COLLEGE OF AGRICULTURE AND NATURAL RESOURCE

DEPARTMENT OF ANIMAL PRODUCTION AND TECHNOLOGY

ASSESSMENT ON BEEKEEPING PRACTICES, PRODUCTION POTENTIAL AND CHALLENGES OF BEE KEEPING AMONG BEEKEEPERS IN SELECTED KEBELES OF CHEHA WOREDA.

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Assessment on Beekeeping Practices, Production Potential and Challenges of Among Beekeepers in Selected Kebeles of Cheha Woreda.

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ABSTRACT

The study was carried out in three selected districts of Wolkite Zone of southern Nation nationality and people's regional state, Sisnemate, Adoshe and Werdene districts which are found in cheha District. The objective of the study was to access production systems, opportunities and constraints of beekeeping in the study districts. Beekeeping is a long-standing practice in the study districts and appears as ancient history of the country as a whole. A total of 60 respondents with differing number from each area were selected randomly based.. The selected respondents were interviewed using pre-tested semi-structured questionnaire and single visit multiple-subject formal survey method was used to collect the data. The data collected was analyzed using descriptive statistics using Statistical Package for the Social Sciences (SPSS) version 20. The results of the household survey showed that the majority of the hives owned by the bee keepers were traditional, followed by modern and lastly transitional bee hives. The majority (70%) of the respondents started beekeeping by catching swarms. Honey was harvested twice a year from May to June and from September to November. The survey result also indicated that beekeeping has a huge number of constraints that hinder honey bee production and profitability. The major constraints are shortage of bee forage, pests and predators, death of colony, swarming; and others respectively. Lack of bee forage associated with deforestation was the main problem, and it was ranks first among all the constraints. The major pests and predators are ants, rats, beetles wax moth, bee lice, spiders, birds, lizards, snakes, etc. The respondents indicated that, they had interest to improve beekeeping practices in the area. So, the government and nongovernmental organizations (NGOs) should support them by providing training on how to manage honey bee flora, and providing modern honey bee equipment to enhance the honey productivity in the study area.

***KEY WORDS**: Beekeeping; Constraints; Opportunities.*

ABBREVIATIONS

GO	Government Organization
HHs	House Holds
KTBH	Kenya Top-Bar Hive
NGOs)	Non-Government Organizations
SNNPRS	Southern Nation Nationality and People's Regional State
SPSS	Statistical Package for the Social Sciences
TTBH	Tanzania Top Bar Hive

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1. Introduction

1.1. Background

Ethiopia is endowed with diverse and unique flowering plants thus making it highly suitable for sustaining large number of honeybee colonies and long established beekeeping practices. In Ethiopia, the land is not only favorable to bees, but also for different kinds of honeybee pest and predators (Desalegn, 2001). Beekeeping is exceptionally sustainable as the activity has no impact on the environment and rather it stabilize fragile area and help in reclaiming degraded lands and increase biodiversity (Adgaba *et al.,*2014). The presence of good climatic conditions and diversified bee flora contributed for the existence of about five million honeys bee colonies in Ethiopia (CSA, 2013/14). The country is the largest honey producer in Africa and 10th largest honey producer in the world (Rivera *et al*., 2007). Ethiopia has the potential to produce high amount of honey per year, but currently production is limited to 48.71 million kilograms of which the greater portion is harvested from traditional hives (CSA, 2014/15). Despite the long tradition of beekeeping in Ethiopia, having the highest bee density and being the leading honey producer as well as one of the largest beeswax exporting countries in Africa, the products obtained from the subsector were still low as compared to the potential of the country (Edessa, 2005).

In Ethiopia, there are about 10 million bee colonies and over 800 identified honey source plants (Kebede et al. 2011). Out of the total colonies, about 5 million are hived. Currently, most of the honey produced in Ethiopia comes from traditional beehives. There are an estimated 5.15 million hives in Ethiopia, which are almost all entirely maintained according to traditional methods. These hives are managed by approximately 1.4-1.7 million farm households, who are keeping bees as a means of additional income generation (Paulos, 2012). Traditional beehives make up 95.57 percent of the total quantity of beehives in Ethiopia, while the percentage of transitional (Kenya top bar) and modern beehives are 1.63 percent (81,596) and 2.8 percent (139,682), respectively (CSA 2012a).). However, beekeeping has been considered as a supplementary activity and traditionally managed, while its potential as source of smallholder income has been underutilized for many years (Melaku, et al. 2008; Kerealem et al. 2009). The supplementary role of beekeeping to household economy had even been declining. Beekeeping activities in Ethiopia mainly constrained by inability in the transformation, promotion, scaling up to rapid growth, lack

of commercial beekeeping development and beekeeping technology, limited credit supply, quality issue, lack of market access and information transmissions (Ayalew Kassaye, 2008). These related and interrelated problems limit the country from getting the potential benefit from the sub-sector.

1.2.Statement of the Problem

Bee keeping is practiced in almost all zones and special Woredas in the SNNPRS. It has the potential for developments through the establishment of small and medium industries. The region has suitable environmental conditions, flora and fauna for bee colony and production of honey (SNNPRS, 2008). Productivity of honey bees in Ethiopia is negatively affected due to the traditional way of bee keeping/rearing, poor management practices, extensive use of unimproved types of hives, lack of interest as well as limited knowledge of the farmers (Gezahegne, 2001b). The above mentioned problems were not so far properly addressed and the problems still exist throughout the country including Guraghe zone. Building up knowledge regarding the current beekeeping practices, production potential and challenges of bee keeping will assist in future interventions in the sector. Therefore this study will be conducted considering the above mentioned factors with the following objectives.

1.3. Objectives

1.3.1 General objective

- To assess beekeeping practices, production, potential and Challenges in selected kebeles of Cheha woreda.

1.3.2. Specific objectives

- To assess the types of beekeeping practices in the study area
- To assess the major challenges of honey bee production practices of the study area
- ➢To assess honey production potential of the study area

1.4 Significance of the study

The outcome of this study will used to knowbeekeeping practices, production potential and challenges (constraints) of beekeeping in the study area, Besides, the information generated will help the beekeeper to take their own measurement on management practices to their honey bee.

The information generated will helping the society to be aware of the challenges of honey bee production. Hoping that the findings of the study was sound enough in addressing the problems of the study areas and it provides a base line data to complement the decision making process ultimately to improve future management practice.

1.5. Research Questions

1. What are the types of beekeeping practices in the study area?
2. What are the major challenges of beekeeping in the study area?
3. What is the honey production potential of the study area?

1.6. Scope and Limitations of the Study

The study was focused on production practices, production potential, and production constraints by sampling beekeeper farmers from three locations (kebeles) in the study area due to limitations associated with time, resource constraints and infrastructure. In this regard, the results cannot be representative of the whole district or the entire country due to the small size of sample. Most of the data collected were based on the recall ability of the respondents who may not have given very accurate information due to most of them illiteracies. However, the recommendations may as well be applicable in other areas having similar ecological and socio-economic characteristics.

