

Full Length Research Paper

# Adoption of frame hives: Challenges facing beekeepers in Kenya

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## Abstract

A survey and inspection of 45 apiaries with 568 hives in eastern, western and coastal regions of Kenya showed that beekeepers adopting frame hives face technical and management challenges. This paper highlighted some of the 'beekeeping mistakes' noted in apiaries as beekeepers transit from traditional hives to frame hives beekeeping which included but not limited to; improper arrangement of frames affecting bee space, lack of enough frames in brood and super boxes affecting colony manipulation, lack of pest control strategies, high cost and less durability of frame hives under tropical conditions, poor construction of frame hives, lack of comb foundation sheets, and lack of accessories such as extractors which hinders the intended purpose of reserving comb. For better adoption and performance of improved hives, the quality of hives needs to be improved through appropriate hive standardization policy and secondly, adequate beekeeper training and extension should be considered.

**Key words:** Beekeeping, frame hives, adoption challenges, Kenya

## INTRODUCTION

Beekeeping is an important component of agriculture, rural development, human nutrition and economic development (Verma, 1990; Crane, 1999; Raina, 2004), supporting millions of livelihoods in Sub Saharan Africa (Mwakatobe, 2005; Lalika, 2008; Gidey and Mekonen, 2010). Apiculture can be regarded as an important livelihood activity for rural populations worldwide for the following reasons: there is no need to own land; in the tropics, beekeeping can be started with bees incoming from the wild; beekeeping equipment is simple and can be easily home-made with very little expenses; it is possible in semi-arid areas; it is a typical part-time activity; honey is a very valuable food under the nutritional point of view. The commercial value of honey is generally high, thus honey can be considered also a supplementary source of income (Lowore and Bradbear 2009). Honey is the most important primary product of beekeeping both from a quantitative and economic point

of view, and has been used by mankind for many years as a source of food, medicine and for religious and cultural ceremonies (Carland, 1970; McInerney, 1990; Mwakatobe, 2005). Other bee products can be used for self-medication (i.e. propolis) and candle making (i.e. beeswax). Through pollination, honeybees maintain biodiversity and increase the production of several agricultural crops and thus indirectly, beekeeping gives incentives for the conservation and restoration of natural vegetation. Therefore, beekeeping represents an important tool in the fight against poverty, gender equality and habitat conservation (Raina et al. 2011).

Like in many parts of Africa, the production of honey in Kenya mostly comes from traditional hives, whose number is estimated at 1.1 million out of the 1.3 million hives in the country. Over 90% of beekeepers use traditional methods, which presumably lead to low yields and low quality honey (Mbae, 1999), though skilled beekeepers produce quality honey from traditional hives (Muli *et al.* 2007). Traditional hives are hollowed out logs, typically of standing or fallen dry wood (Seyffert, 1930) that last many years under dry and wet conditions without

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**Figure 1:** Hives with small entrances in Kakamega, Western region - not ideal for tropical conditions.



**Figure 2:** Poorly constructed frames in Kwale, coast region. There is no bee space.

cracking such as *Terminalia kilimandscharia* and *Melia* species. They vary greatly in size, volume and weight and are normally hung high up in trees out of reach of predators, thieves, grass fires and vandals. In an effort to promote, 'modernized and improved' beekeeping as an alternative source of livelihood, frame hives have been introduced extensively throughout the country by initiatives of the government, Non- Governmental Organizations (NGOs), research institutions and the private sector. The advantages of Langstroth hives are high quality honey, thus yielding greater economic returns, honey is easily harvested, yield greater honey amounts (appx. 45-60 kg/hive/harvest), are easier to inspect for disease and pests, a beekeeper can prevent colony from swarming or absconding and women can participate since they are placed near the ground as opposed to being hung high on trees (MacOsore, 2005).

This paper highlights the challenges being faced by Kenyan beekeepers, as they adopt frame hives and offers practical solutions to some of the challenges.

## MATERIALS AND METHODS

45 apiaries and 568 hives belonging to various beekeeping groups were sampled over a period of 14 months in the year 2011 - 2013 in different regions of Kenya namely eastern (Machakos, Mwingi, Isiolo), western (Kakamega, Busia and Bungoma) and the coast

(Taita Hills, Kwale, Kilifi and Malindi). During apiary visits, colonies were randomly selected for inspection and technical and management shortcomings noted. Technical aspects included size of frames, sizes of hive entrances, quality of queen excluders, comb foundation sheets and bee space. Apiary management was largely on general status of apiaries such as maintenance, pest incidence and control, proper number of frames and spacing, post- harvest handling of frames and training/extension. Beekeepers were informally asked about the incidence of pests and predators and the number of beekeeping training and extension in the previous six months. The challenges facing the beekeepers were noted and classified either as technical (equipment related) or as management related. In each region, the technical aspects and challenges facing beekeepers were recorded and percentages calculated based on the total number of apiaries or beekeepers visited in each region.

