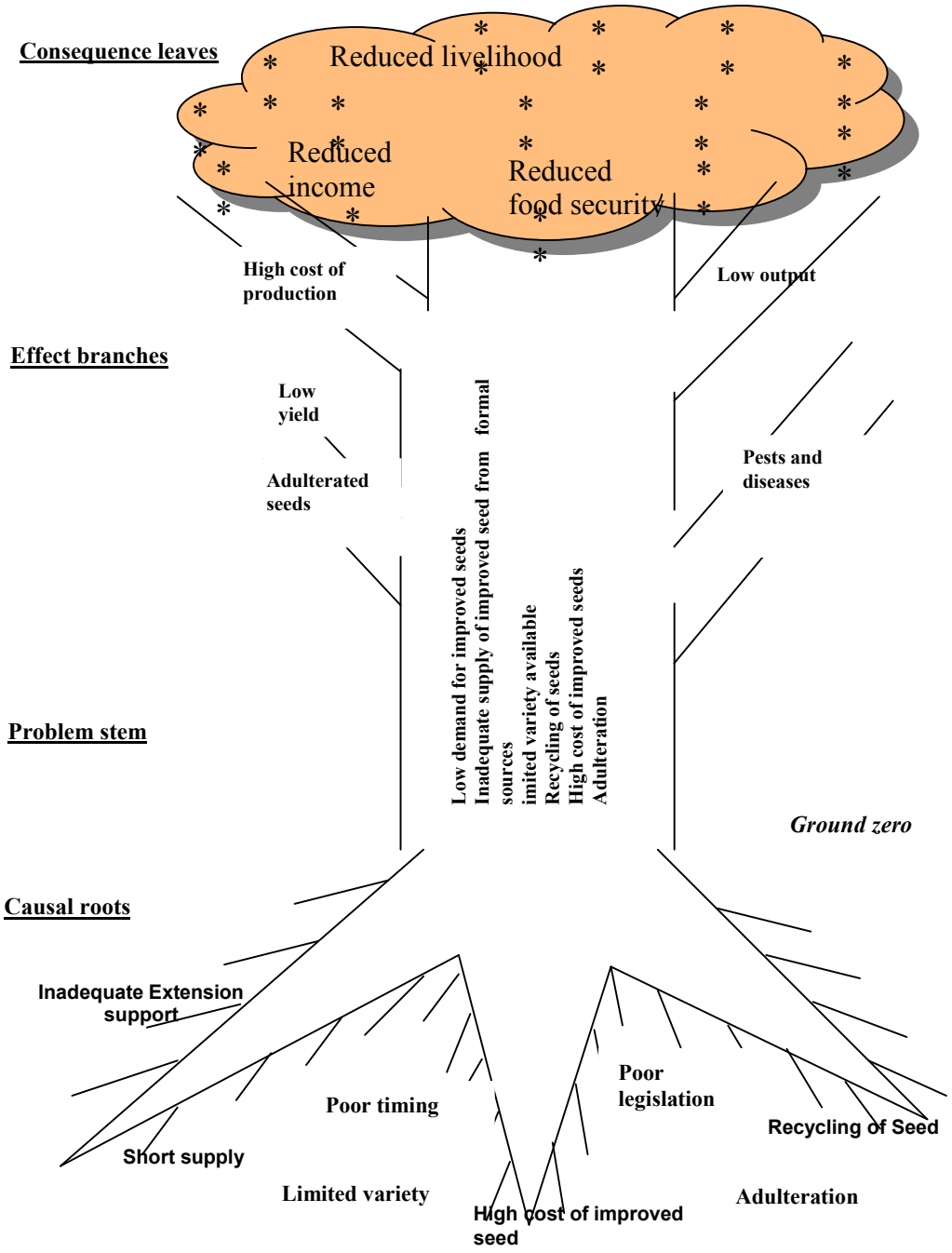

Figure 5. Hypothetical problem tree for improved seed market in Nigeria

Source: Focus group discussion in six geo-political zones, Nigeria, 2010

Table 1. Knowledge of Farmers about Improved Seeds, Local Seeds, Grain and Subsidy

Knowledge	Percentage of Respondents		
	No Knowledge (%)	Poor Knowledge (%)	Good Knowledge (%)
Knowledge of the Difference between Seed and Grain	10.3	22.2	67.5
Knowledge of the Govt. Assistance on Seed (Subsidy and Others)	14.6	23.7	61.7
Knowledge of the Difference between Local and Improved Seeds	10.7	19.5	69.8

Source: Field survey in six geo-political zones of Nigeria, 2010

Table 2. Attitudes of Farmers to Price, Availability, and other aspects of seed use

Attitudinal Issues	Percentage of Respondents			
	Strongly Agree (%)	Agree (%)	Disagree (%)	Neutral (%)
Improved Seeds are Generally Expensive	21	56.9	16.9	5.2
Improved Seeds are not Readily Available	7.9	47.3	35.2	9.6
Improved Seeds Usually Fail to Deliver	3.7	24.5	62.5	9.3
Improved Seeds Require Higher Dose of Fertilizer	18.8	44.5	26.2	10.5
Improved Seeds Pose Problems for Farmers	1.4	9.7	75.5	13.4