2.LITERATURE REVIEW

2.1. Beekeeping practice in Ethiopia.

The study conducted in Kaffa, Sheka and Bench-Maji Zones of Ethiopia by Adeday et al. (2012) and Tesfaye et al. (2017) who state Beekeeping practice in Bale Zone indicated that the beekeeping practice is undertaken by three types of bee hives, traditional, intermediate and Zander model box hives and also according to Malede et al. (2015), depending on their level of economic status, three type of bee hives been have used by the sample beekeeper farmers around Gonder area. These were traditional, top bar (transitional) and movable frame (modern) bee hives. According to Holeta Bee Research Centre (2004), there are four different types of beekeeping practices in Ethiopia namely, traditional forest, traditional backyard, transitional and improved beekeeping.

2.1.1 Traditional forest beekeeping practice in Ethiopia.

Traditional beekeeping is the oldest and the richest practice, which has been carried out by the people for thousands of years. Several million bee colonies are managed with the same old traditional beekeeping methods in almost all parts of the country (Fichtl and Admasua 1994). Traditional beekeeping is of two types: forest beekeeping and backyard beekeeping. In some places, especially in the western and southern parts of the country, traditional forest beekeeping by hanging a number of traditional hives on trees is widely practiced .In the other most parts of the country, backyard beekeeping with relatively better management is the common and dominant type of beekeeping (Nuru Adgaba, 2002; Gallmann and Thomas, 2012). It is placing of hives in the forest on very tall trees for catching swarms. It is commonly exercised in forestcovered areas of the country where the population of honeybees are abundant. The advantage of forest beekeeping is that the bees do not cause harm to the domestic animals and humans and the bees can get abundant forage plants in their vicinity. Its disadvantages are lack of close follow up and during honey harvesting period as the beekeeper drops down the hive from the tree, it damages the honeybee colony. It is also dangerous for the beekeeper to climb tall tree in night (HBRC, 2004). According the survey Conducted by Tesfaye et al. (2017) in Bale Zone until now traditional beekeeping is practiced in two forms, traditional forest beekeeping which is

practiced in forest by hanging beehives on long trees and with no management given for bees and bee products.

2.1.2 Traditional backyard beekeeping practice

It is undertaken in safeguarded area for honeybees mostly at homestead. The advantages of such practices are: construction is very simple, It does not require improved beekeeping equipment; it does not also require skilled manpower; whereas its disadvantages are inconvenience to undertake internal inspection and feeding, in some places the size is too small and causes swarming, it has no possibilities of simpering, there is no partition to differentiate brood chamber and honey chamber,(HBRC, 2004) .According to Tesfaye et al. (2017) study conducted in Bale zone states that the second form is traditional back yard beekeeping which is practiced around homestead relatively better management provided to bee colonies as compared to forest beekeeping and traditional beehives was categorized in to three different types; this includes: Log (Bidiru), Mud (Dogogo) and Basket hive type, but all oval in shape with the dimension of around 90 to 100cm in length and a diameter of approximately 30 cm. As information gathered from the respondents, they were plastering interior of hive by mud and cow dung to protect bees from cold weather conditions and external part were covered with grass and bamboo sheath (hoyine) to protect from rain and sun. Malede et al. (2015) indicated that farmers around Gonder area have greater number of traditional hives because they have easily constructed from locally available materials such as clay pots, woven grasses.

Traditional beekeeping is mostly practiced with different types of traditional hives. The most universal type of traditional hives, known to have been in use is simple cylindrical type. Beekeeping started with traditional or fixed comb hives, so called because the combs are attached to the top and sides of the hive itself and the beekeeper cannot easily remove and replace them. In its primitive form, only one end of the hive could be open, but in more advanced forms each end of the cylinder will be fitted with a removable closure.The beekeepers that are experienced and skilful in using these hives could do many operations with less facility. Edessa (2005), Stated that under Ethiopian farmers management condition, the average amount of honey harvested, from a traditional hive on average was reported to be 6.1 kg/hive/year.

2.1.3 Transitional beekeeping practice

It is one of improved methods of beekeeping practices. Thus, as reported by, HBRC (1997) the types of beehives used more frequently in this system is the Kenyan top-bar hives (KTBH), Tanzania top-bar hives (TTBH) and Mud- block hives (MBH). The hives can be constructed from timber, mud or locally available materials. Each hive carries 27-30 top bars on which honeybees attach their combs. The top bars have 3.2cm and 48.3cm width and length, respectively. Currently, intermediate or transitional beehives that are either the Kenyan top bar hives or the locally made "chefeka" hives. According to Workneh Abebe et al. (2008) the honeybees have accepted the Chefeka hive made from locally available materials. According to the CSA (215/16) the current distribution of transitional bee hives in Ethiopia 70,753 and 1.2%. Transitional (intermediate) beekeeping practice has different advantages such as, it can be opened easily and quickly, the bees are guided into building parallel combs by following the line of the top bars, the top bars are easily removable and this enables beekeepers to work fast, the top bars are easier to construct than frames, honeycombs can be removed from the hive for harvesting without disturbing combs containing broods, the hive can be suspended with wires or ropes and this gives protection against pests. Transitional beekeeping has its own disadvantages such as, top bar hives are relatively more expensive than traditional hives, combs suspended from the top bars are more apt to break off than combs which are building within frames, HBCR (2004).

It is a type of beekeeping intermediate between traditional and modern beekeeping methods. Generally, top-bar hive is a single story long box with slopping sidewalls inward toward the bottom (forming an angle of 115Degree with the floor) and covered with bars of fixed width, 32mm for east African honeybees. Jaco (2013) and, Nicola (2009).

Adjare (1990) suggested that for technical and economic reasons, most African countries are not yet in the position to use movable- frame hives, and for them top- bar hive represents a satisfactory compromise. Although movable frame hives are recommended for experienced beekeepers that want to optimize honey production, the Kenya top-bar (KTB) hive has been proved to be most suitable because of its low cost and the fact that the beekeepers or local carpenters can easily construct it. Transitional beekeeping started in Ethiopia since 1976 and the

types of hives used are, Kenya top-bar hive, Tanzania top-bar hive and Mud- block hives. Among these, KTB is widely known and commonly used in many parts of the country. The advantages of KTB over fixed comb hive and movable frame hive is discussed by Nicola (2002 and 2009).

Top-bar hive in an ideal condition can yield about 50kg of honey per year, but under Ethiopian condition, the average amount of crude honey produced would be 7-8kg/hive/ year (Gezaheg, 2001). Based on the study, the only problem for constructing top-bar hive (TBH) by beekeepers were inabilities keeping the specific size of top-bars Due to this problem the hive distribution was very low. However, the productivity is greater than fixed comb hives next to movable frame hives. Top-bar hive has proved to be the most appropriate because of its low cost and the fact that the beekeepers or local carpenters can easily construct it, Kerealem et al, (2009).

Tesfaye et al. (2017) state that in Bale Zone transitional beehive dissemination is very limited and this might be due to poor beekeeping extension services in the study area. The study showed the average transitional bee owning per households were 1.75 which is insignificant as compared to traditional beekeeping practice. However, there is a recent effort by GO (research centre and Bureau of Livestock Health and Marketing) and NGOs in introducing transitional Kenya top bar (KTB) beehives as well as providing training to framers. The training was focused on hand on practices that equip the beekeepers with skill to prepare his own KTB from locally available material to overcome the high cost of investment.

