# CONSTRAINTS AND OPPORTUNITIES OFHONEY PRODUCTIONIN CHEHA DISTRICT, GURAGHE ZONE, ETHIOPIA


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**APPROVAL SHEET**

Wolkite University College of Agriculture and Natural Resource

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Senior Research Project Approval Form

As *Senior* Research advisor, I hereby certify that I have read and evaluated this *Senior research work* prepared, under my guidance, by MengistuElbaso,WubetieAshagire,TemesgenPola**,** entitled "**Constraints and Opportunities ofHoney Production in Cheha District, Guraghe Zone, Ethiopia".** I recommend that it be submitted as fulfilling the *Senior Research* requirement.

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**DEDICATION**

This work is dedicated to our families for their great sacrifice, ceaseless prayers, support and encouragement.

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First, we would like to thank the Almighty of God for blessing invaluable gifts of health, strength, believes, love, hope, patience and protection to us and our families. We are very much indebted to acknowledge our research advisors Mr. ShimelisMengistu (MSc), his encouragement, genuine guidance, friendly treatment, financially support, constructive comments and adjust times to make ours for excellent cooperation with Cheha agricultural offices. Especially his friendly treatment from the initial conception to the end of this work is highly appreciated. Without him, our success is impossible.

**LIST OF ABBREVIATIONS**

| | |
|---|---|
| CSA | Central Statistical Authority |
| MOARD | Ministry of Agriculture and Rural Development |
| HH | Household |
| SNNPRS | Southern Nations, Nationalities and Peoples Regional State |
| SPSS | Statistical Package for Social Sciences |
| NGO | Non-Governmental Organization |
| USA | United State of America |

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**ABSTRACT**

*The study was conducted in Cheha District of Gurage Zone, with the objective of identifying major constraints and opportunities of honey production using semi structured questioner survey and field observation. Two representative kebeles (one from midland and another from low land) were selected purposively based on beekeeping potential and accessibility, followed by random selection of 30 households perkebele for individual interview. The collected data were analyzed by using SPSS version 20. Average family size in the district is 6.28 ± 1.37 with average of 5.47 ± 1.30 active working member. Majority of the households (63.33%) are in productive age group with education level of primary school and above (63.33%). Largest proportion of honey bee producers (66.67%) are within medium income wealth group with average land holding of 2.33 hectare per household, employing farming activity as main occupation (98.33%).Average colony holding per household is 2.30 ± 2.27, 0.28 ± 0.85, 0.60 ± 1.69 in traditional, transitional and modern hive, respectively. The mean honey yield in the area is 2.94 ± 1.05 kg, 3.84 ± 1.10 kg and 9.09 ± 4.29 kg from traditional, transitional and modern hive, respectively. Most of the farmers (70%) keep honey bee with the objective of producing honey for home consumption.Limited number of farmers (16.67%) have experience to purposively develop bee forage with significantly higher practice in Sisenakebele. The top most important honey bee production constraint are input/material shortage (index = 0.25), feed and water shortage (index = 0.15), colony shortage (index = 0.15), and skill gap (index = 0.15). Largest proportion of educated household, working age group with larger family member, honey production experience, diversified niches for bee flora, increasing demand for honey, high honey market access and presence of different development and research organizations are major opportunity for the future development of the honey production in the area.*

Key word: Cheha district, Colony, Constraints, Honey production, Opportunities.

# CHAPTER ONE

## 1. INTRODUCTION

### 1.1. Background and Justification

Ethiopia has a long-standing beekeeping practices and endowed with huge apicultural resources, suitable environment, own immense bee flora, suitable climate which all enable the country to sustain large number of honey bee colonies. The country owns about 5.92 million bee colonies and about five different bee races (Ayalew, 2001; CSA, 2017). The apicultural sector, in addition to honey production for food and medicinal value, has great contribution for the improvement of income. For instance, income of the country from apiculture was estimated at over $US 60 million/annum (Gezahegn, 2012). Furthermore, beekeeping production is environmentally friend, and ecologically sound activities that can be integrated with other agricultural practices. According to CSA, the major honey and beeswax producing regions in Ethiopia are Oromia (41%), SNNPR (22%), Amhara (21%) and Tigray (5%). Despite the long tradition of beekeeping practice, the outputs obtained from the sector are still low as compared to the vast potential of the country (Hartmann, 2004). This is due to several factors that can be classified as technical, technological,socio-economic and institutional factors which include poor management, handling of product, poor harvesting and storing of crude honey (which often results in large quantities of impurities), pests and predators, poor marketing system, lack of beekeeping knowledge, shortage of skills man power, shortage of bee equipment's, pesticide threat, poor infrastructure development, shortage of bee forage and lack of research extension (Kerealem*et al*., 2009). Low productivity and quality of bee products are the major economic impediments for beekeepers.

### 1.2. Statement of Problems

Cheha district is believed to have diversified type of vegetation and cultivated crops as potential for beekeeping activities. Moreover, apiculture resource is immense in the area according to the district report. But, there is no research information regarding honey production potential, beekeeping constraints and existing opportunities in this district, which is very essential to identify the potential development constraints and make use of best options. Therefore, the intention of this survey is to investigate current status of honeybee production, opportunities & constraints in the district toward answering the following research questions.

### 1.3.Research Question

- What is the current potential of honey production in study area?

- ❖ What are the constraints that affect honey production in study area?
- ❖ What are the opportunities of honey production in study area?

### 1.4. Objective

#### 1.4.1. General objective

- To assess honey production constraints and opportunities in Cheha district ofGurage zone.

#### 1.4.2. Specific objective

- ❖ To assessconstraints of honey production in the study area.
- ❖ To assess the opportunities of honey production in the study area.

### 1.5. Significance of Study

Governmental development and research organizations, and non-governmental organizations have been tryingto design and implement beekeeping intervention programs and projects inorder to improve the household economic and social issues from the sector. This study was conducted to assess the current status of honey bee production, honey production constraints and potential existing opportunities. Accordingly, the results of the study will be significant for policy makersand implementers in providing basic information about status of hive technology utilization, major impediment on improved honey production, potential interventions and improved management options. The result may also be used as a base forfurther investigation by other researchers about the beekeeping development program in the district and the zone as well.

### 1.6. Scope and Limitation of the Study

This study was focused on assessment of the honey production constraints and opportunity in Cheha district. Due to the possible shortage of resources (time, money and logistics), the study covered limited number of representative sites and small number of households.Hence, the result of the study may not represent at zone level.

## CHAPTER TWO

## 2. LITERATURE REVIEW

### 2.1. The Global Overview of Honey Production

The world total honey production is 1.3 million tons a year. Larger honey producing countries are Russia and others 19333,000 tones, China 161,000, USA 75 tones, Mexico 67,000 tons a year. Developing countries produce about 47% of the total world‘s honey production. Ethiopia is the leading honey producer in Africa and 10th in the world. Before 1970s Mexico was the world‘s honey exporter but now China leads. Developing countries are taken as a group accounted for 55.5% total experts. Ethiopia exports honey to traditional customers to the Arab counters (Saudi, Yemen) USA, Sweden etc. Developing counters in general and Africa in particular have many honey marketing constraints including quality problem, absence of honey processing facility, absence of appropriate honey container for storage, retail selling and transportation, using honey for beverages, absence of honey producers, collectors and cooperatives, cultural problems and lack of knowledge about properties of honey and inaccessibility to markets. Price of honey is influenced bysupply and demand condition, distribution time, transportation and storage nature of the product, standardization and promotion, availability of competitive products and tariff and nontariff barriers and government support(MoARD, 2003).

### 2.3. Honey Bee Production Systemin Ethiopia

Beekeeping in Ethiopia is an important activity for many rural people, both men and women, and is carried out in home gardens and even houses in all parts of the country. In many regions of the country, apiculture is considered as one of the income generating activities for resource poor farmers including women, youth and unemployed sectors of the community. There is no nationality in Ethiopia, which doesn't have beekeepers and for some, beekeeping, and the collection and selling of honey and other bee products, is a major economic activity (Mehari, 2007).

According to CSA (2017), 96.46% of bee colony is produced using traditional,1.2% using intermediate and the remaining 2.34% is with modern hive.Because of this data, the yield per colony per year would be 6.7 kg. TheMoARD, 2003.record suggests that the number of beehives in the country have growing at about 4.7% per annum.

