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Socio -economic Evaluation of an Open Pollinated Sorghum Variety: A Case of Macia Variety in Kenya

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Abstract:

A significant proportion of the Kenyan population experiences food insecurity and malnutrition. The most affected are children and expectant mothers who depend on maize meal for food. Maize is a staple food in Kenya with over 90% of the population depending on the crop both for food and cash. However, with the unpredictable global climate change coupled with outbreaks of maize lethal necrosis disease in the high potential maize zones, sorghum is one of the best options for food security. The production of sorghum is hampered by the unavailability of seeds suitable for appropriate agro-ecological and socio-economic needs of small-scale farmers. The farmers are faced by a scenario whereby seed companies supply only hybrid varieties which cannot be recycled meaning farmers have to purchase fresh seeds every planting season. Over the last two years there has been a deliberate effort by farmer groups, through a World Bank supported project (KAPAP) project, to bulk an Open Pollinated Variety (OPV) known as Macia in Siaya County, a variety that is now available to farmers for replanting. The community seed bulking and farmer-farmer sharing of seed has not only increased the number of farmers involved in sorghum production but has enhanced the availability of sorghum seed to other farmers who could hitherto not afford good seed. The objectives of the study were to identify sorghum common interest groups to promote growing of high yielding variety of sorghum and to avail high yielding variety and evaluate its acceptability. The objectives of this study were to conduct an evaluation of the suitability of the macia sorghum as an open pollinated variety and some selected socio-economic factors associated with sorghum growing, namely gender, age and incomes.

Keywords: Community, seed multiplication, open pollinated variety

1. Introduction

1.1. Introduction

Sorghum (*Sorghum bicolor* L. Moench) is a cultivated tropical cereal grass. It is generally, although not universally, considered to have first been domesticated in North Africa, possibly in the Nile or Ethiopian regions as recently as 1000 BC [1]. The cultivation of sorghum played a crucial role in the spread of the Bantu (black) group of people across sub-Saharan Africa [2]. Today, sorghum is cultivated across the world in the warmer climatic areas. It is quantitatively the world's fifth largest most important cereal grain, after wheat, maize, rice and barley. World annual sorghum production is over 60 million tonnes, of which Africa produces about 20 million tones [3]. This makes sorghum, quantitatively, the second most important cereal grain in Africa after maize and the major sorghum producing countries of Africa. It can be seen that sorghum production takes places across the continent, with the northern African countries of Nigeria, Sudan, Ethiopia and Burkina Faso accounting for nearly 70% of Africa's production. It is the only viable food grain crop for many of the world's most food insecure people, who live in sub-Saharan Africa. In the mid 1990s, it was estimated that in 20 of the 29 countries in the region per capita daily food intake averaged less than 2,000 calories [4]; according to the FAO a daily intake of less than 2,400 calories is indicative of widespread hunger.

The problem of food shortage in Sub-Saharan Africa is to a large extent due to the fact that much of the region is characterized by semi-arid and sub-tropical climatic conditions. Africa is the only continent that straddles both tropics. Sorghum is crucially important to food security in Africa as it is uniquely drought resistant among cereals and can withstand periods of high temperature. A yield trial of 30 entries in Zimbabwe (28 sorghum genotypes and 2 maize hybrids) showed that under irrigation the maize hybrids ranked 11 and 22, whereas under drought conditions they ranked 28 and 30[5].

Sorghum tends to be drought tolerant, given that it may grow in areas where the annual rainfall is in the range 500-700 mm per year, hence most of the countries in Africa which are arid grow e sorghum is a significant arable. It also be seen that sorghum is also an important crop in east Africa where overall there is good rainfall. This is related to the fact

that the rain in sub-tropical Africa is intermittent and characterized by brief periods of very high rainfall. In fact, sorghum is not only drought-resistant, it can also withstand periods of water-logging [6].

Seed is the principal means of regeneration of most plants. It serves as the delivery system for the transfer of genetic materials from one generation to the next. Despite this, evidence shows that the seed distribution system for most of these crops is heavily dependent on local varieties, a large proportion of which is retained. In Kenya seed industry, like any other economy, is divided into the formal and informal systems. Sorghum is regarded as low value-OPV with less profitability for seed companies hence have more informal than formal seed system. Farmers do not use improved seed, mainly because very often it is not available to them or they are not aware of the advantages of using improved varieties. Good quality seed is also not accessible to them as there is often a weak linkage between farmers, extension systems, research institutions and market. [7].

