

## ***Vitex payos* (Lour.) Merr Fruit Trees in the Drylands Areas of Eastern Kenya: Use, Marketing and Management**

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**Abstract:** This study explored the local use, marketing and management of *Vitex payos* in drylands areas of Eastern Kenya. Data were collected through household surveys using semi-structured questionnaires; transect walks, informal discussions and direct observations. Questionnaire responses were analyzed to generate descriptive statistics using Statistical Package for Social Sciences (SPSS) while graphs were generated using Excel. *Vitex payos* fruits were found to be used in >90% of the households and the management of the fruit trees was incidental rather than deliberate. A majority of farmers (>80%) pruned the *Vitex payos* trees found on the farm to reduce shading effects on the associated crop plants. Coppices from cut trees were managed to provide new crops. Some farmers smoked the flowering and fruiting trees to repel the flying insect pests while a few others sprinkled ash at the base of the tree to deter crawling insects. Besides the consumption of *Vitex payos* fruits as snacks and sale for income generation, fruits were used for treatment of diarrhoea. The trees were also used for placing of beehives while the leaves, bark and roots were used for making herbal medicine. The wood was used for timber, fuelwood and tool handles. The naturally ripe and fallen fruits were collected on the ground although a few gatherers harvested fruits by climbing and shaking the tree or branches to dislodge the fruits. Within households, the fruits were spread on mats under shade for 1-3 days before taking to the market. Traditionally, mature unripe fruits are placed in buckets and covered with wood ash to hasten ripening. Taste of the fruits was the main criteria used by consumers to select the best fruits. Farmers retained on their farmlands trees with high fruit productivity and those that produce sweet fruits. Ripe fruits were sold on farms, roadside stalls and local markets either by gatherers themselves or through fruit vendors. Gatherers and fruit vendors suffer heavy losses due to fruit damage during transportation to the markets. Lack of storage facilities and low market value lowers the overall income from the sales of the fruits. Small land sizes and lack of planting material negatively affected farmers planting of the trees. There is need to promote the fruits through initiating processing activities to improve on their shelf life and to add value to generate higher income at the farm level. Processing of fruits into high value products like fruit jam and juices should be explored. Increasing the accessibility and availability of good planting material should be explored through vegetative propagation techniques to capture desired traits such as taste, size and high tree productivity.

**Key words:** Black plum, indigenous fruit trees, wild edible fruits, underutilized plants, *Vitex payos*, Kenya

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### **INTRODUCTION**

The genus *Vitex* L. belongs to the Verbenaceae family and comprises of about 250-300 species of trees or shrubs most of which are indigenous to tropical and subtropical environments. Different species of the *Vitex* genera in Kenya are found naturally from the coast

through the dry woodlands to Mt. Kenya area and across the Rift valley to the shores of Lake Victoria. All the species produce fruits that are utilized heavily for herbal medicine while others produce edible fruits that are consumed and sold in local markets among some communities (Li *et al.*, 2002; Maduka, 2004). Locally, the species is known by different local names among different

communities; mfufu (Swahili), muu (Kamba), muburu (Mbeere) and muhuru (Kikuyu). *Vitex payos* (Lour.) Merr. is a small deciduous tree of up to 10 m high with a low, sparsely branched and rounded crown with square branchlets (Beentje *et al.*, 1994; Maundu *et al.*, 1999; Mbora *et al.*, 2008). The species was identified as the most highly ranked indigenous fruit tree species in Kenya through farmers participation (Muok *et al.*, 2000; Teklehaimanot, 2005, 2008). It produces fruits that are black with an oblong or sub-globose shape, 2-2.5 cm long and 1.4-2.4 cm wide, shiny and glabrous (Beentje *et al.*, 1994). Fruits are edible and sweet, somewhat resembling a prune in taste (Teklehaimanot, 2008; Mbabu and Wekesa, 2004; Mbora *et al.*, 2008). *Vitex payos* could also be used in the control of malaria infection, a serious health problem in most areas where the species grows naturally. Anti-larval compounds extracted from *V. payos* were found to inhibit emergence of anopheles mosquito larva and caused morphological deformation in some pupae whose female adults were responsible for transmitting malaria parasites (Mokua *et al.*, 2009). The compounds also caused early death of adult mosquitoes (Mokua *et al.*, 2009).

