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ECONOMIC ASSESSMENT OF MAIZE PRODUCTION USING TWO CHNOLOGIES IN FOUR LOCAL GOVERNMENT AREAS OF KADUNA STATE

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ABSTRACT

The objective of the study was to assess the efficiency of improved technology in maize uction in Kaduna State by comparing Sasakawa and Non-Sasakawa Technologies.

To obtain the data necessary for this study, eighty each of Sasakawa and non-Sasakawa ers involved in maize production technologies were interviewed from four Local mment Areas of the State. Descriptive statistics and gross-margin analysis were employed analysis of the data.

The result of the study shows that the output, gross-return and gross-margin per hectare Sasakawa farmers were significantly higher than for the non-Sasakawa farmers. Therefore, study concluded by recommending that planners for maize production should continue to s on the design and implementation of Sasakawa technology.

INTRODUCTION

Maize is becoming the miracle seed Nigeria's agricultural and economic elopment (Adenola and Akinwumi,). It has established itself, as a very ificant component of the farming m, and determines the cropping pattern the predominantly peasant farmers misin, 1985; Ahmed, 1996). The tional areas of maize cultivation in ria, have been the south of latitude 8 es North (8°N) where it can be grown a year. However, it is now known that higher solar radiation received in the ern part of the country, in comparison e southern parts and the adoption of oved maize seed technology (TZB) led to the increasing importance and expansion of maize production in the northern parts of the country, where it has not been traditionally grown on a wide scale (Ologunde, 1987). Since it has been established that potential for its production is greatest in the Savannah zones of northern Nigeria, it began to attract the attention it deserves from the farmers and researchers in the Guinea Savanna zone.

In Nigeria, many researchers, including Norman (1972) have found improved production technology to be a major factor in effort to become self sufficient in maize production. For instance, Norman, et al., (1976) working with farmers using ox-drawn implements reported that yields of about 3000 - 5000 kg per hectare

can be realized only with high levels of fertilizer, optimum plant population and adequate weed control.

Abalu and Harkness (1978) conducted a study on an economic analysis of production in Northern Nigeria using traditional versus improved groundnut production practices. They found out that hired labour used on family farm was quite high in the study area. The output was about 870kg and 1229kg and a value of ₦261.00 and ₦368.70 per hectare for traditional and improved production practices respectively. The study further shows that the net-return per hectare for the traditional technology was 45 percent of the improved one. Therefore, the improved method of production appears to be superior.

Maize yield is found to respond to fertilizer application. In the Southern Guinea Savannah up to 15kg/ha and with basal application of 60kg/ha each of P_2O_5 and K_2O is required by Maize (Ogungbile *et. al.* 1986). They also found out that nitrogen recommendations do not vary much with differences in plant density in the new locations in optimal combinations. In a study conducted by Wadderburn *et. al.* (1988) to determine crop yield response to fertilizer use at selected Agricultural Development Project Areas, in 1985 and 1986, maize was found to be the most responsive crop to fertilizer use among the cereal crops. Average response of maize was 0.6kg per kg of nutrient, while that of millet was 0.1kg per kg of nutrient in Kaduna Area.

Philip (1980) found that though fertilizer and maize yield are positively related, fertilizer application should be within economic consideration. He noted that economic optimum for fertilizer was always occurring below the technical optimum and if fertilizer price rises in relation to maize price, the economic optimum occurs at lower level of fertilizer use. Idisi (1990), conducted a study on the potential of hybrid maize, his costs and returns analysis shows hybrid maize to be superior to open pollinated variety. Also, based on farmers' observations and perception rating, hybrid maize was found to be superior to the open pollinated variety and could therefore receive a larger crop in the near future. In a similar study carried out by Edwin (1991), the average gross revenue and cost per hectare were higher for hybrid maize grower than open pollinated variety growers.

However, despite the high yields obtained from the use of improved production technology, the national average grain yield of maize has consistently fallen short of the potential yields. Table 1 shows the average and potential yield of cereals in Nigeria. While the potential yields of maize is between 3.5 - 10 (Ton/ha), the average yield is 1.5 - 2.0 (Ton/ha). In order to wipe out the deficit, there must be a significant increase in the domestic production of maize. One of the ways being adopted to achieve this, is the introduction of a new production technology known as Sasakawa.

The Sasakawa maize production technology is a production technology being disseminated by Sasakawa Global 2000. It is basically the outcome of research findings from Nigerian Agricultural Research Institutes and other national and international agricultural research centres. The technology comprises a package of agronomic practices, which include:

Making of ridges between 75cm - 80cm apart

Use of high yielding hybrid maize seeds

Planting dates of between 15th May - 30th June, when rains are established for Northern Guinea Savannah.

Use of 17-18 Kg/ha of seeds by planting one seed per hole or hill at a spacing of between 20cm - 25cm apart.

