

**STATUS QUO OF BEEKEEPING IN DRYLAND AREA OF  
MWANGA DISTRICT AS AN ENTRY POINT TOWARDS  
IMPROVED BEEKEEPING INTERVENTION**

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**Abstract**

Beekeeping is among the economic activities with potential to enhance incomes of smallholder households in the light of climate change through diversification with other activities. Smallholder farmers in the dryland areas of Mwangi district have been affected by climate change. The area has great potential for beekeeping based on the fact that it has abundant availability of bee forage plants such as Acacia and other trees species and herb vegetation types. Beekeeping, thus, is one of the sectors on which efforts towards improving life standards of people can put emphasis on. However, before interventions for improved beekeeping can be implemented, understanding of the field realities on beekeeping is imperative. Such knowledge may include issues related to local household beekeeping strategies, challenges facing the sector, and mechanisms for addressing those challenges. In Mwangi district, the practice of beekeeping entailed the use of log-hives and traditional ways of beekeeping such as the use of fire in harvesting honey which can result into forest fires; beekeepers encountered the challenges of theft of honey, lack of appropriate facilities and working gears, and low knowledge on honey production. Also, beekeepers were not organized to deliberate on their interests, instead they operated independent of one another. It was recommended that training should be provided and incentives created so as to promote beekeeping profitably and eco-friendly, and further research is recommended on the market aspects of beekeeping.

**Keywords:** beekeeping, potential, limitation, smallholder farmers.

## 1. Introduction

Potential exists in Tanzania including Mwanza district for enhancing income from beekeeping at country and household levels but this potential is not tapped productively (Prandin et al., 2000). Honey production through beekeeping is below its potential by far, utilizing only 3.5% of the annual production potential which was estimated at 138000 tonnes in 1998. This contradicts National Beekeeping Policy (NBP) whose main objective states that “sustainable development and conservation and management of natural resources will be promoted through beekeeping” (NBP, 1998). Among the barriers towards achieving the policy objective include: use of less productive traditional ways of beekeeping, viewing beekeeping as a secondary activity, and involvement of few people in the beekeeping sector. Also, the complete value chain of honey from production to marketing level is full of shortcomings and challenges in form of poor tools, inadequate production and processing knowledge, and poor handling methods, among others, such that the quantity and quality of produced honey are inadequate (Prandin et al., 2000).

Tanzania has a great potential also in terms of availability of plant resources that provide bees with forage including agrobiodiversity and natural forest and tree biodiversity that can be used optimally to boost honey production among the communities (Prandin et al., 2000; Mpuya and Hausser, 2004). Also, there exist abundant indigenous knowledge systems that have been reported to be useful for establishing a foundation upon which improved beekeeping practices may build not only for development but also as the basis for research on sustainable beekeeping (Kihwele et al., 2001).

In the era wherein the local people are stricken by climate change, especially in dryland areas of Tanzania wherein drought has been exacerbating, beekeeping can become one of the primary activities for ensuring income and food security of the local poor people, and therefore as a potential adaptation strategy to climate change (FAO, undated). Evidence suggests critical climate change stress causing failure of crops farming and in-turn triggering cutting of trees because local people lack alternative livelihoods. However, while tree cutting seemed to provide short term needs to the vulnerable communities, it had long term adverse environmental consequences. As a result, external based beekeeping interventions resulted into change of life of the people because the produced honey was converted into cash which was used to acquire food for households (BNRCC, 2010). For example, PELUM (undated) reports a case wherein the Maasai communities, that traditionally do not practice beekeeping, were incentivised to install

beehives in order to conserve their water troughs which were formerly degraded, and in-turn diversified their incomes from sale of honey. However, on the other hand, beekeeping is likewise stricken by climate change to the extent that even the yield from beekeeping has been declining. Delgado et al. (2002) have observed that contemporary and historical production of honey differs because of changes of temperature and rainfall (climate change) whereby in the present years the yield has gone down but even areas formerly suitable for practicing beekeeping have shrunk. This suggests that while beekeeping is a crucial way poor people may use to enhance their income in the light of climate change, strategies are required to ensure that the sector is also protected from negative impacts of climate change. As such, analysis of status quo of the potential beekeeping areas in various aspects such as the potential vegetation cover, useful indigenous knowledge, existing production/yield and so forth is important before decisions can be made to improve beekeeping among the local communities. This is the rationale for the present study.

Beekeeping through its potential for enhancing the resilience of the local people in the light of climate change may incentivise conservation of the environment because degradation of the latter results into decrease of beekeeping. Research evidences exist wherein beekeepers ensured supply of bees with additional forage through tree planting but also resisted natural vegetation degrading activities such as charcoal burning in their beekeeping site as such activities remove shade shelter for the bees. Also, this experience shows that beekeepers established stone-bunds and dug trenches so as to harvest water to make it available for beekeeping, and installed a fence around beekeeping sites (Berhe et al., 2013). This case implies that while beekeeping enhances the power of people to cope with climate change, to sustain that power, the social actors need to invest efforts in terms of strategies to ensure that that potential is not lost.

