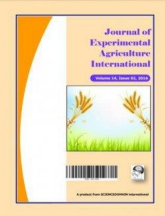

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Assessment of Farmers' Saved Seed and Improved Seed on Maize Productivity in South Western Nigeria

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Authors' contributions

This work was carried out in collaboration between both authors. Author JOO designed the study, collected data, performed the statistical analysis, wrote the protocol and wrote the field aspect of the manuscript. Author OAE managed the analyses of the study and wrote the economic aspect of the manuscript. Both authors read and approved the final manuscript.

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ABSTRACT

Availability of good quality seeds of crop varieties is still the major constraint for farmers in the South Western Nigeria in spite of the existence of national seed program for decades. Farmers have been using their own saved seeds for cultivation without completely knowing its properties and thus incurring losses. Therefore, this study aim to assess the benefits of using improved seed of maize over farmers' saved seed.

The experiment was carried out in 4 states of the South Western Nigeria representing three different agro-ecological zones. 10 farmers growing maize were randomly selected from each state to make a community group. Five varieties were planted out of which four were improved seeds and the other variety was farmers' seed. Planting was done on 20 meters by 5 meters at 75 cm by 50 cm on farmers' field in wet season of 2015. Fertilizer application at the rate of 120 kg of Nitrogen, 60 kg of Phosphorus and 60 kg of potassium was carried out in two splits.

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Grain weight per plot was obtained by shelling all ears harvested from each plot. Partial budgeting was used as analytical technique which includes Net Benefit (NB), Incremental Net Benefit (INB) and Benefit- Cost Ratio (BCR). Varietal mean showed highest yield of 3.93 metric tons in ILE-I-OB and the least yield of 3.020 metric tons was recorded by the farmers' varieties (Local). The partial budget analysis revealed that there is increase in the net benefit of maize varieties across the ecologies. The local variety gave on the average the lowest net benefit of N 73, 580 while ILE-1-OB variety has the highest net benefit of N 122,720.
It was concluded that maize varieties namely ILE-1-OB and BR9928DMR-SR-Y should be adopted by farmers in the study area for short and long run economic benefits.

Keywords: Farmers' saved seed; improved seed; benefit-cost; assessment and maize varieties.

1. INTRODUCTION

Seed is considered as a basic input for agricultural development due to the fact that it ensures grain production and adds new genetic resource to the total crop gene pool. The productivity of the crop is directly linked to quality of the seed used, though management practices and supplementary inputs exert profound influences [1]. Good quality seeds of improved maize varieties are pivotal to achieving food security in Nigeria. This is a current global engagement with particular emphasis on vulnerable continent like Africa. An improved seed is the gateway to good harvest, ensuring food security and improving livelihoods. conventionally, the products of scientific maize breeding programs, whether OPVs or Hybrids are referred to as improved materials, which reflect that their characteristics have systematically been altered in ways that bring economic benefits to those who grow them. When grown with increased levels of fertilizer and an assured water supply, these improved varieties performed significantly better than the traditional varieties, leading to substantial production increases, higher incomes for millions of farmers who adopted the technology, and lower food prices for consumers [2]. Availability of good quality seeds of crop varieties is still the major constraint for farmers in the South Western Nigeria in spite of the existence of national seed program for decades. About 52% of farmers in the Southwest Nigeria use seeds from their previous harvest, 25% obtain seeds from extension agents, 17% from seed dealers and about 5% from research Institutes [3]. Farmers have successfully maintained their indigenous varieties over the years by keeping household seed stocks, obtaining seeds through traditional family, community network and through exchanges nearby communities. Farmers have been using their own saved seeds for cultivation without completely knowing its properties and thus incurring losses.

Low adoption of improved agricultural production technologies that can increase farmers' production is generally known to lead to reduced agricultural output. The low rate of adoption of improved agricultural technologies could be due to low expected benefits from the practices or could be due to other factors such as farmers' characteristics or institutional factors which may not encourage the adoption of technologies by farmers [4]. Many farmers used previous harvest as seeds partly out of fear of uncertainty of getting supply whenever they needed it, or because of prices not being affordable. The quality of the seeds from this source is uncertain and they are often a mixture of several varieties because of lack of technical skills. Thus, improving the supply and the adoption of improved seeds in the south western states is contingent on building the capacity of the resource- limited farmers in boosting yield and enhancing income.

1.1 Economic Assessment of Maize Farmer's Saved Seed and Improved Seed

Before changing from one production method to another the farmer considers many factors, such as agro-ecological requirements availability of required additional production resources (labor, credits, skill, farmland, equipment, etc), additional income resulting from the change. The farmer also considers the compatibility of the new technology with socio-cultural circumstances, goals and the whole farming system. Farmers want to know the implication of the proposed technological change on costs and income. Will the extra income earned by changing to the new technology justify the extra cost?. Development of a partial budget for on

farm maize research involve collecting, organizing and analysing, experimental of data in order to quantify the income, cost and benefits of various alternative maize technologies. In determining the most economically viable variety of maize across agro-ecologies in South Western Nigeria, partial budget analysis was carried out to estimate the gross value of the maize yield from the different maize varieties under the same practices and input using the adjusted maize yield at the prevailing market price for maize output and production inputs [5]. While the interest was on the performance of different maize varieties across locations, the prevailing wage rates paid to farm laborers and market price of other inputs were used to estimate the labor cost and cost of other inputs [6]. The accruing net benefit, incremental net benefit and benefit-cost ratio to each maize variety were then compared across the agro-ecologies of southwest Nigeria. Therefore, the aim of this research was to assess the benefits of using improve seed of maize over farmers' save seed.