2.1.4. Improved beekeeping practices

Modern beekeeping methods aim to obtain the maximum honey crop, season after season, without harming bees. Modern movable- frame hive consists of precisely made rectangular box hives (hive bodies) superimposed one above the other in a tier. The number of boxes is varied seasonally according to the population size of bees. Later on different countries developed their own movable frame hives (for instance Zander, Dad ant) and Lang troth was the prototype of movable frame hives used today. In many countries Lang troth hive boxes have proved to be convenient for handling and management.

In Ethiopia, about 5 types of movable frame hives were introduced since 1970 HBRC (2004) and the most commonly used are, Zander and Lang troth style hives. Based on the national estimate, the average yield of pure honey from movable frame hive is 15-20kg/year, and the amount of beeswax produced is 1-2% of the honey yield. However, in potential areas, up to 50-60kg harvest has been reported (HBRC, 1997). Movable frame hives allow colony management and use of a higher level of technology, with larger colonies, and can give higher yield and quality honey but are likely require high investment cost and trained man power.

2.2. Beekeeping Production Potential

Major opportunities for bee keeping include: Availability of natural vegetation, weather condition, availability of cultivated crops, availability of honey bee colonies, indigenous beekeepers knowledge and experience, water availability, market demand for bee products (Amsalu, 2004).

2.2.1 Availability of natural vegetation, field crops and water

The presence of natural plant habitat and cultivated crops near and around apiary is a basic for the establishment of apiary. The natural vegetation composed of forest trees, shrub herbs and climbers provide adequate nectar and pollen for the foraging bees. Besides this the natural vegetation, the availability of cultivated crops such as oil crops (Naug and sunflower etc), cereals (Maize and sorghum) and legumes (Bean and pea etc) that supply nectar and pollen for foraging bees has also paramount importance (Nuru,2002).

There are also enough water sources from lakes, rivers, dams and streams used for individual consumption, brood rearing and hive ventilation. Apiculture is deeply rooted in Ethiopian rural life and is basic to many cultural activities. Traditional knowledge by Ethiopian bee keepers and others of their botanical surrounding is large but largely unrecorded (Rein Hard *et al*, 2004).

Vegetation characteristics of the country are considered to be an important indicator for potentialities for beekeeping. Beekeeping is more dependable on ecological suitability of an area than any other livestock production (Nuru, 2002).

2.2.2. Availability of honey bee colonies

Recent study on morph cultures geographical races of Ethiopia by Amsalu et al., (2007) indicated that there are five (5) geographical races (*Apis mellifera jemenitica, Apis mellifera scutellata, Apis mellifera monticola, Apis mellifera bandossi, Apis mellifera woyi-gambella*) of honey bees. The strong bee colonies indicate that the area is very suitable for bee business development.

According to Melaku Girma and ShiffaBallo, (2008), the production of honey bees per traditional bee hive per season ranges from 3 to 7 kg, with on average production of 4.61 kg, honey production from modern hives ranges from 10-15 kg, with on average production of

12.5kg per hives per harvest. The average frequency of honey production is twice a year.

2.2.3. Diverse agro climatic condition

Ethiopia has a potential in beekeeping because of growing of different vegetation and crops which are a good source of nectar and pollen for honey bees in the country Nuru et al (2015). Large and diverse botanical resources combined with suitable climatic conditions make it conducive for the beekeeping business Desalegn, (2015). In Ethiopia, there are about 7000 species of flowering plants upon which the bees feed and collect important raw materials necessary to make honey and other hive products EIAR, (2017). Due to this suitable natural environment, around 10 million honey bee colonies exist in the country CSA (2011/2012). In general, the density of honeybee colonies is more in high biomass areas of the west and northwest parts of the country as compared to the low biomass and moisture stress areas of the eastern region EIAR (2011).

2.3 Challenges of Honey Bee Production

The most important constraints present in Ethiopia were bee forage, pests and predators, beekeeping equipment, absconding, honeybee colony, pesticides and herbicides, death of colony, water shortage, honey storage materials and swarming (Yetimwork et al., 2015 in eastern Zone of Tigray; Haftu and Gezu, 2014 in Hadya Zone of southern Ethiopia). Similarly, Kerealem et al. (2009) declared that the major constraints that affect beekeeping sub-sector in Ethiopia are: lack of beekeeping knowledge, shortage of skills man power, shortage of bee equipments, pests and

predators, pesticide threat, poor infrastructure development, shortage of bee forage and lack of research extension.

A study conducted by Tesfaye and Tesfaye (2007), on honey production system in Adami Tulu to identify opportunities and threats on beekeeping and the results shows that most of the respondents (beekeepers) do not visit their bees regularly. Farmers did not have any type of beekeeping equipments and did not bother about their colonies while harvesting. The place where beekeepers put their beehives also considered as the major constraints. According to the beekeepers of Tigray Region, the critical constraints and problems affecting honey production include inadequate production technologies, limited availability of bee flora mainly due to deforestation, lack of beekeeping knowledge/skill, and marketing accessibility. And farmer's access to trainings is generally poor (Gidey and Mekonen, 2008).

But all these problems may not be constraints to all parts of the country and may not be equally pressing to every place. So it requires characterizing the constraints in their respective places to take an appropriate development measure.

2.3.1. Shortage of Bee Forage:

Beyene and Verschuur (2014) in south west shewa zone of Oromia indicated shortage of bee forage is directly related with deforestation of forest coverage from time to time for timber making, construction, fire wood and expansion of agricultural lands. To solve this problem beekeepers migrating their bee colonies from their area to other area during the dry season for searching bee forage. similarly, Haftu and Gezu (2014) in Hadiya zone southern Ethiopia declared shortage of bee forage was the most serious problem affect bee colony. The elimination of good nectar and pollen producing tree species in many areas make it difficult to maintain bee colonies without feeding (Kerealem et al., 2009). Due to deforestation and poisoning of agrochemicals, the honey bee population is in state of continues declining. As a result, it has become a serious challenge to get honey bee colonies to start and expand beekeeping (Nuru, 2007).

2.3.2 Major honeybee Pests and Predators

The honey bee colony is not immune from predation and it can take a variety of forms, from destruction of a comb by wax moth to physical dismembering of a colony by a hungry black bear. According to Yetimwork et al. (2015) and Adeday et al. (2012) honey badger, ants, wax moth, spider, Journal of Biology, Agriculture and Healthcare www.iiste.org ISSN 2224-3208 (Paper) ISSN 2225-093X (Online) Vol.8, No.13, 2018 75 birds, lizard and snake are identified as pests and predator to the bees in eastern part of Tigray. Similar honeybee pests and predator was reported by in other parts of the country Tessega (2009) in Amhara region, Chala et al. (2012) in Gomma district of Jimma zone, South-west Ethiopia, Nubiyu and Messele (2013) in GamoGofa zone of southern Ethiopia, Tariku and Mechthild (2013) in Sidama Zone, Southern Ethiopia and

Tesfaw (2012) in Ada'a district of east

Shoa Oromia region, Ethiopia. Ants are most disturbing to honey bees and bee keeping sector. Ants causes severe economic loss in honey production by killing bees, rob their products, initiate aggressiveness in bees, lead to absconding and destroying the entire colony of honey bees (Amssalu, and Desalegn, 1999). In Ethiopia ants were the series problem in bee keeping as reported by Awraris et al. (2012) in Keffa, Shako and Bench- Maji zone; Tesfaye and Tesfaye (2007 in Adami Tulu; Etsay and Ayalew (2001) in eastern Tigray. In Tigray, Amhara and SNNP regional states and Gomma district Jimma zone bee keepers ranked ants as first problematic pest insect in honey bees (Amsalu et al., 2010). Bees are the first and most victim of the attack with ants followed by honey (Desalegn, 2007).

