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Grafted Mangoes Enhances Smallholder Farmers Livelihoods in Matinyani Division, Kitui County

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Abstract
Mango (Mangifera indica L.) fruit is produced and consumed globally, regionally, and locally. The fruit is a potential source of essential nutrients including potassium, phosphorous, magnesium and is an excellent source of vitamin A and C. Mangoes can also be sold to earn income. Kitui County is among the leading Counties in mango production with smallholder farmers concentrating on local varieties which are fibrous and of little market value. This study was conducted at Matinyani Division of Kitui County to investigate mango varieties grown and income generated by smallholder mango farmers in Matinyani Division. A sample of 120 mango farmers was studied and simple random sampling technique was used to select respondents. Primary data was obtained by use of questionnaires while secondary data was obtained by review of relevant literature. Data collected was analyzed using Statistical Package for Social Scientists (SPSS) version 20.0 of year 2009.The results revealed that in Matinyani Division both local and grafted mangoes were grown. The local mangoes grown included: Ngowe, Dodo and Boribo with majority of the farmers growing Ngowe mango. Varieties of grafted mangoes grown included: Apple, Kent, and Tommy with majority of the farmers growing Apple mangoes. On income generation, the study revealed that, farmers earned KES 1,000 to KES 15,000 per annum from sale of local mangoes with majority earning KES 1,000 to KES 5,000. On the other hand, farmers earned KES 1,000 to KES 20,000 per annum from sale of grafted mangoes with majority earning KES 6,000 to KES 9,000.The study concludes that, grafted mango farming is essential in enhancing livelihoods of smallholder mango farmers and recommends farmers to be sensitized to increase growth of grafted mango varieties.

Introduction

Mango (*Mangifera indica L.)* is one of the most important fruits in the tropics and subtropics. It originated from the foothills of the Himalayas of India and Burma where it has been cultivated in that region for at least 4,000 years (FAOSTAT, 2007). The United States is the largest single-country importer of mangoes and has developed the most popular cultivars traded on the international market (FAOSTAT, 2007). Mango is a major fruit in the horticultural industry and it plays an important role in poverty reduction by providing employment to about 2 million people annually (GoK, 2004 – 2014). It is exported to earn foreign exchange while at the same time acting as a source of food and household income for farmers (HCDA, 2007).

In Kenya, mango fruit has been the third most important in terms of area and total production after bananas and pineapples (HCDA, 2010). The hectares under mango production, production output (Tonnes) and the revenue earned have continued increasing over years (HCDA, 2011). Hectarage increased from 36,304 to 59,260, production from 528,815 MT to 636,585 MT and revenue earned increased from USD 104,616,297 to 139,836,268 (HCDA, 2011).

In Kenya, research on mango has been accorded a high priority under the horticulture program (KARI, 2008) which has concentrated on varietal introduction of high yielding varieties (Gathambiri *et al*., 2006) which have different qualities that are suitable for either fresh consumption or processing. Despite the research efforts, Kenya has not exploited her potential in exporting grafted mango fruits to the developed world due to lack of adequate infrastructure and technology.

Two types of mango are grown in Kenya, the local and the exotic or improved varieties (FAO, 2005). The latter are usually grafted on local mangoes and are grown for consumption and processing. Most local varieties tend to have high fibre content, commonly referred to as “stringy”, and this characteristic makes them unpopular for processing (FAO, 2005). The local mango varieties are usually left to grow naturally without much crop husbandry. KARI, (2008) introduced widely adopted varieties leading to increase in production levels especially in Eastern, Coast and Central regions. Despite this, Kenya’s potential in mango production has not been fully exploited due to constraints such as diseases and insect pests, poor agronomic practices, weak marketing structure and glut during peak seasons (MOA, 2006).

Methodology

The study was carried out in three locations of Matinyani Division namely; Matinyani, Kalimani and Kauma.

