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Literature Review and Socio-economic Analysis of Seed and Fertilizer Availability and Utilization in Hybrid Maize Production Under the Nigerian Deregulated Marketing and Subsidy Withdrawal Policy

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ABSTRACT

Maize is one of the most important cereals grown for human and livestock consumption in Nigeria. In the past its cultivation was restricted mainly to backyards and along lowland areas where there were accumulation of natural nutrients. The introduction of artificial fertilizers coupled with improved seed varieties and crop protection measures, have contributed to spread its production into marginal areas. Although maize production has expanded in Nigeria, a deficit still exists between supply and demand which can be bridged by adoption of hybrid maize varieties. The potential of hybrid maize can, however, be realized only with high levels of fertilizer and good management. Prior to 1998 the marketing of seed and fertilizer were regulated and highly subsidized by Government. In 1998, the Nigerian government deregulated the fertilizer market and withdrew the price subsidies. This paper provides the literature and socio-economics analysis of seeds and fertilizer availability in hybrid maize production under the deregulated system. Both secondary and primary sources of data have been used. The analysis of the primary data shows that, while 80 percent of the respondents reduced the hectarages previously put under hybrid maize production, 39 per cent shifted to local varieties and other crops that were less responsive to high levels of fertilizers. A probit analysis revealed that availability of hybrid seeds and fertilizer, cost and extension contact were the most important significant variables affecting the adoption of hybrid maize. Some recommendations to ameliorate the problems are suggested.

Keywords: Seed and Fertilizer availability, Hybrid Maize Production, Deregulated Seed and Fertilizer Marketing, Subsidy Withdrawal

INTRODUCTION

Maize is a very important cereal crop in Nigeria, grown for human consumption and in compounding livestock feeds. It is also used as a raw material in the breweries and pharmaceutical industries. The intensification of maize production is, therefore, vital for economic growth and the alleviation of poverty in Nigeria. The production of maize, however, requires relatively high soil fertility especially the presence of nitrogen, phosphorus and potassium in the soil. Because of the high fertilizer requirement, its cultivation in the past was mainly restricted to backyards and along low-land areas where there were accumulation of natural nutrients or shifted from a cultivated site to an uncultivated one to avoid significant decline in crop yields. However, with rapid population growth, fallow periods have been shortened. Continuous and intensive cropping without restoration of fertility have depleted the nutrient - base of most soils (Esu, 1991). The introduction of artificial fertilizers coupled with improved seed varieties, better weed control measures and mechanical inputs have spread production into marginal areas (Kasim 1996).

In spite of the increase in the hectarage of land devoted to maize production a deficit still exists between supply and demand. It is a recognized fact that of all the production inputs, good seeds are fundamental requirements to facilitate increase in output. Hybrid maize seeds meant to increase output to meet demand have been developed (Edache 1996), but the potential of hybrid maize can be realized only with high levels of fertilizer application (Chude 1996). The problems of hybrid seeds and fertilizer distribution and use have generated a lot of interest and controversy for at least a decade in Nigeria. It is the problem of seeds and fertilizer distribution system that tends to undermine the resource- poor farmers' efforts in obtaining the potential yields of hybrid maize. Consequently, the hybrid maize seeds meant to increase output remained extremely low, averaging 1.5 t ha^{-1} on farmers' fields in comparison with average yields of 5-7 t ha^{-1} on research stations with better access to fertilizer supply (Yayock and Karikari 1991). The

large increase in maize production required for both human and livestock needs will inevitably involve increased access of the resource-poor farmers to the use of hybrid seeds and inorganic fertilizer.

Although Nigerian government subsidized the prices of hybrid seed and regulated the marketing system, as far back as the 1970s, the subsidy on seed was later removed and the marketing system deregulated (Chikwendu and Omotayo 1993). Despite the serious economic problems in Nigeria and the scarcity of foreign exchange, the government continued to regulate the fertilizer marketing system and provided funds for price subsidization, until in January, 1998 when the subsidy was withdrawn and the marketing system deregulated. This paper reviews and analysis the availability of hybrid maize seeds and inorganic fertilizer under the deregulated marketing and subsidy withdrawal policy. It also analyzes the impact and factors affecting farmers' decision to adopt hybrid maize production under the system.