2.3.3. Problems of agrochemical

In Ethiopia farmers are producing mainly different horticultural crops and they use chemical spray such as pesticide and herbicide for pesticides and weed controlling it cause bee colonies either die or absconded from their hive (Beyene and Verschuur, 2014). Similarly, Haftu and Gezu (2014) in Hadiya zone southern Ethiopia declared pesticides & herbicides application was serious problem affect bee colony. The chemical spray used by farmers is also destroying bee forage like herbs and shrubs which is used as sources of bee forage. The use of pesticides that kill bees and herbicides are not toxic to bee colonies but destroy many plants that are valuable to

bees as sources of pollen and nectar such as Malathion, sevin, DDT, 2-4 and Acetone(Kerealem et al, 2009). Insecticides have more devastate effect on bee colonies compare to herbicides.

2.3.4. Less availability of technology and beekeeping equipments

Somestudies indicate that the level of beekeeping in the region still remains in traditional system and about 94 to 97 percent of bees are still kept in local hives with its various limitations (Ayalew, 2001). An introduction of improved beekeeping technologies to the rural communities are beyond the buying power of the farmers and not easily available for those who can afford it Most of the local beekeepers lack modern hive and the basic tool that would be needed for private work like bee veil, hand gloves, smoker, chisel, and overall (beekeepers suit) (Desalegn 2001).

3.MATERIALS AND METHODS

3.1 Description of the Study Area

The study was conducted in Cheha woreda, located in Gurage Zone of Southern Nations, Nationalities and Peoples Regional State (SNNPRS), Ethiopia. Imdbir, which is the major town in the woreda is located at a distance of 188 km south of Addis Ababa on the way to Wolkite town, the capital of the Zone. The geographical location of the study area extends from 8° 00'18.9" to 8° 15' 28.53" N and 37° 35' 46.48" to 38° 03' 59.59" E at an elevation ranging from900 to 2812 meters above sea level (m.a.s.l). It has a total area of about 57313.85 ha of which 40190 ha is cultivated. Enemor Ener woreda borders the in the south, Oromiya Region in the west, Ezha Woreda in the east, Gumer and Geta in the southeast, and Wabe River, which separates it from Abeshege, and Kebena in the north. The Woreda constitutes 40 rural kebeles (the lowest administrative unit) of which 39 are rural and 1 rural town. As it was true to the other parts of Ethiopia, rainfall and temperature conditions depend on elevation. The area is characterized by a unimodal rainfall pattern with heavy and erratic distribution. 'Kiremt', the main rainy season, extends from June to September with the peak rainfall occurring during July and August. The short rainy season called 'Belg' stretches from March to May. However, the short rains are highly erratic in nature that farmers do not rely on them for grain production, (Woreda office).

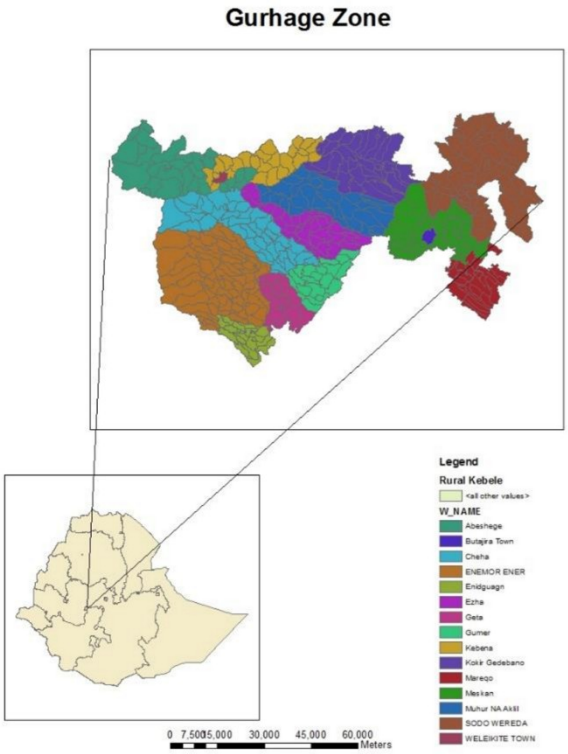

Figure 1. Location of the Study Area

3.2 Data collection and sampling method

The data was collected both from primary and secondary sources in order to get the accurate information about beekeeping practices, production potential andchallenges in the study area. Primary source of data was gathered by interviewing HHs that are involved in live bee keeping by using a semi-structured questionnaire. Semi-structured questionnaire was interviewed by selecting three kebeles purposively based on their beekeeping potential and road accessibility of the study area. Then, the numbers of households/farmers within each kebele was selected based on simple random technique. For this study a total of 60 respondents, of which 20 respondents from each kebele were selected. From this study semi-structured questioner, observation and survey was conducted. In addition to this, data was collected from the discussion held with farmer as a primary data. The secondary data was collected from the woreda agricultural and rural development office by means of different kinds of documents and reports, internet sources, books, different journals and other written materials.

3.3 Method of data analysis

Primary data such as socio-demographic characteristic of respondents, numbers of bee colonies, honey production potential, beekeeping constraints were collected through structured questionnaire. Moreover, ranking of beekeeping constraints was used to identify and prioritize the major beekeeping challenges to beekeeping development in the study district. On the other hand, data collected through interview were analyzed through narration and interpretation. Information about the household characteristics of the sampled beekeepers, types and sources of hive used the swarming and absconding incidences, , attractant materials used to baiting hives, constraints and opportunities and the like were collected through interviews using a semi-structured questionnaire. The generated information was entered into database and analyzed using descriptive statistics such as frequency and percentage were applied by SPSS (SPSS Version 20) the result was presented in the form of table,figure and graphs .

4. RESULTS AND DISCUSSION

3.4 Demographic Characteristic of the Respondents

In the first part of the results, the demographic and social characteristics of the sample respondent households were summarize. Following this, the study addressed the main body of the topic. More specifically, under these subtitles, honey bee production systems, major challenges of honey bee production and major opportunities of honey bee production in the study area were discussed. Demographic characteristic of the respondents with structured questionnaire survey during household survey were presented in the following section.

Gender role: Out of the total respondents, about 90% in the Sisenemate, 85% in the Adoshe and 85% in the Werdene of the beekeeper were males (Table1). In beekeeping women constitute the neglected group in study area. But, the women's share of beekeeping work (cleaning under the hive house, protect from birds and different animals) often exceeds that of men. Her husband's decide how to work it and its advantage.

This may be due to the reduced involvement of the government and non-government organizations in the study area not supporting wisely female house hold headed farmers through beekeeping activity. Consequently, in order to increase the women's motivation in the study area in honey bee production it is important to focus on women's training. This result is similar with the result of Haftu Kebede et al. (2015) which stated that most of the interviewee household heads were male (89%) and the rest were female headed households (11%.).