Matinyani Sub-County comprise of two other Divisions namely; Kwa- Mutonga and Kathivo. The two Divisions are vast and drier compared to Matinyani Division hence, little mango farming is practiced in the Divisions. Matinyani Sub-County in Kitui County, is located between Longitudes 37°45′ and 39°0' East and Latitude 0°3.7′ and 3°0′ South with the Sub-County rated among those with the highest population due to high land potential (GoK, 2005). The altitude ranges between 400 m and 1800 m above sea level. Rainfall occurs in two rainy seasons with two peaks in April- May (long rains) and November- December (short rains). The rest of the year is hot and dry. Rainfall ranges from 500mm to 1050mm with 40% reliability (GoK, 2005). Simple random sampling technique was used in selecting the respondents in each location. This sampling technique was used to provide an independent and equal opportunity of selecting each mango farmer in the entire population. The technique also allowed the researcher to apply inferential statistics to generalize the results about the population. In every location 20% of the mango farmers were selected from a population of 600 mango farmers because according to Gay (1992), a sample of at least 10% of the population is enough. Data was collected using questionnaires as the main instrument. This was in agreement with Mugenda and Mugenda (2003) who observed that, the use of questionnaires is a popular method for data collection in most disciplines because of the relative ease and cost effectiveness with which they are constructed and administered to a large population. Questionnaires were also used because they were effective to administer to respondents scattered over a large area and convenient for collecting information from a large population of 120 mango farmers in Matinyani Division within a short period of time. Kitui County, Ministry of Agriculture, Livestock and Fisheries office was used as entry point to mango farmers in Matinyani Division. A schedule of visits to meet the mango farmers was prepared in consultation with frontline extension workers in Matinyani Division, County administration and village heads. Raw data collected from the field was examined through sorting, editing and coding. Coded data was then analyzed using SPSS software version 20.0 of year 2009 and presented in frequencies and percentages as distribution tables. The qualitative aspects were discussed in the study.

Results

Results from the study revealed that varieties of local mangoes grown in Matinyani Division included Ngowe, Dodo and Boribo (Table1). Majority of the mango farmers were growing Ngowe. However, in Kauma Location there was significantly higher (P<0.05) Dodo mango production at 7% as compared to Matinyani and Kalimani locations at 2% and 2.5% respectively

Table 1: Varieties of Local Mangoes Grown in Three Locations of Matinyani Division, Kitui County

Location	Ngowe	Dodo	Boribo	Standard Deviation
Matinyani	96^{a}	2^{a}	2^{a}	3.26^{b}
Kalimani	95^{a}	2.5^{a}	2.5^{a}	3.9^{a}
Kauma	90^{a}	7^{b}	3^{a}	3.99^{a}
LSD (P=0.05)	14	9	7	

* Means same letters within a column are not significantly different at 5% level of significance.

On grafted mango varieties, the study revealed that the varieties of grafted mangoes grown in Matinyani Division included Apple, Tommy and Kent (Table 2). Majority of the grafted mango farmers in Matinyani Division were growing Apple mangoes. However, in Kauma location there was significantly higher (P<0.05) Tommy mango production at 4% as compared to Matinyani and Kauma locations at 1.8% and 2.0% respectively (Table 2).

Table 2: Varieties of Grafted Mangoes Grown in Three Locations of Matinyani Division, Kitui County

Locations	Apple	Tommy	Kent	Standard Deviation
Matinyani	96^{a}	1.8^{a}	2.2^{a}	2.04^{b}
Kalimani	95^{a}	2.0^{a}	3.0^{a}	4.02^{a}
Kauma	93^{a}	4^{b}	3^{a}	4.3^{a}
LSD (P=0.05)	10	9	7	

* Means same letters within a column are not significantly different at 5% level of significance.

On income generation from mango farming, the study revealed that majority of the respondents earned KES 1,000 – KES 5,000 from the sale of local mangoes (Table 3). However, mango farmers in Matinyani location were earning significantly (P<0.05) higher income than Kalimani and Kauma location.

Table 3: Income Earned (KES) per Year from Sale of Local Mangoes in Three Locations of Matinyani Division, Kitui County

Location	1,000-5,000	6,000-9,000	10,000-15,000	16,000-20,000	Std error
Matinyani	65[a]	30[a]	5[a]	0[a]	1.8[a]
Kalimani	70[a]	28[b]	2[a]	0[a]	2.5[b]
Kauma	72[a]	25[b]	3[a]	0[a]	3.0[b]
LSD (*P*=0.05)	10	7	20	13	

* Means same letters within a column are not significantly different at 5% level of significance

Income from sale of grafted mangoes in Matinyani Division per annum ranged from KES 1, 000 to KES 20,000. Among farmers who earned KES 6,000 – KES 9,000, Matinyani location led with 59% responses, followed by Kauma location with 57% and then Kalimani location with 47% (Table 4). Among farmers earning KES 10,000-KES 15,000 Kalimani location was leading with 29.7%, followed by Matinyani location with 20.5% and then Kauma location with 11%. There was a significant difference ($P<0.05$) between the locations earning income of KES 16,000 – KES 20,000 with Kalimani location attaining 15% while Matinyani and Kauma locations had 8% and 3% respectively. However, Kauma location led on the farmers who earned KES 1,000 – KES 5,000 from the sale of grafted mangoes at 29%.

