



**COLLEGE OF AGRICULTURE AND NATURAL RESOURCE
DEPARTMENT OF ANIMAL PRODUCTION AND TECHNOLOGY**

**PRODUCTION SYSTEMS, OPPORTUNITIES AND CONSTRAINTS OF
BEEKEEPING IN SELECTED KEBELES OF GUMMER WOREDA IN
GURAGHE ZONE, SNNPRS, ETHIOPIA**

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ANIMAL PRODUCTION AND TECHNOLOGY**

BY

1. LOME TADELE.....229/11
2. MEKDELAWIT MANAYE.....239/11
3. MULATU YEMANE.....273/11
4. NEGERO CHARU.....285/11
5. SADIK BEHREDIN.....388/11

ADVISOR - Dr. ZENA KIDANE (PhD).

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APPROVAL SHEET

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Department of Animal Production and Technology

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Submission date: August 2013 E.C.

Advisor: Dr. Zena Kidane (PhD)

Sign _____

Student's declaration: We certify the following conditions of authorship.

We are responsible for the work submitted in this research project and the original work is ourselves.

Students name

Signature

1. Lome Tadele
2. Mekdelawit Manaye
3. Mulatu Yemane
4. Negero Charu
5. Sadik Behredin

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LIST OF ABBREVIATIONS

AMP	Apiculture Master Policy
ANOVA	Analysis of Variance
BoA	Bureau of Agriculture
BoARD	Bureau of Agriculture and Rural Development
CSA	Central Statistical Authority
EARO	Ethiopian Agricultural Research Organization
GDP	Gross Domestic Product
HBRC	Holes Bee Research Center
IBRA	International Bee Research Association
IOS	International Organization for Standardization
KTB	Kenyan Top Bar
Km	Kilometer
Mm	Millimeter
MoARD	Ministry of Agricultural and Rural Development
MoLF	Ministry of Livestock and Fisheries
NGOs	Non-Governmental Organizations
SNV	Netherlands Development Organizations
TTB-	Tanzanian Top Bar
USAID	United States Agency of International Development

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**PRODUCTION SYSTEM, OPPORTUNITIES AND CONSTRAINTS OF BEEKEEPING
IN SELECTED KEBELES OF GUMER WOREDA.GURAGHE ZONE, SNNPRS,
ETHIOPIA**

ABSTRACT

Beekeeping is an important component of agriculture and rural development program of many countries. It provides security in nutrition, economy (for income generation) and ecology. This study was conducted in four purposively selected Kebeles of Gumer Woreda, in Gurague Zone, with the objective of analyzing the major honey bee production systems, opportunities and challenges in these areas. For this study a total of 60 beekeepers were randomly selected from the study areas. The data collected was analyzed; descriptive statistics were employed to analyze the data. As the results of this study indication the sample respondents practice three types of

production systems, traditional hive (67%), transitional hive (5.45%), and modern/frame hive (27.6%). According to the result of this study, the respondents of the study area could harvest twice (61.7%) and once (38.3%) per annum. The productivity of the colony in the three different production systems varies in the three study kebeles. The production system of these areas was dominated by traditional (67%). As a conclusion, the honey bee production system of the study areas has many opportunities for bee keeping in the study areas such as, long standing tradition of bee keeping, marketing access, high demand for honey and bee colonies, availability of water and different honey bee floras. Despite these study areas has been reported to face with different major challenging factors like, pesticide and herbicide application, pests and predators, absconding, beekeeping equipment's and lack of cultivated bee forage with their order of importance. In order to sustain bee keeping activities in the study areas, it is recommended that there should be affordable and appropriate extension service, supply of bee keeping equipment, capacitating to beekeepers (herbicide and pesticide application and pests and predator control mechanisms.

Keywords: *-Bee forage, Constraints, Gumer, Guraghe, Honeybee, Opportunity, Production System*

1. INTRODUCTION

1.1. Background Information

Ethiopia, owing a varied ecological and climatic condition, is home for many diverse plant species that provide surplus nectar and pollen for foraging bees (Girma, 2005). The ideal climatic conditions and diversity of floral resources allow the country to sustain around 6.2 million bee hives (CSA, 2016). Of the total land mass of the country about 71% is suitable for fruit and other crops growth which serve as source forage for the bees and among the 6500 melliferous plant species more than 1500 are identified as bee forage (Demisew, 2010). Ethiopia is the leading producer of honey and beeswax in Africa. In the last 15 years (2001-2015), Ethiopia's honey production increases from 28,000 tons to 54,000 tons (Demisew, 2016). It is also an important integral part of the economic activity that created job opportunity to more than 3 million people (CSA, 2017).

Despite the long tradition of beekeeping in Ethiopia, the productivity has never been proportionating with the country's potential for beekeeping (Chala *et al.*, 2013). Low productivity has always been leading to low utilization of hive products domestically, and relatively low export earnings, according to (Hartmann, 2004) significant proportion of honey produced in the country is used for domestic consumption mainly for making a local drink known as *Taj*. Moreover, evidences indicate that the amount of honey exported is comparatively low and less than 1% of the total produced (SNV, 2005; Beyene and David, 2007). Thus, the beekeepers in particular and the country in general are not benefiting from the sub sector (Nuru, 2002).

Lack of beekeeping knowledge, shortage of trained manpower, shortage and high price of beekeeping equipment's (Chala *et al.*, 2013), the unpleasant behavior of bees (aggressiveness, swarming tendency, and absconding behaviors), drought and deforestation of natural vegetation, marketing constraints, indiscriminate application of agrochemicals, honeybee disease, pest and predators, poor extension services, absence of coordination between research, extension and farmers, absence of policy in apiculture, lack of records and information, and inadequate research institutions to address

the problems (Tessega, 2009; Yetimwork, 2015), are among the major challenges leading low productivity of beekeeping in Ethiopia.