Around the global, beekeeping has been observed to have ecological apart from socio-economic benefits. It is an activity that promotes sustainable use of biodiversity among various land use types including forest, agroecosystems and wildlife landscapes. Bees have been observed to enhance long term and cyclical productivity of these biodiversities in various ways. Among these include pollination of plants in these systems thereby promoting flowering of vegetation as a kind of ensuring biodiversity succession from one generation to another. Also, from socio-economic point of view, protection of the forests in these biodiverse systems has been reported to contribute positively to conservation because of restricted access by other destructive forest use such as tremendous charcoal burning and tree cutting. Furthermore, beekeeping has incentivised

people involved in it to participate in the management and conservation process thereby creating economically important interactions between government institutions entrusted with authority of managing these natural systems and local people and in-turn reduce economic and opportunity costs which could be incurred by the state<sup>1</sup>.

Tanzania, Mwanza district inclusive, faces constraints in the development of beekeeping industry at different planning and operational levels from village, district and national scales. At the village level, the following challenges have been observed: inadequate capital to invest in commercial beekeeping, lack of incentives among the local people especially those who are traditionally not beekeepers to engage with beekeeping, lack of credit facilities and extension services, lack of organisation into groups for effective beekeeping, poor beekeeping production technical skills and lack of appropriate knowledge along the complete beekeeping value chain. The main challenges existing at the district level include the lack of capacity in terms of technical skills and financial resources for promoting beekeeping, and lack of operational tools to translate beekeeping policy at implementation level because of low awareness on the national beekeeping policy. At the national level, among the main challenges include low political commitment to raise awareness at the operational level imperative for promoting beekeeping, lack of institutional coordination resulting into double standards and conflicts, and lack of or low priorities in the allocation of funds to promote beekeeping (MNRT, 2004).

Limited studies have been conducted in Tanzania on beekeeping (e.g. Prandin et al., 2000; Mwakatobe and Mlingwa, 2007; Mwakatobe and Mlingwa, undated). The study by Mwakatobe and Mlingwa (undated) explored the market of bee products in ten regions of Tanzania including Kilimajaro region. These scholars focused their analysis on Municipal urban and sub-urban areas, specifically covering hotels, restaurants, supermarkets, general markets, and shops including pharmacy shops. The scholars observed that while there was generally a high awareness about honey amongst the studied institutional actors, the consumption and production of honey was generally low and along the domestic honey production other honey was imported from Kenya, Switzerland, Australia, USA and UK. The authors therefore recommended that there was a need for strengthening production and consumption of honey in Tanzania. Towards that end, we argue, it is important to thoroughly understand the existing potential in-terms of the present and potential honey production levels, the technologies used, the constraints faced, the

<sup>1</sup><http://ftp.fao.org/docrep/fao/012/i0842e/i0842e08.pdf>.

way beekeepers cope with the constraints and so forth in different areas of Tanzania. Such awareness is important for creating a basement upon which improved beekeeping practices may be devised. This is the rationale for this article.

## 2. Methodology

A diverse-methods-approach that combined household survey, observation, focus group discussions, and transect walks along the areas suitable for beekeeping was used in this study. A total of 64 households, 16 each for the four study villages of Kileo, Kiruru, Kirya and Kwakoa were randomly selected for household survey. The observation method was used throughout data collection whereby symbolic languages and responses from the study subjects as well as relevant practices, that took place during the study period, were documented. Focus group discussions were conducted with groups of beekeepers and therefore these were purposively selected to participate in the discussions. While most of the participants were male, female also participated especially those who had inherited beekeeping activities as a legacy from their deceased husbands or parents. Traditionally, in the study area, it was the men who were involved with beekeeping activities. Transect walks were done wherein the sites that traditionally practiced beekeeping were visited and practices which were implemented including the status of beekeeping vegetations were observed. Through a multi-method approach, it was possible to complement and confirm the data collected using different methods. This enhanced the reliability and validity of the collected evidences.

The collected data were analysed using two analytical tools: Statistical package for social science (SPSS) and Content analysis technique. SPSS was used to analyze quantitative data which were collected through household survey using a questionnaire whereas content analysis was used to analyze qualitative data which were collected through observation, focus group discussions, and transect walks. Then, the results were presented using charts and tables.

## 3. Results and discussion

### *Beekeeping practice*

As was introduced previously, for each of the four study villages (Kileo, Kiruru, Kirya and Kwakoa), 16 people were interviewed on beekeeping making a total of 64 interviewed households. Generally, the majority of respondents for each village ( 87.5% for Kileo, 88.3% for



Kwakoa, 75% for Kiruru and 75% for Kirya) did not practice beekeeping as indicated in Figure 1. On the relative terms, more households practiced beekeeping in Kirya village while fewer households practiced this activity in Kwakoa village. However, the differences in beekeeping among these villages cannot be viewed as significant. In keeping with Prandin et al. (2000) while for all the villages there were suitable vegetations for beekeeping, this potential was not optimally tapped. This indicates a discrepancy between objectives of the national beekeeping policy and the practice at the operationalisation level.

