CHARACTERISTICS AND TRENDS IN PRODUCTION AND MARKET POTENTIAL OF CERTIFIED MAIZE SEEDS IN NIGERIA

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ABSTRACT

The study determined the characteristics and trends in market potential and production of certified maize seed in Nigeria. Data came from certified maize seed and maize grain farmers, and from various issues of Statistical Bulletins of the Central Bank of Nigeria. Data were analysed using descriptive and inferential statistics, markov chain process, time series analysis and budgetary technique. Results of the analyses indicated that certified maize seed production is a modern farming method, and producers were mainly male, literate, had mean age of about 42 years and mean experience of 9 years in certified maize seed production. Producers operated as sole proprietors, obtained farmland largely through inheritance and used informal farm financing sources. The seed farmers prefer selling to government agencies that guarantee purchase of their entire seed output. Significant proportion (55%) of maize grain farmers did not use certified maize seed largely because of ignorance and lack of complementary inputs. Both market potential and production of certified maize seed will grow with time.

INTRODUCTION

Nigeria, with a population of over 100 million people and land area of 98.3 million hectare of which 73.7 million are considered suitable for cultivation (CBN, 1998), is blessed with abundant human and natural resources to achieve high agricultural production and productivity. In addition, successive governments, together with the assistance from bilateral and multilateral agencies, have regularly allocated seeds to the agricultural sector. Despite all these, agricultural production still does not keep pace with demand for food. The agricultural sector's growth rate hovers around 2% while population rises by at least 2.8 % per annum (CBN, 1998) resulting in a decrease in per capita food availability (Brader, 1999).

Lanteri and Quagliotti (1997) noted that the future agricultural progress of many African countries depends on intensified land use rather than on the expansion of cropped area, and that the use of improved seeds can make a substantial contribution. One of the major sources of innovation, specifically in resource-constrained small farm environment is improved seed.

SEED PRODUCTION AND MULTIPLICATION

Seeds carry the genetic potential of crops, thereby determining the upper limit on yield and, therefore, the ultimate productivity of other inputs. Furthermore, new roles for seeds are rapidly recognized all over the world for the delivery systems of many innovative products and techniques for plants biotechnology, and as efficient, ecological preferred carrier of plant protection chemicals, biological and growth regulations (Srivastava and Jaffee, 1993). The biological process by which seeds and grains are formed is basically the same but the functions and objectives of production are different. Grain is produced for food, feed or raw materials while seed is for producing good crops (Joshua et al., 1979). Both commodities (grain and seed) should be handled differently as any attempt to use grain as seed is bound to reduce potential yield and the use of treated seed, as grain may be unsafe for consumption and uneconomical.

The process of seed improvement /multiplication is in stages. The first stage is the production of breeder seeds. Plant breeding techniques through selecting, changing and improving genotype of existing crop plants generally accomplish this stage. The desirable genotypes obtained are widely tested to identify those with the desired characteristics. The selected genotypes (breeder seeds) are finally tested intensively and released for cultivation. The second stage is the multiplication of breeder seed to obtain foundation seed. Foundation seed is known as elite or basic seed. The genetic identity and purity of variety are carefully maintained in foundation seed. It should be noted that in the scheme of production, a great deal of importance is attached to foundation seed, since this class of seed goes to numerous seed growers for further multiplication and any defects therein, could easily cause widespread failure and discontent. The

third and last stage is the multiplication of foundation seed to obtain commercial/certified seed, which is distributed as seed to grain farmers.

In Nigeria, research institutes are responsible for the production of breeder seeds. Foundation seed production is controlled by the National Seed Service (NSS). Apart from seed companies that produce usually mandated seeds and in relatively small proportion, contract seed growers handle the commercial/certified seed production. The contract seed growers are private individuals who are involved in the production of seeds on commercial basis rather than grains and they account for production of significant proportion of certified seeds. Contract maize seed growers obtain foundation maize seed used for production of certified maize seed largely from NSS. The contract seed growers coming from the environment of the grain farmers serve as intermediary between research institutes and the grain farmers, informing the former on the problems encountered by the latter on the varieties introduced.