Even if different challenges exist, different beekeeping development endeavors have been made recently by the governmental and non-governmental organizations (Tilahun, 2006). Establishment of MoLF, registration and control of pesticides, and apiculture resources development and protection proclamation are among the efforts done by the government to ensure apiculture development by strengthening extension delivery system (Demisew, 2016). On the other hand, non-governmental organizations have been prompting low-cost and appropriate hive technologies. Market-oriented Beekeeper Farmer Organization has also been initiated and formed in different districts (Tilahun, 2006; Chala *et al.*, 2013). It has been obvious that the description of production system, and prioritizing the available constraints and suggesting possible intervention areas, are the first steps toward any development planning in any fields and also in the apiculture sub-sector.

The beekeeping research so far conducted in the country is although encouraging but did not cover the special issues of various regions and means of utilizing the opportunities in potentially productive regions. However, the great majority of beekeeping production is based on traditional production system where the results of on station research may not often be applicable to local conditions. An investigation indicated that the number of honeybee colonies in the country has been declining (CSA, 1995). Thus, it requires making efforts to address some of the major problems of beekeeping to its production in a sustainable way. Gumer woreda of Guraghe zone assumed to be one the potential areas for beekeeping and honey production. However, there was no documented information on the current production systems, opportunities and constraints of honey production in the woreda. Therefore, this study focused on the assessments of honeybee production systems, opportunities and constraints of honey production in selected kebeles of Gumer woreda, Guraghe zone, SNNPRS, Ethiopia

1.2. Objectives

1.2.1. General objective

- To assess production systems, opportunities and constraints of beekeeping in the selected kebeles of Gumer woreda.

1.2.2. Specific objective of the study

- To identify the different types of honeybee production systems in the study area.
- To assess the potential opportunities in honey bee production in the study area.
- To identify the associated constraints of honey bee production.

1.3. Research Questions

- What are the commonly practiced honey bee production systems in study area?
- What are the opportunities associated with honey bee production in the study area?
- What are the constraints crating major difficulties for beekeeping associated with honey bee production in study area?

1.4. The statement of Problem

The beekeeping sector is facing so many challenges where the most important one is lack of data regarding existing production systems, the potential and major problems. This is becoming a bottleneck for government and non-government organizations to properly plan and implement their development programs. This study were generally will contribute to the improvement of the beekeeping sector in the study area by filling the existing information gap, which would be valuable for different stakeholders involved in the beekeeping subsector.

2. LITERATURE REVIEW

2.1. Overview of Beekeeping in Ethiopia.

Beekeeping has been a tradition since long before other farming systems, and it is traditionally a well-established household activity in almost all parts of Ethiopia (Ayalew and Gezahegn, 2001). Even though, there are no certain records, it is believed that the keeping of bees in baskets may have started about 5000 years ago in the northern regions along with the early settlements. No countries in the world may have ancient beekeeping as Ethiopia (Fichtl and Admassu, 1994; Gezahegne, 1996 and 2001b).

Traditionally honey is consumed in the form of *Tej* (honey wine) and *birz* (non-alcoholic) and some for medicinal use (Ayalew and Gezahegn, 2006). The report by MoARD (2006) stated that annual honey consumption nearly equals annual crude honey production, currently estimated at 56,000 tones.

Many table honey processing firms are thriving and some have started to process and market table honey for local and export markets. In spite of its potential, income obtained from this sector has been modest due to lack of improved beekeeping systems, low quality of hive products and lack of skill by farmers (MoARD, 2005). To alleviate these problems, the Ministry of Agriculture and Rural Development (MoARD) has formulated a honey and beeswax development and marketing plan for the country.

2.2. Production Systems of Honeybees in Ethiopia

According to (HBRC. 2001), there are four different types of beekeeping practices in Ethiopia namely, traditional forest, traditional backyard, transitional and improved or modern beekeeping.

2.2.1. Traditional Beekeeping

2.2.1.1. Traditional forest Beekeeping

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 (Chala, 2010). In some places,

especially in the western and southern parts of the country, forest beekeeping by hanging a number of traditional hives on trees is widely practiced. In other most parts of the country backyard beekeeping with relatively better management are common (Girma, 2005). 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 (Chala, 2010).

2.2.1.2. Traditional back yard beekeeping

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 supering, there is no partition to differentiate brood chamber and honey chamber (Melaku and Shiffa, 2008). It is a type of beekeeping which is an intermediate between traditional and modern beekeeping methods. For most technical and economic reasons transitional honey production using top- bar hives represent a satisfactory compromise (Adjare, 1990; IBRA, 2000).

2.2.2. Transitional system of Beekeeping

It is a type of intermediate beekeeping between traditional and movable-frame beekeeping. Transitional beekeeping is one of the improved methods of keeping bees using top bar hive. Top bar hive is a bee hive of any size or design in which bees build their comb from top bars instead of attaching comb to the ceiling of the hive. Transitional beekeeping started in Ethiopia since 1976 and the types of hives used are: KTBH, Tanzania top-bar hive and Mud- block hives. (HBRC, 2003). In Ethiopia, Transitional honey production started since 1976 using Kenya top-bar hive, Tanzania top-bar hive and Mud- block hives (Ethic rebab hives). Among these, KTB is widely known and commonly used in many parts of the country (HBRC, 2001; Segeren, 2008).

Top-bar hive in an ideal condition can yield about 50 kg of honey per year, but under Ethiopian condition, the average amount of crude honey produced would be 7-8 kg/hive/year (Gezahegne, 2001a; Demissew, 2016). However, at zonal level (North Wello) it has been reported that production of 24-26 kilograms' crude honey per hive per year (SOS Sahel, 2002), and about 8 percent as much beeswax per kilogram of honey is likely to be obtained. Generally, top-bar hive is a single-story long

box with slopping sidewalls inward toward the bottom (forming an angle of 115° with the floor) and covered with bars of fixed width, 32 mm for east African honeybees (Segeren, 1995; Nicola, 2002). 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.

2.2.3. Modern honeybee production system

Modern beekeeping methods aim to obtain the maximum honey crop, season after season, without harming bees (Nicola, 2002). 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 (HBRC, 2001). Practical movable- frame hive was invented in 1851 by Lorenzo Lorraine Lang troth in U.S.A. (Crane, 2005; Vivian, 2001). Later on, different countries developed their own movable frame hives (for instance Zander, Dadant) 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 hand ligand management. Modern beekeeping systems aim at obtaining the maximum honey crop, season after season, without harming bees (Bradbear, 2002). The number of boxes is varied seasonally according to the population size of a colony.