#### 2.3.1. Traditional beekeeping methods

Traditional beekeeping is a means by which harvesting of honey and wax from traditional hives. The material from which traditional beehive made are clay, bamboo, wooden box, bark and cow dung

(Girmaand Deffar., 2001). There are two types of keeping honeybees traditionally including forest bee keeping and back yard bee keeping. In some places the back yard bee keeping is widely practices relatively with better management (Nuru, 2002). The level of bee keeping still remains in traditional system and about 94 to 97 percent of bees are still kept in traditional hives (Kerealem*et al*., 2009; CSA, 2017).

### 2.3.2. Transitional beekeeping method

This involves low cost traditional technology often using mud top bar hives. Management of these hives is much easier and allows the hives products to be harvested more efficient top bar hives are a comprehensive between a traditional beehive and movable frame hive (MF). They normally just have one box, not two. Horizontal bars are placed along the top of the box, covered with a lid. The bees are intended to build their combs on these bars, with the comb extending down into the box(JAICAF, 2009).

### 2.3.3. Modern beekeeping methods

Frame hive beekeeping is the most intensive system, which needs comparatively expensive inputs and relatively skilled labor to manage the colonies successfully. The hives are more complex and difficult to build but they are easily transportable and generate greater quantities of better quality honey, which will command higher prices (Mehari, 2007). To keep bees form building unwanted comb between vertical combs, or to the side of the hive, the spacing of the top bars is of primary importance; it must give the correct bee space which is precisely 32 mm for tropical A. Mellifera(JAICAF, 2009).

This hive used in this type beekeeping consists of precision-made rectangular boxes which fir one on top of the other. It has at least two boxes (supers) with the lower chamber called the brood chamber. Between the brood chamber and the super sometimes a queen excluder is placed. It limits egg laying activity of the queen to the brood chamber only. The wooden frame are"wired" and complemented with a sheet of wax foundation. Each box contains a set of framed combs (JAICAF, 2009).

## 2.4. Honey and Wax Production in Ethiopia

In the country about 47.71 million kilo gram of honey is estimated to be produced annually (CSA, 2017). The potential for improvement of the traditional honey and wax production has led to apiculture promotion as part of policy initiatives taken by government of Ethiopia although they have been, in the past, defeated by impact of major constraints and lack of appropriate research

(Melaku*et.al.*, 2008). There is a strong, local demand for honey, due to its use for the production of traditional beverage '*Tej' (*honey mead). In Ethiopia, much honey has traditionally been fermented to make *'Tej'* and according to Edessa (2002). From the total honey produced in the country beekeepers are estimated to earn about 360-480 million Birr per year (Nuru, 2002).This makes the country the leading honey producer in Africa and one of the ten largest honey-producing countries in the world.

Beeswax collection in several regions of the countryis not significant and commonly wasted. The wax is mostly left or thrown away because beekeepers do not bother to collect it since it is of little practical value for beekeepers and the people do not know the local beeswax is generating attractive money. Nevertheless, the annual beeswax production of the country is estimated at about 3,658 tones. This makes Ethiopia the fourth largest beeswax producing country in the world after China, Mexico and Turkey. Ethiopia is the third largest beeswax exporter in Africa and the annual average value of beeswax is estimated at about 125 million Birr (Nuru, 2002).

**2.5. Marketing of honey**

The domestic honey market starts at the smallholder beekeepers level, who majorly sells crude honey to collectors in the nearest town/village markets (Assefa A., 2009). Therefore, the producers are price takers. The collectors mainly pass the honey to the whole sellers in big cities and towns, though significant amount of honey they collect also goes to local tej brewers, processors and other consumers (Assefa A., 2009; Assefa M., 2011). The whole sellers are largely situated in cities and big towns and they distribute the honey they get from collectors to retailers, tej brewers, processors and consumers. In some areas, beekeepers form producing and marketing cooperatives to cope with the market challenge they face. The cooperatives collect crude honey from their members and sell the semi-processed honey to processing companies and other intermediaries who buy in bulk and retail. However, in many cases the cooperatives lack proper collection, storage and transportation facilities and hence compromise the quality of the honey. They also have low business concept (market information gathering and analysis, promotion, client handling, etc) to be competitive (Assefa A., 2009). The whole domestic honey market lacks proper structure and legality. It is of lengthy chain of actors that widens the access of producers to bigger and better paying markets. So, the beekeepers complain the business as not rewarding and even lacking market for their product, while the consumers see the ever increasing price of honey as unfair. Moreover, the market faces challenges like smuggling that pushes the legal actors out of market. In many cases, adulteration of

honey has been a frustrating factor for both the producers and legal buyers and sellers as the traceability and accountability is far from practicability.

### 2.6. Major Constraints in Beekeeping

#### 2.6.1. Shortage of bee forage

Shortage of bee forage due to population pressure, lack of land use policy and the high demand for farm lands put pressures on mountainous areas to be used for crop production and livestock grazing. These create deforestation, soil erosion and irreversible ecological degradation. Moreover, burning of undergrowth and destroying of forestland for expansion of farmland could trigger a reduction of honey producing floras and foraging areas. The elimination of good nectar and pollen producing tree species in many areas makes it difficult to maintain bee colonies without feeding (Kerealem, 2005). Based on the results of rural households' socio-economic baseline survey, shortage of bee forage was the major constraint of beekeeping in the Amhara Region (Kerealem*et al.*, 2009).

#### 2.6.2. Pesticides poisoning

The use of chemicals and pesticides for crop pests, weeds, Tsetse fly, mosquitoes and household pests control brings in to focus the real possibility of damaging the delicate equilibrium in the colony, as well as the contamination of hive products. Of the various kinds of chemicals only insecticides and herbicides are now major problems to the beekeepers. 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. Insecticides have a much more dramatic effect on population of bees, thus, the important contribution made by bees to the production of food and human nourishment is being jeopardized. 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. Poisoning of honeybees by agrochemical has been increased from time to time and some beekeepers lost totally their colonies due to agrochemical (Kerealem*et al.*, 2009).

### 2.7. Socio- Economic Importance of Bee Keeping

Beekeeping is a source of food (with very good energy source and medicinal value) and cash income for a family household. This activity does not compete for resource with agricultural endeavors and can be run with other agricultural activities. Globally, honey bee provides pollination service which enhance crop productivity. So that bee-keeping plays significant role to the agricultural economy at

large.Beekeeping activity can be operated by the whole family members of a household at any working age group. That means, it can help efficient utilization of family labor. Abeekeeping can develop knowledge and skill which is rewarding and generate self-reliance. Other local traders benefit by making hive and equipment and from using and selling the products ( Assefa A., 2009; Assefa M., 2011).

### 2.8. Opportunities of Beekeeping in Ethiopia

As reported by Gallman P. and Thomas H.(2012), Ethiopia is currentlylisted as a third country permitted to export honey by the European. There is an increasing demand for honey for domestic consumption and export by different customers and organizations. Availability of rich culture and tradition of beekeeping, suitable environment with different agro ecology, presence of strong bee colony, diversified flora, water sources, indigenous knowledge, skills and interest of the farmers to adopt improved technologies and to undertake beekeeping as a way of life are among the few to mention (Serda*et al.*, 2015). On the other hand, the opportunities for beekeeping in the country were the presence of natural resources and human capital, the current attention of the government towards the introduction of different beekeeping technology packages, the establishments of beekeeping association and the presence of governmental and non-governmental organizations who are involved in beekeeping activities and the presence of micro finance institutes at grass-root level. 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.

## CHAPTER THREE

## 3. MATERIALS AND METHODS

### 3.1. Description of the Study Area

The study was conducted in Cheha districts. It located in Gurage Zone of Southern Nations, Nationalities and Peoples Regional State (SNNPRS), Ethiopia (Figure1). The capital of the district, Endibir, is located at 188 km south of Addis Ababa and about 30 km from 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 from 900 to 2812 meters above sea level (m.a.s.l). It has a total area of 57315 ha of which 40190 ha is cultivated. The district constitutes 38 rural *kebeles*. The average annual rainfall of the area is about 1268.04 mm and the average maximum and minimum temperature in the study area is 24.97 $^{o}$C and 10.69 $^{o}$C, respectively (Cheha Woreda Agricultural Office report).

