

Types of Hives Used By Bee Keepers in Marigat Baringo County- Kenya

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Abstract:- Beekeeping is one of the more universal agricultural activities. The study sought to identify the main types of beehives used by bee keepers in Marigat, Baringo County. The main types of hives are Traditional log hive, improved log hive, Kenya Top Bar hive and Langstroth hives. Majority of the farmers use traditional log hives. This may be caused by the fact that traditional log hives provide cool temperatures for the bees that normally prevail in the study area. The modern hives requires additional cost for construction of grass-thatched shelter to avoid high temperatures that make the bees avoid the modern hives being promoted as new technology.

Key Words: Bee Keeping, Modern Bee Hives, Marigat, Traditional Log Hive and improved traditional log hives.

I. BACKGROUND INFORMATION

Beekeeping is one of the more universal agricultural activity. Bees are found all over the world (Adjare, 1990). Bees work a dual agricultural role by both producing honey and aiding in the pollination of flowering crops. Although much work has focused on improving the practice of beekeeping, it is still possible to manage beehives at a very low level of technological and capital input. Their cosmopolitan distribution, multipurpose nature and relative simplicity in management combine to make bees a natural agricultural supplement for many types of farm systems, (Bradbear, Fisher and Jackson, 2002).

Beekeeping is thriving in cities across the world driven by young hobbyists, commercial beekeepers, sideliners and green entrepreneurs (Adjare, 1990). The People's Republic of China is the world leader in honey production and by a significant factor in 2008, with an estimated production of 257,800 metric tonnes (mt). Argentina is estimated to have produced 85,000 mt in 2008, up 6.25 percent from the 2007 volume of 80,000 mt (Table1.1). The majority of that country's production is exported, with their key markets being the United States of America (USA). and Germany, which accounted for 75 percent of Argentina's total shipments.

Canada is also among the largest honey producers in the world with 5 percent of production. In 2005, Germany was considered the largest honey importing country in the world at 92,200 mt followed by the United States at 65,749mt (Table1.1). The rise in the price of honey from the 2002 production season has been a boon to beekeepers with honey to sell, but drought has prevented many producers from benefiting from the price rise. Antibiotics found in Chinese honey in early 2006 have caused a world shortage of honey in export markets with the resultant price rise and as a result other world countries such as Canada have benefited (FAO, 2012). Production trends of honey globally indicated that honey quantities varied significantly over the years as illustrated in table 1.1.

Table 1.1: Global Honey Production Trends (metric tons)

Year	2006	2007	2008	2009	2010	2010/2009 % change
Argentina	75,000	98,000	93,000	80,000	85,000	6.25%
Canada	46,083	37,097	31,857	35,387	33,296	-5.91%
China,	210,691	236,283	251,839	254,758	257,800	1.19%
Germany	16,306	20,286	20,409	25,951	22,000	-15.22%
Mexico	55,297	55,323	58,935	59,069	55,189	-6.57%
US	99,930	94,000	99,945	84,335	90,000	6.72%
World	1,188,401	1,234,308	1,246,432	1,255,271	1,270,002	1.12%

Source: FAO (2013)