Methodology

Both secondary and primary data were collected for this study. Secondary data were obtained from published reports by the Agricultural Development Projects (ADPs), Federal Ministry of Agriculture, Agricultural Research Institutes, the National Seed Service (NSS), and a review of some literature relevant to the study.

The Primary data were collected mainly through a survey of farmers, using a structured questionnaire prepared with open and close-ended questions administered on selected households in Kaduna State. In addition, data were obtained through personal observations and focus group discussions with farmers, Government and private Companies' officials.

Kaduna State was selected for the primary data collection in consideration of the presence of the oldest fertilizer plant and its position as one of the major maize producing States in Nigeria. In general, however, the soil of Kaduna State is characterized by low fertility, especially low levels of nitrogen and phosphorus (Chude 1996). The soil fertility, therefore, can only be maintained through the application of fertilizer, particularly, inorganic fertilizer.

Two categories of respondents were surveyed for the primary data. These were households known to have been growing hybrid maize since 1997 to 2001, and farmers who had grown hybrid maize in the past but discontinued. A multi-stage sampling technique which made it easier to capture the target groups, was employed in selecting each category of the households included in the study.

For effective administration of agricultural extension, Kaduna State has been divided into four agricultural zones namely: Maigana, Lere, Samaru-Katafand Bimin-Gwari. First, to ensure that the sample was a representative of the four agricultural zones, each zone was represented. In the second stage, one village or farming community where maize production was intensive, was selected in each of the four zones by using purposive sampling technique. The total farm families in the four zones was about 123,000. From this farm families, 30 households representing adopters and non-adopters were selected from each village, using simple random sampling technique. A total of 240 farm families, representing about 20 percent of the population of the farm families with at least 120 hybrid maize farm families were, therefore, interviewed between November and December, 1998. Additional information on the impact of the deregulated system was also gathered in September, 2002.

Basically, the analysis has involved the use of literature to present the hybrid maize seed, and fertilizer production and distribution. Descriptive statistics such as frequency counts, percentages and a probit regression model have been used to analyzed the primary data collected for this study.
The probit model was empirically specified as:

$$Y = b_0 + b_1x_1 + b_2x_2 + \ldots\ldots + b_{10}x_{10} + e$$

where:

Dependent variable

Y = Adoption of hybrid maize (measured as a dummy variable; with a value of 1, if farmer grows hybrid maize and uses inorganic fertilizer, and 0, otherwise)

Independent variables

X_1 = availability of hybrid seed 1, for those who think it was readily available, 0, otherwise
X_2 = ability to purchase desired quantity of fertilizer 1, for those who think they were able to purchased desired quantity, 0, otherwise
X_3 = timeliness of acquisition of fertilizer 1, for those who were able to acquire on time, 0, otherwise
X_4 = attitude to quality of fertilizer 1, for those who think they got the correct quality, 0, otherwise
X_5 = distance from source of fertilizer . This was measured in distance (km)
X_6 = attitude to cost of fertilizer 1, for those

who think it was not costly, 0, Otherwise
X_7 = attitude to hybrid seed labour requirement 1, for those who think it was not labour intensive, 0, otherwise
X_8 = attitude to yield of hybrid seed 1, for those who think, it yielded higher than open pollinated, 0, otherwise
X_9 = attitude to profitability of hybrid maize 1, for those who think it was profitable, 0, otherwise
X_{10} = extension contact. This was measured by the number of extension visits received by the farmer
b_1 to b_{10} = Coefficients
e = Error term

Although the primary data were collected from only one State out of the present 36 States in Nigeria, the results of the study are appraised in the context of the broader social and economic reality of Nigeria. This extrapolation is facilitated by the similarity of problems of maize farmers throughout Nigeria.

