S. Afr. J. Agric. Ext.
Vol. 45 No. 1, 2017: 1 – 9
DOI: http://dx.doi.org/10.17159/2413-3221/2017/v45n1a400
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PROFITABILITY OF *STRIGA* TOLERANT MAIZE VARIETY (SAMMAZ 17) AMONGST SMALLHOLDER FARMERS IN LAPAI, NIGER STATE, NIGERIA

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ABSTRACT

The study was conducted in Lapai, Niger State, North central Nigeria to determine the profitability of improved maize variety (SAMMAZ 17) in cooperative farmer's fields. Demonstration plots were cited in three cooperative farms where the improved variety and a local variety were planted. All agronomic practices were carried out uniformly and simultaneously on the plots. In addition, structured questionnaires were administered to 20 members of each of the cooperative farms. Participants were selected by means of simple random sampling techniques to solicit information on the performance of SAMMAZ 17 maize variety on their farms. Descriptive statistics were used to analyse the socio-economic characteristics of the farmers, while gross margin analysis was used to compare the profitability of maize varieties. The results revealed that maize farmers were mostly male and small-scale in operations. The local maize variety supported high Striga infestation with low yield of 1.7 t/ha, while SAMMAZ 17 yield was 4.4 t/ha under less Striga infestation. The gross margin production of SAMMAZ 17 maize variety was ₦ 254,127.40, while the gross margin for the production of farmer's maize variety was ₦ 102,517.90. Based on these findings, SAMMAZ 17 was found to be profitable and is therefore recommended for planting in Striga endemic fields in North Central Nigeria.

Keywords: Maize, *Striga* tolerant, cooperative farm, action research, farmer's variety, gross margin, profitability, extension implication

1. INTRODUCTION

Striga hermonthica, commonly known as witch weed or witches weed, is widely known amongst Nupe farmers as Edoo, wuta-wuta in Hausa, and Osapoka in Yaruba. It is a parasitic weed which is often referred to as farmers' nightmare due to its negative impacts on cereal crops, especially maize. Atera, Ishii, Onyango, Itoh, & Azuma (2013) described *Striga* spp. as one of the greatest biological constraints to food production in sub-Saharan Africa; a more serious problem than insects, birds, and plant diseases. The economic losses due to *Striga spp.* according to Runo, Macharia, Alakonya, Machuka, Sinha, & Scholes (2012) are

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enormous. The aforementioned authors explained that cereal food-crops such as maize, sorghum, millet, wheat, and upland rice are parasitized by one or more *Striga* spp.

There are 30 to 35 different species of the genus *Striga* found in the world and approximately 23 of these species can be found in sub-Saharan Africa (Gethi, Smith, Mitchell, & Kresovich, 2005). *Striga* species are one of the most troublesome and damaging weed species in the world, especially those that infest agricultural crops which are of great economic importance (Parker, 2008). Several million hectares of the world's arable land is infected by the parasitic weed species, purple witch weed (*Striga hermonthica* (Del.) Benth.), which causes crop losses of billions of $US annually (Parker, 2008). It is estimated that 50 million hectares of land and 300 million farmers in sub-Saharan Africa are affected yearly (Schaub, Marley, Elzein, & Kroschel, 2006). It occurs on 86% of the cultivated land in the Nigerian Savanna and parasitizes all of the cultivated cereal food crops in the Savanna ecological zones (Isah, 2008; Lagoke, Alahira, Alabi, Ndahi, & Singh, 1999).