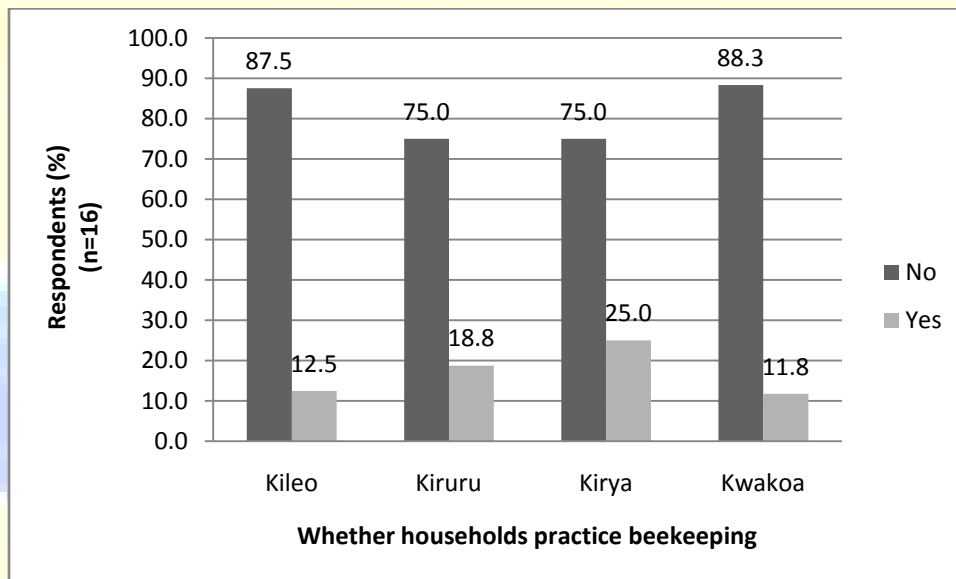


Figure 1: Respondents that practiced beekeeping among the studied households

#### *Rationale for practicing beekeeping*

The results for the rationale for practicing beekeeping are presented in Table 1. The table indicates that people are practicing beekeeping in order to increase their incomes so that they meet other family needs including paying for the school fees for their children and supporting the elderly people in their households. This finding corroborates those presented by BNRCC (2010) on the importance of honey from livelihood point of view. Honey is also used as medicine for various health complications including anaemia (honey mixed with a raw egg or with milk), stomach ache and malaria (a herb locally called *Mwangwi* is mixed with honey), and for treating ulcers, tonsils and pneumonia (boil the leaves of *Mwangwi* or crush its dry leaves and mix with honey). Abeka et al. (2012) had similar findings on the medicinal use of honey and its use as food preservative, thus these authors termed the honey “an asset of the community”. However,

there was a belief in Kwakoa village that if someone eats too much honey his/her bones will break easily but also the bones join easily after breaking. This belief was based on what the respondents had been told by their parents. The respondents were, nonetheless, not sure whether (or not) it was true but suspected that the parents perhaps threatened their children so that they would not eat much honey to allow meeting other socio-economic purposes the honey was intended for. Generally, for all the four studied villages, honey was used as medicine, as sugar and for generating income. Additionally, in Kiruru village honey was used as an ingredient for increasing milk production for the nursing mothers and as a medicine given to a calved cow after parturition whereas in Kwakoa village honey was used as a means of mediating conflicts wherein a tin of honey with a sheep were paid as a fine because of misconduct. Some uses of honey were there in the past but are obsolete today. For example, respondents in Kiruru and Kwakoa villages uncovered that in the past the honey was used as a commodity of exchange (barter trade) with, for example, goats or other commodities.

**Table 1: Rationale for practicing beekeeping**

Objectives for practicing beekeeping	Kileo	Kiruru	Kiry	Kwakoa
To generate income for various needs (pay for education, support elderly parent, etc)	✓	✓	✓	✓
Honey is medicine for human (e.g. if someone is burned, for anaemia, pneumonia, ulcers), mix honey with herbs, with milk, with raw egg, etc.	✓	✓	✓	✓
Pregnant women become energetic when they eat honey			✓	
Nursing mothers produce more milk if they eat honey			✓	
Use of honey as sugar	✓	✓	✓	✓
Use honey with sheep for paying a fine				✓
Can make beeswax from combs				✓
In the past used as a commodity of exchange (barter trade) e.g. with goats		✓		✓
Honey given to the cow that has just calved as medicine			✓	

Note: tick (✓) symbol means the objective is applicable in the specified villages

As was indicated in Figure 1, the majority of the studied households did not practice beekeeping and the reasons are given in Figure 2. The main reasons were: lack of beekeeping gears, lack of enough land, and the fear of bee stings. The lack of beekeeping gears and the fear of bee stings are the interdependent reasons in that if the beekeepers will be provided with beekeeping gears

(e.g. veil, overall coats and boots) the fear of bee stings will not be there anymore as their bodies will be protected from bee stings. These findings agree with those reported by MNRT (2004) that identified the above mentioned challenges as popular constraints facing the beekeeping sector especially at the operational village level. On the other hand, the response that ‘one of reasons for not practicing beekeeping was the lack of enough land’, was somewhat questionable because transect walks indicated that much land area existed with large potential for beekeeping activities although these areas to some degrees have been encroached for establishment of settlements and crops farming. The encroachment of the beekeeping areas was also mentioned during focus group discussions as indicated in Table 2.