MAIZE IN NIGERIA'S FOOD ECONOMY

Maize is one of the important household food crops grown in all the ecological zones in Nigeria, particularly in Southern Nigeria. Maize is consumed boiled, baked or roasted and serves as a major component of several livestock feeds, pharmaceutical and brewery products. The supply of maize in Nigeria is low relative to its demand. According to Fajemisin (1997), this is because of its low crop yield, which could be increased using improved maize seeds. Most studies on maize emphasized improvement in agronomic traits, technical efficiency, and economics of maize grain production (Akinyemiju and Alimi, 1989; Alimi and Alofe, 1992; Fakorede, 1993; Alofe and Adebooye, 1996). Little information is available on commercial maize seed production, hence the objective of this study was: to investigate the economics of maize seed production. Such a study would shed light on the socio-economic characteristics of contract maize seed growers, the characteristics of maize seed production enterprise, and the market potential of the maize seed industry. This information would in turn

help in determining the sensitivity of yield to price changes and factors that would promote the industry.

MATERIALS AND METHODS

The study was based on data collected from a questionnaire survey and from data on farmland published by Statistical Bulletins of Central Bank of Nigeria (CBN). For the questionnaire survey, the maize growing parts of the country were divided into three ecological zones: rainforest, derived savanna and guinea savanna, and a state was randomly selected from each zone. The states selected were Ondo for rainforest, Kwara for derived savanna and Kaduna for guinea savanna. All the contract maize seed growers in the three selected states, and two hundred maize grain farmers selected using nested sampling technique from each state were interviewed. Data collected from maize seed farmers included socio-economic characteristics of the contract maize seed growers such as sex, age, literacy level, experience in seed production; and characteristics of maize seed enterprise (farm size, cropping pattern, form of business organization, and quantity and prices of inputs and output of maize seed enterprise). The primary data collected from maize grain farmers were on the sources of maize seed used for planting and reason(s) for not using certified maize seed source(s).

Descriptive Statistics was used to analyze socio-economic characteristics of contract maize seed growers and the characteristics of maize seed and maize grain enterprises. Inferential statistics was used to compare mean values of relevant variables. Enterprise budgeting was employed to determine the profitability of maize seed enterprise for each of the different maize seed disposal outlets available and used (Kay, 1981).

The enterprise budget was divided into three sections of revenue, variable costs and profits. The unit of analysis chosen was one-hectare farm size. Revenue was arrived at by multiplying the mean yield by the price per unit of certified maize seed output. Variable costs were subtracted from revenue to determine the gross margin from which fixed costs were deducted to obtain return to

management (Profit). Sensitivity analysis was used to determine how resilient maize seed enterprise is to yield and output price changes. This was achieved by computing the break-even yield and price, defined as total cost divided by output price and total cost divided by expected yield respectively (Alimi and Manyong, 2000).

In order to identify the trends in maize seed production, Markov chain analysis was used (Alimi, 1999). A Markov chain is a sequence of random values whose probabilities at a time interval depends upon the value of the number at the previous time. The controlling factor in a Markov chain is the transition probability, which is a conditional probability for the system to go to a particular new state, given the current state of the system. Thus, fairly efficient estimates can be determined if the proper transition probabilities are obtained. It can be expressed as follows:

$x = Ax + f$……..……..(1)

$$x = f + Af + A^2 f + A^3 f + ... = \sum_{m=0}^{\infty} A^m f ....(2)$$

$$W = fi + (Af)i + (A^2 f)i + (A^3 f)i + ... \quad (3)$$

where x is a vector to be estimated; the nxn matrix A, and the vector f are known; and W is the final value (which is the mean value averaged over the random walks that start at index i)

In identifying the trend in market potential of maize seed, time series analysis was employed. The mathematical trends fitted to time series data collected were linear and exponential (Daniel and Terrell, 1979).