Application of seven bags of N:P:K Fertilizer per hectare (350kg) as first application and two bags (100Kg) of urea per hectare in the second application. Incorporating the fertilizer by making a hole 8-10cm away from the plant (Valencia, 1997).

To establish demonstration plots in a munity, extension workers enlist ers who agree to provide labour and a e of their land in order to try out the new ods. These set of farmers are those red to as Sasakawa farmers in this , while the other farmers who do not ow the guidelines of the extension kers are referred to as the Non-Sasakawa kers.

The broad objective of the study is to ss the efficiency of improved nology by comparing Sasakawa technology and Non-Sasakawa technology. The specific objectives are to:

(i) examine the major production practices of the Sasakawa and Non-Sasakawa farmers;

(ii) determine the input-output levels of Sasakawa and Non-Sasakawa farmers; and

(iii) compare the costs and returns to the two types of technologies in maize production.

2. METHODOLOGY

The study was conducted in Maigana and Lere zones of Kaduna Agricultural Development Project (KADP). These zones are located in the North-eastern part of Kaduna State. The bulk of agricultural production is undertaken by small-scale farmers, most of whose labour force, management and capital originate from the household.

For the purpose of this study, Lere, Kauru, Soba and Giwa Local Government Areas were selected. The sample for the study was selected using stratified random sampling techniques. Sasakawa and Non-Sasakawa farmers were identified. Simple random techniques was used to select twenty (20) Sasakawa and Non Non-Sasakawa farmers in each of the four Local Government Areas. This gave a total of 160 farmers that were interviewed. The data was collected based on 1997/98 cropping season with the aid of structured questionnaires.

Analytical Tools

The tools of analysis used for this study are simple descriptive statistics and the gross margin analysis

(1) Simple descriptive statistics were employed in order to present summary description of the data collected. This involved the useof measures of central tendency such as mean, mode, percentages and measures of dispersion such as standard deviation.

(2) Gross-margin analysis was used to compare the profitability of farm production practices of farmers using Sasakawa technology and those of others not using Sasakawa technology for maize production. Gross-margin per hectare is expressed as: GM = GR - TVC

where:

GM = Gross Margin
GR = Gross revenue
TVC = Total variable cost

Test of hypothesis

A test of hypothesis was conducted between the mean gross margin obtained by farmers using Sasakawa and those not using Sasakawa technologies for production. The two means gross margin for the farmers were subjected to Z-test using the formula

$$Z = \frac{\bar{X}_1 - \bar{X}_2}{\sqrt{\frac{S_1^2}{n_1} + \frac{S_2^2}{n_2}}}$$

below:

$\bar{X}_1$ and $\bar{X}_2$ = The mean gross-margins of the farmers

S_1^2 and S_2^2 = Estimated variance

N_1 and N_2 = sample sizes of the Sasakawa and Non-Sasakawa farmers respectively

H_0: There is no significant difference in the mean gross margin of farmers using Sasakawa technology and those using Non-Sasakawa technology.

H_1: There is significant difference in the mean gross margin of farmers using Sasakawa technology and those using Non-Sasakawa technology.

3. RESULTS AND DISCUSSION

3.1. Socio-economic Characteristics of Respondents

Table 2 shows that about 56 and 50 percent of the Sasakawa and Non-Sasakawa farmers respectively were between the ages of 21 and 40 years while 27 and 20 percent of Sasakawa and Non-Sasakawa farmers respectively where middle aged (that is between the ages of 41 to 50 years).

About 56 and 62 percent of the Sasakawa and Non-Sasakawa respondents respectively have formal education, though majority of them terminated at the primary level. The remaining were illiterates. The average farming experience of the Sasakawa and Non-sasakawa farmers was 21 and 18 years respectively.

3.2. Major Production Practices

The Sasakawa farmers purchased hybrid seed from seed agents present in the villages, while the non-Sasakawa farmers used the open-pollinated variety (OPV) seed sourced from the previously harvested crop. Spacing between ridges were 75-80cm and 90-100cm for the Sasakawa and Non-Sasakawa farmers respectively. Both groups of farmers used hoes, sticks and or heels to make holes. While the Sasakawa farmers sowed one (1) seed per hole and the spacing between stands was between 20-25 cm, the Non-Sasakawa farmers sowed 2-3 seeds per hole and the spacing between stands was 30-40cm.

Both groups of farmers generally weeded two times. The weeding operation was done manually with the use of hoes. The first weeding took place 3-4 weeks after sowing, while the second weeding was at about 7-8 weeks after sowing. Both groups of farmers applied fertilizer two times, but the period and method of application differed. The Sasakawa farmers applied first fertilizer just after seedling emergence (within 14 days after sowing). They made holes between the maize stands and put the fertilizer before covering it, to avoid losses due to heavy rainfall and volatilization. The second application was done when the crop was 4 - 5 weeks old. The Non-Sasakawa farmer, on the other hand, applied the first fertilizer 3-4 weeks after sowing and side placement method was used without making holes. The second application was usually delayed until the crop was about flowering that is about 8 - 10 weeks after sowing.