Table 4: Income Received per Year from Sale of Grafted Mangoes in Three Locations of Matinyani Division, Kitui County

Location	1,000-5,000	6,000-9,000	10,000-15,000	16,000-20,000	Std error
Matinyani	12.5[a]	59[b]	20.5[b]	8[a]	2[a]
Kalimani	8.3[a]	47[a]	29.7[b]	15[b]	3[b]
Kauma	29[b]	57[b]	11[a]	3[a]	3.7[b]
LSD (*P*=0.05)	13	10	25	23	

* Means same letters within a column are not significantly different at 5% level of significance

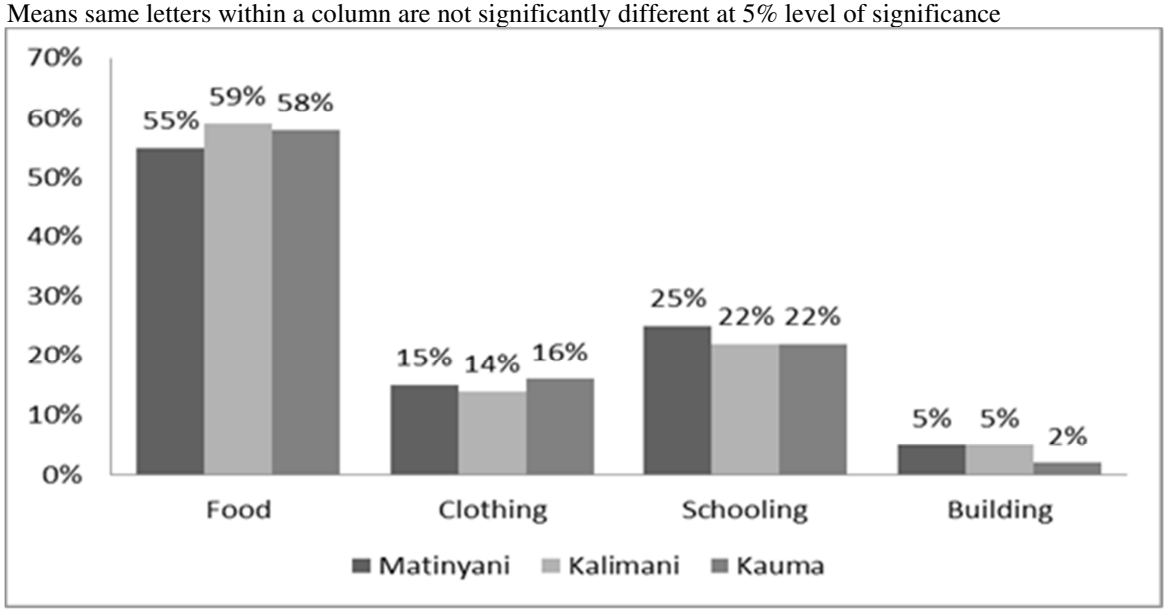

Figure 1: Expenditure of Income from Grafted Mangoes in Three Locations of Matinyani Division, Kitui County.

Discussions

The study showed that, majority of mango farmers in Matinyani Division preferred cultivation of Ngowe as the local variety (Table 1). Ngowe variety was preferred since it was easier for the Ngowe tree to grow naturally at moderate size making it convenient to prune the tree and harvest the mango fruits. Cultivation of Dodo and Boribo varieties was less preferred because the trees grew into large trees making it difficult to prune and harvest the mango fruits. Further, Ngowe fruit was relatively large in size, more attractive and attained maturity earlier as compared to Dodo and Boribo varieties. Due to its big size, the Ngowe mango sold faster than Dodo and

Boribo varieties. This was in agreement with Griesbach (2003) who observed that, Ngowe mango was the most easily recognized local mango fruit due to its size and the fruit develops to an attractive yellow to orange colour when ripe with deep yellow flesh that is of excellent quality, virtually free from fibre and carries no turpentine taste as opposed to Dodo and Boribo local varieties.

