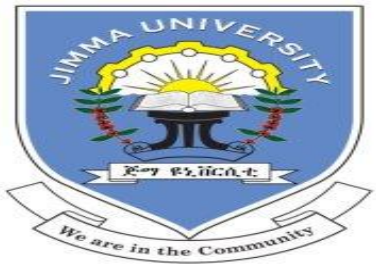

COLLEGE OF NATURAL SCINCE

SCHOOL OF GRADUATES STUDIES

DEPARTEMENT OF BIOLOGY

Beekeeping Practices, Opportunities and Constraints in Three Different Land use patterns in Sheko Woreda, South West Ethiopia

By

Andinet Asfaw Gebrehiwote

A Thesis Submitted to the School of Graduate Studies of Jimma University, Department of Biology, and College of Natural Sciences In Partial Fulfillment of the Requirement for the Degree of Master of Science in Biology (Ecological and Systemic Zoology Stream)

June, 2015

JIMMA, ETHIOPIA

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Advisor: Dr Delinesaw Yeuwalaw (PhD)

Co-Advisor: Dr Derja Tula

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Declaration

I undersigned, declare that this thesis is my original work with the exception of the citation contained herein being submitted to the University of Jimma for the degree of Master Science in Biology (Ecological and System Zoology),Collage of Natural Science .I also declared that this work has not been submitted to any other University earlier for partial or entirety award of any degree or diploma to the base of our knowledge and belief and all the source materials used for this thesis have been properly acknowledged.

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List of Abbreviation

A .melifera	*Apis melifera*
ARSD	Apiculture Research Strategy Document
BFED	Bureau of Finance and Economic Development
CCD	Colony collapse disorder
CIP	Community Initiative Promotion
CSA	Central Statistics Authority)
EARO	Ethiopian Agricultural Research Organization
EBA	Ethiopia Beekeeping Association
EFAP	Ethiopia Forest Action Program
EPA	Environmental Protection Authority
HBCs	Honey bees colony
HBRC	Holeta Beekeeping Research Center
NTFPRDP	Non-Timber Forest Products Research and Development Project)
PFM	Participatory Forest Management
RADCO	Rural Agricultural Development Coordination Office
SWRADCO	Sheko Woreda Rural and Agricultural Development Coordination Office
TARC	Tepi Agricultural Research Center
USDARNSC	United States Department of Agriculture Report on the National Council

USNRDC United States Natural Resources Defense Council ARSD - Apiculture Research

WBIP World Biodiversity Institution Program

WCC Wild Coffee Conservation

Abstract

This study was conducted to assess beekeeping management practice and its constraints and opportunity in three lands use pattern in Sheko Woreda from December 2013-october 2014. Stratified sampling was employed to select study sites and Sample size was determined using a standards formula and study participants were selected randomly .Data were collected using semi structured questionnaire; focus group discussion, and observation. Data were analyzed by using SPSS soft ware package version 20.0.The majority (97%) of the currently existing beehives were traditional while modern beehives account only 3% of the available hives. Sixty seven percent of the respondents had traditional bee hives, 15% had both transitional and traditional, 9% had both modern and traditional and 9% had all three types of beehives. Almost all respondents reported that they got beekeeping skills from their family through traditional method. Majority (90%) of the respondents in the area had no planned time for colony inspection and 90% of the respondents had no the idea of post and pre honey harvesting colony management practice and 80% of the respondents did not practice supplementary feed for their colony .The study also showed that 79% of the respondents had no training on the general principle of beekeeping and the modern technologies and 21 % of them were engaged in some training and all the respondents mentioned that training had significant contribution for the adoption of the modern technologies and seasonal colony management practice. Common beekeeping constraints cited by respondents included: honey bee diseases, migration and swarming, marketing problem, lack of skilled man power, shortage of training, lack of equipment, absence of agricultural extension service ,and poor attention to the sector

Therefore, for sustainable beekeeping practice and to get maximum ecological significance of honey bees, beekeepers and agricultural workers need training on the modern technologies and general principle of beekeeping. Government and nongovernmental organization should give attention in the adoption of modern technologies equipment along with good market linkage for honey and its products. Besides beekeepers consider pre and post colony managements skills for better yield and quality of honey and for the safe life of bees The issue of honey bee enemies and diseases need to be investigated further for developing effective prevention and control measures.

***Keywords**: Beekeeping practice /Apiary management, Honey bees, Constraints and Opportunity*

1. Introduction

Africa is blessed with numerous types of wild honeybees (Adjare, 1990). Ethiopia is one of the countries of the continent which own big honey production potential. Owing to its varied ecological and climatic conditions, Ethiopia is endowed with wide agro-climatic and edaphic variability which resulted in diverse and unique flowering plants (Ayalew, 1978). The country is home to some of the most diverse flora and fauna in Africa. Its forests and woodlands contain diverse plant species that provide surplus nectar and pollen to foraging bees (Girma, 1998).Due to its wide climatic and edaphic variability the country has diverse and unique flowering plants of 6000 to 7000 species thus making it highly suitable for large number of colonies of honeybees and long practice in beekeeping industries (Bista and Shivakoti,. 2001). The diversity of plants species comprises forest trees, bushes, grasses, and cultivated flowering plants that are actually and potentially useful for beekeeping. Most part of the country has also various agro ecological zones that are suitable for the growth of different bee flora and development of beekeeping (Admasu, 1996, Fitchel and Admasu, 1994). On the other hand, apiculture and traditional tree growing and management practice is deep- rooted in Ethiopian rural life. The mixed farming systems in Ethiopia possess indigenous and traditional on-farm trees growing practices, such as agro forestry, homestead tree planting, wood plot, and farm boundary tree planting, combined with apiculture (EFAP, 1994).

Ethiopia produces honey around 23.6% and 2.1% of the total African and world's honey, respectively. Ethiopia is Africa's largest producer and ranks 9th in the world with a current national estimated honey production of 54,000 MT per year (FAO 2010). About 5% of honey produced is consumed at home by rural households, 80% goes to the tej sector and 15% is marketed as table honey (both domestic and export). It is also one of the four largest beeswax producing countries in the world. In Ethiopia, beeswax is one of the 12 major exportable agricultural products and there are approximately 1.5 million beekeepers in Ethiopia and 8 to 10 million bee colony hives (FAO, 2011).The Oromia, Amhara and SNNP regions represent 46%, 24% and 22% of Ethiopia's honey production, respectively, and produce honey in colors ranging from light to dark amber. Tigray produces 5% of the country's honey, which is of a distinct white color. Beekeeping in Ethiopia plays an important role in income generation for beekeeper farmers. Honey production of the country meets beverage requirements of the urban and rural

population. It is also demanded for its nutritional and medicinal values. The other hive products such as beeswax, royal jelly, propolis, and bee venom have high demand globally (Amsalu, 2004).

Ethiopia farmers keep about seven millions hives in local beehives, while the rest exist in the forest as wild colonies (EMA, 1981) which represent the highest bee density in Africa. There are also three types of beekeeping practice in Ethiopia traditional forest beekeeping, traditional, backyard beekeeping, and improved (modern) beekeeping. About 99 % of beekeeping that farmers practice in Ethiopia is traditional which does not consider seasonal colony management practice (Fichtl and Admasu, 1994). Ethiopia is one of few countries in the world with a long tradition of beekeeping that gave an opportunity of supplying honey and other bee products to the international markets. The country exported its first consignment of honey to the European Union (EU) in 2008 after a three year period of preparations towards attaining third Country listing status. This was the result of a deliberate set of interventions to help increase processing capacity in combination with an out-grower scheme to supply honey (Paulos, 2012). Honey and beeswax export marketing in Ethiopia has been started during the 1980s and the total annual honey production has been increased from 21.480 tons to 23,700 tons between the period 1984 and 1994. But, only 3.05 tons per annum has been exported during the specified period (ITC, 1996).

Current honey production estimate represents only 8.6% of the country's production potential. Productivity from traditional hives is very low, with an average of 5-6 kg per year, while production from improved hives (including transitional hives) reaches levels of 18-30 kg per year. Beekeeping has been and still is very widespread, economically important and an integral part of the life of the farming communities of Ethiopia (Fichtl and Admasu, 1994 and Verma, 1990). However, the products obtained from this sub sector are still low as compared to the potential of the country. Although thousands of tons of honey are produced every year it is usually poorly managed and unattractive in appearance. Because of this its place in the local market being taken by imported honey. Moreover, traditional hive honey is of good quality as long as it is in the hive. Faulty handling, from the time of its harvest until it reaches to market is responsible for its inferior quality. The type of hives used, and the methods of removing and storage of honey play a vital role in the quality of honey (Crane, 1970).

According to Shenkuta *et al*, (2010) beekeeping is practiced in three zone Keffa ,Sheka and Bench maji by over 60% of the total household the practice is under taken by three types of bee hives: traditional, intermediate and modern bee hives. Sheko Woreda is one of areas in the country known with its honey production potential. However to the best of knowledge there is lack of information about beekeeping practice and its constraints in the area which can be used to scale up honey production and to intervene on the existing beekeeping constraints. Hence this research was conducted to assess the existing beekeeping practice and its constraints and opportunity in Sheko Woreda South West Ethiopia.

1.1 Statement of the problem

The adverse effects of global climatic change evidenced in the form of drought, temperature variations, rainfall fluctuations and wind speed affect flowering vegetations including crops which further affect the quantity and quality of bee-forage and honey yield. (Seo and Mendelsohn, 2008). Sheko forest is an area where the centers of origin for wild form of *Coffee Arabica* in Ethiopia and activities of traditional farming systems like crop production, animal husbandry and garden coffee production are practiced (WCC-PFM, 2011). Beekeeping is a traditional and important off-farm activity for harvesting honey by many rural people in Ethiopia. From traditional hives, an average of 5 to 6 kg of honey could be cropped per hive. However, in areas where improved technology and beekeeping skills have been introduced, yields of 15 to 20 kg per hive have been recorded. Yet productivity and poor quality of bee products are the major economic impediments for beekeepers (Nuru, 1999).

According to Sheko Woreda agricultural office and other sources the current agricultural practice of the farmers including beekeepers and different unidentified factors influencing honey production and threatened the existence of honey bees by destroying their habitat and causing honey yields to fall and reducing the incomes of farmers. Even though, the area is well known for its honey production potentials, there is little documented information on beekeeping management and having detail information on beekeeping practice and identifying the existing challenges are very essential in the formulating of appropriate development strategies for proper utilization of the available potentials in a sustainable way. Therefore the present study was conducted to assess beekeeping management practice and its constraints to generate information for decision support tool to improve beekeeping management practice in Sheko Woreda South West Ethiopia.

1.2 OBJECTIVE OF THE STUDY

1.2.1 General objective

To assess beekeeping practices, opportunities and constraints three lands use pattern in Sheko Woreda, South West Ethiopia

1.2.2 Specific objectives

To assess the management practices of beekeepers in Sheko Woreda

To identify beekeeping opportunity and constraints in the study are.

To document honey production practice of the study area.

To assess common bee flora found in the study area

1.3 Significance of the study

Sheko beekeeping industries have not recognized any impact of their activities on their environment as well as to the ecology of honey bees and honey production. This study will provide for beekeepers to clearly understand their role to the greater community and know their contribution to the decline production of honey. As well provide the results and recommendations generated from this research provide the public an outline of what all beekeepers should be adopting in their beekeeping practice and management of honey bees for future which has considerable help to beekeepers community in Sheko Woreda in particular and similar areas of Ethiopia in general by the following ways.

- It provides information about the existing beekeeping practice of Sheko Woreda beekeepers.
- It help to identify the current constraints of beekeeping including honey bees enemies in Sheko Woreda
- Determine the existing beekeeping opportunity that can be used to scale up honey production in the study area.
- It provides base line information about potential honey production difference between the three land use patterns in the study district.

- It provides scientific suggestion to the existing constraints that can enhance development of honey production industries that can have a great contribution for conservation of Sheko forest.

1.4. Limitation of the Study

This research was conducted under many constraints as a result different factor such as the geographical nature of the area, being the research is new to the specific area ,and the usual finance problem hence the following major limitation were observed while conducting the research.

- Lack of allocated budget for this particular research hence it was too difficult to collect data from all sources
- During data collection almost all of the respondents and DA worker both expect money after the interview schedule and some were are not even interested for the interview.
- Another critical constraint the researcher face during data collection in focal group discussion bringing together all the planned participant in one center to held the discussion

1.5 Scope of the study

The study was conducted in Sheko Woreda of Bench Maji Zone SNNPR South West Ethiopia on the management practice and its constraints in terms of the existing beekeeping practice of beekeepers, the adoption of the modern technologies, beekeeping constraints and opportunity of the study area and the existing activities in supporting beekeeping sector by different stakeholders and local government. Also explain potential honey production difference among three land use pattern of the study sites (non-human settlement, human settlement and agro- forestry).

CHAPTER TWO

2. REVIEW OF LITURATURE

2.1. Importance of honey bees

In addition to honey production, honey bees play a big role through plant pollination increasing species diversity of flowering plant and conservation of the natural environment. Beekeeping is environmentally sustainable activity that can be integrated with agricultural practices like crop production, animal husbandry, horticultural crops and conservation of natural resources. Thus, it would be one of the most important intervention areas for sustainable development of poor countries like Ethiopia (Gibbon, 2001). According to a study Tolera (2014) in Arsi zone Water shade area on integrating improve beekeeping found that after training, beekeepers highly acquainted in improved beekeeping management and this resulted in increased honey production simultaneously increased local initiative in watershed rehabilitation and protection. Beekeepers maintained diverse honeybee floral resources designed to achieve maximum honey production and watershed rehabilitation Bee feed shortage is directly associated with off flowering period of major honey bee forages.

Pollinators strongly influence ecological relationships, ecosystem conservation and stability, genetic variation in the plant community, floral diversity, specialization and evolution. Honey bees play an important, but little recognized role in most terrestrial ecosystems. In tropical forests, savannah woodlands, mangrove, and in temperate deciduous forests, many species of plants and animals would not survive if honey bees were missing. This is because the production of seeds, nuts, berries and fruits are highly dependent on insect pollination, and among the pollinating insects, bees are the major pollinators (Pyramarn and Wongsiri, 1986). One mouthful in three of the foods you eat directly or indirectly depends on pollination by honey bees. The value of honey bee pollination to agriculture crops from nuts to vegetables and as diverse as alfalfa, apple, cantaloupe, cranberry, pumpkin, and sunflower all require pollinating by honey bees (Melaku *et al.*, 2008).

Beekeeping is taken into account when the economic importance of trees being calculated (Debisa, 2006). The role of honeybees as pollinators of the natural flora is now more than

investigated. Conservation and the sustainable management of natural ecosystems should pay attention to the position of pollinating honey bees that are present in this environment. It is generally known that honey bees are needed to pollinate our crops. It is not however apparent to many that the economic value of bee pollination is several times more than the value of the worldwide production of honeys (Smith, 1960). If we look at the many colorful and different looking flowers, we should not forget that they have developed as an adaptation for the honey bees and other pollinators, and not to please humans! Honey bees and most flowering plants have developed a complex interdependence during millions of years. An estimated 80 percent of flowering plants are entomophilies i.e. depending more or less on insect pollination to be able to reproduce and it is estimated that half of the pollinators of tropical plants are honey bees for fruit and nut crops, pollination can be a grower's only real chance to increase yield. The extent of pollination dictates the maximum number of fruits. Post-pollination inputs, whether growth regulators, pesticides, water or fertilizer are actually designed to prevent losses and preserve quality rather than increase yield. (Fanesi *et al.*. 2000).