2. MATERIALS AND METHODS

2.1 Planting and Field Establishment

The experiment was carried out in 4 states of the South Western Nigeria. These states represented three different agro-ecological zones. The state were as follows; Ogun (Ikenne, High rainforest), Oyo (Eruwa, Derived Savannah), Osun (Ile-Ife, High Rain forest) and Ekiti (Orin-Ekiti, Guinea savannah), respectively. 10 farmers growing maize were selected from each state to make a community group. Planting materials were five maize varieties. Four out of the varieties were supplied by the Maize Improvement Programme for Southern Ecology of the Institute of Agricultural Research and Training (IAR&T), Moor Plantation, Ibadan, Oyo State, Nigeria and the other variety was supplied by the farmers that made up the community groups. Planting was done on 20 meters by 5 meters at 75 cm by 50 cm on farmers' field in wet season of 2015. Chemical weed control was done using a mixture of paraquat (Paraquat) and S-metholaclor (Atrazine) as post and pre emergence herbicides immediately after planting maize. This was supplemented with manual weeding six weeks after planting on all the farmer's fields. Fertilizer application at the rate of 120 kg of Nitrogen 60 kg of Phosphorus and 60 kg of potassium was carried out in two splits. Observations were made on 44 plants selected by making 2 m by 2 m quadrant in 3 different parts of the plot for ease of statistical analysis. Grain weight per plot was obtained by shelling all ears harvested from each plot. The shelled grains were dried, weighed and their moisture content determined before their weights (i.e. plot yield) was finally converted to t/ha using the formula;

$$Y = \mathrm{W}\ (kg)\ \mathrm{X}\frac{10000\ (m^2)}{\psi} X\ \frac{100-\mu}{87}$$

Where W is field weight (kg), ψ is plot dimension, μ is moisture content and Y is grain yield in kg/ha.

2.2 Analytical Techniques

The techniques used in the study include Net Benefit (NB), Incremental Net Benefit (INB) and Benefit- Cost Ratio (BCR).

2.2.1 Net Benefit

Net Benefit was used to determine the overall positive impact of the treatments in monetary values [7]. NB was calculated in the study as the difference between gross returns (GR) and the total cost (TC). The formula is given as:

$$NB = GR - TC \quad (1)$$

2.2.2 Incremental net benefit

Incremental Net Benefit was used to determine whether there is marginal increase among the treatments and was calculated by finding the difference between successive net benefits. The formula is as stated below:

$$INB = (GR - TC)_2 - (GR - TC)_1 \quad (2)$$

2.2.3 Benefit Cost Ratio (BCR)

Benefit Cost Ratio (BCR) is an indicator, used in the formal discipline of cost-benefit analysis, which attempts to summarize the overall value for money of a project [8]. This is the ratio of benefits versus costs. It involves summing the total benefits and dividing it over the total costs of the project or technology. The explicit functional form of BCR used is given as:

$$BCR = \frac{NB}{TC} \quad (3)$$

Data collected were subjected to analysis of variance using [9]. Least significant differences (LSD) at 5% level of probability was used to separate significant mean.

3. RESULTS AND DISCUSSION

Agronomic characteristics of the improved maize varieties used is presented in Table 1. All the improved varieties used have maturity ratings ranging from 100-120 days. Mean values of grain yield of maize across different locations in south western Nigeria is presented in Table 2. The variety, ILE-1-OB had grain yield ranging from 4.436 metric tons (mt) in Orin- Ekiti to 3.312 mt in Ikenne location. ART/98/SW1 ranged from 3.762 mt in Ile-Ife to 2.211 mt in Orin-Ekiti. BR9928-DMR-SR-Y recorded yield of more than 3 mt in all the locations with highest yield of 3.9 mt in Orin-Ekiti. ART/98/SW6 also had yield ranging from 3.769 mt in Orin-Ekiti to 2.518 mt in Ikenne. The local varieties used by the farmers were location specific and the yield ranged from 3.712 mt in Orin-Ekiti to 2.72 mt in Eruwa location. Comparable grain yield between the local variety and some improved varieties in some location is expected. This is because of their access to improved seed distributed to them recently through a West Africa Agricultural Productivity Programme (WAAPP). The improved materials and the local checks used for this study were open pollinated varieties (OPV) and that if properly handled by farmers the genetic potentials can be maintained. Overall mean of the varieties across location indicate that highest yield of 3.612 mt was recorded in Orin-Ekiti and the least in Ikenne with a value of 3.087 mt. Orin-Ekiti is located in Guinea savanna ecology that happened to be the best agro-ecological zone for optimum maize production. This finding corroborates the reports of [10]. They reported that Guinea savanna is the most suitable ecological zone for maize production in Nigeria because the zone is characterized by high solar radiation, favorable temperature and adequate, evenly distributed rainfall during the growing season. Varietal mean showed highest yield of 3.93 mt in ILE-I-OB and the least yield of 3.020 mt was recorded by the farmers' varieties (Local). The highest yield performance in three out of the four locations by ILE-1-OB could be as a result of the genetic potential and favorable environmental conditions during planting. Yield is a direct measure of the seeds performance and a crop variety that is high yielding stands to be adopted by farmers since high yield would raise the output for food security and subsequent gross earnings. From the results, all the improved varieties used had yield advantage over the local varieties. This agreed with the findings of [11] that reported large yield declines when using farm-saved hybrid canola seed compared with certified seed.