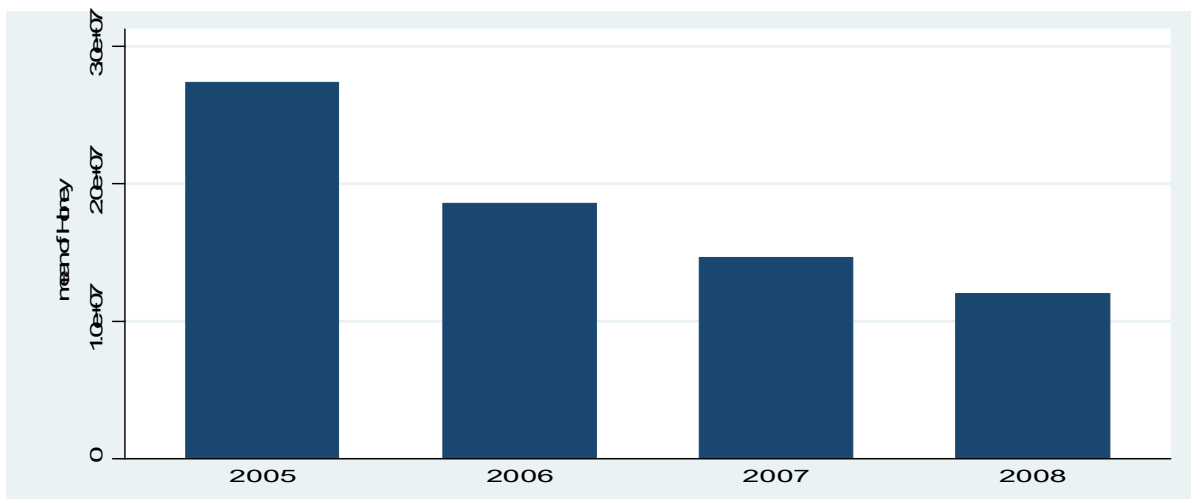
Desertification is a major problem facing many African countries. The land degradation due to desertification has resulted in poor yields and grazing capacity, loss of farmland and rangeland, reduction or disappearance of forests and serious economic difficulties for producers, herders, farmers,

beekeepers and the general population. A growing number of amateur beekeepers are adopting various traditional log hives similar to the type commonly found in Africa. Beekeeping can work almost anywhere. It is multi-functional; bees provide honey, a high energy food supplement that can be sold to

bring cash into a small farm. Bees also provide wax, which has almost unlimited uses. Both honey and wax are valued for their medicinal use in traditional cultures. Bees also provide a valuable ecological service through their role as a pollinator (Friedman and Matti, 2007).

Kenya is largely a traditional beekeeping country which is mostly practiced in Arid and Semi-Arid areas with about 10 million people (KNBS, 2009). With the Development of the Kenya Top Bar Hive, by Kigatiira and Morse, (1979), there was need for farmers to adopt movable Bar Technology as a transition hive between the traditional log hive and the Langstroth hive. Unfortunately, technology adoption has been

very slow among Kenyan beekeepers. In the past, farmers kept their traditional beehives (log hives), on trees in expansive areas, largely unsettled, tapping nectar and pollen from the wild plant sources. With the farming and charcoal burning system approach, this has been restricted. From the census report (KNBS, 2009), the total hive population in Kenya is slightly less than 2 million hives, irrespective of the type of hive, with traditional log hives leading with over 1.3 million hives and 0.7 million is shared between Kenya Top Bar Hive and Langstroth Hive. Table 1.1 shows that the quantity of honey declined from 27,379,481 Kilogram's in 2005 to 12,036,910 kilogram's in 2008



Source: GoK (2009)

Figure 1.1 Honey Production Trends in Kenya (Kilogrammes)

In Kenya, approximately 80 per cent of land is suitable for beekeeping (GoK, 2008 and Hussein, 2001). Yet, the potential of bee keeping and honey production has not been fully tapped in areas where the agro-ecological and climatic conditions as well as the land use patterns are near perfect. Traditionally, lack of market knowledge and the poor quality of honey from rudimentary hives meant that honey was used to produce local liquor. Similarly, beekeepers were prone to exploitation by more knowledgeable middlemen. With the diffusion of its model of sustainable community-based beekeeping, Honey Care Africa (HCA) has been able to provide solutions to overcome these impediments (Najma, 2002).

Marigat in Baringo County is a key producer of honey in Kenya and has enormous potential for beekeeping. Through seminars, workshops, demonstrations and field days, farmers are slowly adopting modern beekeeping practices. Most of the honey produced in the County comes from the traditional *Tugen* log hives. The area has, however, performed poorly during unfavorable weather conditions. Some of the most well known top-bar hives are the Kenyan Top Bar Hive (KTBH) with sloping sides, the Tanzanian Top Bar Hive, which has

straight sides and the Vertical Top Bar Hives such as the Warre or "People's Hive" designed by Abbe Warre in the mid 1900's.