Striga infestation has reached an endemic status not only in the Northern Guinea Savanna, but also in the Southern Guinea Savanna of Nigeria, where it now constitutes a serious threat to maize production as farmers are being compelled to abandon their farm lands to *Striga*, or change to the production of less susceptible crops (Olakojo & Olaoye, 2007). Dugje, Ekeleme, Kamara, Menkir, Chikoye, & Omoidui (2010) have outlined several control measures for *Striga*, such as manual hand pulling, use of catch and trap crops, use of nitrogen fertilizer, application of post emergence herbicide, cereal-legume rotation, and host plant resistance. Furthermore, the selection of good variety is a necessary requirement for successful crop production in line with vigour, growth, and yield. Kamara, Menkir, Chikoye, Omoigui, & Ekeleme (2007) reported that the use of cultivars that are tolerant or resistant to *Striga* is recommended as the most practical approach that is compatible with the low-cost input requirements of small-scale farmers. These researchers stated that tolerant maize hybrids and open-pollinated cultivars have been developed with moderate levels of resistance and reduced numbers of emerging *Striga* plants. Moreover, from an experimental research conducted in the Southern Guinea Savannah, it was reported that a resistance maize variety performed remarkably better than the local variety under *Striga* infested fields (Garba, Yakubu, Gwandu, & Muhammad, 2014).

2. STUDY OBJECTIVES

Striga has been a threat to maize farmers for many years in the study area. Although improved varieties that are resistant or tolerant to maize have been widely distributed, some areas still lack information about the package. The study was conducted to introduce *Striga* tolerant maize variety (SAMMAZ 17) to selected farmers, and it was planted along with the farmer's local variety in field demonstrations. The profitability of the two varieties was determined to encourage adoption of the maize tolerant varieties. The obtained results will assist agricultural policy makers to formulate policies that address factors influencing the adoption of improved *Striga* tolerant maize variety.

3. METHODOLOGY

3.1 Study area

The study was conducted in Lapai, Niger State. Lapai lies at 9°03′00″N and 6°34′00″E in the Southern Guinea Savanna of Nigeria. It has an area of 3,051 km² and a population of 110 127

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at the 2006 census (Wikipedia). The dominant tribe is Nupe and they are of the Muslim faith. They are characterised by mixed farming systems which involve important crops such as maize, guinea corn, millet, ground nut, soybeans, cashew, and livestock production such as rearing of cattle, sheep, goat, and some domestic poultry.

3.2 Sampling procedures

The target population for this study was maize farmers. Samples of 60 smallholder maize farmers were purposively selected from three cooperative maize farms. In each group, 20 maize farmers were randomly selected with the assistance of the community leader since new technology or innovations are better disseminated and accepted in groups rather than by individuals.

The introduction of SAMMAZ 17 maize variety in the study area followed a series of scheduled activities that included sensitisation visits and interactive group discussions regarding the problems associated with *Striga*. The study design was that of a participatory action research, utilising the Supervised Enterprise Projects (SEPs) approach, which signifies learning based on experience (Sambo, Abdullahi, Omenesa, Sani, Sani, & Bello, 2012). The farmers were involved in all stages of production, from land preparation to harvesting, so that the farmers could act as co-researchers while the researcher facilitated the activities of the study. This allowed the farmers to actively participate in and observe the sequential steps involved in the production of *Striga* tolerant maize variety as a means of reducing the menace caused by *Striga* spp. (witch weed). It was agreed that the three groups would offer a section of land that was naturally infested with *Striga* spp. A total of six method demonstration plots were used for the study. Each of the selected demonstration plots were 20 m x 15 m (300 m^2) in size. After harvesting, the maize varieties were dried, shelled, winnowed, weighed, and extrapolated to kg/ha.

3.3 Data collection and analysis

Data for this study were obtained through a structured questionnaire administered to the farmers. The questionnaire comprised of questions to gather socio-economic information of the farmers. Descriptive statistics such as frequency tables, means, and percentages were used for the analysis. In addition, gross margin analysis was used to assess the profitability of maize varieties in the study area. The gross margin is the difference between the gross income (GI) and total variable cost (TVC). The formula that was used in the calculation is shown below as described by Kudi and Abdulsalam (2008).
GM = GI – TVC, where
GM = Gross Margin
GI = Gross Income
TVC = Total Variable Cost

4. RESULTS AND DISCUSSION

4.1 Socio-economic characteristics of maize farmers

From the results shown in Table 1, it was revealed that 33.3% of the farmers involved in maize farming fell within the age group of 36-45 years with a mean age of 41 years. This indicates that many of the farmers are in the prime stage of life and are still active enough to perform farming activities. The farmers who have the lowest participation in maize farming (6.7%) were 56 years of age and older. In accordance, Ibrahim, Aina, Musa, & Bappah

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(2012) reported that age is an important determinant of an individual's stamina to do manual labour, especially farming.