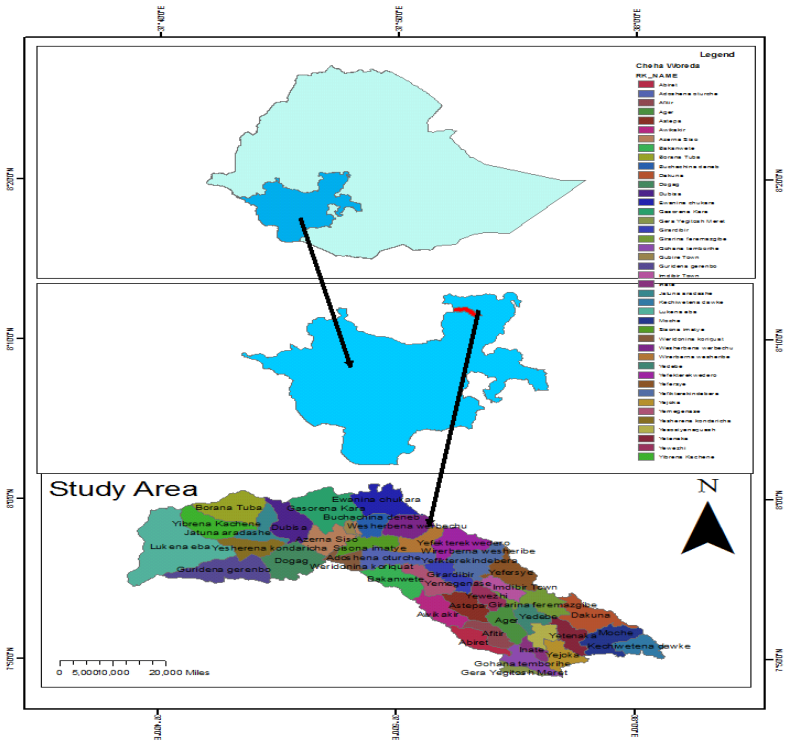


Figure 1: Location of the study area

### 3.2. Sampling Techniques and Data Collection Procedures

Before conducting field survey data collection, discussion was performed with the head of Cheha district Livestock and Fishery Resource office on the objective of the study, and kebele and farmer selection. Out of 38 kebelein the district, the study was conducted in two representativekebeles.The

two Kebelesfrom midland, were purposely selected based on the potential of honey bee production and road accessibility. Out of honey bee producers, sixty households, 30 from each kebele, were selected randomly.Primary and secondary data were collected from the selected kebeles. Primary data were collected through semi-structured questionnaire and field observation. The secondary data were obtained from published and unpublished documents, and district Livestock and Fishery Resource office report. Information on socio-economic characteristics of respondents, honey production, sources of material and input, hive technology utilization trend, colony management practice, honey bee forages, constraints and opportunities of honey production were gathered.

### 3.4. Data Analysis

The collected data were analyzed using descriptive statistics of appropriate statistical packages for social sciences (SPSS) software version 20. Chi-square test at 5% probability was employedto separate means for some categorical variables.Index on constraints was calculated using the following formula.

Index = [(N*Number of HH ranked 1st) + (N-1*Number of HH ranked 2nd) + … + (1* Number of HH ranked Nth) for each parameter considered] / [(N*Number of HH ranked 1st) + (N-1 *Number of HH ranked 2nd) + … + (1* Number of HH ranked Nth) for allparameter considered].

## CHAPTER FOUR

## 4. RESULTS AND DISCUSSION

### 4.1. Socio Economic Characteristic

#### 4.1.1.Household characteristics

Information on family size, age and education level of farm households are presented on Table 1. Among the honey bee producers, male headed household consists higher percentage than female headed households. Majority of the of honey bee producers are literate (primary and above) and within productive age group (18-54 years old) with higher family size and active working members which is in agreement with report for Silte district (Alemayehu, 2011).

Table 1: Household sex, age group, education level and family size

| Description | | Sisenaematye (N=30) | Wordene (N=30) | Overall (N=60) | $X^2$ | SL |
|---|---|---|---|---|---|---|
| Household head sex | Male | 96.67 | 100.0 | 98.33 | 1.02 | 0.313 |
| | Female | 3.33 | 0.0 | 1.67 | | |
| Household education level | Illiterate | 13.33 | 60.0 | 36.67 | 15.21 | 0.002 |
| | 1 to 4 | 10.00 | 10.0 | 10.00 | | |
| | 5 to 8 | 53.33 | 23.3 | 38.33 | | |
| | 9 to 10 | 23.33 | 6.7 | 15.00 | | |
| | 11 to 12 | 0.00 | 0.0 | 0.00 | | |
| | College | 0.00 | 0.0 | 0.00 | | |
| Household head age group (year) | 18 to 30 | 6.67 | 0.0 | 3.33 | 3.76 | 0.289 |
| | 31 to 54 | 63.33 | 56.7 | 60.00 | | |
| | 55 to 64 | 23.33 | 40.0 | 31.67 | | |
| | > than 65 | 6.67 | 3.3 | 5.00 | | |
| Average family size | | Mean±SD | Mean±SD | Mean±SD | F | SL |
| | Male | 3.93±0.64 | 3.63±1.13 | 3.78±0.89 | 3.78 | 0.885 |
| | Female | 3.00±1.17 | 2.30±0.7 | 2.65±0.94 | 2.65 | 0.935 |
| | Total | 6.63±1.42 | 5.93±1.31 | 6.28±1.37 | 6.28 | 1.365 |
| | Active worker | 5.80±1.28 | 5.13±1.31 | 5.47±1.30 | 5.465 | 1.295 |

$X^2$ = Chi-square, SD = standard deviation, SL = Significant level, F = F-statistics

Average family size of a household in the current study is inagreement with previous report (7.3) (Biruk, 2014) conducted in the same location fromdifferent agro-ecology and in Anelemo district (6.47) (Salo*et al.*, 2017). It was alsosimilar with reports in Horro and Gududru districts (Kassahun *et al.*, 2015), and Fogera,Jeldu, and Diga districts (Ayele *et al.*, 2012). However, it was lower than reports (9.92)for Adami Tulu Jiddo-Kombolcha district (Dawit*et al.*, 2013). In most rural part of Ethiopian, family members are the main source of household labor. Hence, large family size could be taken as an opportunity with regard to accomplishing laborious farmactivities. However, large family size could have negative impact on the livelihood of thefamily if economic activities and income sources are limited (Abba, 2010).The presenceof large family size might be attributed to labor demanding agricultural activities in thearea (Yadessa, 2015) and/or lack of awareness on proper family planning methods.Education plays great role in transferring technology and in initiating farmers'willingness to adopt different technologies. Accordingly, presence of large number ofeducated people who attended primary and secondary education in the study area can be considered as an opportunity to easily disseminate different technologies throughstrengthened trainings. Majority of the household head being in the range of activeworking age groups is also a big opportunity to undertake multiple tasks. The average age47of household in the current study was similar with average household age of 39.5 (25-75years) reported for Dandi district of west Shewa zone (Mamaru and Tadele, 2017).

### 4.1.2. Farming Characteristics

Occupation, wealth status and land holding is presented in Table 2. Major occupation of the respondents (98.33%) is farming. Majority of honey bee producers (66.67%) are within medium income wealth group with average land holding 2.33 hectare per household.Major occupation in the district being farming indicated that farming (bothcrop and livestock), is the main means of living in the study area. The average land holding per household in the area as per the current study was higher than the reports for average land holding(0.66 ha) in Anelemo district (Salo*et al.*, 2017) and for Doyogena district (0.5-1 ha)(Mekonnen*et al.*, 2014).