In Ethiopia, about 5 types of movable frame hives were introduced since 1970 (HBRC, 2001) 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 15-20 kg/year, and the amount of beeswax produced is 1-2% of the honey yield (Gezahegne, 2001a). However, in potential areas, up to 50-60 kg harvest has been reported (HBRC, 2001). 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 (Ayalew, 2001a).

It is a modern system of bee keeping, the amounts of honey from this type of beekeeping are high, it is possible to add extra home or supper and also possible to reduce. It uses queen excluder not to transfer the queen to chamber or supper. It can be easily inspecting and manipulate and also easy to manage honey bee colony and harvest honey year-round. In modern beekeeping different types of frame hive are used, some of these frame hives being used in our country are Zander and Lange troth hive (Amsalu, 2007).

2.3. Opportunities and Constraints of Honeybee Production

2.3.1. Opportunities of Beekeeping

Major opportunities for honey production include: availability of natural vegetation's, weather condition, availability of cultivated crops, availability of honey bee colonies, indigenous beekeeper's knowledge & experience, water availability, market demand for hive products (Melaku, 2008). Ethiopia has enormous untapped potential for the development of beekeeping. The prevailing production constraints in the beekeeping sub sector of the country depending on the agro-ecology of the area where the activities are carried out (Edessa, 2005). Based on survey conducted on current status of bee keeping in Ethiopia the potential of apiculture development was enormous & because of the following factors (MOARD, 2003).

2.3.1.1. Availability of natural vegetation, field crops and water

The natural vegetation composed of forest trees, shrub herbs and climbers provide adequate nectar and pollen for the foraging bees. 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.*, 2005). 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).

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 (Noun 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. There are also enough water sources from lakes, rivers, dams and streams end for individual consumption, brood rearing and hive ventilation. (Rein Hard *et al* 1974).

2.3.1.2. Availability of honeybee colonies

Ethiopia has strong bee colonies. These strong bee colonies indicate that the area is very suitable for bee business development. According to Melaka and Shaffer (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 (Chala, 2010).

2.3.1.3. Honey Production

The average amount of honey harvested from traditional, top bar and frame hive were 10.5kg, 16kg and 18kg per hive respectively, (MoARD, 2006). The result obtained from traditional hive is higher than the national average yield (5kg) and the result reported by Gezahegne, 2001, states the average amount of honey harvested per traditional hive in west, south west and north Shao zones was 6.2kg. The sample respondents harvest honey in two distinct harvesting seasons, that is, from September to end of November and April to end of June. Majority of the respondents harvest their honey during autumn season, (Gemechis, 2019).

2.3.2. Major Constraints of Honeybee Production in Ethiopia

In order to properly utilize the beekeeping sub sector, identifying the existing constraints and searching for solutions are of paramount importance. Ethiopia has untapped potential for promoting beekeeping, both for local use and for export purpose. An investigation indicated that the number of the honeybee colonies in the country has been declining (C.S.A., 2017). Thus, it requires making efforts to address some of the major problems of beekeeping and to keep it productive in a sustainable way. Still the country has potentials with enormous nectar and pollen resources that have not yet been exploited, and beekeeping could probably be a profitable activity to undertake. The prevailing production constraints in the beekeeping development of the country are complex and to a large extent vary between agro-ecological zones and production systems (EARO 2000). The variation of the production constraints also extends in socio – economic conditions, cultural practice, climate and behaviors of the bees.

According to HBRC (2001), Ayalew (2001) and Edessa (2002) the major constraints in the beekeeping sub sector are the unpleasant behaviors of bees (aggressiveness, swarming tendency, and

absconding behaviors); lack of skilled manpower and training institutions; low level of technology used; high price of improved beekeeping technologies; drought and deforestation of natural vegetation; poor post-harvest management of beehive products and marketing constraints; indiscriminate application of agrochemicals; honeybee disease, pest and predators; poor extension services; absence of coordination between research, extension and farmers; absence of policy in apiculture; shortage of records and up-to-date information; and inadequate research institutions to address the problems that decreases honey production. However, as indicated in the Comprehensive Bees and Beeswax Marketing Plan 2nd draft document (MOA, 2003), the country has set a long-term plan to raise the current 43,373 tons of honey and 3,658 tones beeswax annual yield to a level of 149,056 tones and 9,928 tons of honey and beeswax, respectively. It was also planned to export 80% and 50% of the total honey and beeswax production, respectively (MOA, 2003).

According to CSA (2003), reported that the number of the honeybee colonies in the country has been declining. Thus, it requires making efforts to address some of the major problems of beekeeping and to keep it productive in a sustainable way. Still the country has potentials with enormous nectar and pollen resources that have not yet been exploited, and beekeeping could probably be a profitable activity to undertake. The potentiality of apiculture could be backed up by research and the beekeepers' indigenous knowledge which should be assessed. In this regard it is important and right time to conduct apicultural research in order to assess the situation at the grass-root level: to identify the system of honey production practices, the available marketing channels and quality status of the product (Mengistu, 2011).

2.3.2.1. Pesticides poisoning

The use of chemicals and pesticides for crop pests, weeds, Tsetse fly, mosquitoes and household pests control bring in to focus the real possibility of damaging the delicate equilibrium in the colony, as well as the contamination of hive products. The chemicals used for crop protection are the main pesticides that kill the bees. Moreover, there are two other circumstances in which bees are killed on plants by chemicals. These are by insecticides applied to non-crop pests such as mosquitoes and *Tsetse* flies and by herbicides applied to plants on which the bees are foraging. On the other hand, herbicides, which are commonly not toxic to bees, destroy many plants that are valuable to bees as source of pollen and nectar. The types of chemicals used include Malathion, Seven, DDT, 2-4 D and Acetone. As it was seen from the beekeeper point of view, poisoning of honeybees by agrochemical

has been increased from time to time. Some beekeepers lost totally their colonies due to agrochemical (Ayalew, 2001; Edessa, 2002).