Currently, information about the species is scanty and scattered in several publications (Maundu *et al.*, 1999; Muok *et al.*, 2000; Mbabu and Wekesa, 2004; Mbora *et al.*, 2008; Mokua *et al.*, 2009). In other studies the species is lumped together with others under the *Vitex* genera (National Research Council, 2008). The species has also been confused with *Vitex doniana* sweet that grows in slightly higher rainfall areas in Kenya (Ondachi, 2002). The specific objective of this study was therefore to document the local use, marketing and management of *Vitex payos* in Eastern province of Kenya. This was answered by addressing the following research question: how do the local people in the study area use and market *Vitex payos* fruits and how do they manage *Vitex payos* fruit trees on their farms?

## MATERIALS AND METHODS

**Study area:** The study was carried out in three districts namely Mbeere, Mwingi and Kitui, all of which are situated in Eastern Province of Kenya (Table 1). The three districts are characterized by low soil fertility, low and erratic rainfall and experience frequent droughts. The distribution of the annual rainfall is markedly seasonal with 80% of the total rainfall falling in two wet seasons: October-December and March-May.

The soils in Mbeere are a mixture of chromic cambisols, rhodic ferrasols and luvisols with varying degree of stoniness, rockiness and soil depth (Njoroge and Gicheru, 1995). The Mwingi soils are red sandy, loamy sandy with patches of black cotton soils. The soils in Kitui are mainly loamy sandy in low-lying areas while along seasonal rivers, the soils are sandy clay loam and low in fertility (Bernard and Thom, 1981). These districts were selected because of the large number of *Vitex payos* trees retained on the farms. Reconnaissance surveys were undertaken in each district jointly with extension staff from the ministries of agriculture and forestry to establish the availability of the species and to determine specific villages where fruits trees were abundant on the farms. Eventually, eight villages (Ivumbu and Yaathi in Kitui; Chianyi and Gitumbi in Mbeere and Mwanzilu, Kiini, Kathumbi and Kaitumbi in Mwingi) were selected for the study.

**Sampling and data collection:** A total of 114 households (Table 2) were randomly selected in the eight villages representing a 20% of the total households. In each village, a list of all households was prepared by recording the names of their heads and allocating them a unique number. The data were collected using a semi-structured questionnaire that had been pretested and adjusted.

Table 1: Location of the study districts, their mean annual rainfall and temperatures

District	Latitude (S)	Longitude (E)	Area (km <sup>2</sup> )	Average annual rainfall (mm)	Average temperature (°C)		Elevation (masl)
					Minimum	Maximum	
Mbeere	00°20'-00°50'	37°16'-37°56'	2093	640-1100	14-22	25-32	1180
Mwingi	00°03' 01°12'	37°47'-38°57'	10030	600-1100	14-22	26-34	1140
Kitui	00°04'03°00'	37°45'39°00'	20402	500-1050	16-28	32-34	895

Table 2: Number of households and interviewees from each village

District	Village	No. of households	No. of interviewees
Mbeere	Chianyi	177	35
	Gitumbi	76	15
Kitui	Ivumbu	52	10
	Yaathi	42	8
Mwingi	Kiini	49	10
	Kaitumbi	53	11
	Kathumbi	51	10
	Mwanzilu	73	15

The questionnaires were administered in the local dialects of Mbeere and Kamba. Additionally, informal interviews, group discussions and observations were made to corroborate questionnaire responses.

The response data were coded and analyzed into descriptive statistics using SPSS statistical package, version 16 while graphs were generated using Excel software for Windows package. Comparisons of districts were carried out using the mean values of villages.