In order to promote diversification in agriculture and reduce poverty in Kenya, beekeeping is one of the major agricultural activities that people need to use as a tool. It offers a great potential for income generation, poverty alleviation, sustainable use of forest resources and diversifying the export base. There is availability of market for bee products both locally as well as internationally or those who wish to continue and it is important to note that pharmaceutical and cosmetic industries utilize bee products such as honey, royal jelly, beeswax to produce cosmetics.

Beekeeping is not an expensive agricultural venture and any bee keeping farmer may save for a short time before investing into beekeeping. Local breweries have high demand for honey which is a significant input in making the local brews. Over the past one decade, the government of Kenya has reduced the number of agricultural extension officers who used to help the farmers a great deal. The few that are remaining are not able to visit most of the farmers on their farms and give personal advice. Most of the bee farmers are also small scale dairy

farmers as well and are always busy on the dairy farming activities.

The situation has changed over time and there has been a general increase in both human and livestock populations in the Kenyan rangelands. This has been occasioned by various improvements in infrastructure, water resources and health facilities. Most of the high potential rangelands have also been alienated for other uses such as game parks and private land leaving less land available for the growing human population.

Honey By-Products and Production Trend in Marigat

The honey by-products and production trend for the period 2005 – 2012 as shown in table 1.2. Between the year 2005 and 2008 there was only one larger Baringo District before it was split into Baringo Central and Marigat in the year 2009. Hive products and production trends showed a general decline in the quantity of honey and the quantity of beeswax harvested in kilograms despite the increase in per unit price per kilogram of honey as shown in table 1.2. From table 1.2 it is evident that honey production declined by 235,100 Kilograms in 2008 compared with the production of 2005 (100 per cent) a growth rate of -37.82 per cent to 62.18 per cent.

Table 1.2: Honey by-products and production trends

Year	Honey and By-Product (Kgs)		Unit Price Per Kilogram		Value (KES) (000,000)
	Honey	Beeswax	Honey	Beeswax	
2005	378100	85	87	-	32.89
2006	320000	40	89	-	28.61
2007	220000	10	90	-	19.80
2008	143000	25	95	-	13.59
2009	17675	20	100	150	1.76
2010	17070	-	130	150	2.21
2011	16000	-	300	150	4.80
2012	30000	20	300	150	9.00

Production from 2005 to 2008 refers total output for the larger Baringo District and from 2009 to 2012 relates to production from Marigat Sub County

Source: GoK (2013)

Further in the period 2009 - 2012 Marigat was a distinct sub district on its own with hive products and production trends showing a general increase of 12,325 kilograms (30000 – 17675) in the quantity of honey harvested, a 69.73 per cent increase. This was attributed to increased unit price per kilogram as shown in table 1.2.

Occupation Rates of Bee Hives in Marigat, Baringo County.

Table 1.3 shows the occupation rates of bee hives in Marigat. The occupation rates in table 1.3 showed that for all categories of hives that farmers had in the field were occupied to the levels indicated which was less than 100% and the quantity of honey in kilograms per hive harvested twice a year. The Langstroth hives are paired.

Table 1.3 Bees Occupation Rates in Marigat.

Type of hive	Occupation rate	Quantity (kg)	Two seasons p.a.
Log hive	70%	8kg/per hive	2
KTBH	20%	18kg/per hive	2
Langstroth	6%	10kg/per hive * 2 hives	2

Source: Researcher, 2010

II. CONCEPT OF BEEKEEPING AND HONEY PRODUCTION

Croft (2007) stated that beekeeping is the maintenance of honey bee colonies, commonly in hives, by farmers. A fixed comb hive is a hive in which the combs cannot be removed or manipulated for management or harvesting without permanently damaging the comb. Almost any hollow structure can be used for this purpose, such as a log gum, skep or a clay pot (Tucak *et al.*, 2004). Fixed comb hives are no longer in common use in most places, and are illegal in some places

that require inspection for pest and disease problems such as varroa and American foulbrood (Gamez *et al.*, 2004).