2.3.2.2. Honeybee Pest and Diseases

Ethiopia, as one of the sub-tropical countries, the land is not only favorable to bees, but also for different kinds of honeybee pest and predators that are interacting with the life of honeybees. The existence of pests and predators are nuisances to the honeybees and beekeepers. Pests and predators cause devastating damage on honeybee colonies with in short period of time and even overnight (Desalegn 2001).

According to (Kerealem, 2005), the pest and predators that attack honeybees and their hives in the study area were identified by beekeepers. It shows the major pests and predators ranked depending on the extent of damage caused to the honey bee colonies. Like all living things, honeybees are attacked at all stages of their development by various enemies either directly as predators, or indirectly, by disturbing the life of the colony in various ways. The most important of these enemies are those that destroy the combs, the stores, the hive itself and some predators that attack foraging worker bees as they leave the hive. These include ants (50.1 %), wax moth (15.6 %), spider 9.5 %), lizard 8.9 %), birds (11.7 %) and honey badger (shelemtemate in Amharic) (4.2 %). According to (Demisew, 2016), the economic loss incurred every year via loss of honeybee colonies and their products due to ant attacks was estimated to be over 3,839,810 Birr. Some of the methods used by the respondents to prevent predators are keeping the apiary tidy and clean from under growth, avoiding throwing/scattering combs around the apiary site, application of ash around the hive stand, plastering the hive stand with plastic materials, finding and killing predators like beef eater birds and the queen of ants Desalegn B (2001).

Similarly, Kerealem (2005) also reported that, ants, honey badger, bee-eater birds, wax moth, spider and beetles were the most harmful pests and predators in order of two decreasing importance. Some studies indicated that Ethiopia appears to be free from various honeybee brood diseases and at the same time at low level of adult bees' diseases incidences. A major category of diseases which because economic loss comprises amoeba, nosegay and chalk brood (Yetimwork, 2015).

2.3.2.3. Less availability of technology and beekeeping equipment's

Some studies 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. 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 Study Area

The study was conducted in selected Kebeles of Gumer Woreda of Gurague Zune, SNNPRS. Woreda is located at latitude of 7° 54' 59.99" N and longitude of 38° 04' 60.00" E and at 1326m altitude a.s.l in lowland land of Ethiopia (<https://en.m.wikipedia.org/wiki/>). It is found South West of Addis Ababa at distance of 208.3km. The Gumer Woreda is classified in to 18 Kebeles for administrative purpose. As far as its boundaries in relation to its neighboring Zones and/or Woredas, it is bordered on South East by Silt'e Zone, on the South West by Geta, on the North West by Cheha, and on the North by Ezha. The area is characterized by two season, the wet season from June to September and dry season from October to May and also the area has a mean maximum temperature of 25⁰c and means minimum temperature of 10⁰c. The area receives about 400mm of precipitation and the mean relative humidity is estimated to be 128% (<https://www.worldweatheronline.com/>). Based on the 2007 Census conducted by the CSA, this woreda has a total population of 80,178, of whom 37,495 are men and 42,683 women; 2,923 or 3.65% of its population are urban dwellers. The majority of the inhabitants were reported as Muslim, (59.98%), while 29.81% practiced Ethiopian Orthodox Christianity, and 9.27% were Protestants.

3.2. Sources and Methods of Data Collection

Both primary and secondary data was used to generate qualitative and quantitative information. In order to collect primary information household survey, interviews with focused group discussion and direct observation of the apiary sites and bee keeping trends was undertaken. Primary data on number of Honey bee colonies per household, honey and beeswax production potential, opportunities and

challenges of beekeeping was collected through structured questionnaire, Secondary data was collected from different published or unpublished source and from woreda and kebele offices.

3.3. Sampling Technique and Sample Size

A two-stage sampling technique was employed to select respondents. In the first stage, among the 18 kebeles of the Gumer woreda, three kebeles were selected purposively based on their accessibility and beekeeping potential. In the second stage – using the list of beekeepers in the sampled area –, 60 (20 from each kebele) beekeeper households were purposively selected based on their accessibility. The lists of beekeepers acquired from the administrative districts were used as a sampling frame. Moreover, key informant interviews and focus groups were used to gather opinions on a specific topic. The questioners were pretested before using it to collect data to identify questions that don't make sense to participants, or problems with the questionnaire that might lead to biased answers. The questionnaire was containing multiple choice questions and open-ended questions.

3.4. Data Analysis

The collected data was summarized and analyzed by using both quantitative and qualitative data analysis. Because of the nature of the issue under investigation, both qualitative and quantitative descriptions were used to present and interpret the data gathered from different sources. Data which was collected through structured and semi structured questionnaires was organized and analyzed by using quantitative method. Data which collected through semi structured interview and focused group discussion was used to give recommendation and conclusion to support qualitative data. The quantitative data was analyzed by simple descriptive statistics like percentage, average and the result was summarized in the form of table, and figure to enable easy interpretation and quick visual comparisons of variables within the study areas.

4. RESULT AND DISCUSSION

4.1. Socio-economic Characteristics of Households

This section provides an overview of beekeeping practices of sample respondents in the study areas based on the results of the study. In this section the results are presented and discussed more specifically focusing on the actual situation of sample households.

4.1.1. Household Characteristics

From the total of 60 sample households interviewed to generate qualitative and quantitative data on beekeeping, about 87% were male headed and the rest 13% were female headed. This shows a limited number of female participation in beekeeping activities in the study areas. This might be due to the fact that even though all or parts of the beekeeping activities were performed by women these are considered as the work of men (head of the household). The average family size of the sample farmers in the study area was 5.73 persons, with maximum and minimum family size of 11 and 2 people, respectively. This variable is an indicator high family size and greater competition for resources in the study area. The beekeepers had a minimum and maximum experience of 1 and 20 years respectively. The level of beekeepers' experience was taken to be the number of years that an individual was continuously engaged in beekeeping practice. This is what one would expect in a situation where people are actively engaged starting from an early age in helping older beekeepers to undertake basic tasks. Based on this exposure, young people gradually move on to become independent beekeepers immediately after they obtain their own hives (Gichora, 2003). They continue accumulating experience by seeking technical advice from fellow beekeepers whenever necessary. The mean age of the respondents were 48.8 years (with SD (Standard Deviation of 11.48 years) ranging from 32 to 75 years old, this shows that beekeeping can be performed by economically active age groups and in most cases people at younger and old age is actively engaged in beekeeping activities of the study areas.