## RESULTS

### Socio-economic and demographic characteristics of the respondents:

Socio-economic and demographic characteristics of the respondents are shown in Table 3. A majority (55.3%) of the respondents were women. About 49% of the respondents were aged between 25 and 45 years. Most (57%) of the respondents were educated up to primary level of education. Many of them (47%) own between 0.4 and 2.0 ha of land. Though all were subsistence farmers, majority (65%) depended solely on their farms. The decision to engage in tree planting activities in households was either controlled by the male head of the household (45.6%) or all members (45.6%). The *Vitex payos* fruits were consumed by all members in majority (93%) of the households. Land was inherited from parents by majority of the respondents (66%) while the rest either bought (23%) or were given part of their land by the parents and bought the rest (15%). Only a small proportion of the population (2%) actually got their land from the community.

### Local knowledge on *Vitex payos* tree species in dry areas utilization of trees and their fruits:

About 50, 44 and 22% of households in Kitui, Mbeere and Mwingi, respectively reportedly cut and use *Vitex payos* trees for timber and firewood. The trees are also used for placing of beehives while the wood is popular in making of traditional water troughs, house building, furniture, stools, carving and tool handles. The leaves are used as mulch to improve soil organic matter while cooked young leaves are eaten as a vegetable or in sauces. Sap from young fresh leaves is used as an eye drop to treat conjunctivitis among other eye complaints. Leaves are also boiled and the liquid drunk to improve appetite. The bark extract is used to treat stomach complaints and kidney troubles. The bark is also used to control bleeding after childbirth and liver diseases. A paste of pounded leaves and bark are applied to wounds and burns. The roots are used as herbal medicine for treatment of stomach problems or gastro-intestinal disorders. The young branch twigs are used as chewing sticks for teeth

Table 3: Socio-economic and demographic characteristics of the respondents in Mbeere, Kitui and Mwingi districts, Kenya (N = 114)

Variables	Response (%)			
	District			
	Mbeere	Kitui	Mwingi	Overall ( $\pm$ SEM)
<b>Sex</b>				
Male	56.0	38.9	34.8	43.2 $\pm$ 6.50
Female	44.0	61.1	65.2	56.8 $\pm$ 6.50
<b>Age</b>				
<25 years	2.0	27.8	6.5	12.1 $\pm$ 8.00
25-45 years	54.0	33.3	50.0	45.8 $\pm$ 5.20
>45 years	44.0	38.9	43.5	42.1 $\pm$ 1.30
<b>Literacy</b>				
None	14.0	22.2	10.9	15.7 $\pm$ 2.80
Adult education	0.0	11.1	10.9	7.3 $\pm$ 3.00
Primary education	60.0	66.7	50.0	58.9 $\pm$ 4.00
Secondary education	26.0	0.0	26.1	17.4 $\pm$ 7.10
College education	0.0	0.0	2.2	0.7 $\pm$ 0.60
<b>Size of land owned</b>				
<0.4 ha	18.0	11.1	15.2	14.8 $\pm$ 1.60
0.4-2.0 ha	70.0	44.4	45.7	53.4 $\pm$ 6.80
>2.0 ha	12.0	44.4	39.1	31.8 $\pm$ 8.20
<b>Occupation</b>				
Artisan	6.0	5.6	21.7	11.1 $\pm$ 4.30
Basketry	0.0	0.0	2.2	0.7 $\pm$ 0.60
Casual labour	0.0	16.7	4.3	7.0 $\pm$ 4.10
Charcoal maker	0.0	11.1	0.0	3.7 $\pm$ 3.00
Formal employment	2.0	0.0	15.2	5.7 $\pm$ 3.90
Peasant farmer	92.0	44.4	47.8	61.4 $\pm$ 12.5
Small business	0.0	11.1	8.7	6.6 $\pm$ 2.80
Wood carver	0.0	11.1	0.0	3.7 $\pm$ 3.00
<b>Who decide on tree planting</b>				
All household members	34.0	16.7	67.4	39.4 $\pm$ 12.1
Male head	58.0	50.0	32.6	46.9 $\pm$ 6.10
Parents	8.0	33.3	0.0	13.8 $\pm$ 8.20
<b>Who eats <i>Vitex payos</i> fruits</b>				
All family members	86.0	100.0	97.8	94.6 $\pm$ 3.50
Children/Mothers	2.0	0.0	0.0	0.7 $\pm$ 0.50
Children	12.0	0.0	2.2	4.7 $\pm$ 3.00
<b>Land status</b>				
Given by parents	60.0	61.1	76.1	65.7 $\pm$ 4.20
Land bought	28.0	33.3	6.5	22.6 $\pm$ 6.70
Given and bought	2.0	0.0	15.2	5.7 $\pm$ 3.90
Given by community	10.0	5.6	2.2	5.9 $\pm$ 1.80