The linear trend is defined by

$Y_T = a + bX$ …… (4i)

where Y_T is the trend value of variable under consideration which in this study is the area of farm land under maize grain production annually, and X is time (in year 1,2…n), 'a' is the trend value of Y at

the origin of time (i.e. where X=0) and the constant 'b' is the trend parameter estimate for Y_T per unit of time.

The exponential trend is defined by

$Y_T = ab^X$ …… (4ii)

where the variables and parameters maintain the meaning in (4i).

The linear trend indicates the constant absolute amount annually by which Y_T changes while the exponential trend shows the constant percentage change per annum (Karmel and Polasek, 1978).

The mean value of annual areas of farmland used in maize grains production, the constant absolute change obtained from linear trend, the constant percentage change from exponential trend combined with seeding rate of certified maize seed was used to determine the mean annual market potential, the absolute and percentage change in market potential respectively of certified maize seed[1]. The value of market potential obtained and the associated change will be the market demand and its change respectively when all maize grain farmers use certified maize seed.

For the trend in certified maize seed production, the maize seed farm sizes of contract maize seed growers for years 2000 and 2001 were subjected to Markov chain analysis to determine the trend in the mean farm sizes and median and modal classes until the equilibrium year.

RESULTS AND DISCUSSION

Characteristics of certified maize seed producers and enterprises

All the 600 maize grain farmers selected these were analyzed. The data collected from twelve out of the ninety two maize seed farmers interviewed were discarded because they had been in the maize seed production business for less than two years, the minimum production period required.

None of the maize seed farmers was female, indicating that the enterprise is predominantly male. The reason given for non-involvement of female farmers was that the female farmers are

interested only in farm enterprises from which household food requirement could be augmented. Alimi et.al (2001) noted that women farmers engaged in the production of food crops, essentially to meet household food needs. Considering the nature of seed production enterprise in which the output (seed) is not primarily for consumption, a group that goes into farming primarily to supplement household food requirement may not be interested in such an enterprise. None of the maize seed farmers was younger than 31 years and older than 55 years (Table 1). Nearly all of them (97.5%) were between 31 and 50 years. More than three quarters were between 36 and 50 years of age and the modal age group was 41 – 45 years. The mean age was 41.75 years (Table 1). All the respondents were literate and could read and write in English and local languages. This attribute would enable them to use information on modern farm practices easily and unaided from printed materials to mass media. Also, they had the potential for farm record keeping. About two-fifths of the maize seed farmers had post secondary education and the remaining three-fifths had secondary education only. All of them had done agricultural science as a subject at the secondary school level and about 75% of those with tertiary education read agricultural or agricultural related courses. This educational background would assist the respondents in farming. All of them claimed to have attended at least a training workshop in maize seed production. A quarter of the respondents had more than 10 years experience in maize seed production. Both the modal and the median classes of years of experience were in 6-10 years and the mean was 8.75 years.

The only form of business ownership in maize seed enterprise was single proprietorship. The main source of financing was through personal savings but loans were usually obtained from friends and relatives and they attracted no interest payments. The pieces of farmland used for maize seed farming were inherited by 52.5%, borrowed by 32.5% and obtained as gift by the remaining 15% of the maize seed farmers. They claimed that getting more farmland to increase maize seed enterprise size is not a problem.

Apart from family labor and inherited farm land, all other factors of production most especially modern production inputs such

as tractorization, foundation maize seed; chemical for weed control and seed treatment, fertilizers etc. were obtained from competitive markets attracting payment in cash.

All the maize seed farmers practised mono cropping and none of them had maize seed plots in more than one location. The number of cropping is once a year and in the late maize season. This is because where both early and late maize season cropping are possible, output of early maize season comes when the weather is wet requiring the use of dryer, which maize seed farmers neither possess nor have access to. The maize seed farm sizes in year 2001 vary from 0.51 to 2.50 ha with a mean size of 1.53ha. The mean output (output per farm) was 1643 kg/farm resulting in the mean yield of 1.074ton/ha.