Of the sampled households, about 30 % in the Sisenemate, 40% in the Adoshe, and 60% in the Werdene were under the age range of 30 to 45, whereas 35% in Sisenemate, 15%in the Adosh and 20% in Werdene were in the age range from 46 to 56 and 15% in the Sisenemate, 10% in the Adoshe and s% in the Werdene were above 65years old, respectively (Table 1).

In this study, the survey result showed that farmers in the most productive age were actively engaged in beekeeping activities. This indicates that in the study area the advantage of beekeeping is known as other agricultural activities such as crop cultivation and livestock husbandry. The result of this study is in agreement with (Haftu and Gezu, 2014) who stated that the majority age of the beekeepers in the study area ranges between 40 to 49 years (37.6%)

Family size: - The beekeepers that have different family size were engaged in beekeeping activity. The minimum and maximum family sizes of the respondents were 2 and 6 respectively (Table 1)

Educational background: - Out of the total respondents interviewed about 61.7 % were illiterate, 28.3% were basic education and 10% of the respondent beekeeper attended grade 1-4 respectively. The remaining (61.7 %) beekeepers were illiterate or who cannot read and write. Therefore in the study area, beekeeping is not considered as a job creation activity on which the active labor force participate as livelihood activity (Table 1).

Table 1. Socio-demographic characteristics of the respondents by percent

Variables	Kebele								
	Sex	Sisnamatie		Adosh		Werden		Over all	
N		20		20		20		60	
		Freq.	Percent (%)	Freq.	Percent (%)	Freq.	Percent (%)	Freq.	Percent (%)
Sex	male	18	90 %	17	85%	17	85%	52	86.7%
	Female	2	10%	3	15%	3	15%	8	13.3%
Age	30-45	6	30%	8	40%	12	60%	26	43.3%
	45-55	7	35%	3	15%	4	20%	14	23.3%
	55-65	4	20%	7	35%	3	15%	14	23.3%
	>65	3	15%	2	10%	1	5%	6	10%
Education level	illiteracy	16	80%	9	45%	12	60%	37	61.7%
	Basic education	3	15%	8	40%	6	30%	17	28.3%
	Grade 1-4	1	5%	3	15%	2	10%	6	10%
Family size	1	0	0	0		0	0	2	3.3%
	2	4	20%	5	25%	2	10%	18	30%
	3	6	30%	8	40%	9	45%	19	31.7%
	4	6	30%	3	15%	5	25%	11	18.3%
	5	3	15%	4	20%	2	10%	9	15%
	6	1	5%	0	0	2	10%	1	1.7%
Marital status	married	17	85%	16	80%	18	90%	51	85%
	widowed	3	15%	4	20%	2	10%	9	15%

Freq. = frequency

4.2. Beekeeping practice in the study area

Beekeeping is not a new activity in Cheha district, and also in the country. In this sub title, beekeeping production system, colony placement, bee flora, water availability, honey harvesting season, beekeeping potential and constraints, activities in the study area have been described. Generally, in the study area, there are three types of beekeeping (traditional, transitional and frame/modern). These systems are therefore explained as follows:

4.2.1. Traditional beekeeping practice

the traditional beekeeping utilizes accessible, cheap and plentiful local materials for hive construction and related issues very easily. These hives are also constructed using the indigenous knowledge among the beekeepers. According to the survey result, the share of honeybee colonies in traditional hives owned by sampled beekeepers were 38.8%, 38.8% and 30.3 % in the Sisenemate, Adoshe and Werdene, respectively out of the 175 hives (Table 2).

Because of the presence of horticultural flowers and diversity of trees, in the Sisenmate and Adoshe and Werdene of the study area beekeepers have number of colonies. This result also revealed that a total of 175 of the colonies owned by respondents are in traditional hives suggesting that it is the dominant beekeeping system in the study area. This is also due to the fact that the construction of the traditional hive do not need accurate measurement and low cost. This result agrees with the result of Haftu Kebede and Gezu Tadesse (2014) who reported that 90.7% of beekeepers own traditional hive. Based on the beekeepers estimate, the productivity of the traditional beekeeping system in the study area is described as follows.

Honeybee colonies in the traditional hives have been found to produce honey with a mean of 5.75±1.62 kg/hive/year in the Sisenmate, 5.68 ±1.8 Kebele in the Adoshe and 6.47 ±1.17 Kebele in the Werdene. Small differences between the areas were due to the practices of supplementation of pollen and nectar substitutes during the dearth periods. Here, differences in the productivity of the bee hives within the same production system could be explained by the reason that different beekeepers do have different colony management practices. Differences

between localities and season were also suggested to bring the productivity differences among the traditional honeybee colonies. Moreover, when the season is dearth the beekeepers managed their bees with extra supplements such as besso, shiro and sugar syrup).

4.2.2. Transitional beekeeping practices

According to the respondents in each of the representative sampled sites; the share of transitional hive was about 29.1%, 33.3% and 37.5% in the Sisenmate, in the Adoshe and in the Werdene, respectively, out of the total of 24 hives (Table 2). In addition to that, in terms of hive productivity, beekeepers explained that they have found a mean of 5.75± 1.62 in the sisenamate, 5.68±1.78 in the Adoshe and 6.47±1.17 in the Werdene, kg/hive year honey with volume of honey ranging from5 kg/hive to 9 kg/hive year. However, honey bee colony absconds from the hive, about days after or do not work well.

The most common causes of absconding mentioned by the respondents were; poor harvesting system, attack of hive by badger and cold season. Due to this reason the majority of the beekeepers didn't harvest honey. Similarly, this could be due to the variations in seasonal management, especially transferring time, technique, and follow ups after transferring do have great effect on adaptability of the colonies to the new hives, differences in vegetation prevailing conditions, and some other factors.

4.2.3. Frame/modern beekeeping practices

In the study area, frame hives were introduced by different non-government organizations (NGOs) and the government and its introduction was greater than the transitional hives. Consequently, the current survey shown that respondents from study area owned a total of 55 hives, 30.9% in the Sisenmate, 29.1% in the Adoshe and 30.9% in the Werdene honeybee colonies in frame hives (Table 2).

Therefore, this could explain different aspects. First, these organizations were using the right training approach to teach and convince some beekeepers to be engaged in frame hive beekeeping because of detailed and practically implemented trainings.

Second, even if the extension is exerting too much effort to train and convince beekeepers to drive them to improved beekeeping, the training package or the training methods or level of teaching skill were not according to the demanding beekeepers. As a result these both have been observed to be implicated in the productivity of the beekeepers using frame hives which ranged from 10– 16kg of honey/hive/year.

Table 2. Types of bee keeping practices

	Sisenamate (N=20)		Adoshe	(N=20	Werdene (N=20)		Over all (N=60)	
variable	frequency	%	frequency	%	frequency	%	frequency	%
Traditional	61	38.8	61	38.8	53	30.3%	175	100%
Intermediate	7	29.1	8	33.3	9	37.5%	24	100%
Movable frame	17	30.9	16	29.1	17	30.9%	55	100%

4.3. Honey Production Trends

According to the interviewed beekeepers and the district bee expert, there are three types of bee hives that the beekeepers use for honey production in the district. The survey result revealed that, the average amount of honey harvested per hive per year in each district from traditional, transitional and modern hive was 3.735kg, 2.43kg and 4.93kg respectively.