cleaning. Fruits are taken as snacks but may be used in large quantities to control diarrhea. Currently, there is no formal processing of *Vitex payos* fruits in the study villages. In 92% of the households, respondents had never processed *Vitex payos* fruits. For a few (8%) who indicated some processing, this was carried out by their children in small quantities especially while herding animals. This mainly involved squeezing the ripe fruit pulp and mixing the pulp with water to make some juice.

### Management practices of *Vitex payos* fruit trees on farms:

Among the households, 87% have managed their *Vitex payos* fruit trees on the farms. The main reasons advanced for managing *Vitex payos* on-farms included opportunity to increase fruit production (32%); reduce shade on the farm to allow crop development next to the

Table 4: Percentage of households in Mbeere, Kitui and Mwingi districts with different numbers of mature fruit trees on their farms

District	No. of mature payos trees on individual farm								Total (n)
	0	1-4	5-8	9-12	13-16	17-20	21-24	25-28	
Mbeere	40	40	16	-	2	2	-	-	50
Kitui	27.8	5.6	16.7	5.6	16.7	11.1	11.1	5.6	18
Mwingi	21.7	56.5	6.5	10.9	2.1	2.1	-	-	46

tree (26%) and enhance production of high quality fruits (18%). Majority of the households (82.5%) pruned the lower branches of the *Vitex payos* trees that are retained on the farms. Other households (4.4%) weeded for their trees while weeding the agricultural cultivated crops. Few people (1.0%) also applied manure (accumulated plant residues) at the base of the trees while tilling the land while another 1.0% applied ashes at the base of the *Vitex payos* fruit trees to protect them from termite and other crawling pests. One farmer reported smoking the trees during the early stages of flowering to repel some flying insect pests from damaging the flower buds.

About 31% of the households interviewed had no mature *Vitex payos* fruit trees on their farms while 41% had between one and four trees (Table 4). Among the three study districts, Mbeere had the highest number of farmers without mature trees (40%) while Kitui and Mwingi had fewer farmers 27.8 and 21.7%, respectively. About 80% of farms in Mwingi and Mbeere had <4 trees, while in Kitui; only 35% had similar number of trees. Among Kitui farmers, 38.9% had >12 mature fruiting trees.

**Harvesting and storage of *Vitex payos* fruits:** Harvesting of *Vitex payos* fruits varied between Kitui and Mwingi. In Kitui, the fruits were harvested using two methods collecting ripe fruits fallen on the ground naturally or assisted by the wind and storms (59%); climbing and shaking the fruit tree and later gathering the fallen fruits from the ground (41%). In Mwingi, *Vitex payos* fruits were harvested in five different ways. First, the fallen fruits were mainly gathered from the ground (91%) and secondly, picking up the tree (74%) as the main methods. The other methods were shaking the tree and collecting the fallen fruits from the ground (6%); shaking the tree from the ground and up the tree (9%) and up the tree and on the ground (56%). In all cases, the people did not lay traps for fruits to fall on.

Majority (75%) of farmers who harvested fruits for marketing in Mwingi and Kitui stored them at home by spreading them out on sacks, mats or bare ground for a few days in houses. Other methods of storage include use of buckets (17.2%) and baskets and tins (7.8%). In Mbeere however, farmers do not store the fruits because they do not harvest them for sale. Both ripe and unripe mature fruits are often collected by the gatherers. Some people put the unripe fruits in buckets or tins and cover them