The maize seed farmers engaged in enterprise/income diversification because they claimed that income from maize seed enterprise alone could not meet their financial requirements. They engaged in the production of maize grains and other food crops both for market and household consumption. Record keeping of maize seed production was practised but no evidence of analysis for effective decision-making.

The identified certified maize seed disposal outlets were: selling directly to maize grain farmers (direct marketing), to agricultural inputs selling firms, and to government agricultural agencies. All the maize seed farmers used the three outlets but would prefer government agricultural agencies because they guaranteed minimum selling price and purchase of entire seed output, thus preventing having to sell seed as grain. All the respondents claimed that maize seed enterprise is profitable if output is sold as seed rather than as grain at reduced prices.

The proportions of maize grain farmers using the identified maize seed sources were: government agencies (11%), individual seed growers (25%), seed companies and agricultural inputs selling firms (9%), previous harvest (46%) and other sources (9%). It could be concluded that only 45% of the maize grain farmers used improved maize seeds because seeds from previous harvest and other doubtful sources would be unimproved. The maize seed demand from the

remaining 55% of the maize grain farmers not using certified maize seeds constitutes the additional maize seed demand that must be captured by the certified maize seed farmers. The non-users claimed either ignorance of its existence (21%) or lack of complementary inputs (68%) such as fertilizers, herbicides, tractorisation to realize the full potentials of improved seeds. Others (11%) perceived it as not better than unimproved maize seed.

Financial analysis

In order to determine the profit and profitability of certified maize seed enterprise, the enterprise budget derived from the mean values of relevant income statement parameters of maize seed farmers is shown in Table 2. Table 2(a) shows the enterprise budget when selling certified maize to government agricultural agencies such as Agricultural Development Program (ADP). The ADP bought the untreated maize seed at N55/kg and with the maize seed yield of 1074kg/ha; the income earned would be N59070. Tractors for ploughing and harrowing were obtained from government tractor hiring services at N3214 per hectare. The maize seed farmers complained that this facility was not easily available and at times resulted in delayed planting and constrained farm size if manual labor could not be obtained. The foundation maize seed planted was obtained at N80/kg and planting seed rate was 25kg/ha. Apron plus used for the foundation maize seed treatment was N100 per sachet with 13 sachets been used. Weed control was with the use of herbicides (primextra), five liters per hectare at N1000/litre, which could be substituted with manual labor. The respondents lamented on the high price and occasional failure of the chemical in controlling weeds. Six bags of N.P.K. and two bags of urea fertilizers were applied per hectare at N1, 200 per bag. Apart from the perceived high price of fertilizer, it was not easily available, at times resulting in using below recommended dosage and delayed application. The farm activities of seed planting, chemical spraying, thinning, fertilizer application, manual weeding, harvesting, winnowing and bagging were by human manual labour and usually family labour.

Family labour, like inherited farmland, does not require cash outflow and is treated in the same way as owned assets. Maize seed production enterprises like some other farm enterprises in developing countries are low in fixed assets investment. The fixed assets used and owned by maize seed farmers were cutlasses, hoes and knapsack sprayers. This resulted in low fixed cost charges (3.3% of total production costs).

Profits and profitability analysis based on the maize seed selling price of N55/kg (price offered by government agricultural agencies) indicated estimated Profit or Return to Management of N12443. This is a profitability of 26.7% and 21.1% when profit is expressed as a percentage of total cost and income respectively. Maize seed farmers perceived profitability to be higher than this because opportunity cost of owned inputs such as inherited farmland and family labor was taken to be either zero or lower than the market price.