Source: Field survey in six geo-political zones of Nigeria, 2010

Table 3. Farmers' practices about improved seed

Zones	Distance Travelled to Buy Seed (Km)	Access to Extension (%)	Membership of Farming Group (%)	Average Size of Holding (Ha)	Average Income from Farming (N)	Income from Other Sources (N)
South West (SW)	14.62	89.9	66.5	4.65	339398	197046.83
South South (SS)	56.57	52.9	29.5	2.65	170575.06	367042.42
South East (SE)	4.29	38	25	4.09	126506.55	111187.90
North Central (NC)	21.82	94.8	63.3	7.82	350274.38	123882.35
North West (NW)	10.46	70.9	49.5	6.11	714845.0	415256.38
North East (NE)	8.12	79	40	3.32	725865.38	144153.12
National	17.91	71.06	66.5	4.76	633916.05	234770.46

Source: Field survey in six geo-political zones of Nigeria, 2010

Table 4. Estimated seed demand for major crops in Nigeria

Parameter estimates	Millet	sorghum	Groundnuts	Beans	Cotton	Maize	Rice
Land Area Cultivated 2009 ('000 Ha)	4404.27	4727.07	1534.03	3419.83	250.25	5090.09	1571.98
Seed Rate (Kg/Ha)	20.76	24.11	26.62	22.77	28.43	31.47	34.31
Quantity Utilized (MT)	91420.05	113960.58	40832.69	77856.00	7115.57	160177.56	53928.02
Factor components (a_i):			0.6344			0.5645	0.8909

Source: Field survey in six geo-political zones of Nigeria, 2010

Table 5. Results of Regression -Variables Representing the Principal Components for Rice

Variables	Coefficients	t-statistics	R2 - Square	Standard error
(Constant)	3.518	.848		
Land area cultivated (ha)	19.636	14.895**		
Attitude to price	5.422	2.796*		
Group membership	.135	1.675*		
Credit	7.290	2.799*		
Seed availability	17.421	13.570**		
Productive inputs – fertilizer	5.898E-5	2.579*		
Model			88.73	0.182

Source: Field survey in six geo-political zones of Nigeria, 2010
Note: significant at 5 percent level **; 10 percent level*

Results indicated that cotton had the least demand at 250,250MT and maize had the highest demand at 5,090,090 MT, while the seed rate for millet was the lowest (20.76 kg/ha) and that of rice was the highest (34.31kg/ha). The results of the factor analysis (table 4) indicated that the amount of total variation in the original number of variables explained by the extracted components were: rice (89.09 percent), maize (56.45 percent) and groundnut (63.44 percent). Initial communality estimates showed that most of the fifteen variables namely: land area (X_1), group membership (X_2), access to credit (X_3), knowledge level (X_4), attitude to price (X_5), seed availability (X_6), seed affordability (X_7), gender (X_8), family size (X_9), educational status (X_{10}), experience (X_{11}), age (X_{12}), seed accessibility (X_{13}), access to other productive inputs such as fertilizer (X_{14}), and seed rate (X_{15}); were well explained by the rest of the data set using the "Direct Oblimin" method of rotation to give the variable which best represents each component or factor extracted. Six of the variables were tested in multiple regression to determine the principal components for rice, namely: land area cultivated, attitude to price, group membership, credit, seed availability, and access to other productive inputs – especially fertilizer. The results of multiple regression testing the effects of these variables on the demand for rice seeds gave the coefficient of determination indicating that 88.73 percent of the total variation in the demand for rice seed was explained by the estimated variables (Table 5). These variables constitute the proximate determinants of seed demand; indicating that much of the sluggish uptake of improved seeds would be explained by the small farm size and low level of crop production. This implied that increased farm size and level of crop production, would likely lead to increased demand for improved seeds and the associated inputs such as fertilizer. So also would membership of farmers' associations likely enhance their access to farm inputs including improved seeds, fertilizer and credit; and timely availability of improved seed at affordable price would likely have positive influence on farmers' attitude towards use of improved seeds, thereby stimulating greater demand for improved agricultural seeds in Nigeria. Jidda et.al.(2010) found that farm size, seed and fertilizer were underutilized in

the production of millet in Sudan-Sahel agro ecological zone of Nigeria, attributed to the scarce availability of the resources in the study area.

Conclusion and Recommendations

The aim of this paper was to identify the factors that determine the demand for improved agricultural seed as basis for the formulation of agri-input policy for Nigeria. Both secondary and primary data were used, obtained through farmer survey involving 300 farmers selected by stratified random sampling from the six geo-political zones of Nigeria. The analysis of the demand side factors for seed system was conducted in terms of its proximate determinants and quantitative estimates for selected crops; namely rice, maize and groundnut; using statistical "factor analysis" approach. The results indicated that farmers generally had a good knowledge of seed, seed subsidy policy and the difference between seed and grains, and between local and improved seed varieties. Most farmers agreed with the notion that improved seeds were not readily available, too expensive, and that improved seeds required higher doses of fertilizers. The average farm size was about 5ha and majority belonged to farmers groups. The estimated demand for cotton seed was the lowest (250,250MT) and highest for maize (5,090,090 MT), while the seed rate was lowest for millet (20.76 kg/ha) and highest for rice (34.31kg/ha).

The results of factor analysis and multiple regression indicated that land area cultivated, attitude to price, group membership, credit, and seed availability were the principal components, thus constituting the proximate determinants of seed demand. It was concluded that the demand for improved agricultural seed could be increased through increased land cultivation, credit utilization, group membership, and timely availability of improved seed at affordable price. Therefore, policies that promote access of farmers to land and credit would likely increase the level of crop production, thereby increasing the demand for improved seeds and the associated inputs such as fertilizer. Similarly, policies that promote group membership among farmers would enhance their access to farm inputs including improved seeds, fertilizer and credit; so also would timely availability of improved seed at affordable price have positive influence on farmers' attitude towards use of improved seeds, thereby stimulating greater demand for improved agricultural seeds in Nigeria.

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