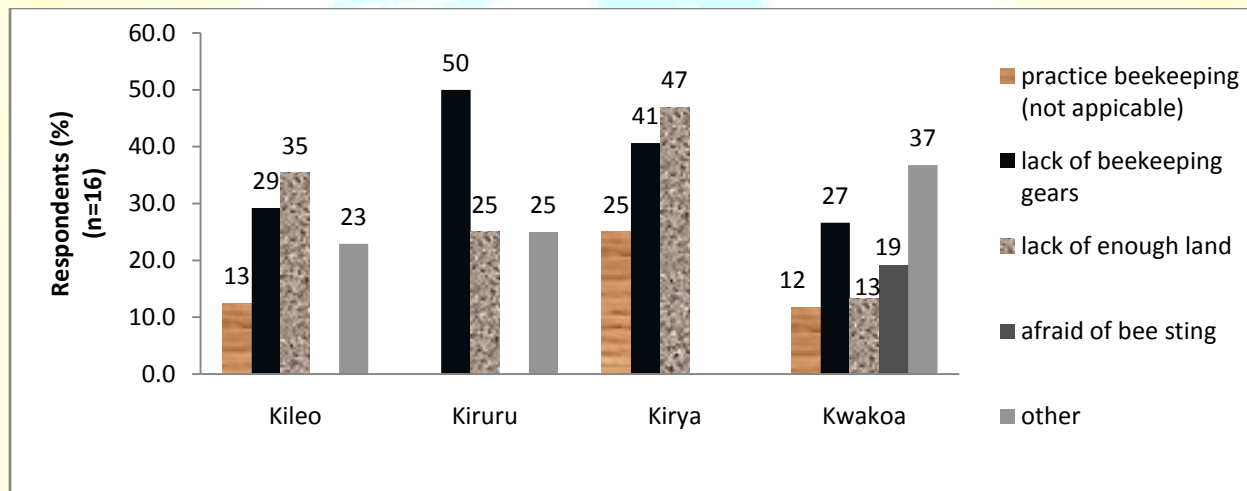


Figure 2: Respondents' rationale for practicing beekeeping

The most commonly used beehives were log-hives wherein out of the 16 households interviewed for each village, those which practiced beekeeping were a quarter (25%) of them in Kirya village, almost one tenth (12.5%) of them in Kiruru village and fewer of them in Kileo (6.3%) and Kwakoa village (5.6%). Fewer of the households in the studied villages used transitional (improved hives) (6.3%) each for Kileo and Kiruru villages and 5.9% for Kwakoa village. Transitional hives are a new technology which had just been introduced in the study area and thus only few households could know and use them. However, still as indicated in Figure 3 only few households practiced beekeeping inline with the findings reported by Prandin et al. (2000). While some households in the study villages practiced beekeeping, the respondents did not have improved honey processing knowledge as indicated in Figure 4. This implies that they sell the honey that was not processed to the best quality in keeping with what Seo and Mendelsohn



(2008) observed. This might be the reason for the lack of good prices for the honey. On average, the honey was sold at the price of Tsh 5,000 to 6,000 per litre (Figure 8). Besides, there was no efficient use of the honey products. Even when honey was harvested, there was no processing of other bee products such as beeswax that could be used as raw materials for other products including candles. There is therefore the potential of increasing income of households involved with beekeeping through efficient use of the raw materials realized from beekeeping. Training on how to make these products could enhance the income of the beekeepers. Presently, the markets for honey are accessed locally (Figure 6), but even at the rural markets, honey was not adequately and sustainably available. This implies that the beekeepers have the opportunity and potential of fetching both local and external markets through promotion of honey production, and involvement in the production of other products such as beeswax. Mwakatobe and Mlingwa (undated) reported that awareness about honey is generally high among the Tanzanians but the shortcoming is on low honey production and consumption.