Table 2: Major occupation, wealth status and average land holding

| Description | | Sisena (N=30) | | Wordina (N=30) | | Overall (N=60) | | $X^2$ | SL |
|---|---|---|---|---|---|---|---|---|---|
| | | N | % | N | % | N | % | | |
| Occupation | Farming | 30.00 | 100.00 | 29.00 | 96.67 | 59.00 | 98.33 | 1.02 | 0.313 |
| | Trading | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | | |
| | Labor | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | | |
| | Farming and trading | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | | |
| | Farming and labor | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | | |
| | Employment | 0.00 | 0.00 | 1.00 | 3.33 | 1.67 | 2.78 | | |
| Wealth group | Low income | 6.00 | 20.00 | 12.00 | 40.00 | 30.00 | 50.00 | 2.90 | 0.235 |
| | Medium income | 23.00 | 76.67 | 17.00 | 56.67 | 66.67 | 111.11 | | |
| | High income | 1.00 | 3.33 | 1.00 | 3.33 | 3.33 | 5.56 | | |
| Average land holding (ha) | | Mean | SD | Mean | SD | Mean | SD | F | SL |
| | | 2.47 | 0.82 | 2.20 | 0.55 | 2.33 | 0.71 | 2.19 | 0.144 |

SD= Standard deviation, SL = significant level, F= F statistics, $X^2$ = Chi-square

### 4.2.Current beekeeping practices and experiences

#### 4.2.1. Type of beekeeping

The type of beehive technology and mean colony holding with each hive technology are presented in Table 3. Accordingly, large proportion of the respondents (71.67%) practiced traditional beekeeping only, 13.33% used movable-frame, and 15% of the respondents practiced two or three types of beekeeping respectively.Concerning hive distribution by typeat district level, traditional, transitional and modern hive are owned by about 86.67%, 8.33% and 23.33% with average holding of 2.3, 0.28 and 0.60, respectively.This hive technology proportion is in agreement with the national average (CSA, 2017). Beekeepers used locally available material and indigenous knowledge to make traditional hives. Traditional hive is the most available technology in the area because farmers can easily made it from locally available materials in the area. The financial & technical constraints affect the development of improved beekeeping in the area as indicated by the respondents. However, some NGOs & agricultural extension office promote improved beekeeping and convinced some farmers to practice it. The current study was in agreement with Beyene and David (2007) who

reported traditional, intermediate, and modern beehives are used for honey production in Ethiopia. The outcome of the investigation is inline with other finding conducted in Central, Northern and South Western part of Ethiopia where traditional beekeeping system is the predominantpractice in the rural areas of the country. Furthermore, MoARD(2007) reported that finance and skill gaps in have constrained the adoption of frame beehives by beekeepers. Movable frame hives allow appropriate colony management and use of a higher level technology, with larger colonies, and can provide higher yield and quality honey but are likely to require high investment cost and good operational skill.

Table 3: Major beekeeping practices and average colony holding per hive type

| Hive ownership | Sisenaematye (N=30) | Wordene (N=30) | Overall (N=60) |
|---|---|---|---|
| Traditional hive only | 70.00 | 73.33 | 71.67 |
| Transitional hive only | 0.00 | 0.00 | 0.00 |
| Modern only | 20.00 | 6.67 | 13.33 |
| Traditional & transitional | 3.33 | 6.67 | 5.00 |
| Traditional & modern | 3.33 | 10.00 | 6.67 |
| Transitional & Modern | 0.00 | 0.00 | 0.00 |
| All three types | 3.33 | 3.33 | 3.33 |
| Average colony size | Mean ± SD | Mean ± SD | Mean ± SD |
| In traditional hive | 2.23±2.21 | 2.37±2.34 | 2.30±2.27 |
| In transitional hive | 0.43±1.14 | 0.13±0.57 | 0.28±0.85 |
| In Modern hive | 0.63±1.43 | 0.57±1.55 | 0.60±1.49 |

SD= Standard deviation

**4.2.2. Beekeeping experience, production purpose and colony source**

Farmers' beekeeping experience, purpose of honey bee production and initial source of colony are presented in Table 4. Regarding overall beekeeping practice, majority of the farmers have one to five years of experience followed by those who have 6 to 10 years and then more than 10 years. But, only 40% of them have practiced beekeeping using modern hive with majority having 1 to 5 years of experience. Most of the farmers (70%) keep honey bee with the objective of producing honey for home consumption while about 28.33% of beekeepers undertakethe task to produce honey for dual purpose, home consumption and income source. Only few farmers (less than 2%) target cash income

from honey production. About 95 % of honey bee producers obtain initial colony by catching swarm using traditional hive hanging on trees in the forest and around homestead. Colony purchase is rarely practiced in the area. Hive placement practice in the area include hanging on tree near homestead (55%), backyard (35%), keeping hive in the house (6.67%) and putting hive under eave of the house (3.33%). Major hive placement is putting on tree near homestead followed by keeping at backyard.The present study on consumption disagreed withGetachew (2018)who reported that about 10% of the honey produced in the country is consumed by beekeeping households in Gesha district of kefa zone.

Table 4: Beekeeping experience, purpose of honey bee production and colony source

| Description | | Sisena (N=30) | Wordina (N=30) | Overall (N=60) | $X^2$ | SL |
|---|---|---|---|---|---|---|
| Beekeeping experience | Less than 1 year | 3.33 | 6.67 | 5.00 | 0.56 | 0.906 |
| | 1 to 5 years | 46.67 | 50.00 | 48.33 | | |
| | 6-10 years | 36.67 | 33.33 | 35.00 | | |
| | More than 10 years | 13.33 | 10.00 | 11.67 | | |
| Modern hive experience | No experience | 53.33 | 66.67 | 60.00 | 2.63 | 0.453 |
| | Less than 1 year | 3.33 | 0.00 | 1.67 | | |
| | 1 to 5 year | 40.00 | 33.33 | 36.67 | | |
| | 6 to 10 year | 3.33 | 0.00 | 1.67 | | |
| | More than 10 years | 0.00 | 0.00 | 0.00 | | |
| Beekeeping purpose | Income source | 3.33 | 0.00 | 1.67 | 1.91 | 0.385 |
| | Home consumption | 63.33 | 76.67 | 70.00 | | |
| | Income and consumption | 33.33 | 23.33 | 28.33 | | |
| Colony source | Catching swarm | 96.67 | 93.33 | 95.00 | 3.018 | 0.221 |
| | Purchasing colony | 3.33 | 0.00 | 1.67 | | |
| | Inheritance | 0.00 | 6.67 | 3.33 | | |
| | Gift | 0.00 | 0.00 | 0.00 | | |
| Hive placement | Backyard | 36.67 | 33.33 | 35.00 | 0.078 | 0.994 |
| | Under eaves of house | 3.33 | 3.33 | 3.33 | | |
| | Inside the house | 6.67 | 6.67 | 6.67 | | |
| | Hanging on tree near homestead | 53.33 | 56.67 | 55.00 | | |
| | Hanging on tree in forest | 0.00 | 0.00 | 0.00 | | |

SD= Standard deviation, SL = significant level

### 4.2.3. Honey bee production and hive technology utilization trend

The trend of different hive technology utilization is presented in Table 5. Utilization of transitional and modern hive technology is decreasing while increasing traditional hive utilization as per majority of the respondents. There was no significant variation on trend among the study kebeles.This study agrees with (Mehari, 2007)who reported that frame hive beekeeping is the most intensive system, which needs comparatively expensive inputs and relatively skilled labor to manage

the colonies successfully. The hives are more complex and difficult to build but they are easily transportable and generate greater quantities of better quality honey, which will command higher prices. This situation made some early adopter farmers to utilize the modern hive technology.

Table 5: Honey bee production trend using different hive technology

| Description | Sisena (N=30) | Wordina (N=30) | Overall (N=60) | $X^2$ | SL |
|---|---|---|---|---|---|
| Traditional hive utilization trend | | | | 0.281 | 0.869 |
| Increasing | 43.33 | 50.00 | 46.67 | | |
| Decreasing | 36.67 | 33.33 | 35.00 | | |
| Stable | 20.00 | 16.67 | 18.33 | | |
| Transitional hive utilization trend | | | | 1.69 | 0.431 |
| Increasing | 30.00 | 16.67 | 23.33 | | |
| Decreasing | 66.67 | 76.67 | 71.67 | | |
| Stable | 3.33 | 6.67 | 5.00 | | |
| Modern hive utilization trend | | | | 0.23 | 0.891 |
| Increasing | 36.67 | 36.67 | 36.67 | | |
| Decreasing | 53.33 | 56.67 | 55.00 | | |
| Stable | 10.00 | 6.67 | 8.33 | | |

$X^2$ = Chi-square, SL = Significant level

**4.2.4. Factors affecting hive technology utilization**

Major reasons for the existing hive technology utilization trend are indicated in Table 6.The increasing trend in traditional hive utilization is mainly due to its being cheap and more accessible followed by the need of simple management. On the contrary, transitional and modern hive utilization is decreasing mainly because of high material cost, and the need of skill and strong follow up.The increasing trend for traditional hive is significantly higher than the decreasing trend. Whereas, the decreasing trend for transitional and modern hive is significantly higher than the increasing trend.