Table 1. Agronomic characteristics of some selected IAR&T improved maize varieties

Variety	Grain colour	Size	Grain texture	Daysto maturity	Plant height (cm)
ILE-1-OB	White	Large	Flint	100	127.5
ART/98/SW1	Yellow	Medium	Flint	105	150.0
BR9928-DMR-SR-Y	Yellow	Medium	Flint/Dent	110-120	200.0
ART/98/SW 6	White	Large	Dent/Flint	120	155.0

Source: IAR&T

Table 2. Mean grain yield of maize across different locations in south Western Nigeria

Variety	Ile-Ife	Eruwa	Orin-Ekiti	Ikenne	Varietal Mean
ILE-I-OB	**3.958a**	**4.012a**	**4.436a**	**3.312ab**	**3.930**
ART/98/SW 1	3.762a	3.727ab	2.211c	3.059ab	3.190
BR 9928-DMR-SR-Y	**3.682a**	**3.541ab**	**3.934a**	**3.791a**	**3.739**
ART/98/SW6	3.606a	3.076bc	3.769b	2.518b	3.242
LOCAL	2.815a	2.726c	3.712b	2.755b	3.020
LSD	NS	718.95	744.75	1022.5	
Location Mean	3.565	3.416	3.612	3.087	

Source: Anova

Table 3. Economic analysis of improved maize varieties across major agro-ecologies in Southwest Nigeria

Variety	1	2	3	4	5	6	7	8	9
	Average grain yield/ha	Adjusted grain yield/ha	Cost of labor (N)	Cost of other inputs (N)	Total cost (N)	Gross returns (N)	Net benefit (N)	Incremental net benefit (N)	Benefit-cost ratio
a. Local (farmers' variety)	3.02	2.718	42,000	47,500	89,500	163,080	73,580	--	0.82
b. ART/98/SW1	3.19	2.871	42,000	47,500	89,500	172,260	82,760	9,180	0.92
c. ART/98/SW6	3.242	2.918	42,000	47,500	89,500	175,068	85,568	2,808	0.96
d. BR9928DMR-SR-Y	**3.739**	**3.365**	**42,000**	**47,500**	**89,500**	**201,906**	**112,406**	**26,838**	**1.26**
e. ILE-1-OB	**3.93**	**3.537**	**42,000**	**47,500**	**89,500**	**212,220**	**122,720**	**10,314**	**1.37**

The result of economic analysis is presented in Table 3. The partial budget analysis revealed that there is increase in the net benefit of maize varieties across the ecologies. The local variety gave on the average the lowest net benefit of ₦ 73, 580 while ILE-1-OB variety has the highest net benefit of ₦ 122,720. This implies that across all agro-ecologies in Southwest Nigeria, ILE-1-OB maize variety would give the highest economic benefit to farmers thereby improved farmers' livelihood. Although, the net benefit of ILE-1-OB variety was the highest, BR9928DMR-SR-Y variety has the highest incremental net benefit ₦ 26,838, signifying that on marginal basis BR9928DMR-SR-Y variety would give the highest returns to farmers in the long run [12]. However, farmers are always often interested in the short run benefit. In sustainability of benefits that would accrue to maize farmers in the area, this study would rather advise farmers to adopt ILE-1-OB and BR9928DMR-SR-Y varieties for both short and long run economic benefits.

On the analysis of returns to investment, a farmer's investment of ₦ 1 on 1 kg/ha of ILE-1-OB, the farmer recoups the ₦ 1 and additional ₦ 1.37. This was followed by return on investment of ₦ 1.26 on BR9928DMR-SR-Y variety. The least return on investment was in the local variety across the agro-ecologies.

4. CONCLUSION AND RECCOMMENDA-TION

The findings showed that improved varieties of maize seed performed better than farmers' saved seed across locations. It is therefore concluded that maize varieties such as ILE-1-OB and BR9928DMR-SR-Y should be adopted by farmers in the study area for short and long run economic benefits. Also, the planting of saved seeds by farmers should be discouraged for optimum productivity.

Based on the foregoing, it is therefore recommended that Government agencies and stakeholders in maize production in southwest Nigeria put more efforts in creating awareness on the benefit of planting improved seeds over saved seed to farmers in the zone. Also, improved maize seed should be made available to farmers on time and at affordable prices.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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