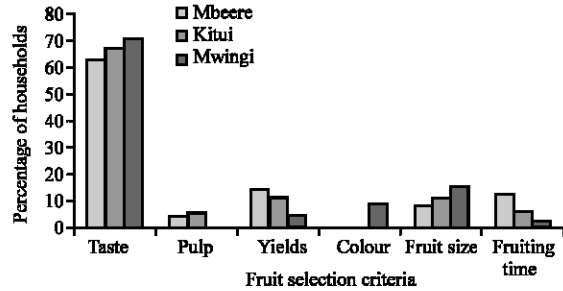


Fig. 1: Percentage of interviewees using different fruit selection criteria in the three districts

with cold wood ashes before closing the buckets/tins with lids. They are then stored for 1-2 days to hasten the ripening process. The fruits are then washed before being eaten or taken to the market for sale. Over 75% of households in Kitui kept and accumulated the ripe fruits for 2-3 days. In Mwingi district, about 52% of the sampled households kept the ripe fruits for 2-3 days at home while approximately 41% kept their fruits for between 4 and 7 days.

**Selection of superior trees and fruits for consumption:** Fruit taste was the most important fruit trait used in selecting superior *Vitex payos* fruits for consumption in all villages with 65.8% overall preference (Fig. 1). Other traits were the amount of pulp per fruit, the fruit size and skin colour. Besides, the high yielding trees were selected for retention on farms.

**Marketing of *Vitex payos* fruits:** In all cases except one, the marketing of *Vitex payos* fruits was done by women who ranged in age from 23-70 years (mean 38.6±2.4 years). All the interviewees in the study area sold their fruits either on farm or in the local markets. In Mwingi, 47.8% of the households sold their fruits in local markets, 17.4% on farm while 23.9% sold both on farm and local markets (Fig. 2). Majority (61.1%) of the farmers in Kitui were involved in sale of fruits both on farm and in the local markets while 16.7% sold their fruits on farm only and 5.6% in local markets only. About 16.7% of the farmers did not sell fruits from their trees.

*Vitex payos* fruits are sold in 20 L buckets on farms and local markets while they are retailed in 375-500 mL cups directly to consumers. On farms, the prices range from Ksh 25-120 (1 US\$ = Ksh 80) per bucket while

Table 5: Challenges in managing *Vitex payos* trees in the study area (Mbeere, Kitui and Mwingi districts of eastern province of Kenya)

Challenges in managing <i>Vitex payos</i> on farm	Percentage response			
	Mbeere	Kitui	Mwingi	Overall ( $\pm$ SEM)
Small farm size	64	33.3	51.1	49.5 $\pm$ 15.4
Unavailability of seedlings	16	22.2	31.1	23.1 $\pm$ 7.60
Lack of water because of drought	4	22.2	15.6	13.9 $\pm$ 9.20
High seedling cost	14	22.2	-	12.1 $\pm$ 11.2
Pests and diseases	-	-	2.2	0.7 $\pm$ 1.30
Few naturally grown trees on farm	2	-	-	0.7 $\pm$ 1.20

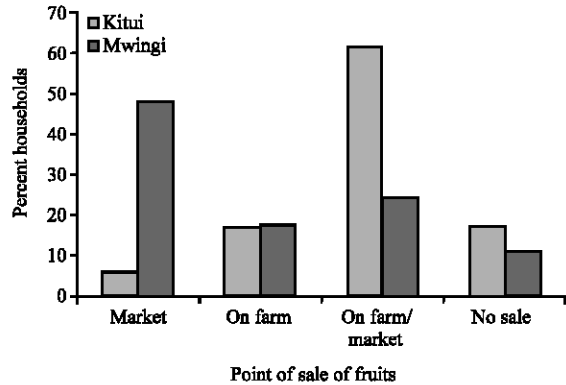


Fig. 2: Percentage of respondents selling *Vitex payos* fruits at different places in Kitui and Mwingi, Kenya

the cup retails at Ksh 3 in roadside stalls in the rural areas. Transport of fruits from the farms to the roadside was usually done by women on their back. However, where the farms were far from the road, fruit vendors hired bicycles or donkey carts to transport their fruits costing Ksh 10 per bucket.