The break-even yield (848kg/ha) shows that ceteris paribus, the yield should not be less than 848kg/ha in the long run if losses would not be incurred and 820kg/ha in the short run. The closeness of the two values is because of the low fixed input level of the enterprise. The break-even price should be N43.4/kg in the long run and N42/kg in the short run. Both yield (output/unit) and output price should not individually fall by more than 21% if economic profit is to be earned in the long run. In the recent time, government agricultural agencies have been disappointing in the purchase of certified maize seed output and the maize seed farmers have resorted to selling directly to the maize grain farmers or to agricultural input selling firms. The enterprise budget of maize seed enterprise is similar in the two cases of selling maize seed to government agricultural agencies and to agricultural inputs selling firms except in the income earned which is lower when output disposal is to the latter because of lower price per unit (an average of N 47.50/kg instead of N 55/kg offered by government agricultural agencies). This resulted in lower profitability performance (8.6%) because of decrease in income emanating from decrease in price. When direct marketing (selling directly to maize grain farmers) is practised, additional function of maize seed dressing

with chemicals (apron plus) would have to be performed by the maize seed farmers. The abridged enterprise budget for this is indicated in Table 4(b). The certified maize seed farmers applied one sachet of apron plus at N100 a sachet to 6kg of maize seed and sold at N82.50/kg of treated seed. After considering incremental income and incremental cost of selling directly to maize grain farmers, rather than to government agencies, an additional profit of N6785 was made. Despite higher profits made in direct marketing, maize seed farmers still prefer selling through government agencies where sales and minimum prices are guaranteed instead of any other sales outlets. This is because of the risk of having to sell seed as grain at reduced prices in the other two sales outlets.

MARKOV CHAIN ANALYSIS RESULTS AND MARKET POTENTIAL OF MAIZE SEED

The distribution of maize seed farmers according to their farm sizes in 2000 and 2001 is shown in Table 3. For the two years (two consecutive production seasons), the farm sizes varied from 0.51 and 2.50 ha. The mean farm size in year 2000 was 1.32ha and 1.53ha in 2001. The median and modal farm sizes were in the class interval 1.01 to 1.50 for the two periods. By these farm size characteristics, these farmers were smallholders, which is typical of farming in developing countries. The mean farm size in 2001 is higher and statistically significant at 5% level (tc=2.0). This indicates that maize seed farmers on the average in 2001 had bigger maize seed farms than year 2000. The results of the Markov Chain process used in assessing and forecasting the pattern of change in the maize seed farm sizes are presented in Tables 4(a) and 4(b).

The movement of maize seed farmers from one maize seed farm size to another between the two periods (2000 and 2001) for which data were collected is presented in Table 4(a). The farm sizes operated by the maize seed farmers were put into four categories. These are 0.51 – 1.00 ha, 1.01 –1.50ha, 1.51-2.00ha and 2.01 – 2.50 ha. Taking the first row of the matrix as an example, the entry in the first cell (8) of the row shows the number of maize seed farmers that cultivated farm size 0.51 – 1.00 ha in the first period (2000) and still

cultivated within the farm size in the following period (2001). The entry in the second cell (8) represents the number of maize seed farmers that was in the farm size category 0.51 – 1.00 ha in 2000 that moved to the farm size category 1.01 – 1.50 in the following period (2001). The entry in the third cell (4) indicates the number of farmers that operated within the farm size category 0.51 – 1.00 ha in the year 2000 that moved to the farm size 1.51 – 2.00 ha category the following year (2001). The entry in the fourth cell (0) implies that none of the farmers that was in the farm size category 0.51 – 1.00 in year 2000 moved to 2.01 and 2.50 ha farm size category in year 2001. Entries in the Total Column and Total Row indicate the frequency distributions of farm sizes of certified maize seed farmers in years 2000 and 2001 respectively. The transition probability matrix of farm size of certified maize seed farmers is shown in Table 4(b). The transition probability matrix provides some useful clues into the dynamic aspect of certified maize seed farm size. The entries in the cells on the principal diagonal indicate the tendency for the maize seed farmers to remain in their farm size category. Examining the size of the proportion in each cell of the principal diagonal shows that the tendency to remain in the same class is highest (0.75) for the highest farm size class (2.01-2.50ha), and only 25% of the farmers in this class dropped to the next lower class. The least tendency to remain in the same class was exhibited by the farmers in the farm size class 1.51-2.00 ha and relatively higher proportion (0.72) moved to higher class compared to lower proportion (0.28) that moved to lower categories. Comparison of the proportion to the right of the principal diagonal with the proportion to the left of it reveals higher proportion to the right than to the left showing higher tendency for increased farm size.