Table 1. Age, Family size, experience and land holding of sample respondents.

Socio economic indicators	Min	Max	Mean	S.D
Age	32	75	48.8	11.48
Family size	2	11	5.73	1.99
Experience	1	20	6.7	3.56
Land holding	0	1.5	0.38	0.49

4.1.2. Landholding

The average land (plowing, backyard and pasture) holding of the sample respondents during the study was 1.125 hectares which is in the range of the National average household land holding of 1.0 - 1.5 hectares. About 8.5% of the sample respondents have no private land holdings which indicates, beekeeping can be applied even with those who have no land. This indicates beekeeping can be performed by landless people. This result corresponds with the findings of different researchers (Yitemwork, 2015).

4.1.3. Educational level of households

Regarding educational status, among the sample respondents 15% had not received any education, while 51.67% could only read and write. The rest were at stages of literacy ranging from elementary to high school level. More specifically, 18.33%, 13.33% and 1.67% of the sample respondents had attended elementary school, junior, secondary and university, respectively.

Table 2. Educational level of the sample respondents

Educational level	N	%
Illiterate	9	15
Can read and write	31	51.67
Grade 5-8	11	18.33
Grade 9-12	8	13.33

University	1	1.67
Total	60	100

As Gichora (2003) noted that for more advanced beekeeping, one should have a good grasp of bee biology and behavior of bees for better colony management. Moreover, for illiterate people there should be an intensive training and persuading of beekeepers before distributing movable frame hives. Therefore, according to the result of this study the presence of illiteracy (15%) in the study indicates that there is a limit in the effectiveness of formal training programs and requires more emphasis to be placed on practical demonstration of essential concepts especially in the values they obtain by using modern technologies (improved beekeeping).

4.1.4. Beekeeping extension service.

The study illustrated that 70% of the sample respondents had the chance of getting beekeeping extension service delivery. This reflects the need for developing concrete and sound beekeeping extension system in the future for sustainable beekeeping development in these areas. According to this study of the total sample respondents, 62.5% were trained and 37.5 % were not trained. The majority of these beekeepers reported that they cannot transfer the colony from local to frame hives, and even those who can transfer were unable to harvest the honey. This might hamper beekeeping technology adoption process. Therefore, training must go side by side to beekeeping technology and input provision and focus more on practical training or demonstration. Among those who are members of the extension service, 53.1 % are extension package participants. This shows that informal knowledge flow plays vital role for sharing of experiences among beekeepers that in turn build up indigenous knowledge like swarm control, queen rearing and pest and disease control. Majority of beekeeping activity in these areas were geared by self-owned form of indigenous knowledge. This again implies that the essentiality of taking indigenous beekeeping knowledge into consideration in each and every modern beekeeping development intervention.

4.2. Honey Production System and Honey-yield

Under this section beekeeping practices, bee flora condition and water availability, honey or beehive product harvesting, colony management, beekeeping potentials and constraints, and the overall beekeeping activities in the honey production systems of the study area are discussed. From the study

results, there were no farmers that solely depend on beekeeping practice. Based on the results of the questionnaire three types of beekeeping practices were mainly used in the study areas. These were traditional, transitional/top bar and frame/modern beekeeping. The productivity of the beehive was different in different study areas, due to differences in management and environmental factors, however, the average productivity of traditional hive in these study areas were 2-5Kg (38.33%), 3-5Kg (43.33%), 5-6 Kg (18.33%)/hive/harvest. This result is in correspondence with the findings of (Gezahege, 2001). As far as the harvesting frequency of honey was concerned, 38.3% and 61.7% of the respondents harvested once and twice a year, respectively.

Table 3. Number of hives and its percentage

Kebeles	Traditional hive	Transitional hive	Modern hive	Total
Jenbero	405	28	83	516
Barcher & Mochie	316	26	145	488
Bade	164	16	137	317
%	67	5.45	27.6	

Table 4. Average of honey harvested per hive with percentage of households.

N	Tradition kg/hive	%	N	Transition kg/hive	%	N	Modern kg/hive	%
23	2-5	38.33	26	3-5	43.33	27	6-8	45
26	3-5	43.33	19	4-5	31.67	17	5-10	28.33
11	5-6	18.33	15	5-7	25	16	5-12	26.67

4.2.1. Traditional Beekeeping

According to the result of this study, the majority (67%) of the sample respondents were practicing traditional type of bee keeping. As many beekeepers practice in almost all parts of the country, the traditional beehives were constructed by using their indigenous knowledge by the owners themselves (Gallman and Tomass, 2012) or purchased from the local market. As a result, the traditional beehives of the interviewed farmers varied in length and width, but all had cylindrical shape. The size of the beehive mainly depended on strength of the colony and number of colonies. According to the interviewed farmers and the Kebele office, the farmers used locally available materials to construct the traditional beehive. This reduces the cost that is allocated for purchasing those materials. The average traditional hive holding of the sample respondents were 7.75. Based on the results beekeepers in Bercher and Mochie kebele had the highest number of traditional beehives (52%).