Table 6: Factors affecting existing trend on hive technology utilization

| | Reason for the existing trend | | | | | | |
|---|---|---|---|---|---|---|---|
| Trend with traditional hive | Cheap and accessible | Feed shortage | Low productivity | NA | Simple management | Poor honey quality | Predator problem |
| Increasing | 33.33 | 0.00 | 0.00 | 0.00 | 13.33 | 0.00 | 0.00 |
| Decreasing | 1.67 | 15.00 | 10.00 | 0.00 | 0.00 | 6.67 | 1.67 |
| Stable | 0.00 | 0.00 | 0.00 | 18.33 | 0.00 | 0.00 | 0.00 |
| $X^2$ = 115.24; SL=0.000 | | | | | | | |
| Trend with transitional hive | Expensive | More productive | Less accessible | NA | Needs more management | Space problem | |
| Increasing | 0.00 | 23.33 | 0.00 | 0.00 | 0.00 | 0.00 | |
| Decreasing | 38.33 | 0.00 | 20.00 | 0.00 | 5.00 | 8.33 | |
| Stable | 0.00 | 0.00 | 0.00 | 5.00 | 0.00 | 0.00 | |
| $X^2$ = 120.00; SL = 0.000 | | | | | | | |
| Trend with modern hive | Expensive | High productive and quality | NA | Needs more management | | | |
| Increasing | 3.33 | 33.33 | 0.00 | 0.00 | | | |
| Decreasing | 38.33 | 1.67 | 0.00 | 15.00 | | | |
| Stable | 0.00 | 0.00 | 8.33 | 0.00 | | | |
| $X^2$ = 107.31; SL = 0.000 | | | | | | | |

NA = Not applicable, because reason was given only for the changing trend; SL= significant level, $X^2$ = Chi-square

### 4.2.5. Honey production from different hive technology

Average honey yield and frequency of harvest from different hive technology are presented in Table 7. Accordingly, the mean honey yield is 2.94 ± 1.05, 3.84 ± 1.10 and 9.09 ± 4.29 from traditional, transitional and modern hive, respectively. The honey yield per colony in the current investigation is lower than a report for Silte district (Alemayehu, 2011) which could be attributed with low bee forage availability. The present result was in contrary with the result reported by WelayKiros and Tekleberhan (2017) in the Jimma and Illubabordistricts ofOromia region, who found that the average honey yield per year/colony was 7.20 ± 0.23, 14.70 ± 0.62, and 23.38 ± 0.73 kg for traditional, transitional, and moveable frame hives, respectively.Largest proportion of beekeepers harvest honey two times a year. There was no significant difference on both yield and frequency of harvest between the two study kebeles.The current research result on harvesting frequency was in line with Tessega (2009), who reported honey harvested twice a year was most common in some Burie district.

Table 7: Honey yield and frequency of harvest from different hive technology

| Description | Sisena (N=30) | Wordina (N=30) | Overall (N=60) | F | SL |
|---|---|---|---|---|---|
| Honey yield | | | | | |
| From Traditional hive | 3.09±1.66 | 2.82±1.35 | 2.94±1.50 | 0.182 | 0.671 |
| From transitional hive | 4.95±1.06 | 3.00±1.15 | 3.84±1.10 | 0.014 | 0.907 |
| From modern hive | 10.88±5.45 | 6.65±2.56 | 9.09±4.29 | 2.039 | 0.159 |
| Honey harvesting frequency | | | | $X^2$ | SL |
| From Traditional hive | | | | 3.680 | 0.452 |
| One times | 8.00 | 3.70 | 5.77 | | |
| Two times | 72.00 | 77.78 | 75.00 | | |
| Three times | 20.00 | 18.52 | 19.23 | | |
| From Traditional hive | | | | 4.350 | 0.360 |
| One times | 25.00 | 0.00 | 14.29 | | |
| Two times | 25.00 | 100.00 | 57.14 | | |
| Three times | 50.00 | 0.00 | 28.57 | | |
| From modern hive | | | | 3.160 | 0.206 |
| One times | 0.00 | 0.00 | 0.00 | | |
| Two times | 55.56 | 85.71 | 62.50 | | |
| Three times | 44.44 | 14.29 | 37.50 | | |

SL = Significant level, F= F statistics

### 4.2.6. Apiary site visit & hive inspection practice

The apiary visit and hive inspection practice of the respondents in the study area is presented in Table 8 below. The investigation revealed that all respondents accustomed to visit the apiary site occasionally just to check the presence of the hive, swarm status and honey preparation. Majority of the farmers have experience to perform both external and internal hive inspection. External inspection is conducted more frequently than internal inspection. Internal hive inspection practice is significantly higher in Sisenaematyekebele than Wordenekebele. About 95% of the respondents have accustomed to clean their hive and apiary site.The result of external inspection process in the current study was more than the report (36.3%) by Getachew (2018) for keffa district. Whereas, internal inspection as per this study was in agreement with Tessega (2009) who reported 46.7%, 20.6% & 7.5% of the respondents in Bure district conducted internal hive inspection rarely.

Table 8: Apiary site visit, hive inspection and cleaning practice in the study area

| Variable | Category | Sisena (N=30) | Wordene (N=30) | Overall (N=60) | $X^2$ | SL |
|---|---|---|---|---|---|---|
| Hive inspection | Yes | 100.00 | 100.00 | 100.00 | 0.00 | 1 |
| | No | 0.00 | 0.00 | 0.00 | | |
| Inspection type | External inspection | 6.67 | 10.00 | 8.33 | 1.20 | 0.549 |
| | Internal inspection | 3.33 | 0.00 | 1.67 | | |
| | Both type of inspection | 90.00 | 90.00 | 90.00 | | |
| External inspection | Frequently | 56.67 | 53.33 | 55.00 | 1.03 | 0.597 |
| frequency | Sometimes | 43.33 | 43.33 | 43.33 | | |
| | Rarely | 0.00 | 3.33 | 1.67 | | |
| Internal inspection | Frequently | 20.00 | 3.33 | 11.67 | 6.37 | 0.041 |
| frequency | Sometimes | 30.00 | 56.67 | 43.33 | | |
| | Rarely | 50.00 | 40.00 | 45.00 | | |
| Apiary site and hive | Yes | 90.00 | 100.00 | 95.00 | 3.16 | 0.076 |
| cleaning | No | 10.00 | 0.00 | 5.00 | | |

### 4.2.7.Bee forage production and honey bees feeding practice

Bee forage production and honey bee feeding practice in the study area is presented in Table 9 below. Majority of the farmers do not produce bee forage except few farmers who plant sunflower and Melilots with more practice in Sisenakebele. Lack of awareness followed by lack of planting

material and land shortage were the major constraints for limited/no bee forage production in the area.The study indicated that only 56.67% and 35% of the respondents practiced watering and supplementary feeding, respectively, of honeybee during dearth period.Major supplementary feeds used in the area were "shuro"followed by sugar.The result is agree with Shenkute*et al.* (2012**)** who reported no provisions of supplementary feeds at the time of sever feed shortage in traditional practices of forest beekeeping, however only few who involved in intermediate beekeeping supplement bees sugar syrups and roasted pulse flour in south west Ethiopia. The respondent of beekeepers that practiced improved beekeeping feed their bees during the off-flowering season of major honey bee plants.

Table 9: Bee forage produced and honey bee feeding practice

| Description | | Sisena (N=30) | Wordene (N=30) | Overall (N=60) | $X^2$ | SL |
|---|---|---|---|---|---|---|
| Do you produce bee forage? | Yes | 33.33 | 0.00 | 16.67 | 12.00 | 0.001 |
| | No | 66.67 | 100.00 | 83.33 | | |
| Reason for no forage production | NA | 33.33 | 0.00 | 16.67 | | |
| | Lack of input | 6.67 | 13.33 | 10.00 | 16.77 | 0.001 |
| | Lack of awareness | 60.00 | 66.67 | 63.33 | | |
| | Land shortage | 0.00 | 20.00 | 10.00 | | |
| | Financial constraint | 0.00 | 0.00 | 0.00 | | |
| Planted forage | NP | 66.67 | 100.00 | 83.33 | 12.00 | 0.002 |
| | Melilotus | 10.00 | 0.00 | 5.00 | | |
| | Sunflower | 23.33 | 0.00 | 11.67 | | |
| Do you provide water? | Yes | 66.67 | 46.67 | 56.67 | 2.44 | 0.118 |
| | No | 33.33 | 53.33 | 43.33 | | |
| Do you use supplementary feed? | Yes | 40.00 | 30.00 | 35.00 | 0.66 | 0.417 |
| | No | 60.00 | 70.00 | 65.00 | | |
| Type of supplementary feed | NS | 60.00 | 70.00 | 65.00 | 1.50 | 0.683 |
| | Honey | 3.33 | 0.00 | 1.67 | | |
| | "Shuro" | 26.67 | 23.33 | 25.00 | | |
| | Sugar | 10.00 | 6.67 | 8.33 | | |

NA= not applicable for forage producers, NP = no producer, NS= no supplementation, SL= significant level at ($P<0.05$).