1.2. Background of the Project

This project was implemented in collaboration with farmer-groups and individual farmers working in Siaya County of Kenya. A major milestone in the Sorghum sector was the works concluded by the World Bank funded Kenya Agricultural Productivity and agribusiness Programme(KAPAP) project in Siaya County by JaramogiOgingaOdinga University of Science and Technology in collaboration with other Universities, whereby an open pollinated variety of Sorghum originally developed by International Crop Research Institute for Arid and Tropical Crops (ICRISAT) as 'Macia' was multiplied by Jaramogi Oginga Odinga University of Science and Technology both on- station and on -farm together with farmers/farmer groups in Siaya County Kenya. This was subsequently subjected to National Performance trials and Distinctive uniformity and stability test (DUS) trails by Kenya Plant health Inspectorate Services (KEPHIS) for two seasons under the name 'JOUST-001' after three-year adaptability on the Siaya Conditions. The variety has the potential for use for value added products such as 'mandazi', cakes, chapati, sorghum pops- an equivalent of pop cones from maize and bread among others.

1.3. Statement of the Problem and Justification

Sorghum is an important climate smart resilient crop suitable for ASAL areas. It is suitable for food and nutritional security. Seed is the principal means of regeneration of most plants. It serves as the delivery system for the transfer of genetic materials from one generation to the next. Despite this, evidence shows that the seed distribution system for most of the common cereals and legumes is heavily dependent on local varieties, a large proportion of which is retained. Sorghum is regarded as low value- open pollinated variety (OPV) with less profitability for seed companies compared to the hybrids which must be purchased every planting season. Unavailability of seed of suitable sorghum genotypes limits marketing of the crop and there is scanty information on post-harvest quality status of sorghum. This study therefore aimed at evaluating the suitability and acceptability of this open pollinated variety-Macia.

1.4. Objective of the Study

The study had one objective namely:

- To evaluate suitability and acceptability of Macia Sorghum variety

1.5. Research Question

- Is Macia as an open pollinated variety suitable and acceptable to farmers?

2. Materials and Methods

The study was carried out in Siaya, one of the 47 counties of Kenya. Siaya County is characterized by high poverty levels (47.56%) and food insecurity. Agriculture is the main source of livelihood in the County, contributing about 60% of the household income and providing almost 61percent of all employment opportunities. Maize, beans, sorghum, and local poultry are the key value chain commodities in the County [8]. Farmers in Siaya County employ a host of on-farm strategies to cope with climate risks and shocks including: planting of drought-resistant crop varieties, diversification, conservation agriculture, value addition strategies, animal feed conservation, and farmer groups to ease access to credit, farm inputs and market information among others. This study employed descriptive survey design through interviews and questionnaires of small holder farmers. Descriptive survey design is deemed suitable because it does not only involve analysis of elements but also involves measurement, classification, comparison and interpretation of data [9]. It was carried out among 150 small scale farmers who had participated in the Sorghum project and had been supplied with the Macia seed.

3. Results and Discussions

3.1. Source of Sorghum Seeds

Respondents were asked to name their sources of Sorghum seeds. Table 1 gives the findings on the sources of sorghum seeds.

Source of Seeds	Frequency	Percentage
Recycling from previous season	30	20
Donation from companies and Extension Officers	20	13
Purchasing from the agro stockists	20	13
Donation from other farmers	80	53
	150	

Table 1: Source of Seeds

The majority of farmers (80%) of respondents reported that they sourced seed from other farmers. The project was designed in such a manner that seeds were bulked and in subsequent years the farmers would donate seeds among themselves hence the high numbers. Given that this was an open pollinated variety, recycled seed was still viable and could be planted and does well. This was followed by the recycling of seed (20%). From the results it can be seen that a small number of farmers sourced seeds from the agro stockists and donations (13%).

3.2. Use of the Macia Variety

A sample of 150 farmers was asked to evaluate the use of this variety to gauge its acceptability. Table 2 provides the results of the evaluation.

Use of the Sorghum	Frequency	Percentage	Rank
Bread (Ugali)	35	23	2
Cake (Mandazi)	31	21	3
Porridge	64	43	1
Sorghum cones	20	13	4
N=150			

Table 2: Evaluation of Macia Variety and Its Utility by Farmers

The results show that most of the farmers liked the variety with an average of 43 percent responding that they like it. In terms of utility of sorghum, porridge ranked first followed by bread. The respondents reported that the variety is brown and sweet and not red like the other local cultivars that are not palatable. Its use for mandazis and pop cones were value additions and farmers appreciated though a majority found these new since they are used to baking floor from wheat.

3.3. Reasons for growing Macia Sorghum Variety

Respondents were asked to rank Mercia variety on the basis of four parameters. Table 3 provides the reasons for growing Macia sorghum.