Table 3. Mean and standard deviation of the honey yield measuring in the respective Woreda

Type of hive	Sisenmate		Adoshe		Werdene		Overall	
	mean	SD	mean	SD	mean	SD	mean	SD
Traditional	4.4	2.15	3.75	1.2	3	2.7	3.735	1.7
intermediate	2.6	3.3	2.2	0.69	2.55	1.59	2.43	1.28
Movable frame	5.75	1.62	5.68	1.8	6.47	1.17	4.93	1.6

4.4. Sources of Bee Colonies

The study indicated existences of huge indigenous knowledge on practicing beekeeping which might differ from a beekeeper to another and also from one location to another location mostly depending on the beekeepers experience. The survey result indicated that 70% of the beekeepers started beekeeping by catching bee swarms, whereas 21.67% beekeepers gained the honey bee from their parents as a gift, while the remaining 8.33% honey bee colony got from the governments and non-government organization.

This finding agree with Tessega (2009) reports that majority of beekeepers initiated beekeeping through swarm catching in Burie district of Amhara region and Gomma district of Oromia Region, respectively. But it also showed that bee colony selling is uncommon as there were no single respondent beekeepers that started beekeeping through others.

Respondents have also explained that if a person wants to start beekeeping, he/she only need to prepare an appropriate hive then they will have a bigger chance to catch a swarm which has been a common phenomenon in the study area. This result agrees with the result of Haftu Kebede (2015) reported that most respondents 60.3% replied that they have got their colonies by catching swarms and the rest from their parents and others ex NGO and GO. From these results it can be concluded that catching swarm from the environment is the highest source of the honeybee colonies in the study area. (Figure 2)

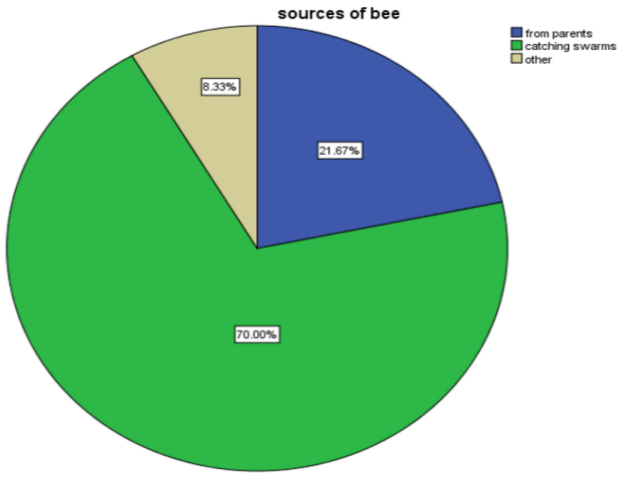

Figure 2. Sources of honey bee colonies

4.4. Placement of Honeybee Colonies

The results of the current study regarding placement of traditional bee hives/colonies, 70%of the beekeepers in warden district kept their bee colonies under backyard of the houses while about 65% the beekeepers from Sisenamate district keep their bee colonies under backyard of the house and, 55 % the beekeeper from Adoshe keep their bee colonies under the backyard of the house.

On the other hand, among the beekeepers owing intermediate bee hives, 66.6% of beekeepers in Sisnamate kept their hive under the shade of the house, and 40% of beekeepers in Adoshe keep their hives at the backyard and 57.14% of bee keepers 'in werden to Keeping honeybee colonies under the eave of the house and at backyard make inspection of colony and other hive managements easier compared with that of "tree apiaries". Degree of hive placement under the backyard and eave of the house in the respective kebeles is indicated the following table. (Table 4)

Table 4. Placement of the hives in the different study area.

Placemat of hive	Sisenamatea			Adoshe			Werden		
	Tra	Inter	mova	Tra	Inter	mova	Tra	Inter	mova
	%	%	%	%	%	%	%	%	%
Under the eaves of house	35	33.3	33.3	45	40	38.89	30	42.85	42.9
Under the backyard	65	66.9	66.6	55	60	61.1	70	57.14	57.1

% = Percent

Tra = Traditional hive

Inter =Intermediate hive

Mova =Movable Frame hive

4.5. Honey bee flora potential and supplementation of bee colonies

Honey bee flora

The respondents grow different types of honey bee flora which serve as pollen, nectar or both pollen and nectar sources, such as shrubs, bushes, cultivated crops, herbs, weeds and some woody plants. Accordingly, all of the respondents indicated that they were growing different bee flora like acacia, wanza, chate, sesbania, and mango. In the same manner, eucalyptus tree (Bahirzaf), vernom (girawa), bedensspp (addeyabeba) and avocado are the major honey bee flora used by bees in the study area. The information collected from the respondents also indicated that even though, there are different types of bee floras in the area during wet seasons, there is shortage of bee flora during the dry seasons. They also indicated that bee forage was found to be declining as compared with the past period due to deforestation and expansion of cultivated lands in the area.

Bee forage types affect the quantity and quality of honey yield obtained per colony. According to the sampled beekeepers, the existence of some special honeybee floras in the study district results in the production of good quality and high-quantity honey and increases the frequency of harvests. The respondents replied that bee forage is highly available, and none of the respondents reported a reduced availability (Table 5).

Table 5. Potential of honeybee flora and supplementation

No	Local or common name of plant	Scientific name	Type of plant	Flowering season	Sources
1	Wanza	*Cordial Africana*	Tree	June-July	Pollen, nectar
2	Bahirzaf	*Eucalyptus Globulus*	Tree	March-April	Pollen, nectar
3	Girawa	*Vernonia Amygdalina*	Shrub	February	Pollen, nectar
4	Addeyabeba	*Bedensspp*	Weed	August-October	Pollen, nectar
5	Avoccado	*Persea Americana*	Cultivated fruit	October-January	Pollen, nectar
6	Khat	*Catha Edulis*	Cultivated shrub	December-February	Pollen, nectar
7	Mango	*MagniferaIndica*	Cultivated fruit	January-Apri	Pollen, nectar
8	Bisana	*Croton Macrosttachy*	tree	Januarymarch	Pollen, nectar
9	Sesbain	*Sesbania Grandiflora*	shrub	Januarymarch	Pollen, nectar

4.6. Farmers attitude towards adoption of new technologies

The small scale farmers in the study area are so eager to access improved technologies. Almost all farmers in the area possess traditional hives with limited number of improved hives. Scientific way of keeping honey bees, and access to improved way of beekeeping was not common in the specific area. They haven't been updated through training and promoted to keep honey bees, rather they had been more following the traditional system of beekeeping which they have inherited from their passed families. Hence introduction of improved honey production technologies, management system and training could make to boost the apiculture production and productivity in the study locality.