Literature on Hybrid Maize Seeds Production and Distribution

The history of organized hybrid maize seeds production and distribution dates back to the establishment of the National Seed Service (NSS) in 1972, and the emergence of the Agricultural Development Projects (ADPs) in 1974. Prior to this period, the production and distribution of certified maize seeds were largely handled by the Institute for Agricultural Research (IAR) of Ahmadu Bello University, Zaria and Special Agricultural Programmes (SAP) such as the National Accelerated Food Production Program (NAFPP). With the establishment of NSS, the function of the various government agencies involved in the production and distribution of maize seeds were redefined as follows:

IAR - Development, evaluation and maintenance of breeder seeds;
- Production of breeder seeds and other planting materials;
NSS - Production of foundation seeds;
- Seed testing and certification;
- Training in seed technology.
ADPs -Production of certified seeds from foundation seed collected from NSS;
- Distribution of seed to farmers.
SAP - Distribution of seed to farmers.

The distribution and marketing of certified seeds to farmers were undertaken by the Ministry of Agriculture and Natural Resources (MA&NR) Agro-Service Centers (ASCs). Before 1984, the production and distribution of hybrid maize seeds was the sole responsibility of government. Prices of hybrid maize seeds were then subsidized and this made them easily affordable to farmers (KADP Annual report 1992). By 1984, however, the deteriorating financial position of the public sector limited its ability to produce, and distribute adequate quantity of hybrid maize seeds. The consequence was inadequate supply of seeds to support demand. As a measure to solve the problems, in 1984, the government decided to allow the private sector to have full participation in the production and marketing of hybrid maize seeds (Table 1).

Table 1. Maize seed development in Nigeria between 1995-1998

Period	Seed Programme Development
prior to 1965	No seed programme
1966 - 1969	Public sector Regional Seed Programme and Breeder Seed Production and Distribution
1972	Establishment of the NSS programme by government
1976 - 1989	FAO - Assisted National Seed Programme implemented
1984	Hybrid seed development and premier seed established
1986 - 1988	Short-spell of Directorate of Food, Roads and Rural Infrastructure (DIFRRI) programme and UTC seed started
1992	National Seed Decree promulgated
1993	UAC Seeds inaugurated. Deregulated Marketing System and partial subsidy removal
1995	Three private seed companies in operation
1996	Establishment of seed science and training centre
1996 - 1997	Community-based Seed Production Programmes. Alheri Seeds. Sun-seeds. Mbilla Farm Seed established
1998	Complete subsidy removal

Source: Various reports of Federal Ministry of Agriculture

Prior to the 1984, the private sector involvement in the production and distribution of maize seeds had been minimal (Kasim 1996). The Premier Seeds Limited, United Trading Company (UTC) Seeds and United Africa Company (UAC) Seeds in Zaria, remain the predominant private sector initiative in seed production and distribution in Nigeria. Others with minimal participation include Alheri Seeds, Sun-Seeds and Mbilla Farm Seeds (Table 1). The private sector agencies obtain foundation seeds from Research Institutes and multiply them through contract growers. The seeds are packaged in units ranging from 2kg to 50kg and are sold through retail outlets such as Coca-Cola Depots, Leventis Superstores, Farm Service Centers, private agencies, individual marketers, etc and until in 1993, despite serious economic problems, the government continued to make funds available for seeds procurement and price subsidization (Table 1).

As indicated by the Kaduna Agricultural

Development Project (KADP Annual Report 1998), less than 10 percent of the total hybrid maize seed requirement was being satisfied. The main task, therefore, had been to produce sufficient quantities of hybrid seeds to satisfy self-sufficient requirements.

A summary of the general problems of hybrid seeds production and utilization reported by the Research Institutes, NSS and KADP collectively during the survey included the following:

i.) inadequate and irregular funding of government agencies involved in seed production, that is, Research Institutes, the NSS and the Multiplication Units of the ADPs;
ii.) lack of proper coordination, monitoring and evaluation of efforts of these agencies, as well as clear-cut definition of roles so as to prevent duplication of efforts;
iii.) lack of seed processing and other infrastructural facilities;
iv.) inadequate and untimely provision of foundation seeds;
v.) insufficient sales promotion and retail outlets, and
vi.) the production and sale of seeds by private agencies without compromising quality.