A growing number of amateur beekeepers are adopting various top-bar hives similar to the type commonly found in Africa. Top bar hives were originally used as a traditional beekeeping method in Greece and Vietnam. These have no frames and the honey-filled comb is not returned to the hive after extraction like it is in the Langstroth hive. Because of this, production of honey is likely to be somewhat less than that of a Langstroth hive. Top bar hives are mostly kept by

people who are more interested in having bees in their garden than in honey production (Croft, 2007).

Some of the well known top-bar hives are the Kenyan Top Bar Hive (KTBH) with sloping sides, the Tanzanian Top Bar Hive, which has straight sides and the Vertical Top Bar Hives such as the Warre or "People's Hive" designed by Abbe Warre in the mid 1900's. Top-bar hives offer some advantages in interacting with the bees and the amount of weight that must be lifted is greatly reduced because of the hollowness in it. Top-bar hives are being widely used in developing countries in Africa and Asia as a result of the 'Bees for Development' program. There are a growing number of beekeepers in the U.S using various top-bar hives (Logan, 1990).

There is a current movement that eschews chemicals in beekeeping and believes that health issues in bees can most effectively be addressed by reversing trends that disrespect the needs of the bees themselves; Crop spraying, unnatural conditions in which bees are moved thousands of miles to pollinate commercial crops, frequent opening of the hive for inspection, artificial insemination of queens, routine medication and sugar water feeding are all thought to contribute to a general weakening of the constitution of the honey bee, (Logan, 1990).

Practitioners of 'natural beekeeping' tend to use variations of the top-bar hive, which is a simple design that retains the concept of movable comb without the use of frames or foundation. The horizontal top-bar hive, as championed by Hardison *et al.*, (2007), can be seen as a modernization of hollow log hives, with the addition of wooden bars of specific width from which bees hang their combs. Its widespread adoption in recent years can be attributed to the publication in 2007 of *The Barefoot Beekeeper* by Cicek *et al.*, (1993), which challenged many aspects of modern beekeeping and offered the horizontal top-bar hive as a viable alternative to the ubiquitous Langstroth-style movable-frame hive, (Croft, 2007).

Natural beekeeping is characterized by a willingness to hand most of the control to the bees themselves, and to minimize interference in their hives. Practitioners expect to take honey only when the bees needs have first been taken care of, and the feeding of sugar is discouraged except as an emergency measure. In the United States, the Langstroth hive is commonly used. The Langstroth was the first successful top-opened hive with movable frames, and other designs of hive have been based on it. Langstroth hive was, however, a descendant of Jan Dzierzon's Polish hive designs. In the United Kingdom, the most common type of hive is the British National Hive, which can hold Hoffman, British Standard or popular Manley frames, but it is not unusual to see some other sorts of hive (Langstroth, 1853). Straw skep, bee gums, and unframed box hives are now unlawful in most US states, as the comb and brood cannot be inspected for diseases, (Croft, 2007).

Langstroth hives are known to beekeepers and laymen alike as the box shaped structures so often seen in apiaries. The design was invented in the early 1800s by a Presbyterian minister named L.L. Langstroth and constituted a stroke of genius that revolutionized beekeeping. A Langstroth hive is made up of stacking boxes called "supers," with about 10 frames in each box. The thin wooden frames hold sheets of machine-pressed beeswax or beeswax-coated plastic, called "foundation," upon which the bees build honeycombs. The supers are where the bees make honey in the spring and summer. These boxes are removed and stored off the hive during the winter (Jodha, 1993).

The bottom one or two boxes are called the "brood nest" and contain honey, pollen and the brood, or larval bees. Eggs are laid in the hexagonal cells by the queen. The eggs then hatch into larvae, which are fed by their adult sisters. The larvae eventually spin cocoons and hatch out as adults in this part of the hive.

This hive is now gaining popularity in a number of different countries but it is not expected to replace the versatile frame hive, particularly when the hives have to be moved to different areas either for the bees to collect nectar for honey production from a different source, or when the hives have to be moved for the bees to pollinate the flowers of different crops such as granadillas, sunflowers and cashew nuts.