Majority of the grafted mango farmers in Matinyani Division were growing Apple variety (Table 2). The reason attributed to this was that, the ecological zone of Matinyani Division was characterized by loam soils (GoK, 2002). These soils are essential pre-requisites for good development of Apple mangoes. Griesbach (2003) observed that, Apple trees were not difficult to grow and, once well established, were relatively tolerant to drought and poor soil condition. Grafted mango farmers in Matinyani Division practiced mixed farming and Apple trees were observed to grow into a moderate size allowing better use of underground space for planting other agricultural crops compared to Kent mango trees. Griesbach (2003) reported that, Kent mango trees grew into vigorous large trees forming rounded canopy which essentially hindered growth of other agricultural crops.

Apple mango fruits were tolerant to pests and disease infection due to the moderate size of the Apple trees which made it possible for farmers to spray chemicals, prune the trees, maintain hygiene underground and reduce bruising during harvesting hence increasing the physical appearance and shelf-life of Apple mango fruit. This was in agreement with Okoth *et al*., (2013) who reported that, Apple mango fruit was the most preferred due to flesh colour, flavor, taste, texture and overall acceptability therefore, suitable for fresh consumption and processing.

The study also showed Kauma location had the highest number of farmers producing Tommy mango varieties compared to Kalimani and Matinyani locations (Table 2). This trend was attributed to Kauma location being located near Musengo where there is a mango processing plant which gives Tommy mango variety a first priority in grafted mango processing. Griesbach (2003) reported that, Tommy mango variety has become important for commercial purpose due to the attractiveness of the fruit with excellent shipping and shelf-life qualities.

According to Chambers and Conway (1992), livelihoods comprise people, their capabilities and means of earning a living, including food, income and assets. Pricing of mango fruits is one of the most important factors that determine the economic status of mango farmers (USAID, 2005). According to Steve (2010), mango fruits prices can be raised if farmers can focus on mango concentrate for juice production, consumption on fresh fruits and dried fruit products. There should be a shift from mere “marketing” to “supply chain management” in order to realize more prices (Sarada, 2013).

The study showed that, majority of the respondents earned KES 1,000 – KES 5,000 from the sale of local mangoes with Matinyani and Kalimani locations earning significantly ($P<0.05$) higher income than Kauma location (Table 3). This was attributed to the main road passing through Matinyani and Kalimani locations which enables farmers to access the market with ease unlike Kauma location.

The study also revealed that, majority of grafted mango farmers in Matinyani and Kauma location earned KES 6,000 – KES 9,000 (Table 4) which was attributed to Matinyani location recording higher levels of mango juice production and Kauma location being situated next to Musengo mango processing plant. Kalimani location had highest percentage of grafted mango farmers earning KES 16,000 to KES 20,000 due to a tarmac road passing near the location enabling mango farmers to access markets with ease. The cost of transport contributes significantly to the price paid by the consumers (FAO, 1989) hence, determining the net income.

According to the study, majority of the mango farmers in Matinyani Division spend their income on food in all the locations (Figure 1). This was attributed to mango farmers growing little food crops hence, selling mangoes to buy food. Also the rainfall reliability was 40% in the Division which was unfavorable for food and cash crops production (GoK, 2005). Other uses of income from mangoes included, payment of school fees, clothing and building respectively. Tharanathan *et al*., (2006) reported that, if grafted mangoes were grown in a large scale they would improve the livelihood of the farmers to a great extent. This is attributed to international trade where the demand for mango fruit has risen significantly by the end of the twentieth century (Galán, 2004). Hence, earning higher income that could improve the livelihood of the farmers further.

Conclusion

This study established that; Mango varieties grown in Matinyani Division include both local and grafted varieties. The local varieties grown include: Ngowe, Dodo and Boribo while grafted varieties were; Apple, Kent, and Tommy with majority growing Apple mangoes. Besides the mango farming, farmers were also growing other food crops. Such mixed farming had a negative effect on the extent to which grafted mangoes were being produced. The respondents were not earning more than KES 20,000 in a year from the sale of grafted mangoes. The earnings per annum can be increased further if grafted mango farming is taken as a potential source of income by farmers in Matinyani Division.

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