On the other hand, the private agencies' seed producers (Premier and UAC) identified the following impediments:

i.) low prices for hybrid seeds which constituted a disincentive to large scale production, and
ii.) inadequate management information such as scientifically estimated demand for hybrid seeds to facilitate adequate production.

Sources of Fertilizers Supply

Until 1976, the domestic demand for fertilizer was entirely met by importation. To decrease the dependency on importation, the Federal Government (FG) decided to establish domestic fertilizer plants. There are, therefore, two major sources of fertilizer supply in Nigeria; viz., domestic production and imports to complement the national fertilizer requirement. The first domestic production is the Federal Super phosphate Fertilizer Company (FSFC), Kaduna which was established in 1976. The FSFC produces Single Super Phosphate (SSP). a phosphorus fertilizer. The second is the National Fertilizer Company of Nigeria (NAFCON) sited in Onne, Rivers State established in 1988 and designed to produce Urea and Nitrogen, Phosphorus. Potassium (NPK) brand of fertilizer.

Other developments in domestic fertilizer production include the installation of private bulk blending plants in Kaduna and Kano, and government blending plants in Minna, Maiduguri and Yola (Table 2). These have resulted in expanding domestic production capacity and in providing

Table 2. The structures of fertilizers production plants in Nigeria

Plant	Location	Year of installation	Products	Installed capacity (mt/year)	Average capacity (mt/year)
01. Fertilizer Granulation Plants					
FSFC	Knaduna	1976	SSP	100.000	20%
NAFCON	Onne, Port-Harcourt	1988	Urea.	450.000	100%
			NPK	330.000	61%
02.Blending Plants					
Fertilizer & Chemicals (F & C)	Kanduna	1989	NPK 20-10-10 NPK 27-13-13 NPK 15-15-15	200.000	36%
Wafert	Kanduna	1993	Dolomitic lime-stone granules	60.000	-
Morris (MNL)	Minna	1990	NPK 20-10-20 NPK 27-13-13 NPK 27-13-13	200.000	28%
Kasco	Kano	1990	NPK 20-10-10 NPK 27-13-13	30.000	38%
Agro-Nutrients	Madobi/Kano	1993	NPK 20-10-10 NPK 27-13-13	150.000	3%
Yerwa Fert	Maiduguri	1995	NPK 26-12-10 NPK 15-10-20 NPK 10-20-10	200.000	-
Adamawa Fert	Yola	1995	NPK 20-10-10 NPK 15-15-15	200.000	-
Total				1.920.00	

Source: Adapted from Ogufowora (1996)

flexibility in formulating fertilizer blends specific to the agronomic requirements of different agro-ecological zones. Table 1 shows that the total installed capacity of all the domestic plants was 1,920,000 metric tones (mts) of different grades of fertilizers in 1996. This was made up of 880,000 mts from granulation plants and 1,040,000 mts from bulk blending plants (Table 2). As further shown in Table 12 capacity production was, on average, less than 40 percent (Ogunfowora 1996).

Fertilizer Distribution Systems to **Farmers**

The first recorded use of inorganic fertilizer in Nigeria was in 1937 (Yayock 1980). Since then, different systems of fertilizer distribution have been practiced. During the 1940s, for instance, it was the Federal Government who procured and distributed fertilizers to farmers. Between 1950 and 1975, it was the responsibility of the States Ministry of Agriculture and Natural Resources to procure fertilizers and distribute to farmers. Under this system, the extension staff, the cooperatives, licensed buying agents and traders acted as sales agents. Due to numerous problems encountered under this system, the Federal Government established the Fertilizer Procurement and Distribution Division (FPDD) in 1976 under the Federal Ministry of Agriculture to coordinate fertilizer procurement and distribution. Under this system, fertilizer licensed buying agents, traders and State Governments acted as sales agents. In 1995, through an edict promulgated by all the thirty-six State Governments, it became illegal for private dealers to sell fertilizers. Within the States, various Government approved outlets were used to bring fertilizers to farmers. These included the ADPs. local government councils, traditional rulers and cooperative groups. However, all these efforts did not help to solve the problems of fertilizer distribution in Nigeria.