The KTBH was developed, as its name implies, in Kenya by Patterson in the 1970's – over 100 years after Langstroth started constructing bee hives with bee spaces and moveable combs. It can be seen as an extension of the Greek Basket Top-bar moveable comb hive theme but it is much easier for the beekeeper to use than the basket hive and it is just as acceptable to the bees.

The combs are built by the bees to fit the shape of the hive body and they are seldom firmly attached to the sloping sides of the hive even when heavy with honey. The bees use a number of adjacent combs for brood rearing. These combs have a fairly small crown of honey above the brood with some cells containing stored pollen between the brood and the honey crown. With a little bit of manipulation (moving) of top-bars with combs attached, it is quite easy to induce the bees to fill some combs completely with honey only – this makes cropping the honey easy – and to have the bees use other combs mostly for brood rearing, (Jodha, 1993). The dimensions of the KTBH can be varied to suit circumstances. For example they can be made longer to accommodate more top-bars and combs where big crops of honey are expected. Experience of beekeeping in a particular area indicated if hives are of a suitable size for the bees and the conditions in a particular area. None of the dimensions of the hive body are critical although it should have a reasonable slope to the sides to minimize the attachment of the combs to the sides, (Muzaffar, 1992).

The top-bar hives need only to be thick enough so that they do not bend with the weight of honey on them. They must,

however, be of the correct width to meet the requirements of the bees which are to occupy the hives, (Koirala, 1997).

Modern business environment requires innovation and entrepreneurial spirit, particularly concerning marketing. These characteristics are perhaps not so critical within the regional sector where the market perception of the primary hive products is one of 'all natural and wholesome', with curative and rejuvenative attributes. With an increasing number of 'health and natural' products on the market and more aggressive marketing by the manufacturers of those products, there were more options for the consumers (ICIMOD, 1998).

New exotic pests, parasitic mite infestation, primary and secondary diseases and viral diseases and viruses associated with mite infestation, and Africanized honeybees are all relatively new to the region. The phenomenal spread of mite infestation and associated secondary diseases and viruses since 1994 has had a significant negative impact on the sector (Collins and Solomon, 1999). While the spread of Africanized honeybees has been much more contained, the impact has been no less traumatic in areas where those bees can now be found. The use of chemicals and pesticides inside hives as part of a treatment regime for disease, viruses and pests brings into focus the real possibility of damaging the delicate equilibrium in the colony, as well as the contamination of hive products. This may eventually affect consumer confidence and perception of the 'wholesomeness' of hive products, (Maskey, 1989).

The traditional way of keeping bees is threatened by the presence of mite infestation. Even elsewhere where Langstroth hives are used there are instances where frames, wax foundation and excluders are not treated as standard inputs. There is the need to find the right balance, one that optimizes the benefits of both worlds (traditional and modern), while simultaneously giving recognition to the realities of the prevailing social and economic conditions in Turkey, (ICIMOD, 1998).

Closely related to the issue of local versus modern beekeeping is the question of technology appropriate for the region. The debate on whether the top-bar hive is more appropriate than rectangular frame hives and consequently whether honey should be removed from the comb by pressing as opposed to centrifugal force is very relevant to beekeeping in the region.

There is also debate whether the top-bar hive is more suited for African honey bees than European bees and whether one system is more appropriate for the small-scale beekeeper and another system for commercial beekeepers, (Koirala, 1997).

Finally is the reduction of foraging areas through commercial and residential development, and more stringent requirements for apiary locations necessitated by the arrival, or in anticipation of the arrival, of African honey bees.

Effect of Beehive Technology on Quantity of Honey Produced

A significant amount of resources have been spent over time by the Kenya Agricultural Research Institute (KARI) and her partners to develop technologies to raise the standards of living of the farming communities (KARI, 2000). Despite this, the impact of agricultural technology and information on the livelihoods of rural communities has been low and restricted to certain areas, most commonly the high potential areas. This led to the formation of the Agricultural Technology and Information Response Initiative (ATIRI) within KARI. The program was an option to enhance up-scaling of the adoption of agricultural technologies in order to promote food security, poverty reduction and environmental conservation, (Wardell, 2007).