All species of honeybees in the world are very good pollinators for native plants due to their related morphological structure of the organs that fit and provide other functions important for pollination, such as a body covered with hairs that help carry nectar and pollen. Further the honey bees do not injure the plants, as the body size and proboscis length are very much suitable for many crops (Pyramarn and Wongsiri, 1986).The efficiency of honeybees is due to their great numbers, their physique (body shape and size) and their behavior of foraging on only one plant species at one time. The honey bees have to find their food in flowers. The food can be nectar or pollen. Nectar is produced to attract the bees. Pollen is also attracting the honey bees, but it has another function too it is produced to ensure the next generation of plants (Cheng and Wong, 1996).

Beeswax

Beeswax is a true secretion produced by four glands on the bottom of the abdomen of worker bees. Beeswax is a chemically complex mixture, consisting of primarily of long chain hydrocarbons, monohydric alcohols, organic and hydroxyl acids. There is a huge demand for bee wax in the wax industry. Wax foundation is a sheet of wax that is pressed between metal dies so

it comes embossed on both sides with the cell pattern bees follows in constructing cell sized for raising workers. The foundation is expensive, therefore beekeepers should save all capping, old combs, and bits and piece of extra wax scraped from frames and other bee hive parts. The cosmetic industry uses beeswax in the preparation of products such as cold creams, lotions, rouges, and lipsticks (Crane, 1990).

Propolis

Propolis is the resinous substance that is used by the bees to seal pups the hive for winter protection and defense. It comes from the sticky exudates of trees and buds such as alders, poplars, and some conifers. Propolis is sold in capsules at health food stores as a health supplement (Crane, 1990).

Bee Brood

Bee brood is rich in proteins. Honeybee brood is not however used much in our diet though it is used on a small scale as food for birds, reptiles, and fish (Graham, 1992).

Pollen

Pollen is the protein rich powder produced by the male parts of flowers. Placing pollen traps on the hives to collect pollen pellets from foraging bees collects pollen. Pollen can be sold to health food stores, pollination business, and bee dealers and to allergy victims. Health food stores sell pollen pellets as vitamin supplement, bee dealers use pollen as bee food and allergy victims use it as desensitizing agent (Graham, 1992)

Royal jelly

Royal jelly is manufactured by young nurse bees to be fed to the queens and queens' larvae. It is collected and used in the oriental world for medicinal purposes. The uses include cosmetics, lotions, and dietary supplements (Crane, 1990).

Bee Venom

Some components of the bee venom might have more effect than other serums in desensitizing people who are allergic to be venom. It might also be useful for persons with rheumatoid arthritis (Walter, 1976)

The beekeepers and other people in a community can create further assets by using honey and beeswax to make secondary products, such as candles, beauty creams or beer. Selling a secondary product brings a far better return for the producer than selling the raw commodity. Bees also generate other products (pollen, propolis and royal jelly) that can in some situations be harvested, marketed and made into secondary products: all of this work effectively strengthening people's livelihoods. (FAO, 2010)

2.2. Beekeeping in Ethiopia

Livestock is an important economic sector in Ethiopia which contributes to economic development. Ethiopia is generally considered to have the largest population of livestock than any country in Africa (Halderma, 2004). Livestock contribute up to 20% to Ethiopia's GDP and livelihoods of 60–70% of the population. Apiculture, which is one of the important livestock subsectors, contributes significantly to the improvement of the livelihoods of the nation's population (Aklilu, 2002). There is no well-documented evidence that indicates when and where beekeeping practice started in Ethiopia.

However according to Ayalew (1978), it had started in the country between 3500–3000 BC The country has a high potential for beekeeping as the climate is favorable for growing different vegetation and crops, which are a good source of nectar and pollen for honeybees. Due to suitable natural environment of the country a large number of honeybee colonies, estimated at about 10 million, exist in the country. Ethiopia produces around 23.6% and 2.1 % of the total African and world's honey respectively. It is the leading honey producer in Africa and one of the 10 largest honey-producing countries in the world (Ayalew, 1990).

According to the Central Statistical Agency (CSA 2010/2011) the annual total production of honey accounts for 53,000 tones. This amounts to only 8.6% of the total potential national production and currently around 250-300 tones of honey exported annually. The wide climatic and edaphic variability have endowed Ethiopia with diverse and unique flowering plant that is

highly suitable for sustaining a large number of bee colonies and the long established practice of beekeeping. Nevertheless, the bees and the plants like all renewable natural resources are constantly under threat from lack of knowledge and appreciation of these endowments (Girma, 1998).

About 10% of the honey produced in the country is consumed by beekeeping households. The remaining 90% is sold for income generation; of this amount, it is estimated that 70% is used for brewing tej and the balance is consumed as table honey; additionally beeswax is collected and traded. Honey is a vital factor in job creation and maintaining livelihoods. Honey and other apiculture products (i.e. beeswax, propolis, pollen, royal jelly and bee venom) are among the growing export commodities with good potential for a number of African countries. The global honey market offers huge opportunities for Ethiopian honey. Large markets include the EU, the United States and the Middle-East. For example, the EU only produced 60% of the honey it consumed in 2009; the remaining 40% was imported (Desalgne, 2012).

2.3. Beekeeping practice

Beekeeping is not a seasonal enterprise, but requires year-round management. The beginning beekeeper needs to consider his or her available labor limitations, and keep the enterprise at an easily managed size. Beekeeping can be labor-intensive during certain times of the year. It also requires a basic understanding of the honeybee's behavior during the various seasons and during handling and moving (Crane, 1990). Well-managed colonies may be kept safely can have opportunity healthy and maintain high yielding and good quality honey without harming the life of honey bees and their colony. Managed honey bees provide pollination services to improve commercial agricultural production and the health of our ecosystems, honey, and other significant economic benefits (Bloch *et al.* 2010).

Colonies of bees existing in the wild, away from the control of human beings will produce small surplus crops of honey above their requirements for survival. Such surplus will vary, depending on the region or locality, but it will produce greater honey in the same area and with the same nectar resources, colonies properly managed will produce surplus honey crops. Intensive two-queen colony management often can result in surplus crops of three fold better product or more with the same resources available. The key to these differences is management practice of the colony (pellet, 1976).

Proper management employs practices that harmonize with the normal behavior of bees and brings the colony to its maximum population strength at the start of the bloom of major nectar producing plants. Management practices are similar in basic principle wherever bees are kept and vary only as regards timing for the desired nectar source of the region or locality concerned

Honey bee biology is constant. Bees respond to their environment as temperatures and food supplies are changed. Beekeepers, in managing or manipulating colonies, are merely facilitating normal biological colony changes to suit their purpose. They can accelerate brood rearing by pollen feeding and hive manipulation, or they can crowd or restrict colony activity by certain other manipulations. Responses of the colony wherever it is kept are predictable. Thus, the basic handling, management and manipulation of bees are universally similar varying only as to localities and the timing of bloom of the major nectar and pollen plants (Crane, 1983).

Regardless of the type of hives or equipment used, proper management aims at providing colonies with unrestricted room for brood rearing, ripening of nectar, and storage of honey, plus provision of adequate food requirements, both pollen and honey, for the time of year concerned. Swarming is minimized and the storing instinct encouraged when proper management is used (Bloch *et al*.. 2010 and Crane, 1990). When the beekeeper has successfully obtained some bees in his hives, he can look forward to a bumper harvest, but he must remember that success in keeping bees depends on the exercise of his knowledge of colony organization in relation to various factors. It is also controlled or affected by seasonal and climatic changes, not forgetting the existence of vegetation or bee forage in the area. A farmer who plants his crop on fertile land with excellent climatic conditions is bound to fail if he leaves everything to chance, neglecting other important managerial practices such as pest control, bush clearing, pruning, thinning, Dividing an established colony swarm control, Apiary site selection ,stinging behavior of bees etc. Beekeeping calls for practices which are vital to the survival and well-being of every bee colony (FAO, 2010). An apiary (or bee yard or bee farm) is a place where beehives are kept apiary can contain a hundred or more bee colonies. Where there are plenty of nectariferous trees for bees to enjoy. Where to locate an apiary sometimes creates problems. It is generally agreed that the beekeeper can make a good living without necessarily becoming a landowner. The ideal apiary site should be away from playgrounds and noisy commercial or industrial areas, near a fresh water supply, the banks of a river, lake or fish-pond, or even a dripping faucet, near food

sources, e.g. citrus, avocado, coconut, palm, cola, or eucalyptus plantation, waste area or marsh land, fairly dry, away from swampy or flooding valley or any bottom land with stagnant water (humid areas promote fungal diseases and prevent proper honey curing) A hive can be suspended, for example between two trees or from sturdy branches of big trees. It can also be installed on a platform or a rock. This is a decision that must be made by the individual beekeeper based on different factors (Crane, 1990).

The honeybee colony is endowed with an instinct which brings about an increase in the number of colonies from time to time. One colony may produce two or more new colonies a year. When a colony in a nest or hive is too populous the old queen accompanied by some drones and thousands of young and old workers flies to a distant place to begin life anew. None of these new settlers will ever return to the old nest. As the bees leave the entrance of the old hive, they fly gratingly into the sky with a loud hum until they cluster on a tree branch (Lorna and Sishi 2010). This cluster is referred to as a swarm_of bees. Swarming divides the population of the colony, and this of course causes a considerable reduction of the working force. As a result, the amount of honey and other valuable products that the colony might produce is considerably reduced. Consequently, the beekeeper would prefer to retain all the bees and make valuable use of them. This can be done by controlling swarming, but in a manner that will not interfere with the bees' natural instinctive desire. Such interference can lead to absconding, another deplorable behavior characteristic of the tropical bee (Fichtl, and Admasu, 1994).

To prevent swarming, the hive must be managed so that congestion will be avoided or, at least, minimized. The idea is to create a commodious area to cope with the ever-increasing brood during the build-up stages. Any managerial activity that will increase the desired cells required for the comfort of the queen and the workers will prevent or delay swarming. Africa has not yet developed to the point where queens or nucleus swarms are produced and marketed commercially, the African beekeeper must be bold and fearless in learning how to capture and move swarms from roofs and cavities when his beehives are not colonized voluntarily by bees. (Otis, 1990). He should not wait unconcerned, hoping that swarms may come by themselves. He must advertise himself in his locality as someone who needs swarms, and he must be prepared to buy them from people who bring them to him. He should consider himself lucky when he finds a swarm and must be prepared to capture it for his empty beehive. He should never be afraid to

catch a swarm. Pioneer beekeepers in Ghana catch them, sometimes wearing no protective clothes (Crane, 1990 and Alemtsehay, 2011).

While the experienced beekeeper can usually have a fair idea of how his colonies are progressing by observing them from outside, the only means he has of knowing for sure whether everything is going smoothly is to open the hives and inspect each comb. This will let him know if honey is being prepared and capped regularly, whether the colony is getting ready to swarm, whether the hive has been attacked by pests, etc (FAO,2008).Bees are feared in Africa for their stinging behavior. They sting painfully, can kill both man and his animals Even though stings can kill, bees should not be considered as extremely dangerous. The beekeeper that is afraid of his bees is like a lorry driver who will not drive for fear of an accident, or a farmer who will not go to his farm for fear of a snake bite **(**HAYDAK, 1970).Causes of bees to sting includes visiting a hive during the warm part of the day; disturbing them without smoke, breathing into the hive, especially if the beekeeper has been drinking any alcoholic beverage, including beer; wearing a cosmetic item which contains beeswax; talking, drumming or making any other noise when bees are busy nearby; standing in their flight path; wearing dark clothes near the hive during the daytime, making jerky movements near the hive ,crushing a bee near a hive or squashing a bee body and smearing the juice on one's body, swatting with the hand to drive a bee away. Remember that every bee that stings dies afterwards. Thus the apiarist who causes his bees to strike in fact kills them. A reduction of the field force means a reduction of output of work which results in less honey production (Crane, 1970 Admasu *et al* 2004). The survival ability of honeybee colonies during severe winter months depends on whether the colony has enough workers, adequately provisioned with food wall and decreasing the volume of the hive can also improve the effectiveness of the colony's thermal regulation (Heinrich and Esch, 1994).The elimination of good nectar and pollen producing tree species in many areas makes it difficult to maintain bee colonies without feeding (Kerealem, 2005).

2.4. Potential of beekeeping in Ethiopia

The honey sector is one of the few sectors that had the most inclusive ability to achieve transformation and growth across all categories of rural households. This is because of its large resource base and low barriers to entry. There are an estimated 8-10 million hives in Ethiopia, which are almost all entirely maintained according to traditional methods. These hives are managed by approximately 1.4-1.7 million farm households, who are keeping bees as a means of additional income generation (FAO, 2011 and Paulos, 2012). Apiculture in Southwestern Ethiopia provides an opportunity for impoverished or low-income people to supplement their earnings by the sale of harvested honey bee products such as honey and beeswax at a suitable market Beekeeping is chiefly conducted to produce honey, but some beekeepers focus on producing royal jelly, beeswax, bee colonies, or queens. Some beekeepers provide bees to pollinate crops. Each type of operation requires specific experience and management techniques, and thus beekeepers often specialize on one type of production. (Melaku *et al*..2008). Ethiopian honey is also considered to be organic as the bee forage is forests and plants grown without the use of chemicals. This would mean that chemical residue would be small in the Ethiopia honey, which is one of the quality criteria for a good table honey (Gezhagen, 2007).

2.5. Beekeeping Constraints

Beekeeping industries in Ethiopia surrounded by different constraints that affect apiculture in countries such as traditional beekeeping practice, lack of beekeeping knowledge, shortage of trained manpower, shortage of beekeeping equipment, pests and predators, climate changes, shifting farming practice and inadequate research works to support development programs are some. The traditional beehives are not comfortable for sanitation and high level of production. Farmers are only selling honey and do not consider wax as means of income in their business (ILRI, 2008). Most of the beekeepers in the Ethiopia have been using local beekeeping technique that result in low hive products. Much of the honey produced by the beekeeper is of very low quality because it is mixed with wax, pollen and brood. Some of the products are even unknown or unexploited. This is mainly poor seasonal management practice and lack of appropriate beekeeping skills (Hepburn, 2001). The Ethiopian government, realizing the potential of beekeeping subsector of the country, established demonstration stations at Holeta, Nekempt and Jimma in 1965. The main objectives of the demonstration stations were to introduce imported

improved beekeeping technologies (box hives, casting mold, honey extractor, honey presser, smoker, water sprayer, veil, glove etc.) to the beekeepers and to offer beekeeping training for farmers and experts (ILRI, 2008).