Fertilizer Subsidies

Nigeria has a long history of fertilizer subsidies dating back to 1937. Over the years, fertilizers were subsidized to ensure reduction in retail price and orderly supply, thus improving affordability. Between 1976 and 1979, for instance, fertilizer attracted 75 percent subsidy, wholly borne by the Federal Government. However, the benefits of the intended subsidy often never got to the farmers for whom they were meant. Apart from scarcity and adulteration, most farmers paid prices far above the Government subsidized rates and fertilizers were usually not supplied at the right time. Because of this, farmers had to leave their farm work and made multiple trips to distant markets in search of a few bags of fertilizer which in most cases they did not get any to buy.

Fertilizer Subsidies Withdrawal

In January, 1998 government withdrew the price subsidies on fertilizers and deregulated the marketing system (Table 3) due to abundant evidence that the government subsidy and benefits of the regulated marketing system did not get to the farmers for whom they were meant. Under the deregulated system, the Federal Government was

Table 3. Policy changes and problems of fertilizer distribution (1976 -1998)

Period	Policy	Problems/Remarks
Prior to 1976	Individual states ordered fertilizers and distribute through sales agents and extension services	Large differences in prices paid by different states for the same brands
1976 -1986	FPDD coordinated procurement and distribution from ports and plants to states	There were unduly long delays and excessive transit losses
	Distribution to farmers vested in state MANR through ADPs. farmers' cooperatives input distribution companies e.g. FASCOM. BASAC. . KASCO, etc.	Price differentials
1986 - 1991	States collected fertilizers allocated to them from ports and plants to their Farm Service Centers	There were considerable variations among sates in cost of fertilizers. Excessive transit losses.
1991 - 1992	Six depots in Minna< Gombe. Lagos. Port-Harcourt. Funtua. and Makurdi created. Fertilizer was deposited from ports and plants for onward distribution	System was ineffective Problem of late delivery and losses
1992 - 1994	FPDD given role of distributing imported fertilizer only. while NAFCON handled locally produced	Transit losses very high. Diversion to neighbouring countries. Long delivery delays
1995	Federal Government stop importation of fertilizer. State Government edict banning sale by private agencies.	Problem of diversion persisted. Long delivery delays.
1996	States arranged to collect fertilizer from plants. 20fertilizer monitoring task forces set up to ensure fertilizer delivered to Local Government areas for distribution to farmers.	There was no significant impact
1997	Government partial subsidy withdrawal	Diversion and scarcity persisted. High cost and adulterated fertilizer
1998	Government deregulated sale and complete withdrawal	Fertilizer more available. high cost and adulteration.

Source: Adapted from Diouf and Ayoola, 1997

not to be directly involved with fertilizer procurement and distribution. The sale of fertilizer became free for all in the open market, but fixing of prices of fertilizers still remained the statutory monopoly of government. The justification for the continued government involvement was to ensure availability of fertilizer to farmers at fair prices throughout the country.

Influence of the Deregulated Policy on Fertilizer Prices and Use, Hybrid Maize Cultivation and Yields (t/ha) in Kaduna State

The policy objective of the fertilizer marketing and distribution system in
Nigeria were to:

i.) maximise distribution efficiency and reduce cost;
ii.) make fertilizer available in the right types, right place, right quantity, at affordable cost and at the right time, and
iii.) improve agricultural yields.