Beekeepers in Ethiopia rarely practice feeding honeybees. Most beekeepers in the study area believe that honeybee naturally sustain by themselves and produce honey via foraging from natural forest and cultivated crops. This result agree with reported in keffa district where the respondents who

practiced supplementing of honey bees, roasted pea, sugar and honey during the feed shortage (Getachew, 2018).

### 4.2.8. Otherbee forage plants in the study area

Major bee forageswhich either naturally grown or planted for other purposes are indicated in Table10.Eucalyptus, coffee and mango, in respective order, are the most important plant that serve as bee forage in the district. The contribution of Wanza(*CordiaAfricana*) as bee forage was higher in Sisenakebele. Majority of bee forage plants flower in May and September.

Table 10: Contribution of existing bee forage plants and their main flowering season

| Bee forage | Sisenaematye | | Wordene | | Overall | | Flowering month |
|---|---|---|---|---|---|---|---|
| | Index | Rank | Index | Rank | Index | Rank | |
| Eucalyptus (*Eucalyptus camadulensis*) | 0.29 | 1 | 0.32 | 1 | 0.29 | 1 | September |
| Coffee (*Coffee Arabica*) | 0.14 | 4 | 0.21 | 2 | 0.20 | 2 | March |
| Mango (*Mangiferaindica*) | 0.15 | 3 | 0.11 | 5 | 0.13 | 3 | April-May |
| Orange (*Citrus aurantium)* | 0.09 | 6 | 0.15 | 3 | 0.11 | 4 | May |
| Wanza (*Cordiaafricana*) | 0.16 | 2 | 0.07 | 6 | 0.11 | 5 | September & May |
| Avocado (*Perseaamericana*) | 0.14 | 5 | 0.13 | 4 | 0.10 | 6 | April-May |
| Sesbania (*Sesbaniasesban*) | 0.02 | 7 | 0.00 | 8 | 0.01 | 7 | May |
| Chat (*Chataedulis*) | 0.01 | 8 | 0.01 | 7 | 0.01 | 8 | May |

This variation in vegetation characteristics of the area could be substantial to secure ample pollen and nectar vital for reproduction of bees & production of honey. The present study is in agreement with Chala*et al.* (2012) who reported similar composition of honey bee plants in Gomma district. Nuru (2002)also described, the honeybee population and their productivities in general are mainly influenced by the nature of honeybee. The interviewed beekeepers also reported many cultivated crops in the area serve as pollen, nectar or both pollen and nectar sources. Mainly trees shrub, cultivated crops and some woody plant are the main bee forges for the honey harvested in October to November while most woody plant are the main source of pollen and nectar for honey harvested in March to May. The reduction in bee forage availability might be attributed with different rate of deforestation & land clearing for crop cultivation could contribute to the disparity on trend of honey bee flora.

### 4.3. Honey Marketing

The current status of honey marketing in the area is presented in Table 11. Small proportion of farmers accustomed to sale honey in the area. Major honey sold is in its semi-processed form in village market for consumers. According to the information collected from the respondents, the price of honey in the area varies from 155.00 to 179.58 Ethiopian birr/kg based on season and the honeyquality. Higher honey price is obtained in the dry season especially during the period when there is no honey production, and lowest price during honey harvesting time (September to November and May). There is no market problem as per major respondents (above 65%) in the district. The emphasis given for honey production is as table food. Although the potential for honey production in study area is low, there is a limited supply of honey due to inadequate yield production practice. A survey on the market for bee products in the district showed that honey is the major product to higher degree other products such as beeswax and honey bee colony. The types of honey which have been marketed in the district are crude honey harvested from traditional hives mixed with unripe and brood honey/comb. The honey produced in the area is sold to consumers and collectors/traders who buy and sell honey to traders coming from neighboring towns. According to results of this study, the main buyers were said to be consumers, and traders. About 94% of the respondents indicated that they sell their honey directly to end consumers and the remaining (6%) of the respondents sold to traders.

Table 11: Current honey marketing status in the study area

| Description | | Sisena | Wordina | Overall |
|---|---|---|---|---|
| Honey sale (%) | Yes | 16.67 | 23.33 | 20.00 |
| | No | 83.33 | 76.67 | 80.00 |
| Form of honey sold | Raw honey | 40.00 | 0.00 | 16.67 |
| (%) | Semi processed | 60.00 | 100.00 | 83.33 |
| | Processed | 0.00 | 0.00 | 0.00 |
| Customer (%) | Consumers | 92.00 | 96.00 | 94.00 |
| | "Tej" house | 0.00 | 0.00 | 0.00 |
| | Cooperatives | 0.00 | 0.00 | 0.00 |
| | Traders | 8.00 | 4.00 | 6.00 |
| Market price status | High | 0.00 | 0.00 | 0.00 |
| (%) | Medium | 40.00 | 85.71 | 66.67 |
| | Low | 60.00 | 14.29 | 33.33 |
| Selling place (%) | In your home | 0.00 | 14.29 | 8.33 |
| | Bush/village market | 80.00 | 71.43 | 75.00 |
| | Public market | 20.00 | 14.29 | 16.67 |
| Honey selling price | Minimum price (Birr/kg) | 170.00±27.39 | 144.29±60.24 | 155.00±49.27 |
| (Average ± Std.dv) | Maximum price (Birr/kg) | 204.00±26.79 | 162.14±66.20 | 179.58±55.82 |
| | Average Price (Birr/kg) | 187.00±25.09 | 153.21±63.16 | 167.29±52.03 |

**4.4. Access to Training and Apiary Materials**

Farmers' access to training and apiary materials are presented in Table12. According to the result, majority of the farmers did not have access training and apiary materials. Largest proportion of the respondents with material access obtain the materials through credit. Largest proportion of farmers obtain training from agricultural extension office.Access to beekeeping train 68.33% of respondents couldn't get any training on beekeeping practice in the study areas. The remaining 31.67 % of the respondents have got training by both NGOS and Agricultural extension office on hive and honey management and honey processing. Lack of knowledge in all aspects was one of the gaps in the study areas for beekeeping practices in combination with lack of other beekeeping inputs. This study agreement with (Gidey Y *et al,* 2012) who reported Poor access to beekeeping training and technical

support causes great difficulties for any beekeepers that adopt modern beekeeping equipment. Because it renders the beekeepers to follow traditional management approaches while using modern hives and fails to reap full benefits from their investment.

Table 12: Farmers' access to training and apiary materials

| Description | | Sisenaematye | Wordene | Overall | $X^2$ | SL |
|---|---|---|---|---|---|---|
| Material source | Agricultural extension office | 33.33 | 13.33 | 23.33 | 8.51 | 0.037 |
| | NGOs | 26.67 | 10.00 | 18.33 | | |
| | Local timber shop | 3.33 | 3.33 | 3.33 | | |
| | Own sources | 36.67 | 73.33 | 55.00 | | |
| Means of material | Purchased cash | 3.33 | 3.33 | 3.33 | 0.04 | 0.998 |
| access | Free gift | 6.67 | 6.67 | 6.67 | | |
| | Through credit | 90.00 | 90.00 | 90.00 | | |
| Did you get training? | Yes | 30.00 | 33.33 | 31.67 | 0.12 | 0.792 |
| | No | 70.00 | 66.67 | 68.33 | | |
| Source of training | Agricultural extension office | 96.67 | 76.67 | 86.67 | 8.31 | 0.040 |
| | NGOs | 3.33 | 23.33 | 13.33 | | |

SL= significant level at ($P<0.05$)

### 4.5. Constraints of Honey Production in the Study Area

Major honey bee production constraints in the study area are presented in Table below13. The most important constraints at district level are material/input shortage, feed and water shortage, colony shortage and skill gap among others. Among pest and predators, the effect of ant, spider and wax moth on honey be production and their protection mechanisms were similar with a report for Ada Berga district (Kerealem et al. 2009; Etenesh*et al*., 2018).These problems are almost similar across the study kebeles.According to the interviewed beekeepers, Shortage of bee forage is directly related with deforestation of forest coverage from time to time for, construction, firewood and expansion of agricultural lands. These are cause shortage of bee forage especially during the dry season. Most beekeepers of the district have been migrating their bee colonies from their area to electric pole and other area during the dry season for searching bee forage. This will increase the expense of farmers in the form of wage and cause colony loss through lack of honeybee flora. The elimination of good nectar and pollen producing tree species in many areas make it difficult to maintain bee colonies without feeding. This study agreement with (Kerealem, 2005)who reported

honey bee colony reduction due to deforestation and shortage of honeybee flora, the honeybee population is in state of continues declining. As a result, it has become a serious challenge to get honeybee colonies to start and expand beekeeping (Nuru, 2007).Beekeeping sector is dependent on healthy flora and a healthy environment.