The projected values of the structure of farm sizes that certified maize seed farmers would have, if the prevailing conditions affecting farm size continue through time are shown in Table5. In the equilibrium year (2018), the proportion of certified maize seed farmers in the least farm size category (0.51-1.00ha) will reduce from 25% in the base year (2000) to 0.8%, and the proportion in the highest farm size category will increase from 10% to 66.8%. Generally, the proportions in the smallest two farm size categories would reduce and

the proportions in the biggest two categories would increase gradually starting from the base year to equilibrium year. The mean farm size rises gradually from 1.32ha in the initial year to 2.03 in the equilibrium year. Both the initial and equilibrium mean farm sizes are still in the smallholder farm size category but about 50% rise in mean farm size will occur in the equilibrium year over the initial year. The median class would move from S_2 (1.01-1.50) ha in the initial year (2000) to S_3 (1.51-2.00) ha in 2003 and to S_4 (2.01-2.50) ha in 2005 till equilibrium year. The modal class of S_2 (1.01-1.50) ha in the initial year, will move to S_4 (2.01-2.50) ha in 2005 and will be maintained till the equilibrium year 2018. Results of the data on estimated areas of farmland put to maize grains production annually fitted into the linear and exponential trends are indicated in Table 6. The mean area of farmland cultivated with maize grains between 1988 and 1998 was 3,177, 545ha. It implies that at the planting maize seed rate of 25kg/ha, the annual mean market potential for certified maize seeds would be 79,438,625kg.

The linear trend indicates that at the origin of time, that is when X (time) is zero (1993), the area of farmland grown with maize grains would be 3,268, 450ha (= b_o) and changes annually by 574,940ha (=b_1). The positive nature of b_1 implies constant absolute increase in market potential of certified maize seed by 14,373,500kg per annum. In order to meet this annual increase, additional 13,383.15ha of farmland will be put into maize seed production. The exponential trend shows that on the average, the area of farmland cultivated with maize grains increases at 21% per annum and thus by inference the market potential for certified maize seed.

However, it should be pointed out that, like other time series analysis, the change in area of farmland put to maize grain production is not strictly dependent on time but on economic variable(s) that change(s) with time. For example, the increase in area of maize grain farmland cultivated is as a result of high demand for maize grains (making its production relatively more economical) arising from probably increase in population or the uses to which maize grain is put. Automatically, an increase in area of maize grain farmland cultivated causes increase in the market potential of certified maize

seed. The demand for maize seed is a derived demand for maize grains (increase in demand for maize grain at constant maize grain productivity level will require putting more farmland to maize grain cultivation, which will increase demand for maize seed).

Thus, a general inter-temporal rise in maize seed farm size is projected that will lead to increase in output (supply) of certified maize seed. In order to enhance growth in farm size and production of certified maize seed, effort should be directed at availability and timeliness of output enhancing modern consumable inputs such as fertilizers, herbicides, seed dressing chemicals etc; agencies such as Agricultural Development Program (ADP) should be available to guarantee purchase of the entire maize seed output to prevent selling maize seed as grain at lower prices that could bring losses to certified maize seed farmers; and enlightenment through extension services on the importance and superiority of certified maize seed for maize grain production should be intensified to increase demand for certified maize seed and for improved maize grain yield.

SUMMARY AND CONCLUSIONS

This paper identified the trends in production and market potential of certified maize seed. Both primary and secondary data were collected and processed using SPSS. The secondary data on area of farmland planted to maize grain annually from 1988 to1998 in Nigeria was obtained from various issues from Statistical Bulletins of Central Bank of Nigeria,. Two categories of respondents were interviewed. These were certified maize seed farmers and maize grain farmers. Ninety-two certified maize seed farmers and six hundred maize grain farmers selected using nested sampling technique from each state were interviewed. Data on sources of maize seed planted by maize grain farmers and on characteristics of certified maize seed farmers and the enterprise were collected. Data were analysed using descriptive and inferential statistics, Markov chain process, time series analysis, and budgetary technique.