To transport the fruits to the local towns (such as Kitui and Mwingi) buses charged between Ksh 2 and Ksh 20 depending on the distance (mean Ksh 13.50). In these markets, a bucket of fruits sold at between Ksh 80 and Ksh 200 (mean Ksh 137.50 $\pm$ 6.95) depending on the quantities of fruits available in the market. The main challenges associated with marketing of *Vitex payos* fruits identified by vendors included: high market charges, fruit perishability and low fruit demand (33%); high transport charges and prolonged delays by the roadside (26.7%) and low fruit values (30%).

**Challenges in managing *Vitex payos* trees in the study area:** There are various challenges in managing in *Vitex payos* trees in study area (Table 5). In both Mbeere and Mwingi districts where land holdings were relatively small 66 and 50% of respondents, respectively indicated the small size of their farms as the main challenge to managing *Vitex payos* and associated fruit trees on farmland. The other constraints were the unavailability of planting material, drought or lack of water to irrigate seedlings and

high seedling cost. Kitui district had a unique problem of browsing of seedlings as a result of uncontrolled grazing after the harvesting of crops.

## DISCUSSION

Many local people in the dryland areas of Eastern Kenya (ecological zone for *Vitex payos*) have known and depended on *Vitex payos* fruit trees since time immemorial. The fruits are known by different names in Chonyi, they are called fudu, mfudu unga in Embu, they are known as muburu, mburu; in English it is known as black plum; in Giriama the fruits are known as mfudu; in Kamba, they are called kimuu, muu; in Kambe, they are called fudu, mfudu unga; in Mbeere they are called muburu while in Swahili they are known as mfudu (Maundu *et al.*, 1999). In the present study, the fruits were gathered and consumed mainly as snacks, especially by the children. Earlier research efforts (Maundu *et al.*, 1999; Muok *et al.*, 2000; Simitu *et al.*, 2008) also indicated that *Vitex payos* fruits are much favoured by children noting that the fruits make significant contribution to children's diets, especially during times of hardship such as drought when there is little to fall to. The fruits were also gathered and sold either on the farms or in the local markets by some households in Mwingi and Kitui to beef-up their incomes. Earlier studies (e.g., Muok *et al.*, 2000; Ngategize and Kaboyo, 2001; Agea *et al.*, 2005; Mbora *et al.*, 2008; Simitu *et al.*, 2008; Teklehaimanot, 2008) also found that most gathered and traded indigenous fruits in Eastern Africa are often sold directly on farms or from the local markets.

It is saddening however, to note that there were no formally organized marketing systems in place for the gathered fruits unlike in the case of conventional fruits like oranges. The pricing of fruits was haphazardly done by gatherers who often doubled as sellers. Consequently, most of them often end up setting very low prices and hence low returns to their gathering efforts. The returns though negligible, nevertheless make a significant contribution to the household income of the dreadfully poor people. Besides, the fruits that were gathered and eaten as snacks or sold to generate some income by members of the poor households, local people in the

study area also harvested the leaves, roots and the bark of the *Vitex payos* for making herbal medicine used in the treatment of various ailments (such as conjunctivitis, stomach complaints and kidney troubles, bleeding after childbirth and liver diseases). There is also available information (Maundu *et al.*, 1999) that the tree is valuable for making wooden spoons for fuelwood and that its straight trunks are used for poles.

In addition, *Vitex payos* were also valued by some people in the study area for hanging beehives due to their extended retention of foliage at the beginning of the dry season and profuse flowering and thus providing nectar for making of honey (Mbora *et al.*, 2008). Though not a preferred fodder tree at the peak of the dry season, some farmers reportedly cut the foliage of *Vitex payos* to feed their livestock.

*Vitex payos* trees retained in croplands were regularly pruned to reduce their shading effects on the associated agricultural crops. There are claims from the farmers that pruning of these trees often results in massive fruit production. This claim could perhaps be associated with the effect of the crown opening that increases the vigour of the plant. The pruned branches are often used as firewood. Management of *Vitex payos* trees varied across the study the study communities. However, at the peak of flowering, most people often smoke the trees by lighting fire on the upwind side of the tree and covering the fire with green foliage. The smoke is said to expel flying insects in the canopy. Some people however, sprinkled wood ash around the base of the tree before and during flowering. Others accumulate debris (mulch) at the base of every flowering and fruiting tree.