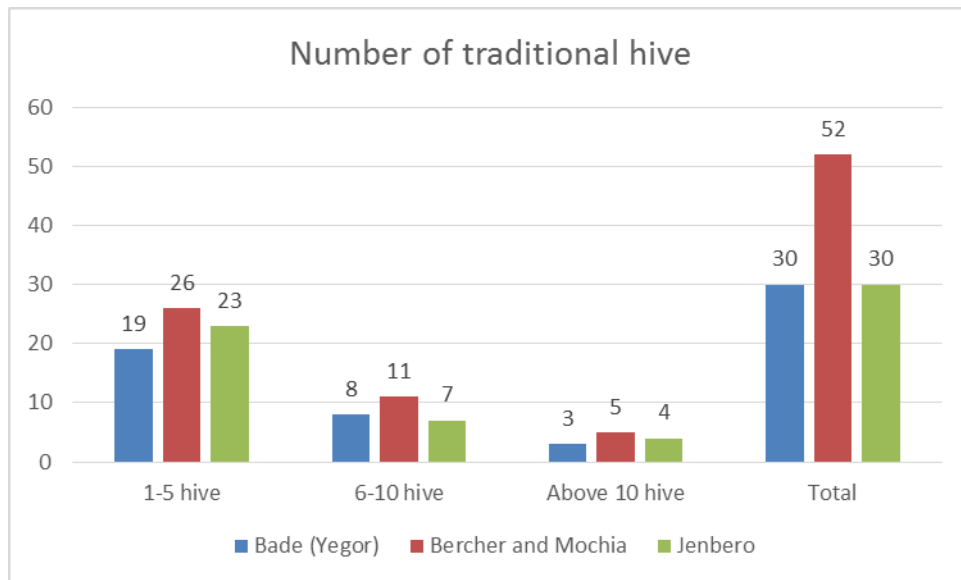


Figure 1. Average number of traditional hives owned per household.

4.2.2. Transitional/Top bar/ Beekeeping

According to the result of this study, 76.7% of the respondents have no transitional hive. The average number of top bar hives owned/house hold was 23.3% hives which is very low and needs the help of Agricultural adepts to increase the utilization of top bar hive since it is a bridge to move to modern hive technology. The average productivity of top bar hives was 3-5kg (43.33), 4-5kg (31.67), and 5-10kg (25%) hive/harvest. This type of beekeeping is mostly used for demonstration purpose for beekeepers. A very few respondents (23.3%) are on the way of using top bar hives, because of their inability to construct and harvesting of the products of beehives. Therefore there should be a strong

support on the side of agricultural office on how they can construct this type of hive from locally available materials and use these materials to solve their major problems in the study areas.

Table 5. Average number of transitional hives per household.

Kebeles	None		1-5 hive	Total
	Count			
Bade (Yegor)	Count	17	3	20
Bercher and Mochia	Count	14	6	20
Jenbero	Count	15	5	20

4.2.3. Frame/modern Beekeeping

According to the result the study, 28.33% beekeepers have no frame beehives. The average modern honey bee colony holdings of the sample respondents were 58.33% hives/household. The average productivity from one frame beehive was 6-8Kg (45%), 5-10Kg (28.33%), and 5-12Kg (26.67%) /hive/harvest. This indicates that the beekeepers are not in the way of producing the amount they can harvest and they are not benefited from this type of beekeeping. The reasons for this low level of productivity as indicated by the sample respondent where the hive is not comfortable for bees.

Table 6. Average number of modern hives owned per household.

Kebeles	Number of households who had modern hive					
	None	1-5 hive	6-10 hive	Above 10 hive	Total	
Bade (Yegor)	Count	5	14	1	0	20
Bercher and Mochia	Count	5	10	3	2	20
Jenbero	Count	7	11	1	1	20

4.2.3. Reasons for involvement in Beekeeping, sources of the colony and Beekeeping experience

According to the results of this study, reasons for involvement of the farmers in beekeeping are consumption and income generating activity (46.67%) followed by easy to perform with other agricultural activities (13.33%), income is used for different house expense (23.33%), inheritance from parents (3.33%) and due to training (1.67%). The level of beekeepers' experience was taken to be the number of years that an individual was continuously engaged in beekeeping. Thus one could expect the situation where people are actively engaged from an early age in helping older beekeepers to undertake basic tasks. Based on their exposure, young people gradually move on to become independent beekeepers as soon as they can obtain their own hives. They continue accumulating experience by seeking technical advice from fellow beekeepers whenever necessary (Gichora, 2003). Reasons and sources for involvement in beekeeping are indicated in Table 6.

Table 7. Sources of the colony and reasons of involvement in beekeeping

Sources	Number	%	Reason	Number	%
Swarm catching and purchasing	2	3.33	Income	14	23.33
Swarm catching	44	73.33	Consumption	7	11.67
Purchasing	0	0	Consumption and income	28	46.67
Parent gift and swarm catching	10	16.67	Easy to perform	8	13.33
Purchasing and parent gift	1	1.67	Inherited from parents	2	3.33
Swarm catching, purchasing and parent gift	3	5	Training	1	1.67
Total	60	100		60	100

As the above table results illustration, the majority of the farmers (46.67%) are engaged in beekeeping in order to use hive products for both consumption and to obtain income.

4.2.4. Beekeeping training

From this study, it was found that two modes of training prevail in the existing beekeeping system of the study areas, that is, informal and formal training in improved beekeeping practices. Beekeepers receive training in traditional beekeeping methods from an experienced family member or local beekeepers which can be considered as informal training. Apart from the informal experience sharing, in these areas formal training in improved beekeeping is offered by BoARD at different levels, Development agents and other different experts. There was a failure to render training which makes the adoption of improved beekeeping practice in these areas were impaired. Therefore, to facilitate and enhance the adoption of improved beekeeping practices, training on improved beekeeping practices should be given to elite beekeepers accompanied with provision of full productivity enhancing technology packages. The training can bridge technical gaps and equip the beekeepers with basic knowledge on how to operate improved hives and bee equipment's, manipulate honeybee colonies, grow appropriate bee forage plants, new processing techniques for production of higher quantity and quality products.

4.2.5. Incidence of absconding and migration

Honeybee colonies abandoned their hives at any season of the year for different reasons. According to the response of the respondents, 75.0 % of absconding incidence of honeybee colonies was recorded in traditional hives. The incidence from top bar and frame hives were 20% and 5% respectively. The reported reasons for absconding of bee colonies as indicated by respondents were lack of bee forage, incidence of pests and predators, unfavorable weather condition, bee diseases, poor management and swarming. Therefore, every beekeeper should get basic training on colony management factors to the extent of reducing absconding and migration rate. To reduce and control migration, respondent beekeepers exercise different traditional and improved ways of migration control like supplementary feeding, smoking hive with local attractant material and the like, frequent inspection, cleaning apiary sites. According to the respondents, bees absconding vary from season to season. September to November accounts for reproductively swarmed colonies. This is happening due to lack of close supervision of colonies and incomplete harvesting of honey, which leads the bee colony into congestion and ultimately to creation of swarm to depart the mother colony. In general, as absconding and migration are the ultimate occurrence of poor management, honeybee colonies

should be well managed year-round with special emphasis to dearth periods and season of reproductive swarming.