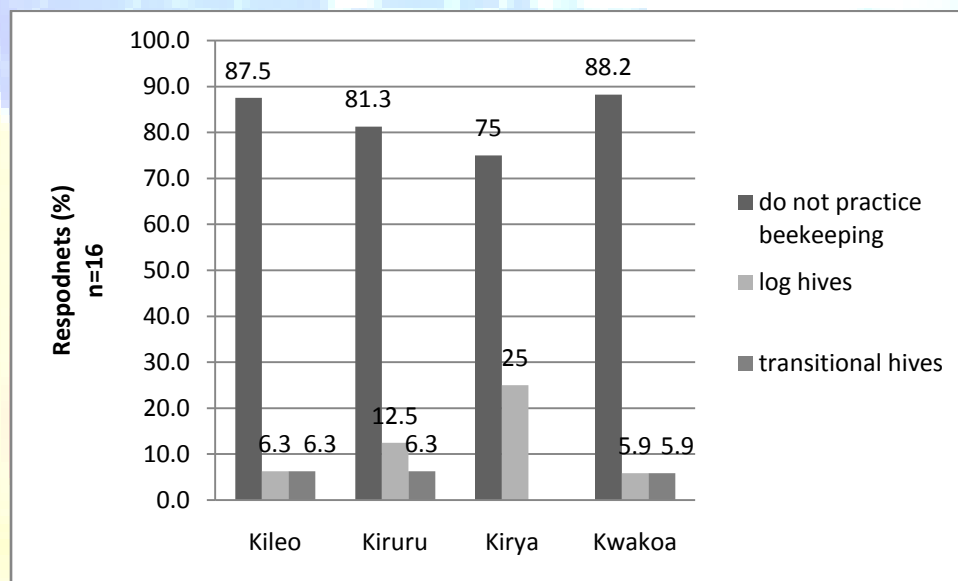


Figure 3: Type of hives used for beekeeping

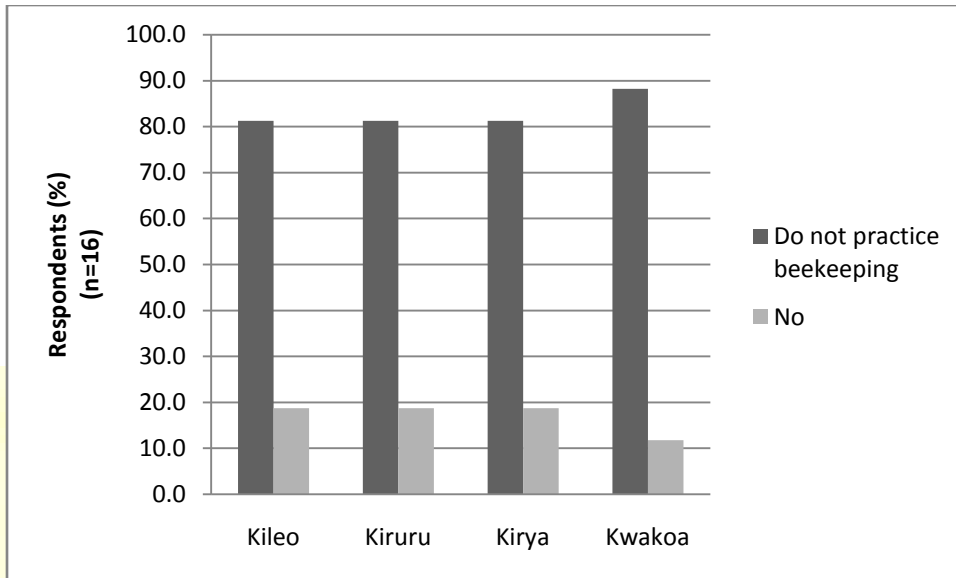


Figure 4: Knowledge for honey processing

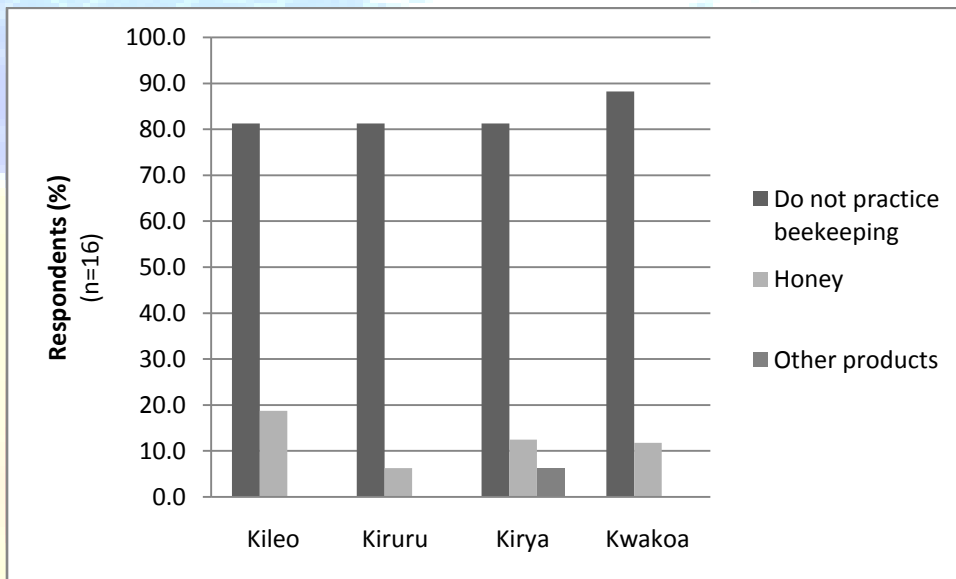


Figure 5: Products realized from beekeeping

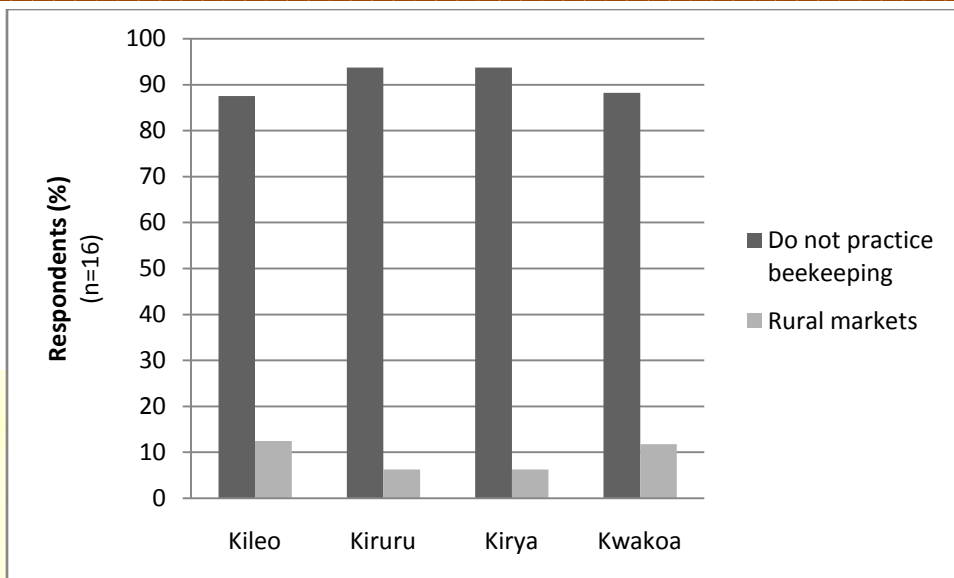


Figure 6: Markets for beekeeping products

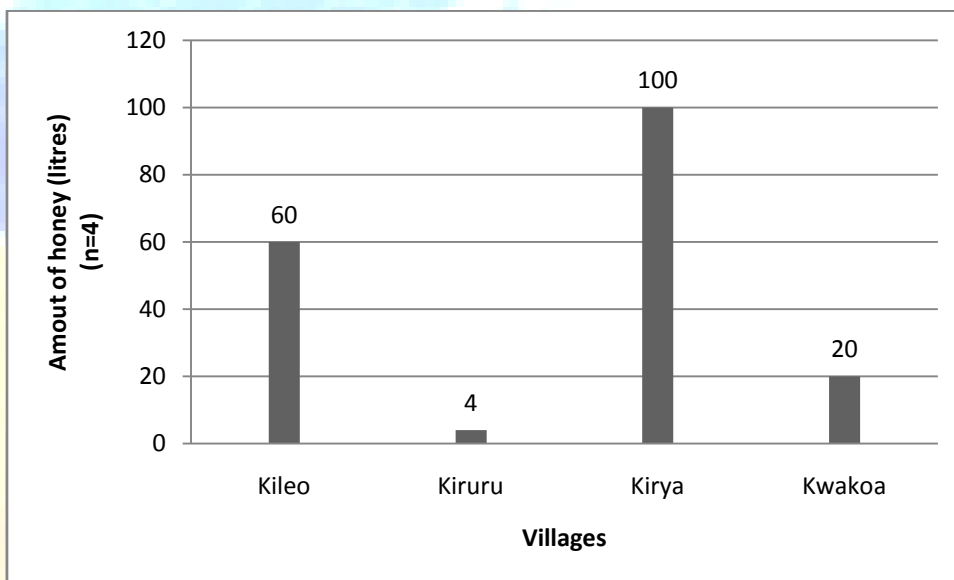


Figure 7: Amount of honey harvested per village

The production of honey at the four studied villages is low (Figure 7). On average, only four households managed to realize honey from beekeeping. However, one household in Kirya village could harvest 100 litres of honey (from 20 log-hives) and another household in Kileo village could harvest 60 litres (from 12 log-hives). Nonetheless, honey production in Kiruru village was low because only four litres could be harvested (from 3 log-hives). While few households were involved with beekeeping, the results indicate that at least for Kwakoa and Kileo villages there was a potential for producing more honey. These findings on low honey realized from beekeeping while high potential exists are in keeping with those reported by Prandin et al.

(2000). On average the price of honey was Tsh 5000 for Kileo village and Tsh 6000 for Kwakoa village.

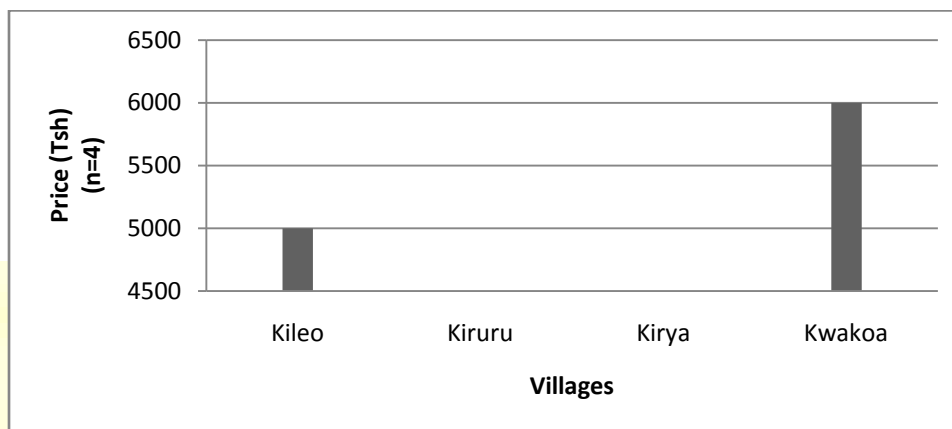


Figure 8: Price of honey per litre

Based on Table 2, some challenges were common for all the studied villages. These included lack of improved beekeeping knowledge; lack of organizational skills; degradation of beekeeping plants because of other human activities such as charcoal burning, settlement establishment, and expansion of crops farms; lack of protective gears; presence of animal pests; killing of bees because of the use of pesticides and insecticides; fire incidences that destroy the hives; breakage of honey combs because of regular trial and error checking of honey in log-hives.