## RESULTS

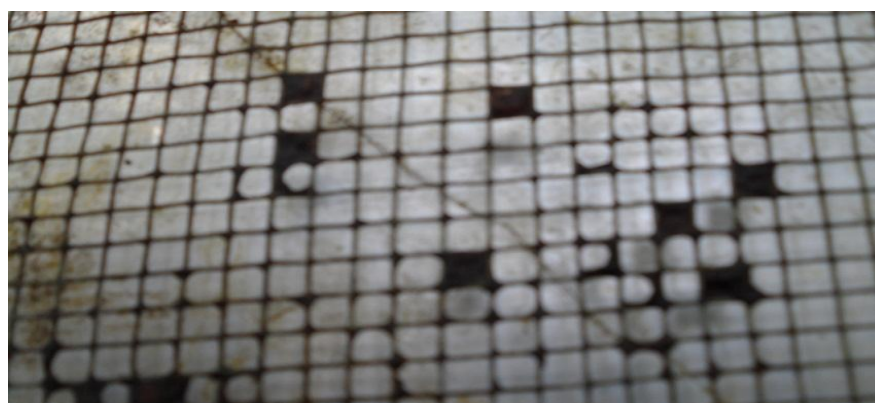
### i). Equipment/Technical Issues

#### a). Hives

Hive technical defects such as small entrances (Figure 1), poorly constructed frames and lack of bee space (Figures 2 & 3), and inappropriate queen excluders was



**Figure 3:** Frames touching hive floors no room for bees to patrol and clear hive debris. In Isiolo, eastern Kenya



**Figure 4:** Queen excluder plugged with propolis. In Kwale, coast region



**Figure 5:** Super heavily infested with wax moth in an apiary

noted in 24% of the hives in eastern region, 25.3% in western and 39.1% in the coast region.

#### b). Queen excluders

The most commonly used queen excluder is coffee-tray wire, which is usually reinforced all round with pieces of timber or plywood. In cases where timber is used, instead of plywood, the gap between the tops of frames and the excluder is large and bees fill it with burr comb and in most cases do not move into the supers. In other cases, the spaces in queen excluders is less than 7 mm and the bees cannot go through and instead plug the excluders with propolis (Figure 4). In Kwale, coast region 30 of the 115 colonies inspected (26%) had rusting queen excluders while 52 % were inappropriate – small spaces.

#### ii). Management

Beekeepers do not regularly clean hives after absconding of bees, thus hives remain unsuitable for reoccupation by natural swarms. In eastern region 100 hives (33.8%) of the hives were empty and had not been cleaned, compared to 62.5% in the coast and 24% in western region. Wax moths were reported as a serious pest by 100% of all the beekeeping groups in the three regions.

In eastern, 14.5% of the colonies inspected were infested by wax moths compared to 15.8% in western and 23.5% in the coast region. (Figure 5). In eastern, 63 colonies (21.3%) were infested by the small hive beetles, compared to 50 colonies (31.6%) in western and 37.5%



**Figure 6:** A colony heavily infested with large hive beetles at Kwale, coastal Kenya



**Figure 7:** Honeycombs left on the ground after honey badger attack in Isiolo district.



**Figure 8:** Lack of enough frames in the hive, this brood will have to be destroyed

colonies in the coast. 10.2% colonies were infested with large hive beetles in eastern region (only in parts of Isiolo), compared to none (0%) in western region and 81.25% in the coast (Taita Hills, Kilifi, Malindi and Kwale)

(Figure 6). The honey badger (Figure 7) was considered a serious predator by 100% of the beekeepers.

The beekeeping groups in eastern and coast, while 66% in western considered it a serious pest. Moreover, 46.2% of the group apiaries in eastern had experienced honey badger attacks in the previous four months, compared to none (0%) in western and 25% in the coast region.

Members of all the 13 beekeeping groups in eastern reported to have received some form of beekeeping training, while 3 of these groups (23%) had not had received extension services in the previous one year, while in western 55.5% of the beekeepers had received some training and 100% had not received any extension services and in the coast 62.5% had received training and 87.5% had not received any extension in the previous one year.

None of the beekeepers in all the three regions store honey combs (supers) after extraction and Comb ends up being destroyed by wax moths. Lack of frames (Figures 8, 9 and 10) was also noted to be a hindrance, especially in cases where beekeepers had lost frames in honey badger attacks. The findings of this study are summarized in Table 1.