However currently as a result of multi-factorial reason and mainly rapid population growth honey bee populations have suffered from high rates of colony mortality, colony collapse and population decline over the past several decades (vanEngelsdorp & Meixner 2010). Although the causes of such declines are a matter of great interest and debate, one often-stated hypothesis suggests that reductions in genetic diversity in managed bees are partially responsible for their alarming global declines (Oldroyd 2007; vanEngelsdorp & Meixner 2010, Sheppard 2012). Within-colony genetic diversity is clearly important in honey bee colonies, which are headed by multiply-mated queens (Fjerdingstad, 2001). The economic and ecological importance of honey bees (*A. mellifera*) as pollinators of many cultivated and native plants make them an important system for studying the effects of illness at both the individual and colony or social levels. In most country and worldwide, it has become increasingly difficult to keep colonies alive as honey bees are challenged with numerous factors that threaten their survival. Mite pests, pathogens, pesticides, and nutritional deficiencies create a combination of circumstances that can interact negatively to jeopardize colony health (Spivak *et al*...2011).

The success of beekeeping essential depends on the abundance of bee flora and management practice of colony in an area. However, a plant that produces nectar and pollen prolifically in one area may not yield the same amount of nectar and pollen in another area (Latif *et al*., 1958).The availability of natural insect pollinators in the world is decreasing rapidly as a result of increased deforestation for agriculture, climate change and human settlement and continued use of pesticides. There is timely need for better management of hive honeybees such as *A. cerana* and *A. mellifera* in rare pollinator areas to increase fruit production. Information on the role of honeybees in pollination leads to increase in the quality and yield of crops that has been reported worldwide (Crane, 1991and Free, 1993).Because of year-to-year weather fluctuations, forage areas should span a variety of regions and land types, particularly as parallels typical beekeeper migratory routes. For example, a drought in one part of the country can drastically reduce the availability and quality of forage plants, and beekeepers need alternative sites and plants to cope with these fluctuations. Although diet supplements are essential for large-scale beekeepers, they

are only a temporary substitute for high-quality floral resources. Therefore, good bee nutrition depends on how land around colonies is managed, and what flowers are available to bees (UNDARNSC 2008). Beekeepers remarked that colonies with access to good floral resources were generally healthier than those located where few floral resources exist (*i.e.* sites dominated by row crops) and fed dietary supplements. Undernourished or malnourished bees appear to be more susceptible to pathogens, parasites, and other stressors including toxins. Thus, nutrition might be a fundamental factor in mitigating negative effects of other stress factors on bee health and important considerations to bear on the issue of alternative forage (NHBSC, 2012).

Shortage of bee forage is mainly resulted in Ethiopia due to population pressure and its ecological impacts such deforestation and shifting cultivation. Beekeeping contributes to conservation of the natural environment since its environmentally sustainable activity can be integrated with agricultural practices (Gibbon, 2001).According to beekeepers in Ethiopia the major beekeeping constraints were pests and predators ,absconding, shortage of honey bee forage and drought .The existence of honey bees pests and predators affect the honey bees life which in turn lead to migration and absconding (Workneh,2007).Absconding (the total movement of honeybee colony by leaving the hives) can happen due to different reason such as lack of feed ,honey bee pests and drought are the main problems that may cause absconding .Shortage of bee forage cause the honey bee colony to absconding to area where resources are available for their survival (BFED, 2004).When a colony in a nest or hive is too populous the old queen accompanied by some drones and thousands of young and old workers, flies to a distant place to begin life anew. None of these new settlers will ever return to the old nest. As the bees leave the entrance of the old hive, they fly gratingly into the sky with a loud hum until they cluster on a tree branch. This cluster is referred to as a swarm of bees. The first swarm to leave a hive during the season is called the prime swarm. A prime swarm is always accompanied by the old queen and some older workers. Before leaving the old hive, they take in honey and other essential commodities from the old hive, so that when they settle in the new nest, they can begin to build combs within a short time to enable the queen to lay. (Partap and Verma, 1994).After the prime swarm, any other swarm leaving the parent hive is termed a secondary swarm. It is composed of young workers, young drones and a young queen, completely docile and showing little or no sign of aggressivity. (They may begin to show some aggressive tendencies after six or seven weeks).

The young bees may need the beekeeper's assistance for some time. Food can be provided in the form of sugar syrup as a supplement to help them. They will survive if no help is provided, but the assistance provided by the beekeeper may enable them to work faster than if they had received no help (Singh, 1981).

CHAPTER THREE

3. Materials and Methods

3.1. Description of the study area

3.1.1 Preliminary Survey

Reconnaissance survey was conducted in January, 2014 to gather relevant information about the study area. During this survey, an overall view of beekeeping, (area of beehives, types of beehives etc) topographical features and vegetation cover of the area were assessed. All the available information about the vegetation and land-use pattern was collected from concerned governmental, non-governmental organization and local people living around the study area and direct observation also dominant plant communities were documented. According to WCC-PFM project report (2011); forest, agriculture and Human Settlement are vegetation structure of the study areas. Sheko forest, the subject of the present study is among the remnant natural forest in Ethiopia where an indigenous wild coffee (*coffee arabica*) grows naturally. Hence, the Ethiopia government designated the brehan konter forest project in sheko woreda as a special reserve of wiled *coffee arabica* at 12 kebeles (10,000) hectares' of forested area of the 24 kebles.

3.1.2. Physical description of the study area

A. Geographical description of the area

The present study was carried out in Sheko district Bench Maji Zone, South west Ethiopia. The area is located at 60 58' N and 350 45'E, 705 km south-west of Addis Ababa. It is drained by the Upper Akobo River which joins the Baro River at the border with Sudan.

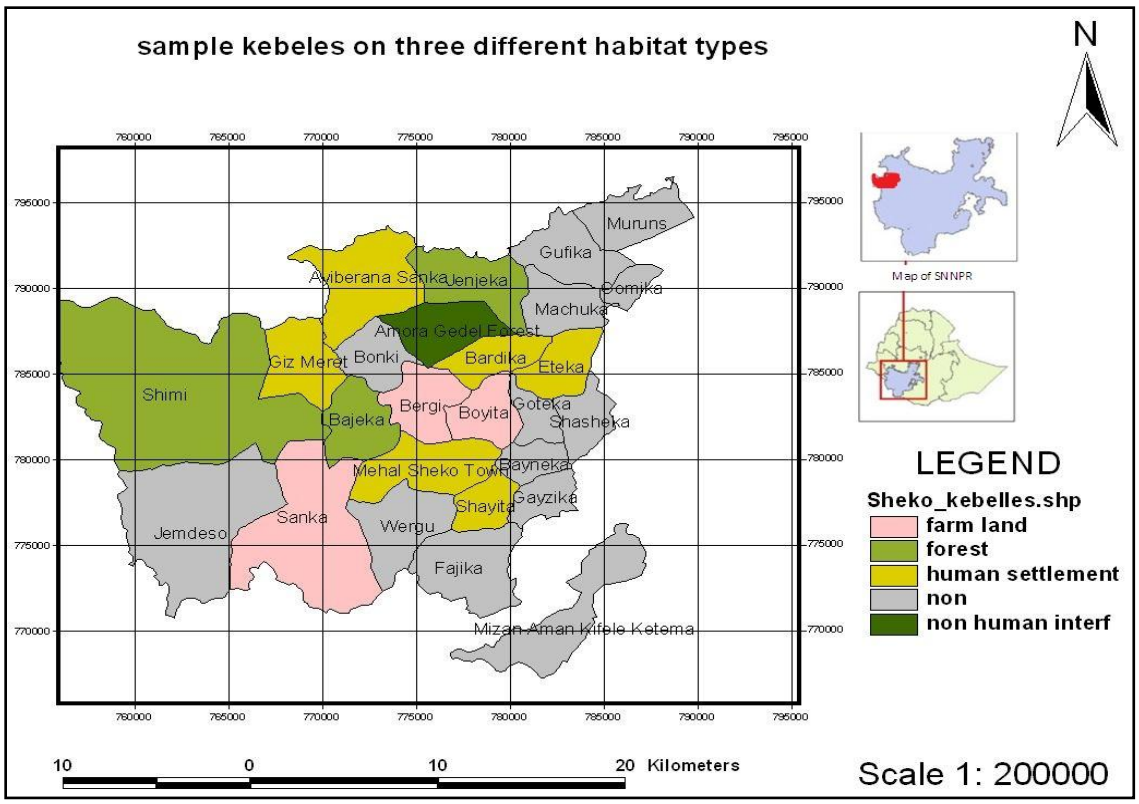

Figure: 1 .Map of Sheko Woreda with different land use patterns (Source: WCC-PFM, 2011).

B. Climate of the area

The rainfall and temperature data collected by Ethiopian National Meteorological Service Agency at Tepi station were used to describe the climate of the study area. The study area has unimodal rainfall distribution (having one long rainy season between April and September with a peak in September). The 10 years rainfall data (2001-2011) shows that the average mean monthly maximum rainfall is 290.03 mm in September and the average mean monthly minimum rainfall is 31.08 mm in January. The mean annual rainfall of the area is 1850.55 mm/year. The 10 years temperature data from the year 2001-2011 of the area, the average maximum monthly ranges from (27.8 ^{o}C) in December to (33.37^{o}C) in March The average minimum monthly temperature ranges from (11.68 ^{o}C) in April to (22.01 ^{o}C) in May. The mean minimum temperature of the coldest month of the area was 15.23 ^{o}C per year. The mean maximum annual temperature of the warmest month is 30.17 ^{o}C per year.

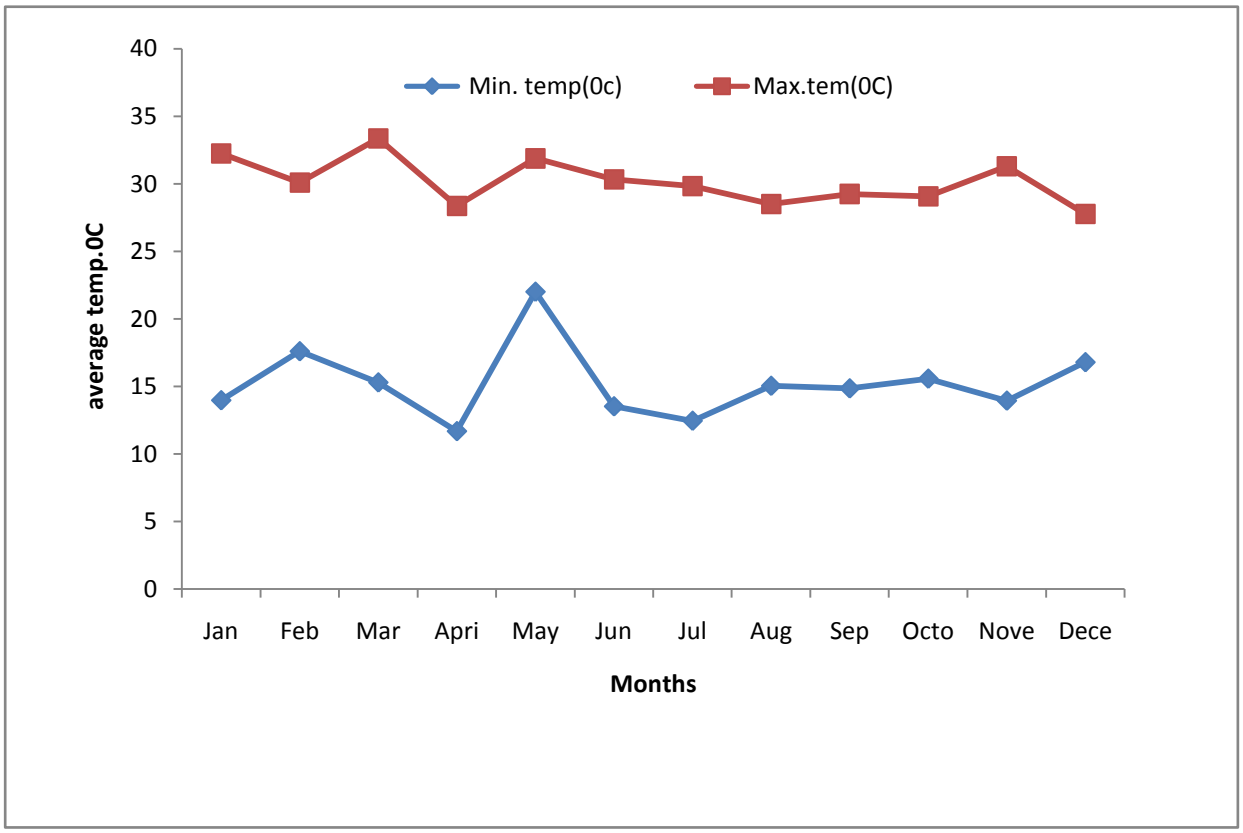

Figure: 2 .Graph that show average temperature changes in different months (Source: WCC-PFM, 2011).

3.2 .Study design

The design of the study was community based cross-sectional study house-to-house survey conducted between January and November 2014 in which the relevant data was collected from different beekeeper, DA workers in the Woreda, and researchers from TARC. Semi-structured interview, group discussion, and personal observations were used to gather the required data and analyzed to draw a conclusion about the existing beekeeping activities.

3.3. Sampling techniques and Sample size

Stratified sampling technique was employed to select study site, in which the study sites are defined and classified based on different land use patterns into three strata (three study site) Sample size of the study were determined by using standard formula single population proportion and with regard to the sample size of each farmer's groups or stratum proportional allocation was used under which the sizes of the samples from the different strata are kept proportional to the sizes of the strata. Finally respondents were selected based on the allocated sample by simple random method from their actual residents.

Therefore, according to Sheko Woreda Agricultural office information the total number of kebeles in the study area were 24. Based on the different land use pattern four kebeles that are categorized into three study site were selected .This means the four kebeles that were found in three study site, two of them found in agro forest study site (Shimmy & Sanka), and named land use pattern "A" the second study site in human settlement under Shayta kebele and named land use pattern "B" study site and the third study site belong nonhuman settlement Jemdose kebele and named land use pattern "C" study site. The total number of beekeepers in three study site were 154 that means, land use pattern -A has 86 beekeepers, land use pattern - B, 37 beekeepers and land use pattern C, 41 beekeepers. Reliable sample size determined by standard formula single population proportion formula (Cochran, 1977) by assuming 90% confidence level with marginal error 0.10 and p= 0.5

Thus, the sample size was calculated as shown below by single population proportion formula

$n=Z^2pq/d^2$

$=2.56^2(0.5x0.5)/0.1^2$

$=163.84=164$

$n= Z^2pq /d^2$ at Confident level of 90%

Z, at 90% the value of alpha =2.56

P=o.5 (No research result on similar topic)

q=0.5 (1-P=0.5)

N=154(number of beekeepers in study site)

d=0.10 (marginal error)

n=164

NF = n/1+n/N

= 164/1+164/154

= 78

Where Z=Confident level (90%)

n=Sample size

N=Total population=154

d=Marginal error

P=Proportion =0.5

q=1-p=0.5

Z=2, 56

The single population proportion formula reduce the sample size into 78 out of the representatives households which are found in three study site were represent the whole study population and based on the number of beekeepers found in each agro ecological zone proportional allocation was made in considering the determined sample size and total number of beekeepers in each study sites. So that the sample size from each studies sites were from A-land use patterns 44 (agro forest) beekeepers, B-land use patterns 18 (human settlement) beekeepers and C- land use patterns 16 (non human settlement) beekeepers. Finally respondents were selected from the three study site based on the allocated proportion by using simple random method in their actual residents and the prepared questionnaire papers were interviewed.