Inadequate beekeeping knowledge was one of the challenges mentioned by beekeepers in all the four study villages. Beekeepers use indigenous ways of beekeeping which they mentioned during the focus group discussions. They usually send their hives for installation in the forest after baiting. Installation is done when bee swarms fly from one place to another usually from July to October. Beekeepers stated that bees from mountains to the valley move during the dry season. The baiting activity starts with first cleaning the hives using a plant locally (in *Pare* language) termed as *lwenye*. The plant is put onto the fire to produce a smoke which smells like honey; then the soot is applied onto the hives. Thereafter, the mixture of beeswax and some herbs is applied onto the hive; this mixture is locally called *lwambi*. Fire is directed towards the *lwambi* for the *lwambi* to melt and flow into the hive which is kept at upright open position. Not all the people were knowledgeable about making the *lwambi* mixture but there were specific clans called *Kingondi*; these made the *lwambi* mixture. In return, the *lwambi* maker takes a goat as his

payment. According to beekeepers, hives treated with *lwambi* will be quickly be occupied by bees vis-à-vis untreated ones. Nonetheless, beekeepers wanted to improve and complement indigenous knowledge with scientific beekeeping knowledge to enhance honey production. Inadequate knowledge is among the challenges at the level of local people and district experts as reported by MNRT (2004) which contributes to suboptimal taping of existing beekeeping potential.