Table 13: Major honey bee production constraints in the study area

| Parameters | Sisenaematye | | Wordene | | Overall | | $X^2$ | SL |
|---|---|---|---|---|---|---|---|---|
| | Index | Rank | Index | Rank | Index | Rank | | |
| Lack of inputs/materials | 0.23 | 1 | 0.27 | 1 | 0.25 | 1 | 1.50 | 0.473 |
| Feed and water shortage | 0.14 | 4 | 0.17 | 2 | 0.15 | 2 | 6.23 | 0.285 |
| Colony shortage | 0.21 | 2 | 0.08 | 6 | 0.15 | 3 | 2.09 | 0.912 |
| Skill shortage | 0.15 | 3 | 0.15 | 4 | 0.15 | 4 | 4.45 | 0.487 |
| Financial constraints | 0.10 | 5 | 0.16 | 3 | 0.13 | 5 | 6.77 | 0.562 |
| Pest and predator | 0.05 | 8 | 0.09 | 5 | 0.06 | 6 | 2.00 | 0.368 |
| Swarming/absconding | 0.05 | 6 | 0.05 | 7 | 0.05 | 7 | 7.29 | 0.121 |
| Disease | 0.05 | 7 | 0.01 | 9 | 0.03 | 8 | 10.69 | 0.098 |
| Market constraints | 0.02 | 9 | 0.01 | 8 | 0.02 | 9 | 1.02 | 0.313 |
| Herbicide and pesticide | 0.00 | 10 | 0.01 | 9 | 0.00 | 10 | 11.80 | 0.066 |

**4.5.1.Pestand Predator Problem**

Major pests and predator problems are listed in Table 14. Almost all respondents indicated that there is pest and predator problem which affect beekeeping activities in the area. Ant, wax moth and spider were the most important pest and predator problem with no significant difference in occurrence among the two study kebeles. Homagot ("Shelemetmat") incidence, though less important problem, was more common in Sisena than in Wordinakebele. Ethiopia, as one of the sub-tropical countries, the land is not only favorable to bees, but also for different kinds of honeybee pests and predators that are interacting with the life of honeybees (Desalegn, 2001). Pests and predators cause a serious devastating damage on honeybee colonies with in short period of time and even overnight. The interviewed beekeepers stated that the major bee pests and predators in the district were the most serious problems to beekeeping development. This result agrees with the report bysimilar investigation in Amhara region (Kerealem, 2005).

Table 14: Major pest and predator problems in the study area

| Pest/Predator | Sisenaematye | | Wordene | | Overall | | $X^2$ | SL |
|---|---|---|---|---|---|---|---|---|
| | Index | Rank | Index | Rank | Index | Rank | | |
| Ant | 0.26 | 1 | 0.25 | 1 | 0.26 | 1 | 2.37 | 0.668 |
| Wax moth | 0.21 | 2 | 0.25 | 2 | 0.23 | 2 | 9.31 | 0.097 |
| Spider | 0.18 | 3 | 0.16 | 4 | 0.17 | 3 | 6.46 | 0.264 |
| Bird | 0.05 | 6 | 0.05 | 6 | 0.05 | 6 | 3.02 | 0.389 |
| Homagot | 0.16 | 4 | 0.12 | 5 | 0.14 | 5 | 19.3 | 0.001 |
| Lizard | 0.13 | 5 | 0.17 | 3 | 0.15 | 4 | 11.4 | 0.078 |

$X^2$ = Chi-square, SL = Significant level, Source: survey data.

### 4.6. Opportunities of Honey Production in the Study Area

Existing opportunities in the study area are indicated in Table 14. Majority of the farm households being in the range of productive age group have active working family members with education level of primary education and above.

Table 15: Honey production opportunities in the study area

| Parameters | Response result |
|---|---|
| Household education level (primary school and above) (%) | 63.33 |
| Active working age range (18-54 years old) (%) | 63.33 |
| Active working members per household (No.) | 5.47 |
| Sufficient average land holding (Ha) | 2.33 |
| More than 1 year honey production experience (%) | 95.00 |
| Diversified bee forage plant (No.) | >8.00 |
| Sufficient honey market access (%) | 65.00 |

Honey market problem in the area is negligible based on the response of major respondents that indicated the presence of increasing demand for honey. The area is endowed with diversified niches suitable for different bee forage plants. The presence of different expertise from government extension office and Wolkite university are other opportunity for the betterment of honey production in the area. The government's attention given for the sector is also considered as an opportunity for the future development of apiculture. Majority of the opportunities indicated in this study are common in the region as mentioned by other findings (Bassa*et al.*, 2016).

## 5. CONCLUSION AND RECOMMENDATION

### 5.1.Conclusion

There is ample amount of beekeeping experience by farmers in the district. But majority of bee colonies are kept using traditional hive with traditional practice. Moreover, there is shortage of improved apiary material and inputs, skill gap, small colony holding, shortage of bee forage during dry season, and financial constraints as well. As a result of all these factors, the amount of honey yield per colony is minimum and limited for home consumption by majority of the households in the district.

On the other hand, the presence of an increasing demand for honey, largest proportion of households being in productive age group with larger active working family member,educated households,diversified niches for various bee flora, beekeeping experience by farmers, and presence of different development and research organizations are the existing opportunities in the district. Proper linkage and utilization of those existing opportunities can enhance the production and productivity of apiculture sector.

### 5.2.Recommendation

The following recommendations are suggested to alleviate honey production constraints and better make use of existing opportunities in the district.

- ✓ Strong awareness creation should be given for farmers by concerned stakeholders about improved apiary management practices, including modern hive operation, colony management, bee forage production and feeding.
- ✓ There should be sufficient distribution of modern hive technology and apiary accessories with affordable price for the farmers.
- ✓ Honey value chain study followed by establishment of strong linkage between different actors is recommended for the district.
- ✓ Reducing the constraints by using appropriate measurement method.
- ✓ Designing effective honeybee pests and predators controlling methods.

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## 7. APPENDIX

### 1.General Information

| | | |
|---|---|---|
| Region | SNNPR | Starting time: _____ |
| Zone | Gurage | |
| Woreda | Cheha | |
| Kebele | | |
| Got/ village | | |
| Household Head Name:_____ Sex: 1.Male 2.Female Age:_____ | | |
| Respondent Name (if different from HH): _____Sex: 1.Male 2. Female Age:_____ | | |
| Enumerator Name:_____ Phone No. _____ | | |
| Date of interview: | | |
| GPS location: Latitude _____ Longitude_____ | | |

### II. Socio economic characteristics

### 1.House hold characteristics

- **Age, sex and educational status of family members**

| Age | Total | | Educational status (indicate number) | | | | |
|---|---|---|---|---|---|---|---|
| | 1. Male | 2.Female | 1.(Illiterate) | 2.Primary (1-8) | 3.Secondary (9-12) | 4.Diploma | 5.Degree |
| Children (< 15) | | | | | | | |
| Adult (15-64) | | | | | | | |
| Dependent (>65) | | | | | | | |
| Total | | | | | | | |

- Educational level of household: 1. Illiterate 2. 1-4 3. 5-8 4. 9-10 5. 11-12 6. Diploma and above
- Age of household in year: 1. 18-30 2. 31-54 3. 55-64 4. 65 and above
- Religion: 1. Orthodox 2. Muslim 3. Protestant 4. Catholic 5. Others (specify)_____
- Marital status of HH: 1. Single 2. Married 3. Divorced 4. Widowed 5. Others (specify)_____