Results indicated that all the certified maize seed farmers were male, literate, lay between the age range of 31 and 55 years with the

mean age of 41.75. Their length of experience in certified maize production was between 2 and 20 years with the mean of 8.75 years. They all claimed to be trained in certified maize seed production and could obtain more farmland if necessary. The main source of farmland was inheritance and family labour was available for seed production. The form of business ownership was sole proprietorship and cultivation was monocropping and in the late maize season only. Modern production inputs such as tractorization, fertilizers, herbicides and seed treatment chemicals were used but there were complaints of timeliness and unavailability problems. The main source of farm financing was informal and regarded as insufficient.

Certified maize seed farmers perceived the enterprise as profitable and preferred selling seed through government agencies that guarantee minimum price and sales of all their produce. The market potential for certified maize seed indicated a rising trend of about 14000 tons or 21% annually. This market potential will translate to demand if all maize grain farmers' use certified maize seed but about 55% did not use it due to ignorance and lack of complementary inputs. Profitability analysis of certified maize seed enterprise indicated that the enterprise was profitable and that a decline in yield or output price by more than 21% could wipe off profit/ return to management. If the prevailing production conditions persist, certified maize farm size is expected to increase gradually until equilibrium year (2018) when it will be 150% of the initial year 2000.

In order to encourage the supply and use of certified maize seed, maize grain farmers should be enlightened on the benefits of certified maize seed; modern complementary production inputs (tractorization, fertilizers and herbicides) should be made available to the certified maize seed farmers at affordable prices, and effective marketing outlet for the produce should be provided by government agencies to prevent selling seed as grain at reduced and uneconomical prices.

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Table 1: Socio-economic characteristics of maize seed farmers, farm size and output distribution.

Characteristics	Distribution %	Mean	
Age (years)			
<35	20.0		
36 –40	15.0		
41 –45	37.5	41.75	
46 –50	25.0		
< 55	2.5		
Secondary School only	60.0		
Complete post secondary	40.0		
Experience (years)			
< 5	15.0		
6 – 10	60.0	8.75	
11 – 15	20.0		
< 20	5.0		
Sources of farmland			
Inheritance	52.5		
Borrowing	32.5		
Gift	15.0		
Farm Size (Ha)			
0.51 – 1.00		12.50	
1.01 – 1.50		42.50	1.53
1.51 – 2.00		22.50	
2.01 – 2.50		22.50	
Output (kg)			
501 – 1000		7.50	
1001 – 1500		37.50	1643
1501 –2000		25.00	
2001 – 2500		30.00	

Table 2: Enterprise budget (₦) for certified maize seed production

(a) Sales to government agencies

Income:(1074kg/ha.x₦55/kg)		59070
Variable costs:		
Ploughing and harrowing	3214	
Seed	2000	
Seed dressing	1300	
Planting	1324	
Weed control (herbicides)	5000	
Herbicides application	1100	
Thinning and supplying of missing Stands	865	
Fertilizers	9600	
Fertilizer application	2105	
Spot weeding	1352	
Harvesting	3256	
Shelling	2971	
Winnowing, weighing and bagging	2815	
Transportation	1952	
Miscellaneous	2150	
Interest on variable costs	4100	
Total variable costs		45104
Income less variable costs		13966
Fixed cost:		
Machinery depreciation	1123	
Land charge	400	
Total fixed costs		1523
Total production costs		46627
Estimated Profit/Return to Management		12443

(b) Direct marketing (maize seed farmers selling directly to maize grain farmers)

Income: 1074kg/ha×₦82.50/kg		88605
Total production cost		46627
Marketing costs:		
Chemical for seed dressing	17900	
Chemical application	1930	
Selling expenses	2920	
Total marketing costs		22750
Total costs		69377
Estimated Profit/Return to Management		19228
Effect of Direct Marketing		
Incremental income	29535	
Incremental costs	22750	
Incremental Profits		6785

Table 3 Comparison of distribution of certified maize seed farmers' farm Sizes (2000 and 2001)

Farm Size (ha)	**Distribution (%)**	
	2000	**2001**
0.51 – 1.00	*25.00*	*12.50*
1.01 – 1.50	*47.50*	*42.50*
1.51 – 2.00	*17.50*	*22.50*
2.01 – 2.50	*10.00*	*22.50*
Mean (ha)	*1.32*	*1.53*
t_c	*2.0*	

Table 4(a): Transition matrix for different farm sizes (ha.)