The effectiveness of the fertilizer deregulated system can, therefore, be measured in terms of fertilizers available in the right types, at the right time, right place, right quantity and at affordable cost. These parameters allow underpinning farmers perception of the distribution system using a rating scale with responses of "very good", "good", "fair" and "poor" to describe the various attributes of the distribution system. Although many farmers could be biased in their assessment of the distribution system, they are experts in their profession and are the beneficiaries or otherwise and hence should be the best judges of the system. In the analysis of the effectiveness of the deregulated system, none of the farmers interviewed in Kaduna-State described the timeliness of fertilizer supply as being very good. On the other hand, 11.2 percent of the farmers, considered the timeliness as poor. In other words, fertilizers were not supplied at the time they were most needed. In the same vein only 9.2 percent of the farmers perceived the timeliness of fertilizers supply as fair. With respect to price, over 50% of the farmers described the distribution system as poor, however, 74.6 percent of the farmers indicated that following the deregulation, fertilizers, particularly NPK and Urea were readily available in the open markets, but prices were higher than previous subsidized levels (Table 4).

Table 4. Farmers' perception of the fertilizer Distribution System

Attributes of distribution system	Kaduana State				
	Poor	Fair	Good	Very good	undecided
Availability	3.6	11 2	41.4	33.2	5.5
Right types	17.1	30.0	12.8	7.6	4.9
Right time	11.2	9.2	22.9	-	8.2
Right place	39.4	17.9	8.6	18.5	6.6
Right quantity	42.6	2.3	1.4	14.3	16.4
Affordable Price	56.8	2.6	0.8	0.3	1.5

Source: field survey, 2002

Fertilizers Price Differentials

Although fertilizers were supposed to be sold at fixed Government rates, most farmers paid prices far above the government rates. Table 5 shows wide price differentials between the prices paid by farmers during and after the subsidy periods. In 1998 for instance, when the official average price of the high nutrient types of fertilizer was N1000.00 per 50kg bag and the low nutrient types - N800.00 in Kaduna State (Table 5), majority of the farmers (83.2%) bought fertilizers at a mean price of N1600.25 per 50kg bag. Consequently, the demand for fertilizers by most hybrid maize farmers was very low (Table 6). About 78 percent of the respondents indicated that fertilizers has become too expensive and beyond reach of small-scale maize producers. As a result, while 47 percent had reduced the dosage application per hectare, 80 percent of the respondents had reduced their hectarages, and 39 per cent had shifted to local maize varieties and other crops that were less responsive to high levels of fertilizers (Table 6). The reasons attributed to the reduced dosage of fertilizer, less hectarages cultivated, and the shift to local maize varieties included the high price due to the removal of subsidy and the deregulated marketing system.

Table 5. Government approved and actual market prices of fertilizer in 1997 and 1998

Fertilizer Type	1997		1998	
	Government Approved (N*)	Actual Market Price (N*)	Government Approved (N*)	Actual Market Price (N*)
High Nutrient Type				
NPK (all types)	800	1050	950	1800
Urea	900	1100	1000	2000
Low Nutrient Type				
SSP	600	800	750	1150
MOP**	6000	800	70	1150

N* = Naira (N130 = 1 $), MOP** – Muriate of potash

Table 6. Reaction of hybrid Maize procedure to cost of fertilizer in 1998

Variables	N = 240	
	No.	%
Increase in fertilizer use over previous years	3	0.3
Reduction in amount of fertilizer used (kg/ha)	113	47.1
Reduction of hectarages cultivated	96	80 2
Shift to other crops with lower fertilizer needs	48	39 6

Multiple Responses Recorded

Low soil fertility is the most limiting factor to maize production in Nigeria and this was equally observed in the study area. Sixteen percent of the non-hybrid farmers pointed out that fertile land was becoming a limiting factor, while the fallow system through shifting cultivation was fast disappearing. This has forced many farmers to bring marginal land into production and to intensify the use of available land. However,49 percent of the non-hybrid farmers indicated that the high fertilizer requirement of hybrid hinder them from putting these marginal lands into hybrid maize production. Because of the limited access to fertile land, the traditional method of shifting cultivation which permitted farmers to stabilize their soils and production was no longer a viable option. Even though 45 percent of the non-hybrid farmers pointed out that new cultural practices such as planting in mixtures with nitrogen fixing crops, efficient recycling of organic materials and suitable crop rotation could enrich the soil, the remaining 55 percent identified lack of inorganic fertilizer as the reason for their non-adoption. Hence, the deregulated marketing system can be described as the most difficult policy regarding farmers' ability to cope with fertilizer procurement for hybrid maize production.