The ATIRI program enabled a greater number of farmers to access appropriate technologies on demand over a wider geographical span in the country. This empowered farmers in the 'less favoured areas' (the arid and semi-arid lands) to access superior technologies for improved livelihood. Among the technologies widely demanded by farmers in the pastoral areas of Baringo County are those for improving honey production. The Langstroth bee hive, an improvement on the Kenya Top Bar Hive (KTBH), since it has a queen excluder and a super compartment, was highly sought for by the bee keepers. The KTBH is in turn an improvement on the Log Hive in the sense that its internal volume was bigger and it has bars to assist the bees start honey manufacturing more easily, (Wardell, 2007).

The traditional log hive is a hollow tube made from wood with both ends partially closed by timber. Bees could access the hive through any of the myriad holes characterizing the hive. The KTBH consisted of waxed bars suspended inside the box. The wax on the bars provided a foundation from which the bees constructed their combs to hold honey and the brood. The Langstroth is similar to the KTBH and differs mainly in the fact that former has two boxes instead of one. The lower box, brood box is separated from upper box by a queen excluder. In this scenario, the queen is restricted to brood box meaning the super box contained honey free from brood.

The architecture of Langstroth is more preferred by bee keepers since it produced honey with best quality (KARI, 2000). However, it could not match KTBH in honey production and bee colonization; in turn KTBH could not compete with log hive in bee colonization. The main challenge was to come up with a bee hive that could maximize advantages of three types in one unit. There are several possible approaches to improvement of African traditional apiculture. Whichever approach is adopted would need to be holistic and preferably integrated with other rural activities. It should not, however, be highly sophisticated and demanding of advanced technology in early stages.

The use of movable frame hives, for example, might not be advantageous in early stages because of the requirements for prepared hive construction components and precision needed in construction. Instead an intermediate hive of top bar type

might be a more appropriate early stage intervention. Often known as Kenya Top Bar Hive in Africa - because it was first introduced there in 1960s - such hives, of which there are several variations have many advantages of movable frame hives but have a lower capital cost and minimal recurrent costs (Bailey, 2001).

A suggested series of activities in support of improvement of apiculture might be: develop new or rehabilitate infrastructure including bee development centres and extension services; carry out a programme of genetic improvement for more docile bees and superior queens and make these available to producers and potential producers; promote participation of individuals and households especially women in beekeeping by creation of awareness benefits of beekeeping through more focused extension programmes with improved delivery; train extension staff in modern methods of beekeeping and honey

production and in participatory methods of technology transfer; train farmers in modern methods of beekeeping, honey extraction, processing and marketing; organize wherever feasible beekeepers and honey producers in groups and associations in order to strengthen their position vis-à-vis market and provide assistance in marketing; train local small scale tradesmen to construct modern, yet simple hives of top bar type to promote their self sufficiency and make available these hives for purchase by prospective bee keepers; and assist individual beekeepers, producer groups and associations to obtain or gain access to credit for purchase of bees and equipment, (Nkunika, 2002).

Below are examples of different types of bee hives. Figure 2.1 Traditional log hive; Figure 2.2 Improved Traditional log Hive, Figure 2.3 Kenya Top Bar Hive (KTBH) and Figure 2.4 Langstroth Hive.



Figure 2.1 Traditional Log Hive

Source: Kapkuikui farmers in Marigat (2013)