4.2.6. Inspection of honey bee colony, incidence of reproductive swarming

As the results of this study, the majority of the respondents (48.33%) practice everyday inspection of their hives for controlling different honey bee enemies, like pests and predators. As the mass of the respondents (31.67%) illustration there was inspection of their hive two to three day per week. The others respondents answered that the remaining percentages (20%) was inspection their hive every week. As the responses of the respondents, there were different methods of attracting a swarming colony, mainly by using different swarm attractant materials.

Table 8. Periods of visit and inspection of hives by sample respondents

Period of inspection	Frequency	%
Every day	29	48.3
Two to three day per week	19	31.67
Every week	12	20
Total	60	100

As the above table demonstration there is a need to intervene in the bee keepers to make aware about the importance of frequent inspection of bee hives for the purpose of preventing bee enemies from attacking the honey bees. Therefore, frequent inspection is recommended.

4.2.7. Honey production season

As the results of the study, the majority of the bee keepers harvest their honey in periods of September to October (95%) and a very few respondents (5%) harvest their honey in the periods of Jun to August. However, there is a difference in the amount of yield of honey in these two different harvesting seasons as reported by the sample respondents of the study areas. This result corresponds with the results of (Haftom, *et al.*, 2013). Therefore, it shows that season is one of the factors that influence the amount of honey harvested in a production year.

Table 9. Honey production season

Kebeles	Sept to Oct	June to August	Total
Barcher & Mochie	18	2	20
Jenbero	20	0	20
Bade	19	1	20
%	95	5	

4.2.8. Herbicide and pesticide application and pests and predators

The result of this study showed that the majority of the sample respondents were faced a difficulty of keeping bees because of the application of pesticide and herbicides. Therefore, there should be an intervention to solve this problem for the study area. The sample respondents reported that, pests and predators are the second enemies of keeping bees in the study areas and the majorities of these are ants, lizards, birds and others.

4.3. Opportunities and Constraints of bee keeping in the study areas

In order to utilize the beekeeping sub sector, the area has many opportunities and it had a potential to become a model in the sector of apiculture. Those opportunities were described by the sample respondents as follows.

- ✓ The presence of diversified bee forage plants
- ✓ The increasing demand of hive products
- ✓ Environmentally friendly of the sector
- ✓ Availability of honey bee colonies in a required amount
- ✓ The presence of eager bee keepers
- ✓ Market accessibility.

Even though, there are different challenges in the study areas. The identification of the existing constraints and searching for solutions are of a great importance. The respondents identified major

constraints in the practice of keeping bees, like, herbicide and pesticide application and high wind, pest and predator, shortage of bee forage, lack of beekeeping equipment's, absconding and migration in order of importance. As a result, prioritization of the problems should be given that mostly hinder the development of beekeeping sub sector in the study areas, especially in the application of pesticide and herbicides. Based on the result of this study, beekeepers much suffered from a number of difficulties and challenges that are antagonistic to the success desired in honey production. A major problem that the respondents raised was recorded and identification of these challenges was made in the study and most of these can be prevented by the beekeepers, except the natural constraints, like occurrence of high wind. The different constraints of keeping as reported by the sample respondents of the study areas is illustrated in the following table.

Table 10. Major constraints of bee keeping in the study area

Constraints	N	Rank
Pest and predator	9	5
Herbicide & pesticide application	8	1
Shortage of bee forage	12	3
Lack of bee equipment	14	2
Absconding	11	4
High wind	5	6

5. CONCLUSIONS AND RECOMMENDATIONS

CONCLUSIONS

Beekeeping is practiced as an integral part of other agricultural activities mainly livestock and crop production with commercial type of production system. The majority of the sample respondents (67%) of the beekeepers own traditional beehives and modern/ frame bee hives 27.6% respectively, the rest (5.45%) of the respondents practice top bar/ transitional bee keeping practice. Therefore, we can conclude that from the three types of production systems of bee keeping the areas are dominated by traditional system of production. This indicates that the areas are late adopters of modern bee keeping technologies. Even though the mass of the respondents practices traditional bee hive bee keeping system, there were few respondents that practice a modern system of keeping bees. As the yield comparison indicates that the honey produced from the frame hive by far higher than the transitional and traditional beehives. The beekeepers are on the way of losing significant amount of honey and honeybee colonies due to the prevalence of different challenges, like, application of agro-chemicals (pesticide and herbicide application), shortage of cultivated bee forage, pests and predators, lack of bee equipment, absconding, death of colony and swarming. Even though the bee keepers face different challenges, there were different opportunities that encourage them to keep bees, like the presence of bee forage, availability of honeybee colonies, increasing demand of honey and other hive products, environmentally friendly of the sector, presence of eager bee keepers and others. Some of the major possible intervention areas are recommended below.

RECOMMENDATIONS

- Since most of the beekeepers in the study areas used traditional beehive, the kebele experts and other responsible bodies should actuate these bee keepers to use a modern and also a transitional bee hive and to be a model for modern beekeeping technology for the country.
- The current effort of natural resource rehabilitation should strongly consider the plantation of indigenous potential bee forages based on the appropriate propagation technique
- Regular and up to date market value of honey and different hive products should be channeled to the beekeepers using different communication channels that the bee keepers easily acquire in order to initiate them.

- Strengthening of existing beekeepers' associations and establishment of new ones which can play significant role for production need immediate attention
- The extension system should actively aware the beekeepers towards the importance of hive products and their market value.
- The opportunity of wax, propolis, pollen and other products production and awareness creation on the use, processing system and market value of these products should be given special attention by the responsible bodies.
- The use of agro chemicals requires a strong attention by the experts of bee keeping and also a research is required to alleviate this major problem of the bee keepers.