Besides the beekeepers data were collected from agricultural worker from Woreda as well as developmental agent working on the selected kebeles and each kebele has at least two expert and both of them were used to fill the questionnaire prepared for them .The other data were collected from Tepi research center three researchers working on beekeeping and related issues. Therefore 12 Agricultural experts along with 78 beekeeping farmer a total of 90 represent the whole study population.

Table: 1Sampled population and their sampled respondents in three different study sites

Sample group	Kebeles	Land use patterns	Total beekeepers	Sample size
Beekeepers	Shimmy and Shyta	A	86	44
Beekeepers	Sanka	B	37	16
Beekeepers	Jemdose	C	41	18
Total			**154**	**78**
DA-Workers	Shimmy	A	2	2
DA-Workers	Shyta	A	2	2
DA-Workers	Sanka	B	2	2
DA-Workers	Jemdose	C	2	2
WRACO	Sheko	-	2	2
TARC	Tepi keble	-	2	2
Total			12	12
Ground total				**90**

3. 4. Data collection instruments

The study was conducted in Sheko Woreda due to its beekeeping practice ,honey production potential as well as the current increasing impact on the habitat of honey bees , poor management practice of beekeeping farmer and environmental factor affecting the life of honey bees that in turn affecting the production system of honey and their ecological significant .So as to make the data more heterogeneous and reliable, the study used three method of data collection instrument namely questionnaire (two type),focus group discussion and direct observation .The required social data which consists of socio-demographic information and the existing beekeeping practice of the study area collected from respondents from the three study sites.

Questionnaire

Semi structured questionnaire were prepared to interview the respondents by well trained interviewer. Door to door interviews were conducted in each household. Expertise from TARC, Sheko Woreda Agricultural Office and developmental Agricultural workers were interviewed in their working area.

Focus Group Discussions (FGDs)

Focus group discussions was conducted in the study area with purposively selected individual from community for the sake of this particular study which include Developmental agent workers from selected kebeles, expertise from Tepi Agricultural research center(TARC), individuals who are believed to be knowledgeable about bee flora plants in the study area were part of the discussion.

Direct observation

The researcher with extension workers, volunteer's working on beekeeping activities and some beekeeping farmer visited the different beehives, flora of the area, method of hanging traditional beehives the existing application of the modern beehives the different forest of the area and for each of these issues a photograph or original picture were taken from the study area.

3.5. Data analysis

After all primary and secondary data were collected, similar variable organized which means the social data, beekeeping practice, management style, honey bees enemies bee flora of the area that was taken from the study population using the three data collection instrument .The data collected during the survey were analyzed by using SPSS software version 20.00 and summarized using descriptive statistical methods (such as percentage and graphs).The summarized data were presented in the form of tables and figures. Descriptive statistical procedures were used to summarize the data. After all possible data are described common dependent and independent variables are compared to check whether there is significant relationship exist and explained by taking into account the basic objectives of the study.

CHAPTER FOUR

4. Results

4.1 Socio-Demographic Characteristics of Respondents

This section provides the profile of the sample respondents with regard to their age, sex, religion marital status, education level and ethnicity this can tell as the overall picture of study population about their socio-demographic characteristics of the people. Regarding the marital status, most of the household heads surveyed (95%) were married with only 5% percent divorced household head. The educational status of the survey population is about 53% were 1-4 grade level, 15% can read and write (informal education), 12% are illiterate, and the rest 12% 5-8 grade and 6% of them are high school (9-10) graduates. Concerning religion of the sampled respondents were 62% protestant, 24%, Orthodox Christian, 8% Muslim and 8% others households . Concerning ethnicity majority (52%) of the respondent are Mejengire followed by Sheko (23%), Bench (14%) and the rest 10% are Amhara

About 58% of the respondent age was 31- 35 years followed by 26-30 years (21%) and 36-40 years old (21%) and almost all respondents are male with only one female beekeeper. Concerning occupation of the respondents all of respondent's populations are farmers according to evidence from the data. This indicates currently honey producing farmers has huge experience and most found productive age that can help to introduce new agricultural technologies and possibility of honey production investment to maximize annual honey production potential of the area.

Table: 2 Socio-Demographic Characteristics of respondents in the study area

Variable	Categories'	Frequency	Percent
Educational status	Illiterates	10	12.8
	Read and right	12	15.3
	Grade 1-4	42	53.8
	Grade 5-8	9	11.5
	Grade 9-10	5	6.4
	Grade 11-12	-	-
Age distribution	20-25	5	6.5
	26-30	17	21.5
	31-35	30	38.5
	36-40	17	21.5
	>40	-	-
Religion status	Orthodox Christian	19	24
	Protestant	49	62
	Muslim	5	6.4
	Other	5	6.4
Occupational status	Farmer	78	100
	Merchant	-	-
	Student	-	-
	Government employee	-	-
Marital status	Married	76	97
	Single	-	-
	Divorce	2	3
	Widowed	-	-
Sex distribution	Male	77	98.7
	Female	1	1.3
Ethnicity	Mejengir	41	52.2
	Sheko	11	14.1
	Bench	18	23.1
	Amhara	8	10.3

4.2 Beekeeping practices

4.2.1. Beekeeping experience and Honey Production

The annual crude honey produced in 2012/13/2014 per traditional box beehives was 18.33 Kg and that of improved one was 33.75 Kg. Depending on seasonality and size of the beehives, some farmers indicated that a well-managed traditional beehive can produce up to 20 kg of honey/hive. About 316.38 kg of honey is reported to be produced per year per household in average. The level of beekeeping experience is taken to be the number of years that an individual was continuously engaged in beekeeping activity. Majority of the respondents had about 15 years of beekeeping experience (Figure-5)The average years of experience for the entire respondents was about 13 years, the minimum and maximum years of experience being 5 and 25 years respectively.

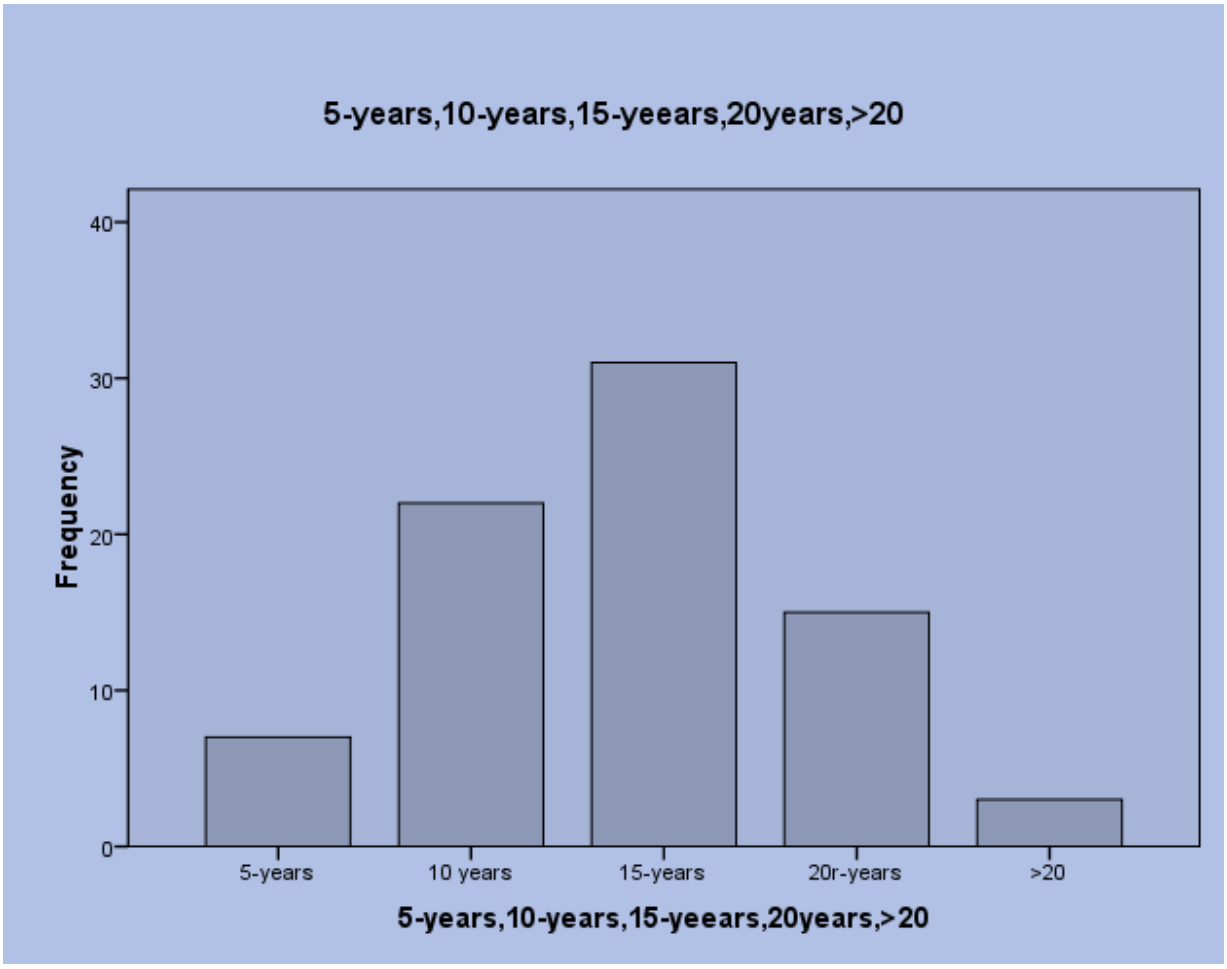

Figure: 3 Beekeeping experiences of the respondents in the study area

4.2.2 .The type and number of beehives used by Beekeepers

According to Sheko Woreda Agricultural office information the total number of beehives in the study site are 3276 in the years 2012 and 2014. From this number 3209 (96.4%) of the hives are totally traditional and the rest 63 (1.8 %,) 54 (1.6%) account transitional (Chefeka, intermediate beehives) and the modern beehives respectively. These beehives number may be very low compared to the expected number of hives currently used by the farmers because they are not interested to register the exact number of their beehives due to various reasons such as poor activities of agricultural office and forest beekeeping is difficult to access the information.

Table: 3.Number of beehives in by kebele of Sheko Woreda in the year 2012/13 and 2014

Land use patterns	Traditional beehives	Transitional beehives	Modern beehives	Total
A	1951	52	18	2024
B	380	11	32	423
C	878	-	4	882
Total	3209	63	54	3326

Table: 4The different types of bee hives owned by respondents in the study area

Types of beehives used by farmer	Frequency (n)	Percent
1.traditional beehives	52	66.1
2.traditional and transitional	12	15.4
3.modern and traditional	7	9.0
4.All three types of beehives	7	9.0
Total	78	100.0

Table-5 Distribution of respondents in terms of types of beehives in Land use patterns

Study sites	Total no of beekeepers	Sample respondents	Traditional only user	Traditional &transitional	Traditional & modern	All type
A	90	44(57%)	36 (70%)	3(25%)	2(28%)	3(44%)
B	34	16(20%)	3(5%)	7(58%)	4(58%)	2(28%)
C	39	18(23%)	13(25%)	2(17%)	1(6%)	2(28%)
Total	163	78(100%)	52(100%)	12(100%)	7(100%)	7(100%)

Evidence from the respondents 67% of them owned only traditional beehives followed by both traditional and transitional (Chefeka) 15% (but with this proportion majority of them is still traditional) (Table-5) This is because absence of extension program for the adoption modern technologies ,Shortage of professional (experts) to the sector ,lack of NGO's working on the adoption of modern beehives ,poor attention given by the local government in supporting beekeeping and farmers attitudes towards the modern technologies. According to Sheko Woreda agricultural office document the current number of beehives found in the different kebeles for the year 2012/13-2014 is organized above. The adoption of modern box beehives (plate-1c) in the area is mainly practiced by the transitional beehives (plate-1a) which are replaced by locally prepared material as part of adoption of the modern technologies which is called" Chefeka "beehive (plate -1b). It is very cheap compared to the modern transitional beehives and constructed by locally available material and have equal production potential with modern transitional beehives.

a b c

Plates: 1 .Locally prepared Transitional, Chefeka and modern beehives in sampled kebele Transitional beehives (a) Chefeka beehives (b) and Modern box beehives(c)

a

b

c

Plates: 2 Apiary site with Chefeka (a) and transitional beehives (modern hives) (b) in Shyta kebele of the study area

4.2.3. Annual Honey production potential

As mentioned above by RADCO the exact information about the exact amount of honey produced in the area is too difficult because various reason such as poor communication of the office with kebeles and they have no well organized planned activities on documenting honey production as well as no professional expertise working on beekeeping. However from different source honey production potential of the Woreda from the year 2012-2013 is organized below From the data annual honey production potential of the area seems increasing from the year 2012 to 2014 however if we compare the newly added individual farmer to the industries as well as honey production potential of the area the increasing number is insignificant.

Table-6 Honey production potential in selected study sites for the year 2012-2013

Roll	Land use patterns (study sites)	Production potential (tone)
1	A	28(58%)
2	B	8(16%)
3	C	13(26%)
Total		49(100%)

4.2.4. Colony inspection

Respondents were interviewed the frequency of inspecting their colony and 44% of the respondents had no regular time of inspection (they have no any planning about colony inspection except integration with other activities) , 33% do not take look their hives completely externally except chalking repining of honey, and 20% of them take look every around 2-3 month. According to them some of the inspection practice common in case of human settlement area(agro-ecology-C) that are currently using modern and Chefeka beehives and compared to the traditional bee hives owner farmers they had better and improved practice of inspection of their colony.

Table: 7.Frequency of colony inspection by respondents

Apiary inspection time	Frequency (n)	Percent
Every2- 3 months	16	20.5
Had no regular time of inspection	35	44.9
Do not take look completely	26	33.3
Every week	1	1.3
Total	78	100

4.2.5 .Honey harvesting, method its potential and income from the sale of honey

Most beekeepers harvest honey two times a year so there are two honey harvesting seasons but a few farmers even harvest three times per year. October, November and December are regarded as the main honey flow season and harvesting period of the year as this period is the main flowering season of the year; whereas, May, April and June were regarded as the second honey flow season/ harvesting period of the year. Majority (90%) of the respondents harvest honey two times per year and the rest (10%) harvest honey even three times. However all of them mention that for the last five years honey harvesting amount and the quality is not as much similar than before and decreasing strength of colony become common to the area.

Table-8.Honey production by types of beehives in selected study site for the year 2012/13

Land use patterns	Average product per hives (kg)	Average product per hives(kg)	Average per product hives (kg)
Study sites	Traditional	Transitional	Modern
A	19	30.5	34
B	16	26	28
C	15	27	29
Average	16.6	27.8	30.3

The amount of honey yield per hives in harvesting season varies from places to places, which in most cases is determined by the existences of plenty pollen and nectar source and the level of colony management & input. The maximum and minimum amounts of honey harvested from traditional beehives were 20 kg and 10 kg respectively. The average honey yield obtained per hives from Chefeka hive made from locally available materials and modern hive is 27.8kg and 30.3kg, respectively.