Table 1: Socio-economic characteristics of sampled maize farmers

Variables	**Frequency**	**Percentage (%)**
Age		
15-25	12	20.0
26-35	14	23.3
36-45	20	33.3
46-55	10	16.7
56 and above	4	6.7
Total	**60**	**100**
Marital status		
Single	8	13.3
Married	52	86.7
Divorced	0	0
Widowed	0	0
Total	**60**	**100**
Household size (HHS)		
1-5	12	23.1
6-10	24	40.0
11-15	8	13.3
16 and above	16	26.6
Mean	10 persons	
Total	**60**	**100**
Educational status		
Islamic Religious knowledge	40	66.7
Adult Remedial Classes	2	3.30
Primary education	10	16.7
Secondary education	6	10.0
Tertiary education	2	3.30
Total	**60**	**100**
Farm size of farmers (ha)		
0-1	24	40.0
2-3	24	40.0
4-5	12	20.0
6-7	0	0
8 and above	0	0
Total	**60**	**100**

Source: Field Data, 2014

Furthermore, the majority of the participating farmers reported being married (86.7%). These farmers are also faced with numerous other challenges which may influence them to be more willing to accept and adopt any new technology that might enhance their livelihoods. Similarly, Sambo *et al.* (2014) found that the marital status of an individual signifies the states of being responsible, especially to one's family.

Table 1 also shows that farmers who have household size of 6-10 members accounted for 40% of the sample. The mean household size was 10 persons. Larger household sizes observed in this study could be a contributor to the availability of family labour which enhances productivity and income generation amongst farmers. This corroborates the findings of Bunu, Ndaghu, Dorcas, & Malami (2014) who reported that household size determined the family labour that can be used to produce food and vice-versa.

Moreover, the acquisition of formal education is a tool that enhances productivity. As such, it was also revealed that the majority of the sampled maize farmers (66.7%) have acquired only Islamic religious knowledge. This signifies that there are possibly higher rates of illiteracy in terms of western education (primary, secondary, tertiary education) in the area and that could result in a poor adoption of information new technology by farmers. Tiri, Oshoke, & Tumar (2014) revealed that education enables the individual to appreciate and adopt innovations as well as make informed decisions which is likely to impact positively on performance. In addition, the sizes of most participating farmers' land fell between 0-3 ha (80%) which indicates small-scale farming. This result is in line with the conclusions drawn by Ojuekaiye (2001), who reported that 0.1-5.9 ha is classified as small farms.

4.2 Information source and farm input usage

Farmers' awareness of existing or newly released resistant, tolerant, or hybrid varieties strongly depends on their access to agricultural information. The results shown in Table 2 highlight that prior to the introduction of the new technology (SAMMAZ 17 *Striga* tolerant maize variety), 73.3% of the farmers were not aware or had no information on any type of maize that is either resistant or tolerant to *Striga*. Only 26.7% of the sample had received prior information about some *Striga* resistant or tolerant maize varieties which they have not seen nor planted in their community other than the SAMMAZ 17 that was newly introduced to them. Although some of the farmers admitted that some hybrid maize varieties had been introduced to them more than 15 years ago by the Agricultural Development Project (ADP), they were not *Striga* resistant or tolerant maize variety. Lack of information regarding innovations is a disadvantage to farmers, especially rural farmers.

The vast lack of information received by participating farmers may be due to their high level of illiteracy coupled with a lack of committed agricultural extension agents in the area whose responsibility is to introduce new technologies to the farmers. This notion is supported by the results of a study conducted by Daneji, Tafida, & Ali (2006), who found that extension agents were ineffective in information dissemination.