3.3. The Input-output Levels in Maize Production

The inputs used for the production of maize in the study area by both group of farmers were seed, fertilizer and labour, while the output dried threshed was the total grain obtained per unit of the area planted. Since the area of land cultivated by each farmer vary, data in this sub-section was expressed on per hectare basis. The input-output levels for maize production per hectare is shown in Table 3.

Table 3 shows that, while the Sasakawa farmers used about 18kg of seed per hectare, the Non-Sasakawa farmers used as much as 28kg per hectare. The high amount of seeds used by the non-Sasakawa farmers might be as a result of the low viability of planting material (local maize variety) used and also because of the more than two seeds that the farmers usually planted to safeguard against any poor germination of the maize seeds. Further analysis revealed that, while the Sasakawa farmers applied as much as an average of 485kg of fertilizer per hectare, the Non-Sasakawa farmers used about 277kg per hectare. The right amount of fertilizer used by Sasakawa farmers might be attributed to the adequate information received from extension agents.

The average man-day per hectare in the study area for producing maize were 103 for Sasakawa and 88 for the Non-Sasakawa farmers. The higher labour used for the Sasakawa farmers might have been caused by increased output, which consequently increased the labour for harvesting and threshing. (Table 4).

The output is the total quantity of maize produced from a given area of land. For this study, the various output levels were converted to per hectare basis, thus giving an average yield per hectare for the two groups of farmers. The average yields were found to be higher for Sasakawa than for the

Non-Sasakawa farmers. The average yields were 3801 kg and 2507 kg per hectare respectively and their difference was significant at 5% level of probability as shown in Table 4.3.

3.4 Cost and Returns

The costs incurred in running the farm and the returns accruing from it show whether the farm business is profitable or not. If the returns are higher than the costs, there is a surplus that could be put to economic use. Table 5 shows the costs, returns and gross margin of maize production per hectare.

Labour costs.

The total labour force consisted of family and hired input in man-days. The average wage rate was put at ₦150.00 per man-day. For the family labour input, the evaluation was carried out using the opportunity cost principle. It was assumed that family labour was perfectly substitutable for hired labour and imputed labour cost was used for family labour equal the wage rate of hired labour.

Table 5, shows that the average cost of labour input per hectare for Sasakawa Technology was ₦15, 469.50, while that of the Non-Sasakawa technology was ₦13, 305.90. The average cost of fertilizer per hectare accounted for about ₦13, 580.00 and ₦7, 777.00 for the Sasakawa and Non-Sasakawa technologies respectively.

Hybrid maize seeds mainly used by the Sasakawa farmers was valued at ₦80.00 per kilograms, while the local seeds were valued at ₦17.00 per kilograms. Both types of seeds were valued based on the prevailing average market price. Table 5 shows that the average cost of seeds per hectare was ₦1, 481.12 and ₦480.41 for the Sasakawa and Non-Sasakawa technologies respectively. Other costs, such as the cost of transporting produce from the field to the market, and the cost of bags were calculated. For the Sasakawa farmers, the cost incurred was ₦1, 900.00, while that of the Non-Sasakawa farmers was ₦1, 250.00.

Both the yield and gross return obtained from using Sasakawa technology to produce maize were higher than that obtained from the use of Non-Sasakawa technology. The average gross return per hectare of the Sasakawa technology was ₦64, 619.00, and ₦42, 633.00 for the Non-Sasakawa technology. Also, the Sasakawa farmers earned a gross margin of ₦32, 186.92 per hectare, while the Non-Sasakawa farmers earned ₦19, 811.13 per hectare. The study shows that the Sasakawa farmers were earning a profit of about 62 percent higher than the profit earned by Non-Sasakawa farmers.

3.5. The gross-margin statistical test for significance

The mean gross margin data were statistically tested for significant difference using the Z-test for comparing two sample arithmetic means between farmers using Sasakawa technology and farmers not using Sasakawa technology for maize production. (Table 6).

Since t_{cal} is > t_{tab}, we reject the null hypothesis and accept the alternative hypothesis, that is, there is significant difference in the means of farmers using Sasakawa technology and those not using Sasakawa technology. Therefore, the test of significance of the mean gross margins confirms that there is significant difference between the farmers using Sasakawa technology and those not using it.

5. CONCLUSION AND RECOMMENDATION

The foregone results and discussion have shown that the use of both types of technologies for maize production was profitable. But further analysis revealed that the use of Sasakawa technology for maize was more profitable than the type of technology farmers were using in the study area. Therefore, planners for maize production should continue to focus on the design and implementation of Sasakawa technology.