Concerning annual income from the sale of honey majority respondents (72.5%) their annual income 50% covered by the production and sale of honey and the rest (27.7%) about 60-75% annual income covered by honey production (Figure- 14) . If we convert the annual gross income of respondents from the sale of honey output in the study area, ranged from 10400 to 10500Birr. This is calculated by considering average number of beehives, harvesting season, the amount of honey produced per year and per hives and the average cost of honey per kg. This indicates beekeeping is the main economic resource and the possibility of scaling up honey production by implementation of intervention activities such as adoption of the modern technologies along with training and beekeeping equipment.

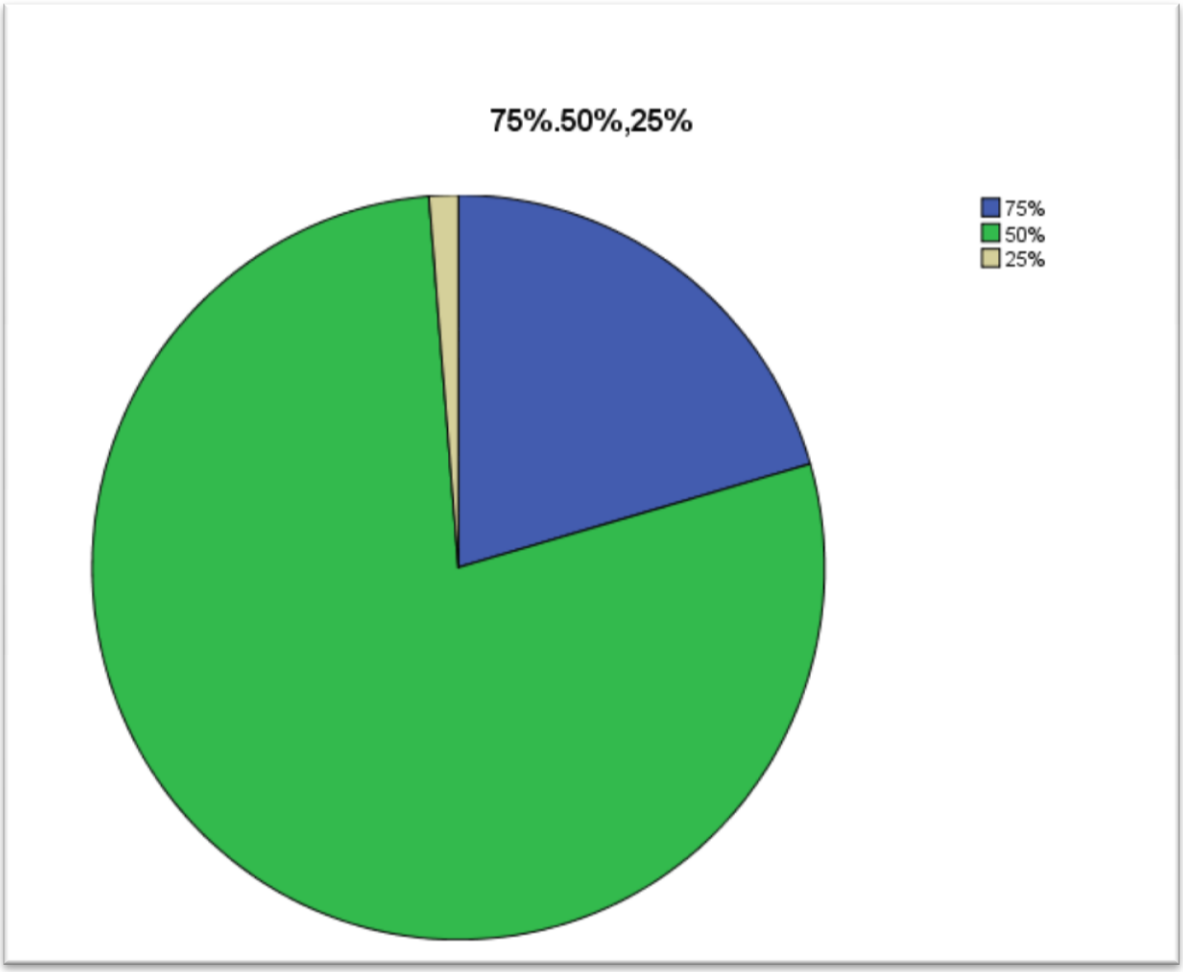

Figure: 5 Annual income of the respondent's from the sale of honey in the study sites

Respondent population also administered mechanism of knowing honey ripening and they mentioned that no planned system of identifying ripening of honey in the hives which is part of traditional practice. The different indicators that the beekeepers use for identifying honey harvesting season are, counting the beginning of flowering time to forward, smelling of honey, honey bees decrease their activities if honey is ripened ,accumulation of bees around the entrance of hives, and end of flowering season. Some beekeepers identify honey season honey bees become more aggressive during the time of honey season and still very few identify by inserting

a thin piece of stick into the hives and if the honey is ripe the stick come with some honey as the traditional beehives is not suitable for inspection hence some of them mentioned that collection of unripe honey is common. Almost all respondents during harvesting of honey use similar practice that is the use of different smoke commonly at night such as animal dung, *teff* straw etc. for the same purpose.

The respondent's also administered that during honey harvesting season weather they take care or not for the safe life of honey bees and majority of them (79%) do not take measure for the life of honey bees. Evidence from the respondent specially those beekeepers that are currently using traditional beehives (forest beekeeping) the degree of taking care for the honey bees during harvesting is very low because the large tree and the traditional beehives are not comfortable for handling the life of honey bees. Besides the respondents mentioned during harvesting majority of them collect the entire honey comb from the hives. However relatively beekeeper that owned Chefeka beehives (transitional beehives) in human settlement and very few modern box beehives had some improvement practice in carful harvesting of the honey from the hives.

4.2.6. Supplementary feed and best honey flora

About 90% of the respondents believed that honey bee flora shortage is common during some season of the year. The peak months in which feed shortage occurs are April and March. These months are indicated as dearth period because there was no much flowering plant .However as an important component of seasonal colony management practice respondents were mentioned practice of their supplementary feed during feed shortage and about 80% of the had no practice supplementary feed their colony during bee flora shortage and the rest 20% had some activities of supplementary feed specially apiary site that are found in human settlement (Agro-ecology-B) that are currently using Chefeka beehives. Concerning knowledge of the respondents about the best flora of the area about 80% of them well know the best flora of the area and the rest 20% did not identify bee flora of the area

4.3. Beekeeping Constraints

4.3.1. Beekeeping training and its interest

Concerning Farmers' training on general principle of beekeeping and modern technologies, 79% beekeepers did not take any training. But 21% beekeepers have taken some training on modern technologies of beekeeping. Majority of the beekeepers lack the knowledge of appropriate principle of beekeeping activities. According to respondents (21%) the training has helped them to know basic improved beekeeping technologies and general principle of beekeeping. However, even if they trained still there are various problems in adoption of the modern technologies. Introduction of improved beekeeping technologies to the rural communities are beyond the buying capacity of the farmers and not easily accessed for those who can afford it.

All respondents including those who had no chance of visiting beekeeping center are interested to be train about the modern beekeeping and basic of beekeeping. During group discussion the entire participant mentioned that both beekeepers and agricultural expertise mentioned the major problems of beekeeping activities in the study area is lack of awareness about the modern technologies and general principle of colony management practice such as transferring colony, apiary selection, feeding of colony ,honey harvesting ,transferring colony. From 21% respondents who engaged training on the modern technologies and principle of beekeeping about 62% of them belong from land use patterns "B "(human settlement)

4.3.2. Incident of Reproductive Swarming and absconding and migration

Regarding season of colony swarming during group discussion all participants mentioned that sources of colony for their traditional beehives were swarming that are constantly emerges from different colony. Also 93% of the respondents reported swarming is common to most part of the study area and they also mentioned that September, October and November are the main swarming months. According to the principle of honeybees 'seasonal colony management practice if bees face different environmental hazard both the strength and the number of colony tend to decrease. Among the representatives 60% of believe colony in the area decreasing, 27% increasing and the rest 13% do not recognize the situation. In addition 94% of respondent believe

that migration of colony is common to the area as a result of different driving factors. Beekeepers indicated that colony migration occur mainly January --March up to flowering time

4.3.3 Honeybee enemies and traditional controlling methods

Table: 9.The most common honey bees enemies ranked in order of to decreasing importance in the study sites

Roll no	English name	Scientific name
1	Wax moth(larger and smaller)	*Galleria mellonella*
2	Different kinds of ants	*Dorylus fulvus*
3	Death head hawk moth	*Daphnis ner*
4	Different beetles	*Aethina tumida*
5	Lizards	*Hemidactylus frenatures*
6	Birds	*Serinus canaria*
7	Spider	*Theraphosa blondi*
8	Wasps	*Vespula Vulgaris*
9	Bee lice	*Braula coeca*
10	Honey badger	*Mellivora capensis*

The result from respondents, majority (70%) and during group discussion honeybee enemies are causing losses both the quality and amount of honey affecting the life of honey bees. However 30 % of the respondents believe that the number and types of honeybees' enemies increasing from time to time but they cannot recognize their impact except decreasing quality of honey (changing the test and color sometimes). Also during the group discussion one of the center of discussion were honey bee enemies and the participant mentioned that the impact of honey enemies increasing from time to time. The honey bees enemies are causing honey bees migration, decreasing colony strength, and some honey bees dies in the hives after fighting with their enemies. During group discussion participant mentioned that the honey bees after fighting they tend to migrate from their hives some may die inside the hives in which dead bees observed and the major cause of migration of colony is caused by this enemies. According to Tepi research center report and respondents description Nosema and Chalk brood disease caused by

fungus (*Ascosphaera apis*) are the most common honeybee diseases that are currently producing severe damage to the beekeeping sector in the study area.

4.3.4 Honey flora and its shortage

Most probably the main reason for this honey yield difference in the different harvesting time was due to the different availability of bee flora species in the different harvesting time. Respondents and participants from focus group discussion and expertise on apiculture and related professions were asked to list common bee flora of their area. According to their responses from all group the two flowering season of the year are September –October and February. Common bee flora of the area includes Girawa -*Vernonia amygdalina*, Sesa -,*Cordia Africana* ,Avocado- *Persea americana* ,Mango- *Mangifra indica* . Coffee,*Coffee arebica* Maize, *Zea mays.* Meskel Abeba mekala- *Bidens sklp* Banana *Musa paradisca* , Geteme *Schefflera abyssinica* are some of the most common flowering plant.

All respondents mentioned that after harvesting of honey shortage of honey bee forage is very common as majority of the plant has the same flowering season but almost all of them underlined that from year to year flowering period and duration of flowers fluctuation become common in the area. They also mentioned that this is because climate change, shifting agricultural practice, huge deforestation and most beekeepers did not practice development of bee forage. Here is some of the most common honey bee plants and their flowering period in the study area which is obtained from beekeeping farmer and Woreda agricultural worker as well as volunteers.

Table: 10 Common bee floras in the study area of Sheko Woreda

Botanical name	Common name	Flowering period
Cordia Africana	Wanza Wadessa	Jan-July
Hygenia abyssinica	Kosso , Hexxo	Sept-Oct
Euphorbia sp.	Kulkual Adami	Sept-Oct
Ficus vasta	Warka harbu (Oromifa)	Oct-Dec
Erythrinia abyssinica	Korch Walanso	Sept-Dec
Schefflera abyssinica	Geteme	March-May
Anigaria altisma	Keraro	March-April
Pterolobium stellatum	Kontir (Ah); Haragma (Oromifa)	Sept-Dec
Vernonia sp	Grawa Ebicha (Oromifa)	Dec-Feb
Zea mays	Maize	Sept-Oct
Bidens sklp	Meskel Ababao mekala	August-Oct
Sida sp	Chiferge	Sept-Oct
Helian thns annus	Sun flower	Variable
Ruta chalopensis	Tena adem	Sept
Lippiaadoensis	Kessie	Sept-Oct
Persea Americana	Avocado	Sept-Dec
Mangifra indica	Mango	Sept-Dec
Papaya carica	Papaya	Sept-Nov
Musa paradisca	Banana	Sept-Oct
Coffee arbica	Coffee	April-May

4.3.5 Marketing problems and practice of processing beeswaxes

Another critical issue for the development of beekeeping is market condition, so the respondents population were interviewed that honey marketing problem and 81% of them answered that stable market problem is common to the area and the rest 19% said that no marketing problem. Beekeepers also administered that the practice of processing bees waxes and they mentioned that majority (94%) of the respondents never process bees' waxes for better benefit.. The respondents reported that they have good interest bees to improve the practice of wax processing if these all issues are accessed in relation to waxes processing.

Table-11 Reason for poor processing of beeswaxes in the study area

Reason of poor waxes processing	n	%
Lack of awareness	19	24.5
Lack of processing skill	43	55.1
Lack of processing material	5	6.4
All of the reason	11	14.1
Total	78	100

4.3.6. **Practice of seasonal colony management**

From the different practices in effectives and productive beekeeping activities seasonal colony management is vital for sustainable beekeeping .So that the respondents interviewed that in their honey production trained weather they practice pre and post season colony management and majority (90%) of them had no even knows the practice and its components. Besides during the discussion the participant mentioned that they do not has any idea about the significance of selecting apiary site as well as the practice of supplementary feed for their colony during feed shortage. Besides during the discussion majority of them accepted lack of management practice is critical problem for their beekeeping activities. So that according to respondents and expertise on apiculture one of the major constraints to effective beekeeping activities was inadequate skills of seasonal colony management.

4.3. 7.Common problems associated with beekeeping mentioned by beekeepers

Beekeeping is one of the disciplines which suffered and is being suffering from the lack of skilled manpower, appropriately skilled trainers, and the availability of modern beehives, training materials and training institutions in the district. Respondents were interviewed that to list down common problem that has an impact on beekeeping activities and almost all of them mentioned similar answers such as being the practice is totally traditional ,lack of access to the modern beekeeping and its training ,lack of support from different organization ,relatively high price of the modern beehives ,high risk of hanging beehives and harvesting honey in large tree which is life treating practice ,shortage of bee-flower because of shifting agricultural system of

the area, huge deforestation practice, increasing population ,climate changes , poor adaptation of honey bees in human settlement from their wild area and lack of NGOs working on beekeeping development are some of critical beekeeping constraints.

They also underline that the key issues associated to the improvement of the current status of beekeeping industries to the existing huge potential of honey production and maximum ecological benefit of honeybees depend on solving the existing problems. Every problems associated with beekeeping activities in the study area is the traditional practice that does not give opportunity of seasonal colony management as well as caring the safe life of honey bees. Therefore most respondent's, expertise from SWRDAO and research center and the group participants suggested that the existing beekeeping challenges can be improved by accessing training opportunity for beekeepers and expertise as well as the concerned stakeholder should do hand in hand in the adoption of the modern technologies along with beekeeping equipment.