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7. APPENDIXES

Wolkite University

College of Agriculture and Natural resource

Department of Animal Production and Technology

Questionnaire used in the study

Questionnaire for beekeeping system, opportunities and challenge in the study area

General information

1.1 Zone _____ 1.2 Woreda _____ 1.3 Kebele _____

1. House hold characteristics

1. Name of house hold head-----2.Sex-----3.Number of years in beekeeping practice-----

4. Age of the household head-----

5. Marital status: A. Married B. Single C. Divorced

6. Family size-----

7. Education level of household head:

A. Illiterate B. Can read and write C. Primary education (1-4) D. Junior (5-8) E. Secondary education (9-10) F. University

2. Landholding (ha)

1.1 Total land holding _____ 1.2 Farmland __ 1.3 Grazing land _____

Others _____

3. Beekeeping/honey production/ Activities and Potentials of Beekeeping

1. Do you own honey bee colonies? (1) Yes (2) No If yes,

2. How many honeybee colonies you owned? Traditional-----, Transitional -----, Modern.....

3. When did you start beekeeping? _____year (s).

4. How did you start beekeeping? (1) By training (2) learning from family (3) other specify

5. What is the source of bee colonies when you start?

A. By catching the swarm B. By purchasing the honeybee colony C. Gift from parents D. other

6. If the answer for question 5 is purchased, where is the market?
A. In our locality B. Woreda market C. at the neighbor woreda D. Other specify

7. What is the price of one colony? _____ ETB

8. How many times in a year do you harvest? A Once B. Twice C. Three times

9. How much honey do you harvest from a single hives per harvest?

Traditional hive.....Kg

Transitional hive.....Kg

Modern hive.....Kg

10. In which types of hive your colony remains or stays for a long time? (1)Traditional (2) frame/modern

11. What are the sources and costs of the bee hives you are using?

- A. Constructed by myself
- B. Bought from local market
- C. Supplied by NGOs on credit basis
- D. Supplied by NGOs free of cost
- E. Others (Specify)

12. Does your honey production increase or decrease every year?

Traditional A. Increasing B. Stable C. Decreasing

Transitional A. Increasing B. Stable C. Decreasing

Modern A. Increasing B. Stable C. Decreasing

13. If there is an increase in trend in honey yield over the years, what is the cause?

- A. Good management practice
- B. Uses new technologies

C. Added many bee colonies

D. Others (Specify)

14. Did you plant bee forage purposely for your bees?

A. Yes B. No

15. Does water available for your honey bee at all times?

A. Yes B. No

16. Did you feed your bee colonies?

A. Yes B. No

17. If your answer is yes for No 14 when did you feed your honey bees?(Month)

18. What kind of feed do you offer to your honey bees?

A. Besso-----Kg/colony/season B .Sugar syrup-----Kg/colony/season

C. Honey +water -----Kg/colony/season D. Shiro -----Kg/colony/season

E. Other (Specify)

4. Concerned to Honey harvesting, Colony Management and characteristics

1. Do you visit and inspect your beehives and colonies? A. Yes B. No

2. How frequently do you inspect your hive? A. Every day B. Every two to three days C. Every week. D. Other (specify)_____

3. If no inspection, what is the reason? _____

4. Do you clean your apiary? A. Yes B. No, If no why? _____

5. If yes, what material do you use for cleaning? _____

6. When the following activities occur in your area?

No	Activities	Sep. to Nov.	Dec. to Feb	March to May	June to August
1	Honey flow season				

2	Colony migration				
3	Absconding				
4	Colony swarming				
5	Brood rearing period				
6	Dearth period				
7	Others				

7. Is there colony absconding following the main honey fallow season and through the dry season? A. Yes B. No

8. If your answer is yes, what do you think is the reason? A. Shortage of feed
B. Shortage of water C. Pests and predators D. Poor bee management E. Others (Specify)

9. During harvesting do you remove all honeycombs? A. Yes B. No

10. During harvesting do your bee colonies leave? A. Yes B. No

5. Concerned to swarming

1. Does swarming occur in your colonies or locality? A. Yes B. No

2. If your response is yes, what is the frequency?

A. Every season B. Every year C. Once in two years D. Others, specify: _____

3. When does swarming occur more frequently? (Months) From _____ to _____

4. Do you control / prevent/ swarming? A. Yes B. No

5. If yes, what methods do you use to control / prevent/ swarming?

Removal of queen cells A. Yes B. No

Harvest or cut honey combs (1) Yes (2) No

Supering A. Yes B. No

Using large volume hive A. Yes B. No

Others, specify: _____

6. Do you have swarms catching experience? A. Yes B. No

7. If yes, do you use swarm attractant materials? A. Yes B. No

8. How many swarms do you catch in this production year? (2013 E.C).

Concerned to constraints of beekeeping

1. What are the major constraints of beekeeping in the area? (Rank them)

Constraints	Rank
Pest and predators	
High wind	
Herbicide and pesticide application	
Absconding	
Beekeeping equipment's	
Shortage of water	

2. Does beekeeping profitable to the area? A. Yes B. No

7 Concerned to beekeeping extension linkage

1. Do you participating in beekeeping extension packages? A. Yes B. No

2. Did you receive training/ advice of improved beekeeping management practice from DAs? A. Yes B. No

3. If yes where you obtained?

A. Development agent B. community leader C. Market participant farmer

D. Neighbors E. Relatives and friends F. Radio, television, newsletter G. Others-----

4. If yes in what aspects? A. General inspection of hive B. Queen and brood management C. Dry season management D. About absconding and swarming E. Honey harvesting and processing F. Bee health and management G. Other, specify_____

5. Did you apply the training/advices received to your bee colony? A. Yes B. No

6. If you applying the training/advices, did you achieve any improvements in your colony?

A. Yes B. No

8. Is there a beekeeping association in your area? A. Yes B. No

9. If your answer to the above question is yes, are you a member? A. Yes B. No,

10. Do you get market information of honey? A. Yes B. No

Thank You for Your Cooperation!