4.7. Availability of Beekeeping Equipment

Local equipment such as a smoker, queen catchers, knife and water sprayers were produced by beekeepers in the study area. Among which, smoker (86.67%) and knife (96.67%) were predominately made locally & purchased as compared to other bee equipment. Queen catcher was the least equipment (30%) which can be made by beekeepers. As it was mentioned in the group discussion, some equipment such as casting mold and honey extractor were not made locally. These are either purchased or donated by governments and non-governmental organizations through cooperatives and unions. However, these equipments were not in use because of lack of spare parts and durability related to quality

Table 6. Locally Available Beekeeping Equipment

variable	Home made		Locally made & purchase		Provide on credit		Donated by GO & NGO	
N	F	%	F	%	F	%	F	%
Hive	35	58.33%	10	16.66%	0	0	15	25%
Smoker	3	5 %	52	86.67%	0	0	5	6.33%
Water sprayer	10	16.67%	48	80%	0	0	2	3.3%
Bee brush	50	83.3%	20	33.3%	0	0	0	0
Queen catcher	18	30%	42	70%	0	0	0	0
Queen excluder	0	0	0	0	0	0	24	40%
Chisel	0	0	48	80%	0	0	12	20%
Knife	2	3.335	58	96.67%	0	0	0	0
Honey presser	0		40	66.67%	0	0	20	33.33%
Casting mold	0	0	0	0	0	0	60	100%
Honey extractor	0	0	0	0	0	0	60	100%
Honey container	25	41.67%	35	58.3%	0	0	0	0

4.8. Constraints of Beekeeping in the Study Area

4.8.1. Major constraints of beekeeping

Shortage of bee forage, Honey bee pest's disease and predators, Pesticides and herbicides application, death of colony, absconding, swarming, bad weather and shortage of water were reported to be the major constraints of beekeeping faced by the respondents.

The prevailing honey production constraints in the beekeeping development are important issues to bring solution for the challenge. The interviewed respondents were able to lists the major beekeeping constraints in the district.

4.8.1.1. Shortage of bee forages

Shortage of bee forage was the 1st constraint reported by the respondents particularly during the dry season. Like other living organisms, honeybees need adequate nectar and pollen to survive, reproduce and honey production. Moreover, as the presence of bee forages varied from place to place and all plants are not equally important for bees in supplying both nectar and pollen resources, it should be understood that honey plants are home for bees and provide basic nutritional requirements for the survival and reproduction of honeybees. However, currently, misuse of honey and pollen source plants in the environment through significant deforestation has brought about shortage of bee forages endangering life on earth in general and in the study area in particular. Most of respondent beekeepers do understand shortage of bee forage problem in their respective localities; this problem has been pronounced to be a nationwide most important problem endangering the beekeeping sub sector (Table7).

However, very few beekeepers from each of the sampled in the study area explained that they were working on bee forage development around their apiaries. According to the result of this survey, lack of bee forage associate with deforestation is the main problem. This finding also agrees with Haftu (2014) who declared that shortage of bee forage was the most serious problem negatively affecting bee colony in Hadiya zone southern Ethiopia. The Deforestation of good nectar and pollen producing tree species in many areas was the root cause of the problem. According to the information collected from the respondents, the existence of pests and predators

is seen as a challenge to the honeybees and beekeepers. Pests and predators cause devastating by causing an extensive damage on honeybee colonies.

4.8.1.2. Honeybee pests and predators.

According to the beekeepers perception and experience pests and predators were the 2nd ranked major cause of colony absconding in the study areas. The frequencies of occurrences of pests and predators varied in different areas. The most frequently and widely distributed pests and predators were: ants, spiders, wax moth, lizards, bee lice, birds, and spiders. The other predators and pests which are not as such important were Snakes. Even though, there inappropriate prevention and control methods for honey bee pests and enemies in the country in general and in the study areas in particular, some beekeepers put ashes and burned oil around hives to protect ants, and cleaning spider nets around hives. Beekeepers perceived no prevention and control practices at all for bee-eater birds.

Honeybees are exposed to a broad range of various environmental stressors, which can be having an impact to apiculture. Most beekeepers distinguished the problem of their bee colonies and the time at which this problem occurred. According to the survey of beekeepers, birds, ants, spiders, wax moth, lizards, were identified as the major honeybee pests and predators**.** Beekeepers in the study area used different methods to control those pests and predators. The bee eater birds as a predator of the honeybees and difficult to control have been identified as a serious problem (challenge) for beekeeping in the area. This bee eating bird is sitting on a nearby branch of a tree or a fence and catches the worker bees at the hive entrance. The beekeepers used different methods to control the birds. Such as keeping their apiary in the morning, remove the constant place of the bird if it is around home and destroying the nest of birds. The current data shows that 6th level of beekeepers in the study area reported the problem of pest and predators (Table 7).

4.8.1.3. Misuse of pesticides and herbicides

The use of different agro-chemicals or pesticides is an important and common practice in crop production to fight against most crop damaging pest populations and diseases to produce high quantity of food round the world. However, if they are not used properly (according to their prescription for time of application and dosage), they bring about very crucial damage to pollination fauna (the honeybees in our case), environment and human health. As a result,

reduction in pollinating insect population, quantity and quality reduction in hive products and crop yield reduction are some of the associated risks encountered. As a matter of fact, honeybees visit flowering plants in search of nectar, pollen or both and fly from one plant to another. In this process, the honeybees are foraging on flowering plants on which some agro-chemicals have been applied for different reasons. Moreover, indiscriminate use of pesticides and herbicides has negative effects on the environment and the life of all pollinating insects. Sometimes, the effects of these chemicals on human beings are observable from different points which have been understood also by the local beekeepers. From the result, *teff*, wheat, maize and different horticultural crops were some of the most common crops grown by the farmers in the district whereby they need different agro-chemicals for the control of different plant pests and diseases. Interviewed beekeepers themselves confirmed to use agro-chemicals for different purposes majorly for the control of weeds in their crops.

This observation (affected of honey bee colonies by agro-ecology ,due to the use of agro chemicals on the crops) coupled with our results clearly could elucidate that the local farmers in the study area doesn't have any information of the risks of indiscriminate use of chemicals and/or do not know how to use the chemicals appropriately with minimum damages. We hope, responsible bodies could understand our explanations here so that appropriate intervention shall be in place both from the extension wing and decision makers.

As an option to minimize risks of chemical use on honeybees specifically and pollinating insects and the environment generally, we would like to suggest that extension and research wings should collaborate with local administration bodies in awareness creation among the local farmers including the beekeepers on appropriate use of chemicals only for targets crops. Moreover, some of the possible practical options which could be advised include use of chemicals before flowering, late evening and/or early morning application, appropriate preparation of the chemicals according to their dosage and time of application, closing hive entrance for 1 or 2 days and transporting colonies for very few days away from the chemical application area.

In this case, respondent beekeepers have confirmed that even if they are applying the agro-chemicals in the early morning and late evening, the other crop farmers are applying the

chemicals at any time of the day in general and around the mid-day in particular. We could, therefore, understand here that not only local crop farming farmers but also significant numbers of beekeeping farmers do not know the importance of honeybees other than hive products production.

4.8.1.4. Honeybee diseases

As we know, honeybee diseases are causing a significant effect on the health status and wellbeing of the honeybees. Even if they couldn't identify the common name of the disease and which is, areas of the respondent beekeepers have confirmed the presence of honeybee disease in their apiaries and can be detected once in a while. As the beekeepers respond the sign of the disease such as bees fail to fly, crown on the ground in front of hive, we probably say that these disease called virus. Fortunately, the most important brood and adult bee diseases (like the American and European foul brood diseases and some major viral diseases) nominated as killers of a colony have not been identified in the country in general and in the study area in particular. To know and control the disease from the study area the government should take the measurements such as identifications of the disease, means of transmission, season of prevalence and by what method it controlled.