4.4. Focus group discussion result

During focus group discussion the researcher explains the objective of the discussion along with the guidance question with detail explanation about the contribution of the study to the development of beekeeping industries as a whole in the area(plates-3) .The group discussion, suggested that both the types of beehives used by the beekeepers as well as management practice of beekeepers is traditional and participants identified the main reason were lack of training on the general principle of beekeeping skills and modern technologies, Lack of awareness about the significant of using modern system of beekeeping .poor attitudes of beekeepers to modern beehives (they consider modern beehives more complex and needs some complex procedure and skills compared to the traditional beehives),Poor extension program , lack of attention by concerned body like political administrator's, RACO ,beekeepers has no concept of seasonal colony management practice Lack of NGO's working on beekeeping and related issues in order to provide training and accessing the modern technologies and difficulty to socialize(adapt) honey bees as most bees are wild and some of the participant mentioned that honey bees killing domestic animal and cause economic damage hence farmers had no good attitude towards the modern technologies.

Plates: 3 a picture that are taken during focal group discussion in the selected kebles in the study Sites.

The other basic issues raised during group discussion were deforestation practice it is clear that the area is well known for its dense forest which is protected by local government. The researcher during field observation along with Tepi research center worker observed the protected dense forest and taken some picture. Previously there was NGO named NTFM working on forest management by protecting different forest in the study area for conservation activities. However following termination of the project they close their office which was found in central Sheko. Currently only one NGOs WCC-PFM working on management of wild coffee and conservation of forest. They create awareness about how to manage wild coffee in the forest but as a result of increasing human impact on the forest the organization change their strategies of conservation into organizing local farmers association and giving protected land in order to make the farmers a sense of owner ship of the forest and responsibility in protecting the forest The organization provides training and awareness creation for the association hence newly established farmers association in their local community have the right to explore the forest resources for non timber product only including coffee cultivation and every locally established association formulate their own rule and regulation as an association to use the wild coffee along with different resources in conservation manner . Therefore the farmers benefit resources in the

forest and conserve the forest for sustainable utilization. However due to different reason such as poor practice of the association members implementing their low and regulation ,huge increase population ,habitat fragmentation for different purpose ,huge cutting of tree for fossil fuel such as charcoal ,monoculture agricultural system(coffee only) and new settlement to the area are the major reason the increment of deforestation in the study area .Therefore according to them all the existing practice affecting foraging activity of honey bees and climatic change increasing temperature making the honey bees more aggressive and unstable behavior that lead them migration and poor adaptation of the area.

The study site was around Tepi agricultural research center which is established first under sub branch of Jimma Agricultural Research Center. However currently it fully organized as one of research center under National Agricultural Research Institution .The objective of TARC is conducting research on different crops, spice and apiculture to develop new verities based on the existing environmental problems and community need .Therefore among the various prioritized issues given by the center for better production is beekeeping

4.5 Statistical analysis of different variable

One of the objectives of the study was to compare honey production difference in three land use pattern. So that to determine significance production different among the three study sites the following variable were analyzed such as the types of beehives used by beekeepers ,annual honey production variation ,yielding potential per hives ,the adoption of the modern technology, beekeepers preference of the agro-ecology , bee forage shortage and farmers training on beekeeping.

Table12- Mean and Standard devotion of the type of beehives that are found in three different study sites Sheko Woreda

Statistical test	Traditional hives	Transitional hives	Modern hives	Annual production	Yield from traditional	Yield from transitional	Yield modern
Mean	1069.6	21	18	21.33	16	27	29
Variance	644562.34	761	196	216.7	7	3.12	25
S.D	802.84	27.58	14	14.72	2.645	1.766	5

From statistical analysis of mean and standard deviation the number of bee hives currently owned by beekeepers in three study sites is quite different from the standard. If we consider the human settlement (land use patterns -B) 380 traditional beehives found and the standard number is around 800 beehives which means if we compare to the normal it is too small and in agro-forest (land use patterns -A) contains 1957 bee hives which is very huge compared to the standard. But the non human settlement (land use patterns -C) relatively consists of average number of beehives compared to the stated standard.

Therefore the result shows significance different in supporting huge beehives among the different agro-ecology. However in terms of the adoption of modern technologies the standard number of modern beehives is 14 but human settlement (land use patterns -B) currently owned around-34 modern beehives so from the analysis of the result we can conclude that the B- land use patterns (human settlement) relatively the study site has better in the adoption of modern technologies

Honey yield variation per hives in three different land use pattern observed 36 kg ,24kg and 29kg in " A " ",B "and "C " land use patterns respectively and annual honey production variation in three land use patterns found that 38 tone ,10 tone and 16 tone in " A " ",B "and "C " land use patterns respectively. To determine the effect of land use patterns on honey production variation we use hypothesis and null hypothesis test. So that the production difference between the three study sites probably as a result of the real effect of the different land use patterns (hypothesis) or absence of difference land use patterns impact on honey production different (null hypothesis). If the likely range of variation of the average yield and annual honey production are due to land use patterns difference the null hypothesis become wrong This is tested by the standard deviation of the estimated mean formula called Standard deviation of estimated mean and sample mean by the formula SD of estimated mean = $\sigma/N^{½}$ (Snedecor and Cochran, 1980)

Yielding difference in three land use patterns

S.D of estimated mean = $\sigma/N^{½}$

Where σ *=Standard deviation of all yield*

N=number of agro ecology

σ=5

N=3

S.D of estimated mean = $\sigma/N^{½}$

$=5/3^{1/2}$

=3.33

Annual production potential difference

S.D of estimated mean = $\sigma/N^{½}$

σ = *Standard deviation of all annual production*

N=number of land use patterns

σ=14.72

N=3

S.D of estimated mean = $\sigma/N^{1/2}$

$= 14.72/1.5$

=9.8

From the result if we compare both honey yield per hives and annual honey production potential variation between the three land use pattern their means of standard deviation result is significantly larger than standard deviation of estimated mean (5 with 3.33 and 14.72 with 9.8) Therefore we have evident that the null hypothesis is not correct instead the different land use patterns has an effect on both honey yield per hives and annual honey productions potential between the three land use patterns (study site).

Training involvement

From 21% respondents who engaged training on the modern technologies and on the basic principle of beekeeping from the three land use patterns Majority (62%) are from land use patterns - B study site, 36% of the beekeepers belong to land use patterns –C and land use patterns -C accounts 12% has been taken training. The report show that land use patterns- B which is human settlement study site beekeepers relatively a better training engagement and hence better adoption of the modern technologies as well as good practice of seasonal colony management specially colony inspection and deliberate feeding of colony during feed shortage.

Beekeepers agro ecology preference and occurrence of feed shortage

87% respondents prefers honey production in terms of supporting huge number of beehives and the quality of honey, A- land use patterns zone is better followed by non human settlement(C-land use patterns) Evidence from the study feed shortage during some season of the year is common to the study area and the shortage is critical in land use patterns -B followed by land use patterns –C and land use patterns –A .Flora shortage is sever in human settlement in both honey season.

Table 13- Results of regression analysis showing the relationship between training and different management practices of beekeepers in Sheko Woreda

Dependent variable	Sum of square	Df	Mean square	F	Sig
Processing bees wax					0.000
Between group	1.573	3	0.524	17.456	
Within group	2.222	75	0.30		
Total	3.795	78			
Control bee flora					0.002
Between group	1.562	3	0.521	5.386	
Within group	7.156	75	0.097		
Total	8.718	78			
Removing all honey comb					0.648
Between group	0.426	3	0.142	0.553	
Within group	19.022	75	0.257		
Total	19.449	78			
Identifying best bee flora					.000
Between group	0.645	3	0.215	1.387	
Within group	11.470	75	0.155		
Total	12.115	78			

Finally important variables also tested using SPSS soft ware package version 20.00, Anova one way test between different dependent and independent variable (Table 13).The relation between colony management practice of beekeepers and educational back ground and training on beekeeping were related. The result of the analysis show that, training has significant contribution on the tendency of adopting modern beekeeping and increasing productivity of honey from different beehives, that means those farmer who had practice of seasonal colony management activities such as occasionally visiting their apiary, chalking bee enemies and disease and taking care during honey harvesting for their colony has better experience of training and they have relatively better educational back ground.

Therefore from the analysis it possible to conclude that training on beekeeping has significant contribution for the development of beekeeping and the adoption of the modern technologies. The other situation in relation to educational back ground of beekeeping farmer is the tendency of processing bees' waxes for better income, removal of all honey comb during harvesting and

identifying the best bee flora of the area .This also significant contribution to the educational back ground of farmer $P < 0.5$ or $P< 0.01$ for these analysis.

4.2. Discussion

The present study was conducted to assess beekeeping practice and its constraints in three land use pattern of Sheko Woreda. According to the result of the study 97% of the honey production practice and the types of beehives used in the study Woreda were completely traditional. Besides, respondent's 67% of them currently owned only traditional beehives. The traditional beekeeping system has many disadvantage in management of beehives as well as the amount and quality of honey produced. This study is in line with the Survey conducted by Derejie *et al* (2003) in seven beekeeping potential zones of Oromia (west and east Wollega, Ilubabor, Jimma, Bale, Guji, and Borana) from 2002 -2003 in view of assessing honeybee management practices and post-harvest handling of bee products, the analysis showed that traditional beekeeping system ranges from 89.3% (in Jimma) to 99% (in Borena) with overall average of 95.2% and only 4.8% of the beekeepers are exercising improved beekeeping, which ranges from 1% (Borena) to 10.7% (Jimma, 3.1% intermediate (top-bar) and 7.6% framed box hive). According to respondents majority of the traditional beehives are found in the forest (both densely and agro forest).

In this study, the sex of the interviewed beekeepers except a single female all was males. This is in line with the report of Hartmann (2004) as sited by Solomon who noted beekeeping as the men's job in Ethiopia. Almost all of the respondents mentioned beekeeping activities like hanging traditional beehives in large tree, collecting honey during honey season, preparing traditional beehives etc are mainly male responsibility. However a study conducted in Alaba Woreda by Shiferaw *et al* (2010) on indigenous beekeeping knowledge found that the good involvement of female in various activities in beekeeping. Such as, honey harvesting, colony inspecting, apiary sanitation and honey marketing. This shows Poor understanding of the community about beekeeping potential that can be performed by all individual without sex reference.

During the survey period it has been also observed that the adoption of intermediate (Chefeka beehives) and improved box hives (modern beehives) is very low. This shows that large proportion of the respondents had little exposure to improved beekeeping practices as well as according to information from Sheko Woreda agricultural report less than 3% 0f currently

available beehives in the Woreda are modern and from the respondents 9% both modern and traditional, and 15% both Chefeka and traditional beehives owned by the farmer (still under this proportion 90% of the beehives are traditional).

According to the present study poor adoption of the modern technologies is most likely due to different factors such as: little attention given to the sector by concerned body ,lack of NGOs working on the adoption of modern beehives in the Woreda, the local government officials and rural agricultural coordination office do not consider the sector as means of alleviating poverty, lack of skilled man power on the sector , lack of awareness and different beekeeping equipment , and the farmer themselves are not interested for adoption of the new technologies .

Information from Woreda Agricultural expertise (DA-worker), during the group discussion and respondents mentioned that the adoption of the modern beehives and supporting beekeeping by the local government is very low compared to the existing potential. The rural development coordination office and Sheko Woreda political administration admitted during the discussion poor attention given to the sector and lack of extension program. This is not in line with , a study conducted by Gidey (2009) in Northern part of the country about various efforts done by the government for the adoption of the new technology (91%) in respect to honey production and improved honey production system. Also, Great effort has been made by government extension package and Relief Society of Tigray (REST) to adopt movable frame hive technology to the region to increase quantity and quality of honey production and for better management of bees. This recently introduced new technology has shown significant improvement in the management of hives, bees and production of honey and wax and the beekeepers were mentioned that technology/innovations are available to improve the production of honeybee in Tigray.

According to the respondent estimate, maximum and minimum amount of honey harvested amount in kilograms taken per hive 14-20, 18-28 and 20-35 of crude honey for traditional, transitional and modern bee hive respectively. This is not similar with a study by Greener Journal of Business by Chala *et,al* (2013) mentioned the national honey production result was average of 5 kg 12-15 kg and 15-20kg for traditional intermediate and movable frame hives (modern) respectively. Moreover, according to the survey conducted in West Showa Zone, average honey yield of traditional hive is 6.1 kg per hive per annum (Edessa, 2002). Therefore honey production

per hives compared to the national standard as well as in different area the study area has better yield and quality which show the possibility of planning large scale beekeeping activities in the area.

The study revealed that almost all of the traditional beekeepers identify honey season by traditional indicators such as smelling of honey, the honey bees become more aggressive, end of flowering season and weighing of the hive. Very few beekeepers identify honey season by inserting a thin sized stick in to the hive if there is honey the stick comes back with the honey strips. According to the farmer due to the nature of traditional beehive all of the beekeepers mentioned internal inspection is difficult to controls and observe the internal part and majority of the hives that are hanged in large tree are not suitable checking the ripening of honey. Therefore the various methods of indicators could not be efficient in identification of honey from brood by weighing and it is also impossible to identify externally whether the honey has ripened or not

Farmers' training is one of the essential inputs in beekeeping sector in order to increase yield, to attain good management practice, to sustain business, appropriate input utilization, honey quality maintenance and handling bee forage development, and pest and disease control (FAO, 2010). Of the total 78% farmer did not take any training and 21% beekeepers have taken some training on modern technologies. According to respondents training has helped them to know basic improved beekeeping practices and principle of colony management but they reported that difficulties of implementing their skill because of many constraints due to little attention in adopting the modern beekeeping technologies by concerned body in the area. This finding is similar to a study conducted by Workneh Abebe (2007) On farm demonstration of improved beekeeping technologies in Ejere district of west Shoa zone, Oromia the accessories are cost effective when it is used in group and beekeeping training is also needed for enhancing the technology promotion which, in turn, increases the productivity of the beekeepers and utilization of the technology. This show that a big need of beekeeping training and the adoption of modern technologies in improving honey production system.

The objective of colony seasonal management is to coordinate the colony development with all the natural plant resources available in order to have the maximum number of foraging bees

when the major nectar producing plants are in blossom and every colony will have maximum population and production level. However evidence from the present study found that 90% of the respondents had no practice of seasonal colony management in order to increase product of honey and for the safe life of honey bees which is one of fundamental beekeeping constraints in the area. This finding is similar with a survey conducted in Jimma zone by Tolera and Dejene **(**2010) on Seasonal honeybee management practices result, most of the beekeepers (86%) did not practice seasonal bee management activities. About 41% of the respondents did not reduced supers and not withdraw queen excluder during dearth periods. Likewise, due to lack of skill on seasonal bee management, they practiced bee colony transferring during inappropriate time and with poor techniques. Moreover, according to a study by Gidey and Mekonen (2010) in northern part of the country reported the higher adoption rate of improved beekeeping technologies and significant increment of honey production in northern Ethiopia. Practical based beekeeping training, apiary visit and education could increase promotion of improved beekeeping technologies in order to obtain the intended amount of hive products as diagnosed; the development of improved apiculture was severely hampered by the lack of knowledge and skills at Woreda level.