Table 2: Awareness and farm input usage of maize farmers

Variables	**Frequency**	**Percentage (%)**
Awareness of new maize variety		
Yes	16	26.7
No	44	73.3
Total	**60**	**100**
Source of information		
ADP extension agent	4	6.7
Radio/Television	4	6.7
Cooperate society	2	3.3
Friends/Relations	6	10.0
None of the above	44	73.3
Total	**60**	**100**
Farmer's opinion on the new maize variety		
Fast growth and good vigour	0	0
Striga tolerant	0	0
Better yield	14	23.3
All of the above	46	76.7
Total	**60**	**100**
Yield of farmer in the previous year (ha)		
1-5	22	36.7
6-10	22	36.7
11-15	14	23.3
16-20	0	0
21 and above	2	3.3
Total	**60**	**100**
Adoption level of SAMMAZ 17 Maize Variety		
Strongly agreed	44	73,3
Agreed	16	26.7
Undecided	0	0
Disagreed	0	0
Total	**60**	**100**

Source: Field survey, 2014

Striga tolerant maize variety (SAMMAZ 17) was introduced to the participating farmers through the use of field demonstration. Table 2 also shows that all of the farmers either agreed or strongly agreed to adopt the use of SAMMAZ 17 maize variety and promised to continue with the practice in the subsequent years. This indicated that the sample of farmers held positive opinions about the improved *Striga* tolerant variety. Furthermore, field performances of the new variety were shown to be fast in terms of growth and good vigour, tolerance to *Striga*, and production of better yields as compared to the local maize variety. Similarly, Benjamin (2010) also found that farmers would adopt agricultural innovations because of high yield advantages.

4.3 Profitability of maize varieties

The findings presented in Table 3 indicate that gross revenue realised from the sales of SAMMAZ 17 was ₦ 311 110.40, while the farmers' variety received ₦ 116 666.90. Therefore, the gross margin for SAMMAZ 17 was ₦ 254 127.40 greater than the farmers' variety that recorded a gross margin of ₦ 102 517.90 against the total input cost of ₦ 14 149.00 for farmers' variety and ₦ 56 983.40 for improved SAMMAZ 17. Based on this result, the improved variety brought in the highest income which encouraged the farmers to fully agree to the adoption of the SAMMAZ 17 maize variety in the subsequent cropping seasons.

Table 3: Costs and benefit analysis for SAMMAZ 17 and farmers' maize variety in the 2014 cropping season at Lapai, Niger State

	SAMMAZ 17 maize variety			Farmers maize variety		
Variables	Qty/Kg/ha	Unit cost (#)	TVC (#)	Qty/Kg/ha	Unit cost (#)	TVC (#)
Activities						
Seed	33.33 kg	180	5,999.40	0	0	0
Fertilizer (NPK)	120 kg	250	30,000.00	0	0	0
Seed dressing chem.						
Apron plus (sachets)	10g (6kg)	250	1,500.00	0	0	0
Bags (sacks)	33/kg	50	1,650.00	33	50	1650.00
SUB TOTAL			39,149.40			1,650.00
Labour (#)						
Land preparation			3,333.00			3,333.00
Planting			2,500.00			2,500.00
Weeding			3,333.00			3,333.00
Fertilizer application			3,334.00			0
Harvesting			1,667.00			1,000.00
Transportation			1,667.00			1,000.00
Threshing/Winnowing			2,000.00			1,333.00
TOTAL			17,834.00			12,499.00
Total Variable Cost (TVC)			56,983.40			14, 149.00
Average yield			4,444.44 kg/ha			1,666.67 kg/ha
Average price/unit			70/kg			70/kg
Gross revenue			311,110.80			116,666.90
GROSS MARGIN (GM)						
GM= TR –TVC			254, 127.40			102, 517.90

Source: Field survey, 2014

5. CONCLUSION AND RECOMMENDATIONS

Prior to the commencement of this study, the participating farmers were unaware of the existence of SAMMAZ 17 (*Striga* tolerant maize variety). The study has now generated awareness for the participating farmers as well as the neighbouring farmers who witnessed the crop performance on the field. Yield and other attributes of the maize variety, such as *Striga* tolerance, plant vigour, and cob size encouraged the acceptance of the maize variety by the farmers. Moreover, on-farm demonstrations in many locations by the extension services of the state's Agricultural Development Project (ADP) will further create awareness for mass adoption of the maize variety by maize farmers in the state where the *Striga* problem is endemic.

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