4.8.1.5. Colony absconding

As one of the major problems in beekeeping, colony absconding was identified by only about 5th rank of the respondent beekeepers (Table7). In addition, they have explained that colony absconding is happening at any time of the year regardless of the hive types because of continues colony disturbances from different factors in which pest infestation is the most common cause. This result is agree with the result of FirisaWoyessa and Dejene Alemu, (2016). reported that The most common causes of absconding mentioned by the respondents were poor harvesting techniques and invasion of hives by badger, spiders, ants, birds, . This was further explained that absconding has been a major problem in traditional hives because of the fact that the hives are not convenient for internal inspection and also in frame hives because of the lack of skill in frame hive colony management. Off course, this has been also a self-explanatory problem happening because the majority of the beekeepers are not inspecting their colonies frequently. This is also because; most local beekeepers believed that opening colonies in any time of the year

will increase absconding which needs to be changed. As a suggestion beekeepers should have always follow their bee hives to know, the colony problem and control it from bee enemies. Seasonal management such as feeding in dearth period, follow after transferring, reducing the space/super, were essential for transitional and frame hives.

Table 7. Major constraints of honey bee production

Constraints	Rank by frequency									Overall rank
	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	
Lack of bee forage	24	15	6	3	7	3	2			1st
Lack of water	10	5	15	6	12	5	3	1		3rd
Drought	3	3	13	18	9	7	4	1		4th
Migration	4	3	2	7	9	13	6	4	2	6th
Absconding	5	8	9	12	19	8	6	1		5th
Pest& predators	7	12	9	6	6	11	4	7	3	2nd
Diseases	2	1	2	3	9	9	15	13	6	**7th**
Pesticides & herbicides application	3	2	5	8	11	9	10	11	1	8th
Death of colony	4	2	1	6	6	7	9	11	13	9th

5.CONCLUSION AND RECOMMENDATIONS

Generally the area is very potential for beekeeping and the majority of the households keep bees. Beekeeping contributes for more than 15% of the total house products used as domestic consumption purpose for the majority of the rural communities in the area. The survey result indicated that 70% of the beekeepers started beekeeping by catching bee swarms, whereas 21.67% beekeepers gained the honey bee from their parents as a gift, while the remaining 8.33% honey bee colony got from the governments and non-government organization. The survey result revealed that, the average amount of honey harvested per hive per year in each district from traditional, transitional and modern hive was 3.735kg, 2.43kg and 4.93kg in mean value respectively. Local equipment such as a smoker, queen catchers, knife and water sprayers were produced by beekeepers in the study area. Among which, smoker (86.67%) and knife (96.67%) were predominately made locally & purchased as compared to other bee equipment. Queen catcher was the least equipment (30%) which can be made by beekeepers.

In the districts, despite the presence of different constraints and challenges, there is a high potential and lots of opportunities to maximize the output of the resource to improve the livelihoods of the communities in a sustainable ways. Different elements of the community involved in beekeeping activities in the study area have varying levels of indigenous knowledge on how to harvest honey successfully without damaging colonies, some also know how to protect their bees from pests like ants using biological control methods. Despite the close proximity of the three districts, improved beekeeping practices are not well assimilated to other areas due to limited support from the scientific community and institutions and as such planned interventions are needed in this regard. Therefore, it requires intervening to change the very old and unimportant traditional beekeeping practices through adopting improved technologies and management practices and practical skill trainings.

Some of the major possible intervention areas are recommended here below:

- Designing effective honeybee pests and predators controlling methods.
- Introduction of full package improved beekeeping technologies with adequate practical skill training on all bee keeping trends and queen rearing practices on which farmers get and enhance a bunch of queens and new colonies without climbing trees to get colonies.

- Promoting beekeepers important indigenous knowledge and promoting the construction of non-timber hives with low costs
- Multiplying areal major honeybee plants in large scale and distributing to farmers of the area in a package form with a respective seasons.
- Avoid discarding of bee colonies after honey harvest: beekeepers of the area should be aware on the possibilities of maintaining their colonies for successive harvesting
- Availing the strategies to support farmers with beekeeping business through credit provision, cooperative formation, input supply and market facilitation should be put in place with value chain approach.
- Improving pre- and post-harvest handling of bee products.
- Improve the utilization of stingless bee's resources: effort should be made how to identify, domesticate, document and utilize stingless bee resources without damaging the colony.

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APPENDI

Questioner

1. Sample questionnaires

Part one: Socio economic and demographic information

1. Name of household head----------

2. Kebele……

3. Sex: A. Male □ B. Female □

4. Age: A, ≤18 □ B, 18-35 □ C, 36-45 □ D, ≥ 46 □

5. Marital status A, single □ B, married □

6. House hold size A, 1-4 □ B, 5-7 □ C, ≥8 □

8. Educational level of households head

A, Illiterates □ B, Grade 1-4 □ C, Grade 5-8 □ D, Grade 9 and above □

9. Land size in hectare A, <0.5 □ B, 0.5-1 □ C, >1 □

Part two: Beekeeping related questions

2.1. Beekeeping Practices

10. What types of production do you practice?

A, traditional hive □ B, Transitional hive C, modern hive □ D, both □

11. In which type you are more advantageous? (A, B, C, D) How?

_____

_____

12. Experience in beekeeping A, ≤5 year's □ B, 6-10 years □ C, ≥11 years □

13. Do you use extension service when under taking the production? A, yes □ B, no □

14. What advantage you get from extension services?

___

15. Do you use credit access for production and expansion? A, yes □ B, no □

16. What are the constraint /problems you face in the production of honey bee?

___

___

17. In what mechanism you solve this problem?

___

___

18. Does your involvement in honey bee production have a contribution on your income?

A, yes □ B, no □

19. In what amount your income increases/decreases?

___

20. For what purpose you use this income?

___

21. What are the factors that affect the adoption of bee keeping?

22. Number of years lived in the area, ----------

24. Do you keep honeybees? A, Yes ---------- B, No ----------

25. If you yes, when did you start beekeeping, ---------- year

26. How you start beekeeping? ----------

27. How many honeybee colonies you owned? ----------

28. Where did you keep your bee colonies?

No.	Site or placement of hive	Traditional	Transitional	Modern
1	Backyard			
2	Under the eaves of the house			
3	Inside the house			
4	hanging on trees near home steady			
5	hanging on trees in forest			
6	other/specify/			

29. For how many years colony remains or stays in the hive?

30. Traditional minimum ------years maximum --------years.

Transitional minimum --------years maximum -------years.

Modern minimum --------years maximum ------years. 29.

Do you have empty bee hives? A, yes B, No If yes, list the no of empty hives you have.

No	Types of beehives	Number	Reasons
1	Traditional		
2	Transitional		
3	Modern		

30. Honey production of yields.

4.1. How many hives?----------.

4.2. How much yields? ----------.

4.3. What type of hives you use? ----------.