The use of debris (mulch) has also been reported in mango orchards where they were noted to assist in suppressing weeds and retaining moisture at the base of mango trees (Varela *et al.*, 2006). Some farmers also poured ash around the base of the flowering and fruiting *Vitex payos* trees to discourage the crawling insects from moving up the tree.

Harvesting of fruits was found to be rudimentary with no observable attempt by most fruit gatherers to capture and preserve all falling ripe fruits. Fruits are mostly collected from the ground, a practice that discourages many potential fruit consumers. Beside, the time it takes to collect the fruits from the ground is long. However, the opportunity costs in most situations are low as there are few farm activities during the fruit ripening periods. Although, many farmers participated in the fruit collection themselves, some allowed other fruit gatherers to collect fruits from the trees on their farms and accordingly charge

them some money for what they have collected. Management of the gathered fruits is still a major bottleneck. Due to the high moisture content of the ripe fruits, storage under ordinary home conditions is a challenge. Nonetheless, the fruits must be collected and kept for some days to allow accumulation of adequate quantities for the market. The fruits collected initially are spread out on mats or the ground under shade. This practice however, exposes fruits to damage from domestic animals.

Other fruits dry out and their skin gets wrinkled, leaving an appearance that fends off buyers. While in storage, some fruits also get over ripened and are thus eliminated from the batches destined for the market. Overall, the gatherers lose a substantial quantity of fruits between collection in the field and the marketing point.

Other challenges in management of *Vitex payos* tree resources include competition from food crop production due to small farm sizes; seedlings of *Vitex payos*, like those of most indigenous fruit tree species are not available in tree nurseries as there is no demand for them (Nieuwenhuis and O'Connor, 2000; Lengkeek *et al.*, 2004). However, *Vitex payos* regenerates profusely after the rains. Therefore, the regenerates (wildlings/seedlings) could either be protected *in-situ*, transferred to other locations in the farm or transplanted into containers for management in a nursery. Like others, these seedlings could subsequently be planted at appropriate niches in the farm. However, as long as these fruits are still perceived as God given and freely available (Agea *et al.*, 2010) few people will consider to deliberately manage them as a market resource.

## CONCLUSION

*Vitex payos* fruits were found to be used in >90% of the households and the management of the fruit trees were incidental rather than deliberate. A majority of farmers (>80%) pruned the *Vitex payos* trees found on the farm to reduce shading effects on the associated crop plants. Coppices from cut trees were managed to provide new crops.

Some farmers smoked the flowering and fruiting trees to repel the flying insect pests while a few others sprinkled ash at the base of the tree to deter crawling insects. Besides the consumption of *Vitex payos* fruits as snacks and sale for income generation, fruits were used for treatment of diarrhoea. The trees were also used for placing of beehives while the leaves, bark and roots were used for making herbal medicine. The wood was used for

timber, fuelwood and tool handles. The naturally ripe and fallen fruits were collected on the ground although, few gatherers harvested fruits by climbing and shaking the tree or branches to dislodge the fruits. Within the households, the fruits were spread on mats under shade for 1-3 days before taking to the market. Traditionally, mature unripe fruits are placed in buckets and covered with wood ash to hasten ripening.

Taste of the fruits was the main criteria used by consumers to select the best fruits. Most farmers retained on their farmlands trees with high fruit productivity and those that produce sweet fruits. Ripe fruits were sold on farms, roadside stalls and local markets either by gatherers themselves or through fruit vendors. Gatherers and fruit vendors suffer heavy losses due to fruit damage during transportation to the markets. Lack of storage facilities and low market value lowers the overall income from the sales of the fruits. Small land sizes among households and lack of planting material negatively affected their planting of the trees.

#### RECOMMENDATIONS

There is need to promote *Vitex payos* fruits through initiating processing activities to improve on their shelf life and to add value so as to generate higher income at the farm level. Processing of fruits into high value products like fruit jam and juices should be explored. Increasing accessibility and availability of good planting material should be explored through vegetative propagation techniques to capture desired traits such as taste, size and high tree productivity.

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