Majority (80%) of the respondents reported the occurrence of feed shortage following harvesting time mainly in February and March and July and August both in the first and second harvesting season of the year. Besides, majority 90% respondents and during the focal group discussion participant indicated that there is no provisions of supplementary feeds in spite of sever feed shortage. This is relating with the traditional practices of forest beekeeping and lack of completely seasonal colony management practice which show most beekeepers has no the expected beekeeping skills. This result is not similar with a study conducted by Shiferaw *et al* (2010) revealed that deliberate feeding of bees in Alaba farmers is relatively common, some farmer have the practice of feed flour of pea, boiled pumpkin and provide solution of sugar in dry season when there is feed shortage. They also provide that they avail water for their honey bees. Besides a report by Solomon (2009) who stated that during dearth period when there is little honeybee forage, beekeepers provided supplementary feeds. Beekeepers give additional feed for their honeybees when they think the time is dearth period (when there is no better pollen and nectar source).

The study also revealed that more than 90% the farmers annual income 50% and some of them 75% annual income by the production and sale of honey. This result is in line with a study conducted by Shenkuta *et al*.(2012)in three zone of Kaffa Sheka and Bench maji honey production contributes about 50% to the total household cash income of small scale farmers involved in beekeeping

According to the present study more than 60% of the respondents know the best honey bees' flora common to the area. A beekeeper needs a good knowledge of plants and their flowers, an understanding of honey plants, the plants that produce nectar used by honey bees to make honey, helps a beekeeper know where to put the hives According to a study conducted by Almtseay (2010) on seasonal availability of common bee flora in relation to land use and colony performance in Gergera watershed Atsbi Wembwrta District, eastern zone of Tigray, Ethiopia, the main reason for increasing trend of honey production was improvements in bee forage next to hive management (like use of modern bee hive) in the recent years.

According to the present study beekeepers reported about colony inspection: 33% of do not take look their hives completely as well as 44% of inspect occasionally both internally and externally. Farmers need regularly inspect their colony. This result is in line with a study conducted by Shenkutea *et al* (2012) in three zone of south west part of the country on assessment of beekeeping found that 80% respondents do not inspect their bees both internally and externally and in both study associated with lack of training on beekeeping technologies. This result is not in agreement with a study conducted in eastern and northern Tigray by Gidey and kibrom (2010) on beekeeping for rural development. Its potentiality and constraints found that 91% of the sampled population practice adoption of the modern beehives with its training which is associated good practice of colony seasonal management and very good inspection of their hives frequently in well planned manner as a result significant increase in honey production.

Concerning colony migration majority (64%) of respondent believe that problem of honey bees migration become common that seems to be like real absconding and more than half (60%) respondents also mentioned colony decreasing observed in the area. The current decrease colony is not similar with CCD and past losses in that colony loss are occurring mostly because bees are failing to return to the hive (which is largely uncharacteristic of bee behavior) (Bradbear, 2004)

Besides during focal group discussion the participant in relation to migration of bee's reason out that one of important reason they discourage the practice of modern beehives in their local area is the high rate of migration after the establishment of honey bees colony into the new modern hives. According to beekeepers, report the main reasons behind migration of bees are shortage of feed, lack of skill in managing hives (in proper transfer of colony), poor adaptation of wild bees, increased intensity of deforestation, Shifting agricultural practice, bee enemies, lack of protection against bad weather as a result of climate changes and poor management practices of the modern beehives. This is similar with a study conducted in Jimma zone by Chala *et al*. (2012) who reported honeybees migrate in response to resource depletion as a result of environmental degradation and poor management practice of beekeepers. This result also revealed that beekeeper has no any activities of planting any bee flora to overcome the current problems associated with bee forage which is not similar with a study conducted in Burie District of Amhara Region by Tessega (2009), beekeepers try to overcome the problem of reduction of honey bee plants hence beekeepers grow different local bee forage plants near by the apiary site. Despite these local efforts, the national beekeeping resource base is deteriorating at a faster rate warranting sustainable intervention progress (Melaku *et al.,* 2008). Hence, to address environmental problems as well as to improve household food security, a number of interventions have been made in Ethiopia. Migration mostly takes place in dry season (January to February) and main rainy season (July to August) following honey harvesting periods and lower flowering plants available. The colony strength as well as honeybee products mostly depend on the availability and type of bee flora next to level of seasonal colony management practice (Bista and Shivakoti, 2001).

Swarming is the mechanism that permits the reproduction of the colony. It is the means by which the number of honeybee colonies in the world increases. According to the present study 84% of them replay that swarming is common in the study area. The productive of honey bees colonies and the quality of honey greatly influenced by reproductive swarming it greatly reduces hive strength, is most often associated with overcrowding in the hive. This result is in agreement with a study conducted by Shenkuta *et al* (2011) in three zones Sheka Keffa and Bench 89.3% mentioned that reproductive swarming of honeybee colonies is a frequent phenomenon. An increase in the number of colonies during a honey flow, whether through swarming or division is

usually made at the expense of the honey crops. In localities having either a long or a late major honey flow, both the number of colonies and the honey crop may be increased by dividing strong colonies early to make medium-strength colonies, which can build up to maximum strength for at least part of the main flow. This study similar to a study conducted by Dereje Woltedji (2010) in North Shewa zone found that The effects of hive volume and management on reproductive swarming intensity and honey yield of local honeybee colony found that the effect of frequent swarming tendency of the colony resulted in reduction of colony work force and less collection of nectar and honey yield on the colonies, which faced shortage of space.

Regarding season of colony swarming, beekeepers of the survey area indicated that September, October and November were the main months in which colony swarming occurs because of availability of plenty flower (pollen) increase vegetation coverage and instinct behavior of bees; while, March, April, July, and December were months in which there was no record of incidence of reproductive swarming so beekeepers should consider swarm cache season and the management of swarm as important components of seasonal colony management. This finding is similar with a study conducted by Adgaba, *et al* (2010) on Swarming and migration in the honeybees (*Apis mellifera*) of Ethiopia found that A high swarming tendency is characteristic of African honeybees and is a mechanism for balancing the annual loss of myriad colonies due to various hazards in their environments. Relatively high reproductive swarming tendencies were noted for *A. m. scutellata* and *A. m. jemenitica* and low for *A. m. bandasii*, *A. m. monticola* and *A. m. woyi-gambella*. Eight swarming periods correlated with variations in rainfall, physiography and temperature were observed

Swarm control is part of proper Seasonal colony management practices which is the combination of activities which are undertaken by beekeeper(s) such as hive inspection, building up of the colonies, adding or reducing supers, inserting queen excluder. While they may look frightening, bees that are swarming and carrying honey from their old hive are much less defensive or likely to sting than they would be if they were protecting brood (immature bees) at the old hive According to the beekeepers response and during the group discussion all of them mentioned common honey bees' enemies that are currently affecting honey bees in the area by disturbing colony, eating honey and brood killing and making the bees to migration. They mentioned common honey bee pests including *Yesem Etchi* (Wax moth) the (greatest enemies), and enemies

like ants (both black and red), birds, spiders honey badger, snake and lizards. Honeybee pests and diseases cause high mortality rates and severe economic loss. The existence of pests and predators were additional nuisances to the honeybees and beekeepers. Similar threats were reported from a study conducted in Tigray region by Gidey (2010) on bee lice found that Pests and predators that cause devastating damage on honeybee colonies and ranked in order of to decreasing importance were honey badger, ants, wax moth, bee-eater birds, lizard, snake and spiders. The needs for effective honeybee health delivery service and appropriate control methods in order to reduce diseases, pests and predators constraint remain very important and investigation and diagnosis of factors that endanger the health of local honeybees in different agro ecology zones and establishing ways of prevention and control measures need to addressed.

Bees waxes processing is the major activities to maximize income from beekeeping and majority (94%) of the respondents never process bees waxes for better benefit because of the following reasons such as majority (55%) lack of processing skill followed by 24% lack of awareness about bees waxes and 11% of them that lack of processing skill, lack of awareness and lack of processing material. According to a study conducted by Yohannes Agonafir (2005) Intervention plan on honey & beeswax value chains beeswax largely collected from traditional hives rather than the modern hives, which presently promoted by the Ministry of Agriculture and several NGOs. The wax yield from traditional hives is 8-10% of the honey yield, compared to 0.5-2 % from modern hives. The bulk of the supply of beeswax obtained as residual from "Tej" production, a mild alcoholic beverage popular throughout. Most of the local markets are far away from the beekeepers and are inaccessible. This study also found that marketing problem is common to the area which is in most case the price of honey changes widely based on the good will of buyers thus absence of grading systems does not encourage farmers to produce high quality products, . According to Gezahegne, (2001) discussed the constraints to marketing of honey and beeswax in the country and these include low and discouraging price of honey and beeswax in local markets, lower quality of products, lack of market information, absence of organized market channel, transportation problem, lack of appropriate technologies for collecting, processing, packing and storage of honey to keep its natural quality, lack of government support in promoting market development, and low involvement of private sector.

Most honey come to market is un-extracted, and poorly managed therefore marketing interventions have to be introduced different marketing interventions.

According to the present study the most common beekeeping constraints cited by respondents included: honey bee diseases, migration and swarming, marketing problem, lack of skilled man power, shortage of training, lack of equipment, absence of agricultural extension service ,accessibility of skilled man power in the field of apiculture ,and shortage of beekeeping equipment shortage of bee forage and environmental impact The finding similar with a study conducted by Workneh Abebe 2010 on the Adoption of improved box hive in Atsbi Wemberta District of Eastern Zone, Tigray Region: determinants and financial benefits It was also shown that credit, knowledge, education level of household head, perception and visits to demonstrations positively and significantly influenced adoption of improved box hive. Ranking showed that drought; honeybee pests and diseases; lack of beekeeping materials; death of colony; lack of adequate extension support; marketing problem; shortage of bee forage; lack of adequate beekeeping skill and reduction of honeybee colonies were the major constraints in the beekeeping development in their order of importance.

CHAPTER FIVE

5. Conclusions and Recommendations.

5 .1 .Conclusions

Southwest parts of Ethiopia are well known with very diverse and dense natural forests that favors for the existence of dense honeybee population and high potential of honey production. Therefore this study was conducted with the objective of understanding the assessment of beekeeping practice and its constraints and opportunity in three different land use pattern in Sheko Woreda.

The study revealed that beekeeping in the area common traditional practice in which about half of the house hold get their income from the sale of honey and they get the practice of beekeeping from their family through traditional method hence, more than 97% of the hives in the area and 67% of respondents owned only traditional beehives along with traditional management system, with very low (3%) adoption rate of the modern technologies. Majority (90%) of beekeepers have no practice of pre and post harvest management hence 80% of the respondents had no practice of supplementary feeding for their colony and 44% of the beekeepers inspect their colony occasionally and 33% do not inspect their colony totally but majority (95%) of respondents believed feed shortage is common following harvesting season. The result also indicates lack of training on modern technologies and basic beekeeping skills were critical constraints. Therefore all of the respondents has no the idea of seasonal colony management and waxes processing skill. The study also showed that there is significant difference honey production between the beehives found in three difference land use patterns in terms of the amount of honey produced per colony per year and the number of colony supported in each land use patterns as well as the extent of beekeeping constraints hence, most respondents prefer agro-forest land use patterns. The study revealed that training on general principle of colony management and modern technologies has significant contribution in maximizing honey production and safe life of honey bees as well as the tendency of adoption of modern technologies.

Generally beekeeping is a well established practice in the farming communities of Sheko district and it plays a significant role as source of main cash incomes and nutrition for many farmers.

However, in spite of its significant economic contribution and its great potential for sustainable development for the area attention is not given to the sector by concerned stakeholder. Totally traditional beekeeping practice, lack of appropriate seasonal colony management skills, absence of colony inspection, lack of skilled manpower and institution, marketing problem, shortage of records and up-to- date information, poor extension program me, lack of NGOs working on adoption of the modern technologies are the major challenges facing beekeeping activities in the study area.

5.2. Recommendations

Possible recommendations on the basis of the study so as to be considered in the future intervention strategies which are aimed at the promotion of honey production practice and to get possible ecological benefit of honey bees without harming their life include:

- Both the local and regional government need to revised their extension program in relation to beekeeping and take in to consideration as one of the strategies for reducing poverty and ensuring household food security with existing huge beekeeping potential.

- Every pre and post honey harvesting constraints associate with lack of proper seasonal colony management skills and lack awareness about general principle of beekeeping These indicate the importance of institutional support in the form of adequate and practical based training; improved beekeeping technologies, credit and marketing linkages need to be addressed simultaneously.

- Integration of beekeeping to other development activities such as conservation of natural resources, income generation, promote the sowing of multipurpose plant that can provide ample nectar and pollen for bees need to be practiced and encouraging more farmers to participate in beekeeping.

- Sheko district has huge beekeeping potential and many opportunities to scale up honey production. Therefore the possibility of extensive beekeeping and a room in increasing production by adoption of the modern technologies. So concerned body ,educational institution and developmental organization should look for different option in introducing NGOs working on beekeeping and work hand in hand to change the life of beekeepers as well as to exploit the existing apiculture potential.

- The impact of honey bees enemies and diseases increasing from time to time especially for the last five years So colony inspection and control of honeybee disease are important phases of colony management which must not be neglected by the beekeepers and further deep investigation (research) should be needed by concerned body to control the various honey bees enemies especially the newly emerging.

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ANNEX I

ANNEX I-.*Questionnaire paper for developmental agents and researchers*

Questionnaire (Type one)

JIMMA UNIVERSITY COLLEGE OF NATURAL SCINCE GRADUATE STUDIES DEPARTMENT OF BIOLOGY

This Questionnaire paper is designed for Tepi Agricultural Research center worker, (researcher) Woreda's Agricultural workers and other researcher working on related issues with beekeeping, So as to find out the current beekeeping activities and its Constraints

Dear Agricultural worker or Researcher (Expert)

The objective of this Question is to gather information about the existing beekeeping industries its current status, the major threats and other related issues including commenting local solution for the problems. Therefore since your vital (accurate information) is decisive for the researcher you are kindly request to give genuine information based on question provided below

Thanks for your cooperation!!

Part one Short Answer Read the following sentence carefully and answer the question briefly

1 Currently, from your experience on the trend of beekeeping activities and honey production in Sheko Woreda is the production of honey is increasing or decreasing?

---

2. If your response is either increasing or decreasing for question what is the main reason?

---

3. What are the major natural bee plants (trees) lists below them in their degree of abundances?

No. Name flowering period

1. ----------

2 ----------

3 ----------

4 ----------

5 ----------

6. ----------

4. As one of governmental and non-governmental organization working on related issue with Apiculture and have you ever been working any activities to the development of the beekeeping industries (Beekeeping) as a whole? Can you list down some of the major activities and communities response to wards it (result)?

5. As one of agricultural expert, professional is working on related issues with beekeeping what are the most common problems associated with beekeeping activities in the area.

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6. Can you mention the most common honeybees enemies (parasite, disease….) which are found in Sheko Woreda that affect the life of honeybees?