Table 2: Challenges experienced in beekeeping in the study villages

Challenges	Kile o	Kiru ru	Kiry a	Kwakoa
Lack of improved knowledge on beekeeping	✓	✓	✓	✓
Lack of group organizational skills	✓	✓	✓	✓
Hives are rotting	✓			
Women were not given chance to participate in the group	✓			
Lack of unity	✓			
Difficult to manage traditional hives	✓			
Degradation of natural trees suitable for beekeeping as apiary and as bee forage plants	✓	✓	✓	✓
Climate change	✓			
Lack of market for honey products	✓			
Fire destruction of hives and trees where the hives are installed	✓	✓	✓	✓
The pesticides and insecticides kill bees so lead to the lack the bee swarms	✓	✓	✓	✓
Animal pests eat honey and also bring down the hives	✓	✓	✓	✓
Charcoal burning has degraded most of bee trees (e.g. <i>Mgungamawe</i> )				✓
Bee stings because of lack of protective gears	✓	✓	✓	✓
Theft of bee hives and honey		✓	✓	✓
Unreliable rains/water and thus bee swarms are scarce. Swarms vacate the hives because of drought		✓		✓
Children today do not want to practice beekeeping		✓		
People's houses constructed on areas appropriate for installing hives		✓		
Strong winds today on the lowland areas that chase bees away				✓
Breakage of honeycombs because of frequent trial and error checking of honey	✓	✓	✓	✓



Dangerous animals e.g. leopard, because hives are installed far away from the village				✓
Climbing up the tree to install the hives is difficult			✓	
Use of primitive harvesting ways			✓	
Area used for beekeeping turned to crops farming			✓	
Removal of hives because crops farmers complain about possibility of being stung by bees			✓	
Some people bring hives down from trees on which they are installed (Maasai were accused for this)			✓	✓
Decline in honey harvest				✓
Birds make holes in hives which has not been occupied by birds ( <i>kigong'ota</i> ).				✓

Note: tick (✓) symbol means the challenge occurs in the specified villages

Lack of organizational skills was another challenge experienced in beekeeping in the study area. Generally, beekeeping activities were taking place on the individual basis. During the focus group discussions, beekeepers uncovered that they had not thought about working as a group but also they did not have any knowledge about groups as, traditionally, they were used to practicing beekeeping on the individual basis. Also, there were views that because benefits from beekeeping have to go to the individuals, then, beekeeping practice had to follow the same rails. Another reason for operating individually, mentioned by focus group discussants, was the lack of market that demotivated beekeepers to work as a group. While the government and other development actors have been mobilizing organizational building by arguing that working in groups enables easy access to training, market accessibility, easy recognition by the government, easy access to microfinance services, and so forth, such mobilization efforts seemed to have not reached the study area, among beekeepers in particular.

Decrease in bee swarms because of the use of pesticides and insecticides that kill many bees was another challenge unveiled through focus group discussion. This was exemplified by some beekeepers who kept many hives but only few were occupied by bees. For example, one beekeeper in Kwakoa village had 20 log-hives but only five of them had been occupied by bees; another beekeeper had 200 log-hives but only 40 of them had been occupied by bees. However, the lack of bees in the beehives cannot solely be attributable to the decrease in bee swarms' availability. Other factors such as lack of knowledge on how to trap bees into the hives, and the lack of close and regular monitoring of the hives to clean them could explain the non-occupation of some beehives. Through transect survey (especially in Kirya village) it was observed that

some log-hives appeared to have been abandoned. Another challenge mentioned, which to a certain extent is connected with the previous one, is the less honey yield. For example, a beekeeper with 20 log-hives all occupied by bees in Kwakoa village could harvest 20 litres while the capacity of each hive was 10 litres. Prandin et al. (2000) and Nsenga, et al (2004) attribute realisation of small amounts of honey to inadequate knowledge on beekeeping, among other reasons.

Some challenges were specific to certain villages. Unreliable rains/water supply was reported in Kiruru and Kwakoa villages. These are areas that experience drought and do not have irrigation systems. Rains in these villages hardly exceed 600 mm per year. Of the two villages, the Kiruru village is the extreme in terms of the scarcity of water. Beekeepers in the two study villages therefore install their hives a far distance from their households/village centre. This, on the other hand, has made it difficult for them to regularly monitor the progress of their hives against any theft and encroachment.