The Impact of the Deregulated Marketing Policy on Area Planted to Different Crops and Hybrid Maize Yields

Maize, sorghum, millet, and yam are the major crops grown in Kaduna State. Other crops cultivated are groundnuts, cassava and vegetables. Based on the percentage of the total cultivated area planted under each crop, the deregulated marketing system caused a significant decrease between the percentage area planted to hybrid maize in 1997 and 1998 (Table 7). The information in Table 7 also shows that the percentage area planted to hybrid maize suddenly decreased between 1997 and 1998 by 4.8 percent.

The deregulated marketing policy on fertilizer sale also resulted in 12.3 percent lower hybrid maize yields in the year 2001 than previous period (Table 8). This may be because farmers were not able to supply the recommended doses of fertilizers due to the high cost. Although the yield levels of hybrid maize could have been influenced by other factors, the figures in Table 8 allow room for speculation that the deregulated system resulted in lower grain yields in 2001. The consequence was a reduction in maize grain for human and livestock consumption in Nigeria.

Table 7. Percentage of area planted to different crops in 1997 and 1998

Crops	percentage of area planted 1997	1998	percentage area difference
Millet	9.3	13.6	+4.3
Sorghum	29.4	36.8	+7.4
Hybrid Maize	24.3	19.5	-4.8
Local Maize	10.9	12.6	+1.7
Yam	10.3	16.1	+5.8
Groundnut	3.4	6.5	+3.1
Cassava	9.1	14.6	+5.5
Vegetables	1.5	2.9	+1.4

Source: Field Survey, 1998

Table 8. Hybrid maize yields as influenced by deregulated policy on fertilizer supply (t/ha)

Variables	Maize
After deregulated	3.8
Before deregulated	4.3
Difference	0.5 (12%)

Source: Field survey. 2002

Factors Affecting the Farmers Decision to Adopt Hybrid Maize Production

Ten variables likely to affect farmers decision to adopt hybrid maize production were studied. These were availability of fertilizer, ability to purchase desired quantities of fertilizer, timeliness of fertilizer acquisition, attitude to quality of fertilizer, distance to source of fertilizer, attitude to cost of fertilizer, attitude to hybrid labour requirements, attitude to yield of hybrid seed, attitude to profitability of hybrid maize production, and extension contact. The responses were analyzed using a Probit Regression model. An alpha level of .01 and .05 was established *a priori* for determining the significance of the coefficients. Holding other factors constant, cost of fertilizers made the greatest contribution (Table 9). This implies that as fertilizer becomes less costly, available, and timely to farmers, the likelihood for expanding the adoption of hybrid maize increases. For instance, if fertilizer is available in adequate

Table 9. Probit regression model on factors affecting the adoption of hybrid maize production

Variables	Coefficient	Asymptotic standard error	Asymptotic t - values
Constant	1.0768	10.6825	0.1008
Availability of fertilizer	0.6987	0.4537	1.5401
Ability to purchase desired quantity of fertilizer	1.8163	0.5685	3.0949**
Timeliness of acquisition of fertilizer	1.6273	0.5788	2.8116*
Attitude to quality of fertilizer	0.5956	0.3533	1.6119
Distance from source of fertilizer	0.3286	1.0031	0.3276
Attitude to cost of fertilizer	1.8331	0.4016	4.5639**
Attitude to hybrid labour requirement	0.5953	0.7211	0.8256
Attitude to yield of hybrid seed	0.4923	0.1163	4.2347**
Attitude to profitability of hybrid maize production	0.9058	0.0024	2.4551*
Extension contact	0.3132	0.1545	2.0275*

* significant at 1% level
** significant at 5% level

quantity, at prices affordable and on time, the farmers will be induced to make favorable decisions on planting hybrid maize.