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7. What are the most common cultural practice used by the local People to protect Honeybees colony from their enemies?-

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8. As one of agricultural worker and researcher (Environmentalist) is working on apiculture and other related issues what has to be done for sustainable production of honey without harming both the environment and the life of honeybees specific to your area?

ANNEX I I. *Questionnaire paper prepared for representative beekeeping farmer*

Questionnaire (Type Two)

Jimma University Natural Science College of Graduates Studies Programs
Department of Biology

Dear beekeepers!!

This questionnaire paper prepared by Jimma University Biology Department MSc Graduates student under the stream Ecological and Systematic Zoology .The objective of this questionnaire paper is to determine information about the existing beekeeping management practice and its constraints that can be used to identify the major challenge in honey production and provide appropriate scientific suggestion which can contribute to improve honey production system .Therefore you are kindly request to give genuine information based on question provided below Thank you for your cooperation !!

INSTRUCTION ONE Read the following question carefully and circles your choice from the given alternatives (Data collector will explain about how to Select their answer)

1, Socio-economic demographic variable

1.1 Sex A. Male B, Female

1.2 Age ----------

1.3 Ethnicity A, Amhara B, Bench C, Tigre D, Gurage

E, Shekecho F, Oromo G, Sheko H. Mejengir I .any other

1.4 Religion A, Muslim B, Orthodox

C, Catholic D, Protestant E, Others

1.5 Educational status A, Illiterate B, Literates

1.5.1 Literates A. Church and adult education B. Grade 1-5 C. Grade 5-8

D, Grade 9-10 E, Grade 11-12

F. Diploma graduates G. Degree and above graduates

1.6 Marital status A .Married B, Single C, Divorce D, Widow

1,7 .How money children you have ? A.2 B.3 C.4 D.5 E. 6 F. >7

1.8. Occupational status A, Full farmer B, Employer C, Student

D, House wife E, Merchant F, Other

2, Beekeeping management practice of the farmer, the status of Beekeeping and its challenge variable

2.1. How money beehives currently you have (with their types of beehives)? ----------

A .5 B.8 C.10 D, 12 E.15 F. >16

2.2 What types of beehives you are currently using A. all traditional B. modern (box beehives) C transitional (Chefeka) D. both traditional and modern E. both traditional and Chefeka

2.3 How long it has been you start beekeeping activities? (When)

A, 5 years B, 10 years C, 15years D.20 E, any other specify it -------

2.2 .How did you get beekeeping experience?

A. From my own family

B. From my community

C. From government agricultural office

D. Non-governmental organization working on beekeeping and related issues

E, Any other mention it

2.3 How much percent of your annual income honey production (beekeeping) contributes

to the total household cash income of your family

A, 75% B, 50% C, 25% D, 15% E, any other specify it

2.4 What types of beehives you are currently use for honey production

A, traditional B, modern C, transitional D. Chefeka

E, all type F.A and B G.A and C H. A and D

2.5 If your answer for question # 2.2 is traditional, what is the reason your production of Honey mainly based on this type of beehives? Because

A, I have no skill and concept about the use of modern beehives

B, lack of access to the modern beehives

C, it is not suitable using the modern beehives

D I'm not personally interested in using the modern beehives

2.6 If your respond for question # 2.4 the modern beehives from where you get the hives (Modern)

A. from private organization

B. from NGOS working on honey bee and related issues

C .Woreda Agricultural office

D. Microfinance enterprise

E. any other mention it

2.7 If for question # 2.4 you select the modern beehives do you take some care in transferring the honeybees from traditional to modern beehives A. Yes B .No

2.8. If your respond for question # 2.5 is yes what kinds of care you consider?

A. Taking care in picking up the traditional hives from large tree into underground without any disturbance

B. protecting the bees not to escape by using different material

C preparing pre condition before transferring the honey bees into the modern such as preparation of suitable site selection, clearing the site from any grass and other things, the transfer should be at night

D. Planning the transfer season before the flowering period of the area

E. considering the site far from road and animal site

F. following and caring up the newly transferred honeybees very frequently in the modern beehives

2.9. Have you ever been practiced supplementary feed during flora shortage A. yes B. no

2.10 Have you ever be taken any training about the management practice of beekeeping?

A, yes B, no C, any other

2.11 If your answer for question # 2.10 is yes, from where did you have the training?

1. Research center 2. Agricultural and rural development 3. Non Government

2.12. If your answer for question # 2.10 is yes, on what area did you get training?

A. Colony split B. Honey bee colony management C. Processing, handling &storage

D. Market information and linkage E .Input utilization F. Bee forage development

G. General beekeeping H. all

I. Other specify_____

2.13. What benefits have you gained due to training?

A. Understanding effective beekeeping management using modern hives

B. Understanding improved beekeeping management (eg. feeding, inspecting, supering swarm control) C. Any other (specify) _____

2.14. If your respond # 2.10 is yes, can you agree, the training contributes for honey production System?

A, yes B, no C, I don't know the impact -2 D any other specify it

2.15. If your respond for # 2.10 is no, do you want to get training opportunity?

A, Yes B, No

2.16. Where is your beehives found in the three agro ecology of the area? Which one can give you high quality and better product per hives? (You can select all but specify the best

A, in human settlement B, agro forestry C, non-human settlement (dense forest)

D. A and B E. A and C F.B and C

2.17. How money times you collect honey per year?

A.1- B. 2 C. 3 D. any other mention it –

2.18. Is there any bee forage shortages in your area A. yes B. no

2.19. When does bee flora shortage common for a source of nectar and pollen in your Localities?

A, October - January B. February-April

C, May –June D, July – August-

2.20 .Is there any provisions of supplementary feeds at the time of sever feed shortage

A .yes B. no C. any other mention it

2.21 What is the general trend in colony numbers for your operation over the last four Years?

A, Increasing in colony numbers B, remaining about the same

C, decreasing in colony numbers D; I have no information about it

2.22. Is there colony absconding/migration? A, Yes B, No

2.23. If your respond for question number 2.16 is yes what is the main reason for migration of bees

A. shortage of feed

B. Lack of skill in managing hives

C. increased intensity of deforestation,

D. Shifting agricultural practice,

E, bee enemies and disease

F. lack of protection against bad weather

G. poor management practice of the modern beehives

2.24 Have you ever been employee the principle of beehives management practice?

A, yes B, no

2.25. If your respond for question # 2.8 yes what kinds of management you usually using?

A, Requening (changing the aged queen from the hives)

B, accessing water for honeybee

C, additional feeding activities

D, Chalking parasite and disease

E, locating hives near nectar

F, considering the distance between apiaries in the area

2.26. How often you inspect your traditional beehives from different honeybee's enemies and other factor?

A .per week B. every two week C. every month D. every three month

E. no I do not regular time of inspection F. any other G. no inspection totally

2.27. Where did you get your honeybee colony?

A, I get bee colony by hanging traditional hives upon trees

B, Buying honeybee colony

C, wild nest

2.28 .In terms of honey production conformity easy to manage and the quality and amount of honey harvested per hives and per year which agro ecology is suitable rank according to sequence of quality from best to poor

Human settlement

Agro forest

Non human settlement

2.29 For how many years your colony remains or stays in the hive?

1. Traditional: Minimum _____year (s) Maximum _____years

2. Transitional: Minimum _____year (s) Maximum _____years

3. Movable-frame: Minimum _____year (s) Maximum _____years

2.30 What kind of honey is produced in your village?

1. White honey

2. Yellow honey

3. Red honey

4. Black 5. All can produce

6. If other_____

2.31 Is there enough number of bee colonies in your area? 1. Yes 2. No

2.32. Do you have any contract agreement with the buyers/processors? 1. Yes 2. No

2.33. Do you have willing to enter in to contact agreement with the processors/exporters in the future? A. Yes B. No

2.34. Do you know any company exporting honey and or beeswax to abroad? A. Yes B. No

2.35. Where did you get your hive?

A Constructed by him/her self

B. Bought from local market

C. Supplied by the government on credit basis

D Supplied by NGOs on credit basis

D. Supplied by NGOs free of cost

. E Any other mention it

2.36. Do you have protective cloths/equipments that can be used during honey harvesting?

1. Yes 2. No

2.37. Do you make experience sharing with beekeepers based on the managements of beekeeping practice? A. Yes B. No

2.38. If your answer for #2.37 is yes, on what occasion do you undertake?

A. During formal Peasant meeting B. During beekeeping training C during `idir` meeting

D Any other_____

2.39. How could you treat colonies when they are affected by disease?

A. By traditional medicine B. Modern medicine C. Nothing is used D .Metal or plastic Covering E. any other specify

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

2.41. Do you identify the best flora that important for bee forage?

A. Yes B. No

2.42. Do you process and sell beeswax? A. Yes B. No

2.43. If your answer is no, what is the reason?

A. Lack of awareness about its importance B. Lack of processing skill

C. Lack of processing material D. Lack of beeswax market in the area

E. Other (please specify)

2.44. Lack of Skilled Manpower and Training Institutions A. Yes B. No

2.45. Control of weed species that provide pollen and nectar for honey bees; A. Yes B. No

2.46. Marketing Problems A. Yes B. No

PART 2.Instruction two Read the following sentence and answer shortly based on the Question provided below

2.47. How do you attract swarms? ----------

2.48. Do you take some measure to care of the honeybee's life and habitat during harvesting time? And how did you know weather honey is ripened or not? Traditional honey season identification----------

2.49 Annual honey yield per colony in hive type

From traditional hive ……..

From intermediate hive…….

From modern hive----------

2.50. What are the major honeybee enemies found in the area and during which month of the year they are common? What is the reason they become common during this season?

2.51. What are the major natural bee plants (trees) in degree of abundances?

No. Name flowering period

1. ----------

2 ----------

3 ----------

4 ----------

5. ----------

6. --- ----------

2.52. Is there reproductive swarming? A, Yes B, No

2.53. If yes, in which months of the year swarming takes place and why?

2.54. If your respond # 2.24 Yes, in which months of the year absconding /migration occur and why? What are Traditional beliefs that lead bees to absconding?

2.55. Who is responsible from your family to hang traditional beehives in large tree?

2.56. What are the most common problems associated with beekeeping industries from different source?----------

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2.57 .Have you ever been noticed that the use of fertilizer and pesticides impact on the life of honeybee and their environment?

. A. yes B. no C. I have no information about it D. any other mention it

2.58. If your response for question # 2.30 yes what are the most common impact as a result of these activities----------

2.59. Can you mention the root cause of the entire problem associated with Honey Production Practice of the area? ----------

2.60. As a beekeeper in the area what would you suggest to maximize honey production Potentials by sustaining the life of honeybee and the environment in Sheko Woreda?

2.61. What kind of problems commonly observed in your area in relation to honey production?

A. Honey production problem B. Colony production problem C. Bee forage problem D.A&B E. B&C E.A&C F. all

2.62. Do your colonies affected by disease? A. Yes B. no

ANNEX III

3. Guidance Question for Focus group discussion

Jimma University College of natural Science Graduate studies Department of Biology

The objective of this focal group discussion is to gather information about the existing beekeeping industries its current status, the major threats and other related issues including its local solution .So far beekeeper practiced which enable the researcher to suggest scientific solution that can minimize the various impact on apiculture industries**.**

Focus group discussion will be include in the discussion such

-Developmental agent workers from selected kebele -Beekeeping association

-District agricultural & Rural Development Expert - District officials -NGO'S

As introduction for the discussion the chair person explain about on the following issues

-The researcher explain the important of the study -Management practice of Honeybee

-The impact of distracting bee forage - Major problems of apiculture

1 .Among the three different types of beehives namely traditional, intermediate and modern, which one is commonly used in Sheko and why?

2. What are the most important concepts of beekeeping management practice and their Contribution in the production of honey?

3. What are the most common honeybee's enemies that are currently affecting beekeeping industries in Sheko Woreda and their method of controlling?

4. What are Government and other nongovernmental organization working on beekeeping? Activities and their support (workshop, training etc) in making the industry more Productive and minimizing environmental impact

5. What are the most common problems that negatively affecting the beekeeping activities of the area from different source such as poor management practice of beekeeping farmer, lack of bee forage, environmental problems etc (with their solution)

6. How is your access to improved beekeeping technologies (modern hives, credit facility, harvesting equipments, etc)?

Plate -5 A picture taken from the different deforestation activity and apiary site in study site

a b

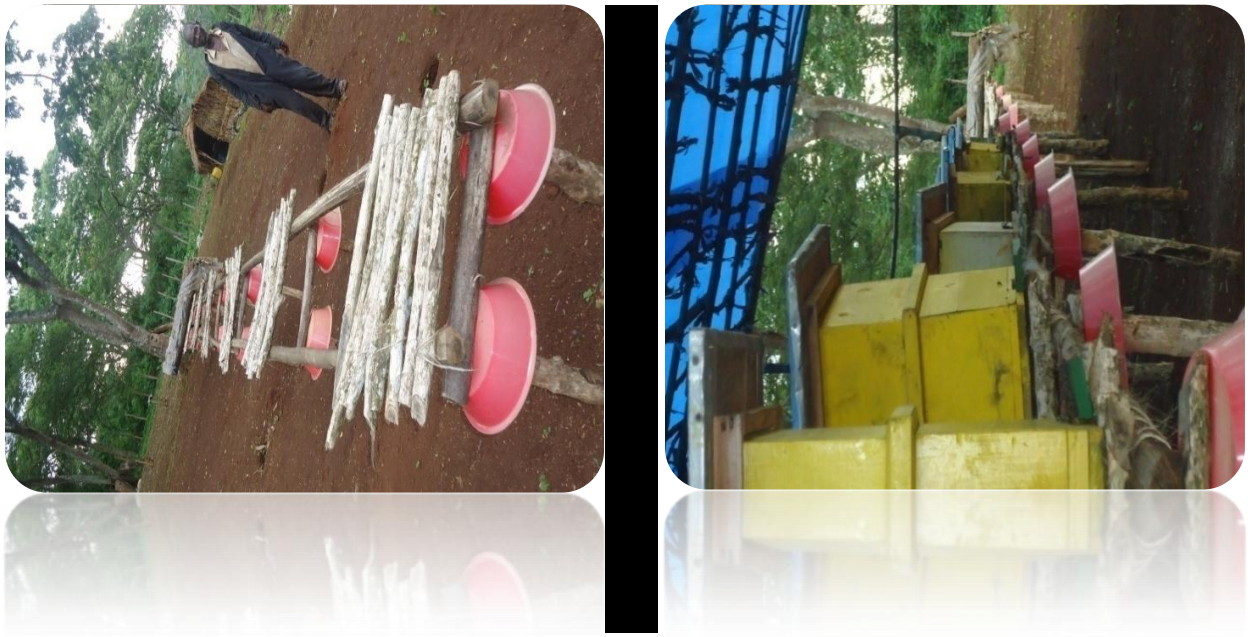

Plate: 6 A pictures that can be used for method of preventing honey bees enemies currently used by different beekeepers and TARC

Plate: 7.Apiary site for modern beehives in the Tepi agricultural research center in Tepi city

Plate: 8 The three different types of beehives that are commonly used in the study area

Plate: 9 A pictures taken while conducting focal group discussion in the study sites