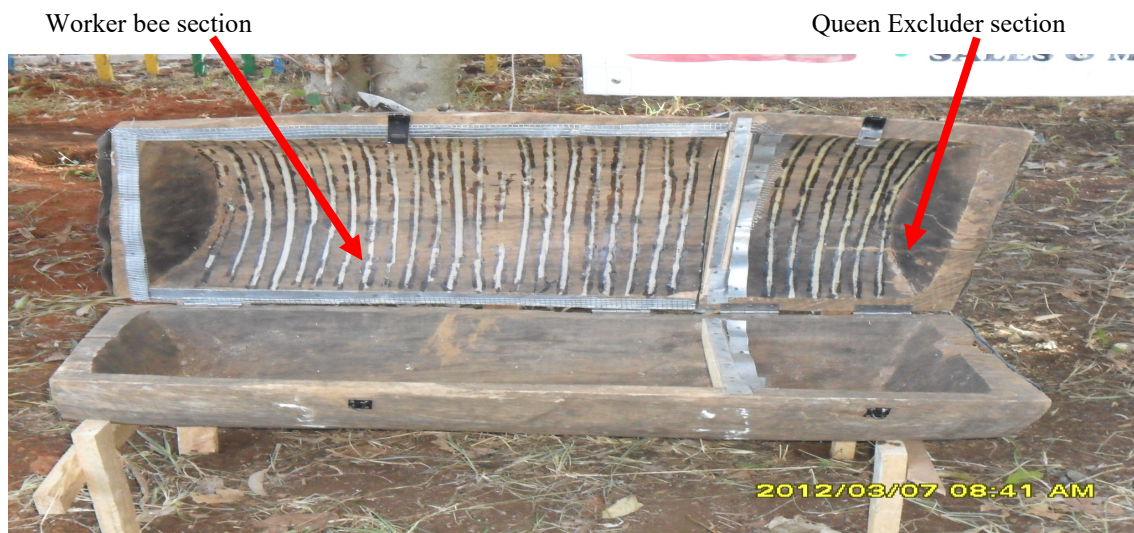


Figure 2.2 Improved Traditional log Hive

Source: KVDA Workshop, Kabarnet



Figure 2.3 Kenya Top Bar Hive (KTBH)

Source: KVDA Workshop-Kabarnet (2012)



Figure 2.4 Langstroth Hives

Source: KVDA Workshop – Kabarnet (2012)

Bee keeping constitutes the line of production that makes up agribusiness. It is also referred to as apiculture. Beekeeping, entails rearing or keeping of bees and aiming at exploiting their products that include honey, pollen grain, propolis and comb. Bee keeping has significant economic importance to both primary and secondary agribusiness. Some areas of significance are good to note.

According to Carter (2004), scientific tests carried out through agricultural research, have shown that, yield of fruit is considerably increased when powerful stock of bee is allowed access to tree. Honey and pollen grain also has significant nutritive value. Arabian travelers during middle age (100-1500AD) used honey in preparation of meals (honey wine) (Lewicki, 1974). The earliest practices of bee keeping was characterized by individuals putting on trees as many as 100 hives, made of straws, in a season, Taylor, (1942). Further improvement was made with use of pots so as to achieve honey separation. Bee keeping also has some constraint facing

it. The use of fire in harvesting in traditional bee keeping usually result in destruction of trees (Crane, 2004). There is also a marked supply deficit of honey given the fact that a great proportion of honey in market is from traditional hive (Ntenga, 2000).

The initial capital required in the establishment of modern bee keeping has hampered efficient honey production (Hilmi, Bradbear and Mejia, 2011). The practice of bee keeping is as old as any other agricultural practice. It has been an alternative source of income to farmers especially in rural communities. Old or traditional bee keeping differs from modern bee keeping in management style. This has influenced output in terms of quality and quantity per annum. Both methods of apiculture are somewhat alternatives since apiculturist or farmer is availed with knowledge of both methods. Apiculture-being an agribusiness enterprise - requires that the most suitable management practice (considering other environmental factor) to maximize output

be applied. It has been found to be profitable with little investment made in it (Gurung, 2005).

This study basically sought to identify social – economic characteristics of bee keepers; determine cost and returns associated with modern bee keeping and traditional bee keeping; examine factors affecting technical efficiency of modern and traditional bee keepings; examine some performance indicators and determinants of the enterprise profit of two practices and identify constraints to profitable bee keeping.

III. CONCLUSION

The new improved technology in terms of Langstroth and Kenya Top Bar Hive is not being adopted by the bee farmers because there is high rate of absconding of it by the bees. Thus, for the new technology to be used in Marigat, it requires grass thatched canopies to provide shelter to the modern hives that leads to low temperatures inside it to enable the bees to stay inside. A further research should be done to improve on the new modern technology that provides cool temperatures to the bees.

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