Reason	Frequency	Percentage	Rank
Suitability as food	53	35	1
Short maturity	47	31	2
Its colour (Brown)	30	20	3
Not attracting birds	20	13	4
N=150			

Table 3: Suitability of Macia Seed

Quite a large number of farmers (35%) of respondents reported that they preferred the variety because of its suitability for food, mainly bread and porridge and would grow it for this purpose. The reported that unlike the other local cultivars it is relatively sweet. Notably, however, unlike the local cultivars, the variety ranked lowest (13 %) in *NOT attracting birds* characteristic. Because of its light colour and early maturity meaning it reaches physiological maturity before other varieties are ready hence suffering from bird infestation, hence much of it goes to waste because of attack by birds.

From the results it can be seen that a high percentage of (31%) prefer the variety because of its drought escaping characteristics. Sorghum being tolerant to drought, water logging, saline - alkaline, infertile soil and high temperatures, has a strong adaptive advantage and lower risk of failure than other cereals in such environments. The study area does not normally receive a lot of rains hence a short maturing variety would mature within the rainy duration. The variety appears to have some drought resilience which concurs with studies which have shown that sorghum often has very deep penetrating and extensive roots [9]. Apparently, it conserves moisture by reducing transpiration when stressed by leaf rolling and closing stomata; higher than normal levels of epicuticular wax appear to be of importance in this respect [10].

3.4. Age of Respondents and Sorghum Production

Figure 1 shows the income distribution of the three age sets of farmers: the first category are farmers below 35 years, the second set is 35-60 and the last is above 60 years. From the findings, the majority of the farmers are in the age bracket of 35-60 years at 84 percent having the highest income indicating that the youth (under 35 years) are not quite involved in sorghum production, represented by 6 percent which was largely attributed to the fact that sorghum was not

promising in terms of returns due to lack of market for the commodity. It also emerged that the labour involved in sorghum harvesting was not acceptable to the youth. Activities like winnowing are commonly done by women and not youths. More friendly technologies needed in processing of sorghum, to separate seeds from the hulls and husks.

Figure 1: Age of Respondents Involved in Sorghum Production

3.5. Gender Involvement in Sorghum Production

Gender is one of the socio-cultural issues that affect agricultural productivity. Gender refers to the socially and culturally constructed differences between men and women; as distinct from sex which refers to their biological differences and the social constructs vary across cultures and time. Two thirds (67.7%) of Kenya's population lives in rural areas and significantly more women (77.8%) than men are rural dweller [11].

Figure 2: Gender involvement in sorghum production

In terms of gender, the results revealed that 56.0% of the farmers that are involved in sorghum production are women, although a significant proportion (44.0%) of men are also involved (Figure 2). The women appreciate sorghum as a food crop and thus more involved in growing the crop). Studies have shown that women are food producers and caretakers of their families, manage farms and allocate household resources to various needs as well as caring for their children hence their access to productive resources such as land, they need access to agricultural and nutrition extension information, better access to technology, access to credit and control over income as well as decision making authority both at household and national level. Their most important role is to provide household food security for their households, which they are able to do by supplementing household earnings, diversification of household incomes and raising livestock to augment household assets [12].

3.6. Income of Respondents Involved in Sorghum Production

The study also sought to establish the incomes of the farmers who are involved in sorghum production. The results indicate that most farmers (40%) had an income of less than 10,000, while the 36 percent had an income range of Kshs 10-30,000 whereas 24 percent had an income of more than Kshs30, 000. The disparity in incomes from investment can be attributed, to the fact that fewer female farmers have access to loans, especially, microfinance e.g., Merry go round) compared to their male counterparts. According to the 1997 WMS, the poverty line per person per year was defined as Kshs 21,848 (US\$288) in rural areas and Ksh46, 693 (US\$615) in urban areas, both expressed in 2003 prices and unadjusted in US dollars [12]. The results, therefore, show that more than 70% of the farmers live below the poverty line. The low income from sorghum production among those aged above 60 years is also evidenced by the fact that this age group does not have access to credit facilities.

Figure 3: A Comparison of Income Earned by Gender

3.7. Seed Production and Multiplication

As shown in Figure 4 the macia variety grown had fast growth (maturing in 2½ months), drought resistant and was found to be high yielding. The average yield was between 2- 3 bags per acre.

Figure 4: Macia Variety at Milking Stage in One of the Plots in Siaya

4. Conclusion

In view of the data analysis and results discussed the study concluded that: that with the availability of the Open pollinated Variety seed, farmers more farmers can access seed from among other farmers or donate seed to other farmers in the community. Secondly, Women folk tend to be involved in sorghum production. They should be encouraged to participate more in sorghum production; however, men should be incentivized to participate in sorghum production.

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