Based on the findings of this study the following are recommended:

There is need to educate farmers on the type, quantity and time of fertilizer application.

Efforts should be made to ensure that fertilizer is available to farmers at the beginning of the planting season.

National Research Institutes and rganizations such as UAC, UTC and Premier Seeds, which are into the development and production of hybrid maize should be encouraged to produce more stable, higher yielding hybrid varieties.

Since the use of improved technology involves training, the level of education of farmers is an important factor. Government policy should give priority to adult education in order to develop and increase the educational level of farmers.

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Table 1: Average and potential yield of cereals in Nigeria

Crop	Average Yield (Tons/ha)	Potential Yield(tons/ha)
Upland rice	0.8 - 1.2	1.5 - 2.5
Lowland rice	1.0 - 2.0	2.5 - 8.0
Maize	1.5 - 2.0	3.5 - 10.0
Sorghum	0.5 - 1.2	2.0 - 2.5
Millet	0.5 - 1.0	1.0 - 1.5

Source: National Cereal Research Institute Survey, 1988.

Table 2: Socio-Economic Characteristics of Respondent Farmers

Variables	Sasakawa Farmers		Non Sasakawa Farmers	
Age	Number of Respondents	Percentage of Total	Number of Respondent	Percentage of total
21 - 30	16	20.00	12	15.00
31 - 40	29	36.25	28	35.00
41 - 50	22	27.50	16	20.00
51 - 60	11	13.75	16	20.00
> 61	2	2.50	8	10.00
Total	80	100.00	80	100.00
Level of Education				
No Formal Edu.	34	42.50	30	37.50
Primary School	18	22.50	28	35.00
Secondary School	16	20.00	12	15.00
Tertiary School	12	15.00	10	12.50
Total	80	100.00	80	100.00
Farming				
1-10	18	22.50	18	22.50
11-20	22	27.50	34	42.50
21-30	18	22.50	18	22.50
31-40	1	17.50	6	7.50
>41	8	10.50	4	5.00
Total	80	100.00	80	100.00

Table 3: The input-output levels for maize production per hectare

	SASAKAWA FARMERS				NON-SASAKAWA FARMERS			
	Seed (kg)	Ferti-lizer (kg)	Labour (Manday)	Yields (kg)	Seed (kg)	Ferti-lizer (kg)	Labour (manday)	Yield (kg)
Max	23	750	152	6400	33	450	106	3400
Min	15	300	78	2600	27	150	76	1700
Mean	18.51	485.86	103.13	3801.14	28.13	277.78	88.706	2507
SD	2.14	165.86	115.86	911.24	2.35	75.31	7.18	383.16
Z-value	-81.00	37.46	2.16	11.07	-81.00	37.46	2.16	11.07
LOS*	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05

Source: Field Survey data (1998) LOS*: Level of Significance

Table 4: Average Labour input by activity per Hectare in production of Maize (man-day/ha)

	Sasakawa Farmer			Non-Sasakawa Farmers		
Activity	Hired	Family	% of Total	Hired	Family	% of Total
Land Preparation	7.25	12.03	18.69	5.75	11.20	17.95
Sowing/Planting	3.48	10.00	13.07	3.40	7.05	10.45
Fert application	1.71	8.34	9.74	1.25	6.90	8.15
Weeding and Remoulding	8.67	17.88	25.74	10.05	15.95	26.00
Harvesting	7.86	15.64	22.76	5.35	12.70	18.05
Threshing	2.75	7.52	9.96	2.22	5.89	8.11
Total	31.72	71.41	100.00	28.02	60.68	88.71

Source: Field Survey data, 1998.

Table 5: Average Cost, Returns and Gross Margins per Hectare

Item	Sasakawa Technology	Non-Sasakawa Technology
Labour		
Hired ₦	4,758.00	4,203.00
Family ₦	10,711.00	9,102.00
Total ₦	15,469.00	13,305.00
Fertilizer ₦	13,580.84	7777.84
Seed ₦	1,481.12	488.41
Other costs ₦	1,900.00	1250.00
Yield (kg)	3,801.14	2,507.840
Price (₦/kg)	17.00	17.00
Gross Return (₦)	64,619.38	42,633.28
Gross-Margin (₦)	32,431.92	19,811.13

Source: Computed from Field Survey Data (1998).

Table 6: Means and Standard Deviation of Gross-Margin of the two Groups of farmers.

Farmers group	N	Mean	SD	Z-value	Z table	Los
Sasakawa	80	32,186.92	9,130.50	10.66	2.58	0.01*
Non-Sasakawa	80	19,811.13	4,953.00			

Source: Computed from Field Survey Data, 1998.
*Significant at 1%.