Summary and Recommendations

On the basis of the study, it can be concluded that the deregulated Nigerian fertilizer and seeds marketing subsidy withdrawal policy has not yielded positive impact on hybrid maize production, especially, in Kaduna State. Although the policy was meant to control prices of fertilizers in particular, it was found that farmers bought fertilizers at prices far beyond government approved rates. This price increase reduced the amount of hectarages put under hybrid maize production.

Since the policy is unsatisfactory, there is a need to reverse to the regulated and subsidy policy, but government should formulate policies aim at a better distribution system. The first step, is to broaden and strengthen the distribution channels to include farmers associations, ADPs, Farm Service Centres and Local Government Councils. The second is to include the private sector in the distribution and supply. It is obvious that the private sector is better suited for the supply and distribution of crop production inputs. Government should, however, provide the conducive environment that will make the private sector function efficiently. This will make the whole process competitive, thereby making good quality seed and fertilizer available to farmers at the right time and place, and at affordable prices.

Distant markets were identified as a problem of high seed and fertilizer distribution. It is, recommended that adequate infrastructure must be provided in the rural areas to ensure that private dealers are not discouraged from reaching out to the hinterlands. New feeder roads should be constructed and existing ones maintained to ensure that they are in good conditions all the year round. The availability of good roads will reduce the time spent by farmers in search of production inputs and also reduce cost of procurement and distribution.

The private agencies' seeds producers identified the lack of information on demand as a problem. To create wider awareness, government, should continuously provide comprehensive information on estimated demand for hybrid seeds by Nigerian farmers.

Extension contact was identified as important variable affecting farmers' decisions to adopt hybrid maize seeds and fertilizer. The linkage between extension and the private sector producers and marketers of agricultural inputs must also be strengthened. It is hoped that if the above recommendations are implemented, they will positively affect farmers' decisions to adopt hybrid maize production in Nigeria.

REFERENCES

Chikwendu DO and Omotayo MA 1993 Making Fertilizer Available to Small-scale Fanners: Rural Development Policy Options for Nigeria. Philippine Journal of Public Administration. Vol. xvii, No. 2 (April): 189 - 200.

Chude VO 1996 Fertilizer in Maize Production. Unpublished paper presented at the National Workshop on Maize Production in Nigeria, held at Kaduna, Nigeria, July, 22.

Diouf S and Ayoola GB 1997 The Liberalization of Nigerian Fertilizer Sector : Case Studies of Agric-inputs Retail Systems. Unpublished paper presented at the workshop on Liberalization of Nigerian Fertilizer Sector, held at Lome, Togo. July 27-29.

Edache DA 1996 Maize Production and Utilization in Nigeria: Problems and Prospects. Keynote address presented at the National Workshop on Maize Production in Nigeria, held at Kaduna, Nigeria, July, 22 (Unpublished).

Esu IE 1991 Detailed Soil Survey of NIHORT Farm at Bunkure, Kano State, Nigeria. Institute for Agricultural Research, Ahmadu, Bello University, Zaria, Nigeria: 218 pp.

KADP 1992 Annual Report.

KADP 1998 Annual Report.

KADP 2001 Annual Report: pp.26.

Kasim AA 1996 Maize Production in Kaduna State-Sasakawa Global 2000 experience. Unpublished paper presented at the National Workshop on Maize Production in Nigeria, held at Kaduna, Nigeria, July, 22.

Ogunfowora B 1996 Input Supply and Distribution for Crop Production in Nigeria: Problems and Prospects. Keynote address presented at the first ISNAR/I.A.R/NAERLS/FAO joint seminar, held at NAERLS, Zaria, Nigeria, June, 13 (Unpublished).

Yayock JY 1980 Rertilizer and their Application to Crops in Nigeria: Fertilizer Use Series No. 1. Federal Department of Agriculture, Federal Ministry of Agriculture and Rural Development.

Yayock JY and Karikari SM 1991 Adoption of Research Findings in Africa: The Nigerian Experience. In Proceedings of a Workshop on Agricultural Mechanization and Strategies in Africa: Case Studies from Commonwealth African Countries held at Ahmadu Bello University, Zaria, Nigeria, August 13,17th. Geoffrey. C. Mrema(ed.):99-120.