**Figure 9:** Lack of enough frames in the super (only 4 frames instead of 10), notice the cross combs making colony manipulation impossible

## DISCUSSION

The introduction of improved beekeeping technologies as a tool to fight poverty in rural areas has continued to receive increasing attention and many projects have been carried out in different areas of the world (Bradbear *et al.* 2002). However, the high costs of beekeeping inputs are a major constraint to modernization of beekeeping in Sub Saharan Africa (Mbae, 1999; Obwocha, 2007; Okwee-Acai *et al.* 2010), where majority of the population are resource poor. However, with the current efforts to improve beekeeping through the introduction of modern hives, many artisans and



**Figure 10:** A super with no frames in Taita coast region - this frame hive has no difference with a log hive

**Table 1:** A summary of challenges facing beekeepers adopting Frame hives in 3 regions in Kenya

CHALLENGE	PERCENTAGE NUMBER OF BEEKEEPERS/APIARIES/COLONIES PER REGION		
	EASTERN	WESTERN	COAST
<b>Technical Issues</b>			
Poorly constructed hives (small entrances; poor frames; poor queen excluders)	24.0	25.3	39.1
<b>Management Issues</b>			
Empty un-cleaned hives	33.8	24.0	62.5
Colonies infested with wax moths	14.5	15.8	23.5
Colonies infested with small hive beetle infestation	21.3	31.6	37.5
Colonies infested with Large hive beetles	10.2	0	81.25
Incidences of honey badger attacks	46.2	0	25.0
Beekeepers trained on improved beekeeping	100	55.5	62.5
Beekeepers not accessed extension services in previous one year	23	100	87.5
Beekeepers preserving honey combs after extraction	0	0	0

carpenters have ventured into the lucrative business of hive making. In almost all cases, the artisans are not beekeepers and do not understand the importance of small but crucial details such as bee space in hive designs. This has resulted into production of hives which are not useful to beekeepers in terms of manipulation or management. Where bee space is not maintained, bees end up building cross combs and it becomes impossible to manipulate or inspect such colonies. The problem of poor hives is compounded by low training of beekeepers and extensionists (Kigatiira, 1982; Muriuki, 2010; Ministry

of Trade, GoK 2001). In addition, hives are produced largely in the big towns, especially Nairobi City, too far from beekeepers hence it becomes very costly to acquire hives or hive parts. However, the production of standard beekeeping equipment can only be realized through training and development of policy for the industry and decentralization of beekeeping services to areas where beekeepers are located. In addition to poor construction, constraints similar to those reported in Zambia (Clauss and Zimba 1988) were noted, namely communities were not familiar with the financial investment leading to neglect

of the hives and extension personnel have no or little means and practical skills to conduct necessary intensive training and follow-ups.

Even though there is a major drive to introduce frame hives, there have not been enough studies to evaluate their suitability (socio-economic analysis) under prevailing climatic and economic conditions. Svensson (1997) reported that frame hives are not suitable since they are too expensive, less durable, lack of inputs such as foundation sheets and low occupancy. Muriuki (2010) also reported that traditional log hives have high occupation rates and low absconding rates compared to Kenya Top bar Hives (KTBH) and Langstroth hives. Similar results were reported in Baringo, Kenya (Gichora, 2007). The aggressive nature of the tropical honeybees discourages beekeepers from manipulating colonies, and frame hives may not make a difference (Paterson, 1985). Wax moths, ants, hive beetles and honey badger are serious pests of honeybee colonies (Frazier *et al.*, 2009; Torto *et al.*, 2010). Babarinde *et al.*, 2012 reported that in Nigeria, rectangular top bars with flight entrance on the floor and the wall had the highest incidence of *Galleria mellonella* and the least bee population. However, colony attack by wax moths is largely a management issue, and beekeepers can take several measures to reduce incidences of infestation. These include removal or destruction of idle comb in hives especially during the dearth period when bee populations are low. Cleaning of hives after absconding becomes potentially critical in apiaries where hives are placed too close to each other, due to cross infection. Cross infestation is greatly reduced under extensive traditional beekeeping where hives may be placed tens of meters apart. The removed wax can be rendered to include production of beeswax, a valuable hive product. Beekeepers should be sensitized to avoid throwing comb around the apiary sites and infested hives or frames should be cleaned and exposed to direct sunlight for several days or put in hot water to kill wax moth eggs and larvae. Infestation by large hive beetles can be controlled by reducing the sizes of hive entrances and deployment of traps. Traditionally, log hives are hung high up on trees to protect them from predators especially the honey badger. Due to the design of frame hives, it is cumbersome to hang them high up on trees and are placed on stands about one metre above the ground hence are more prone to badger attacks.

In view of these findings, there is need to strengthen beekeeping programmes through adequate training and extension. Emphasis should not only be on provision of equipment (hives) but also other accessories (foundation making machines, smokers, protective gear, extractors), in addition to training and offering practical skills to enable beekeepers acquire adequate colony inspection and manipulation techniques. The training curriculum for beekeepers needs to integrate basic bee biology and management practices such as de-queening and re-queening, colony combining, making splits, pest control,

proper harvesting techniques and bee botany. Efforts should also be enhanced to diversify hive products to production of beeswax, propolis and bee packages, which do not need much further investment apart from hives and bees.

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