### 2.Farming characteristics

### 2.1Occupation and land holding

- What is your major occupation? 1. Farming 2. Trading 3. Laborer 4. Others (specify)_____

- In which wealth group do you get yourself? 1. Low income 2. Middle income 3. High income
- How much area is your land holding (please specify the unit if different from hectare)? _____

**2.2Major crops grown in the order of coverage**

| Types of crop | Rank with area coverage |
|---|---|
| | |
| | |
| | |
| | |
| | |
| | |

**2.3Honey bee production and ownership**

- Do you own honey bee colonies? 1. Yes 2. No
- If yes for Q.2.3.1, what type of hive you used? 1. Traditional 2. Transitional 3. Modern 4. Others (specify)_____
- If yes for Q.2.3.1, number of honey bee colonies: in traditional hive _____ in transitional hive _____ in modern hive _____
- For how long did you practice beekeeping? 1. Less than 1 year 2. 1 – 5year 3. 6-10 Years 4. Greater than 10 years
- If you use modern hive, for how long did you use it? 1. Less than 1 year 2. 1-5 years 2. 6-10 years 3. More than 10 years
- What are the driving forces to have bee colonies?1. Income 2. Home consumption 3. Both 1 & 2 4. Others (specify)_____
- How did you start beekeeping? (Source of bee colonies 1st time) 1. By catching the swarm 2. By purchasing the honeybee colony 3. Through inheritance 4. Any other (specify) _____
- If you purchase, what is the price of one colony? _____ ETB
- Where did you keep your bee colonies? (Site or placement of hive) 1. Backyard 2. Under the eaves of the house 3. Inside the house 4. Hanging on trees near homestead 5. Hanging on trees in forests

- What is the trend of your colony number and honey yield?

| No | Types of beehives | Increasing | Decreasing | Stable |
|---|---|---|---|---|
| 1 | Traditional | | | |
| 2 | Intermediate | | | |
| 3 | Movable-frame | | | |

- Did your colony abscond? 1. Yes 2. No
- If yes for Q.2.3.14, what are the reasons for absconding? 1. Shortage of feeds 2. Disease 3. Parasite 4. Drought E. Others (specify)_____
- If yes for Q.2.3.14, how is its frequency of occurrence? 1. Twice a year 2. Once a year 3. Once in two years 4. Once in three years 5. Others (specify)_____
- Is there pest and predator occurrence that affect honey production? 1. Yes 2. No
- If yes for Q.2.3.14, rank major pest and predators in order of importance.

| No | Pest /Predators | Rank | Local control methods |
|---|---|---|---|
| 1 | Ants | | |
| 2 | Wax moth | | |
| 5 | Spiders | | |
| 8 | Birds | | |
| 9 | Hama got /Shelemetmet | | |

- Do you use agrochemicals/chemicals in your farm? 1. Yes 2. No
- If yes for Q. 2.3.16, why do you apply agrochemicals/chemicals? 1. Crop pest control 2. Weed control 3. Malaria control 4. Tsetse fly control 5. Others (specify) _____
- If there is swarming, when does it occurs more frequently (month)? _____
- Is swarming advantageous to you? 1. Yes 2. No
- If yes for Q.2.3.19, describe the reason. 1. To increase number of colonies 2. To sale and get income 3. To replace non-productive bee colonies 4. Others (specify)_____
- Do you control/prevent swarming? 1. Yes 2. No

- If yes, what methods do you use to prevent swarming? 1. Removal of queen cell 2. Harvest or cut honey comb 3. Return back to the colony 4. Supering 5. Using large volume hive 6. Others (specify)_____

**2.4Harvesting**

- What are the products you harvest from modern hive? 1. Honey 2. Bee wax 3. Propolis 4. Others (specify)_____
- List the amount of your beehive products and frequency of harvest per year

| No | Types of beehives | Honey production | | Crude beeswax | | Propolis | |
|---|---|---|---|---|---|---|---|
| | | Kg/hive | Frequency | Kg/hive | Frequency | Kg/hive | Frequency |
| 1 | Traditional | | | | | | |
| 2 | Intermediate | | | | | | |
| 3 | Movable-frame | | | | | | |

**2.5**
**Training and material sources**

- What are your source of modern hive and wax? 1. Agricultural extension office 2. NGOs 3. Research centers 4. Local timber shop 5. Farmers' cooperatives 6. Others (specify)_____
- How do you access those materials? 1. Purchased cash 2. Through credit 3. Free gift 4. Other (specify)_____
- If you purchase, how much is the cost (ETB)? Modern hive _____Frame ____ Wax _____
- Did you ever get beekeeping training? 1. Yes 2. No
- If yes for Q. 2.5.4, who offered you the training?
  1. Research center 2. Agricultural extension office
  3. Non-Governmental Organization (NGO) 4. Any other (specify) _____
- If yes for Q.2.5.4, on what area did you get training? 1. Colony split 2. Honey bee colony management 3. Processing, handling & storage 4. Market information and linkage 5. Input utilization 6. Bee forage development 7. Other (specify)_____
- What is the advantage of modern hive over other hive types?
  1. Increased honey yield 2. For pure honey production 3. Pure Beeswax production 4. Queen rearing 5. Others (specify)_____

**2.6Bee forage production, water availability and feeding**

- Do you produce improved bee forage? 1. Yes 2. No
- If yes for Q. 2.6.1, where is the production niche? 1. Backyard 2. Terraces 3. Cultivated land 4. Other (specify)_____

- If yes for Q.2.6., list bee forages you planted and their rank in coverage and flowering time

| Type of bee forage produced | Rank (by importance) | When does it flower (month)? |
|---|---|---|
| | | |
| | | |
| | | |

- List major naturally occurring bee forage plant, their rank and flowering time.

| Type of bee naturally growing | Rank (by importance) | When does it flower (month)? |
|---|---|---|
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |

- Is there any poisonous plant for honey bees in your locality? 1. Yes 2. No
- If yes for Q. 2.6.5, list those poisonous plant and time of flowering

| Type of poisonous plant | Rank (by importance) | When does it flower (month)? |
|---|---|---|
| | | |
| | | |
| | | |

- Do you provide water for your bee colony? 1. Yes 2. No
- Do you provide supplementary feeds for your bee colony? 1. Yes 2. No
- If yes for Q. 2.6.8, list supplementary feeds you used for your bee colony.

  _____

**2.7Hive inspection**

- Do you visit and inspect your bee hive and colonies? 1. Yes 2. No
- If yes for Q. 2.7.1, which type of inspection you perform? 1. External inspection 2. Internal inspection 3. Both inspection
- How frequent you conduct external inspection? 1. Frequently 2. Sometimes 3. Rarely

- How frequent you conduct internal inspection? 1. Frequently 2. Sometimes 3. Rarely
- Do you clean your apiary? 1. Yes 2. No
- If No for Q. 2.7.5, Why? _____

**2.8 Marketing condition**

- Do you sell honey? 1. Yes 2. No
- If yes for Q.2.8.1, what was the form of honey sold to buyers? 1. Raw honey 2. Semi processed 3. Processed.
- To whom do you sell your hive products? 1. Consumers 2. "Tej" house 3. Cooperative 4. Traders
- How do you evaluate the local market price? 1. High 2. Medium 3. Low
- Where is your major sale place? 1. In your home 2. Bush/village market 3. Large public market place 4. Shops in nearby town 5. Cooperative site
- At what price do you sell a kilo gram of honey (ETB)? Minimum _____ Maximum _____
- Is there market problem to sell your honey product? 1. Yes 2. No

**2.9Constraints of beekeeping**

- What are the major constraints of beekeeping with modern hive? (Rank them)

| No | Constraints | Rank | What measures will be taken |
|---|---|---|---|
| 1 | Lack of apiary materials/inputs | | |
| 2 | Shortage of honey bee colony | | |
| 3 | Lack of skill | | |
| 4 | Shortage of be forage and water | | |
| 5 | Pests, predators and diseases | | |
| 7 | Herbicide and pesticide effect | | |
| 8 | Disease | | |
| 9 | Swarming | | |
| 10 | Marketing problem | | |
| 11 | Financial constraints | | |

*Ending time:* _____

*Thank you very much for your kind cooperation*