Table 3: ways used to address the challenges encountered in beekeeping

How coped with challenges	Kile o	Kiru ru	Kiry a	Kwako a
For easy of managing bee hives we should change from log hives (traditional) to improved hives			✓	✓
On the conflicts with Maasai who steal the honey from our hives we cooperate with the government to address this problem. However, some leaders are bribed by the Maasai				✓
Because of drought we have moved our hives to areas with water (close to Kirya Village) and Ruvu river, but we do not go there often because of long distance.		✓		
We are not able to address knowledge based challenges	✓	✓	✓	✓
We can't do anything because honey is stolen at night			✓	✓
Iron sheets to enclose the hives to control drilling birds				✓
When the hole drilling birds enters the hive we close the entrance and direct the heavy smoke towards it and the bird dies through suffocation				✓

Note: tick (✓) symbol means the way for addressing challenges is applicable in the specified village

According to Seo and Mendelsohn (2008) climate change in terms of drought, temperature variations, rainfall fluctuation and wind speed has affected flowering plants which translated into

decreased quantity and quality of bee forage plants and honey yield. However, Abeka et al. (2012) assert that while beekeeping is affected by climate change, social communities have the opportunity of adapting new technologies to counteract the challenge. These scholars presented a case wherein women in Kenya could successfully counteract climate change strike on beekeeping by switching to new improved technologies.

While few respondents (4 out of 64) involved in the household survey practiced beekeeping, the main challenges they faced in beekeeping were lack of knowledge, tools, and improved hives, and insufficient water such that in some more drier areas beekeeping was not feasible (Figure 9). These confirmed the responses given through focus group discussions but are also in agreement with findings reported in other studies (e.g. Prandin et al, 2000; MNRT, 2004)

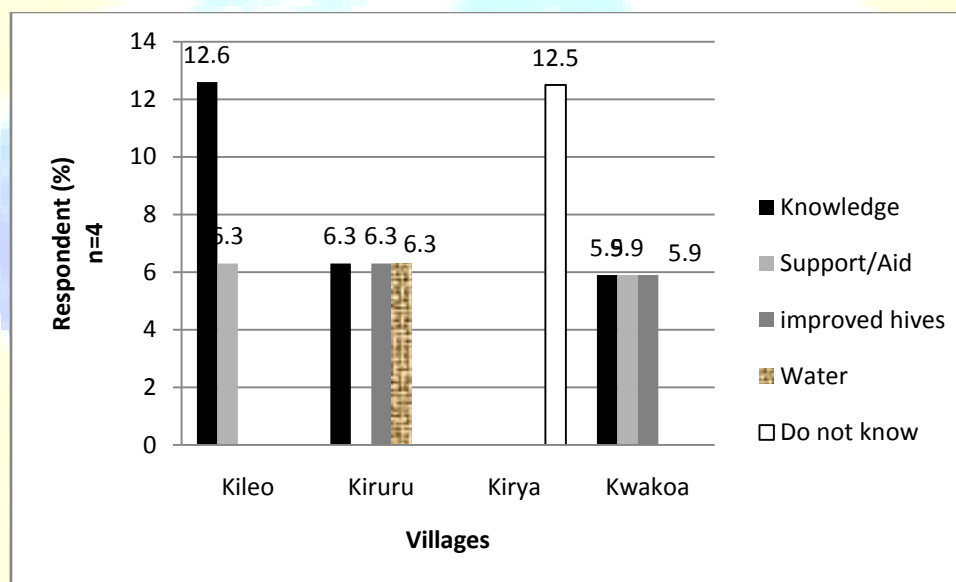


Figure 9: Constraints of beekeeping in the study villages

#### 4. Conclusion

- The popular reasons for practicing beekeeping were: to generate income for various needs (pay for education, support elderly parent, etc); to use honey as medicine for human (e.g. apply on burned body area, and for treating anaemia, pneumonia, and ulcers) by mixing it with herbs, or milk, or with raw egg, etc; and use of honey as sugar for tea.
- Common challenges experienced in beekeeping in the study area were: lack of improved knowledge on beekeeping, lack of group organizational skills, degradation of natural trees suitable for beekeeping as apiary and as bee forage plants, fire destruction of hives and trees

where the hives were installed, the pesticides and insecticides kill bees so lead to the lack the bee swarms, animal pests eat honey and also bring down the hives, bee stings because of lack of protective gears, theft of bee hives and honey, and breakage of honeycombs because of frequent trial and error checking of honey.

- For keeping the experienced challenges under their control, beekeepers suggested the following measures: changing from traditional hives (log-hives) to the improved hives (e.g. Tanzania Transitional Hives); moving the hives to distant areas not easily accessed by people, which, nonetheless, makes it impossible to do monitoring of the hives regularly; using smoke to direct towards the drilling bird to kill it by suffocation, as well as using iron sheets to encircle around the hives so that they cannot be drilled by the bird. However, for some challenges, beekeepers seemed to have no solution such as theft of honey from beehives by some people because this occurred at night. Also, the beekeepers could not address knowledge based challenges.

## 5. Recommendation

Beekeepers should to be trained on improved beekeeping including the use of appropriate beehives and beekeeping gears, and planting bee plants in beekeeping sites in order to enhance the production of honey, but also on processing and hygienic honey handling and straining, to ensure the quality of the honey and honey by-products.

Also, beekeepers need to be mobilized to form groups so that they could use the groups as instruments for knowledge sharing, and as tools through which they can access training and credits from financial institutions because such services are rarely provided to individuals. But also, there should be a point of departure between what has to be organized using a group approach vis-à-vis what should be organized at private or individual level.

Further research is required on, among others, the marketing aspects of beekeeping so that to determine modalities for incentivizing smallholder beekeepers to participate more in beekeeping and hence improve their income and conserve the environment.

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