Year	**2001**					
2000	**Farm Size**	**S_1(.51-1.00)**	**S_2(1.01-1.50)**	**S_3(1.51-2.00)**	**S_4(2.00-2.50)**	**Total**
	S_1(.51-1.00)	8	8	4	0	20
	S_2(1.01-1.50)	2	24	10	2	38
	S_3(1.51-2.00)	0	2	2	10	14
	S_4(2.00-2.50)	0	0	2	6	8
	Total	**10**	**34**	**18**	**18**	**80**

Table 4(b): Transition probability matrix for different farm sizes

Year	2001					
	Farm Size	**S_1(.51-1.00)**	**S_2(1.01-1.50)**	**S_3(1.51-2.00)**	**S_4(2.00-2.50)**	**Total**
2000	S_1(.51-1.00)	.40	.40	.20	0.0	.250
	S_2(1.01-1.50)	.05	.64	.26	.05	.475
	S_3(1.51-2.00)	0.0	.14	.14	.72	.175
	S_4(2.00-2.50)	0.0	0.0	.25	.75	.100

Table 5: Actual and projected structure of certified maize seed enterprise sizes (ha.)

Years		Farm Enterprise Sizes						
		S_1. (.51-1.00)	S_2 (1.01-1.50)	S_3 (1.51-2.00)	S_4 (2.01-2.50)	Mean	Median Class	Modal Class
Actual	2000*	0.250	0.475	0.175	0.100	1.32	S_2	S_2
	2001	0.125	0.425	0.225	0.225	1.53	S_2	S_2
Projected	2002	0.124	0.429	0.223	0.225	1.53	S_2	S_2
	2003	0.071	0.355	0.224	0.351	1.68	S_3	S_2
	2004	0.046	0.287	0.225	0.442	1.79	S_3	S_4
	2005	0.033	0.234	0.226	0.508	1.86	S_4	S_4
	2006	0.025	0.194	0.226	0.555	1.91	S_4	S_4
	2007	0.020	0.186	0.226	0.589	1.97	S_4	S_4
	2008	0.016	0.146	0.226	0.612	1.97	S_4	S_4
	2009	0.014	0.131	0.226	0.629	1.99	S_4	S_4
	2010	0.012	0.121	0.226	0.641	2.00	S_4	S_4
	2011	0.011	0.114	0.226	0.649	2.01	S_4	S_4
	2012	0.010	0.109	0.226	0.655	2.02	S_4	S_4
	2013	0.009	0.105	0.226	0.659	2.02	S_4	S_4
	2014	0.009	0.103	0.226	0.662	2.03	S_4	S_4
	2015	0.009	0.101	0.226	0.664	2.03	S_4	S_4
	2016	0.009	0.100	0.226	0.665	2.03	S_4	S_4
	2017	0.008	0.099	0.226	0.667	2.03	S_4	S_4
	2018**	0.008	0.098	0.226	0.668	2.03	S_4	S_4
	2019	0.008	0.098	0.226	0.668	2.03	S_4	S_4

*Note: * means starting state (initial) probability vector*
*** means equilibrium probability vector*

Table 6: Results of linear and exponential trends of maize grains farm areas (ha) harvested.

Parameters	Linear	Exponential
b_o	3268.45	3.430 (2691.53)
b_1	574.94	0.0838(1.21)
F	90.46	79.95
Sig F	0.000	0.000
R^2	0.910	0.899
Degrees of Freedom.	9	9

Note: The figures in brackets are the antilog of the exponential values

The currency exchange rate was ₦115 (₦ is Nigerian currency) = $1