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ASSESSMENT OF HONEY PRODUCTION SYSTEM, CONSTRAINTS AND OPPORTUNITIES IN SELECTED KEBELES OF HAWASSA CITY ADMINISTRATION, ETHIOPIA

Dinku Negash [*1], Bereket Mengeste [2]
[1] South Agricultural Research Institute, Ethiopia
[2] Hawassa City administration, Ethiopia

Abstract

The study was intended to assess honey production system, constraints and opportunities in selected kebeles of Hawassa city administration, sidama zone in 2018/19. Production limitation has resulted with a significant complain among the beekeepers and all concerned bodies regarding the possible threat for decreasing honey production in the area. Cross-sectional types of studies were used to collect data. 20 beekeepers were selected from each kebeles using purposive sampling method to conduct formal survey with semi-structured questionnaire making a total of 100 interviewed bee keepers. The main purpose of keeping honey bees were for both income generation and home consumption. The main sources of the foundation colony were catching swarm (80%) and gift from parents (20%). Most (40%) of the beekeepers in the study area have owned only traditional hives and all the three types of hive owned (32%). Beekeepers in the study area prevent the incidence of swarming by return back to the colony (56%), removal of queen cell (16%) and cutting of combs (28%). The average amount of honey harvested per hive per year from traditional hive, transitional and frame hive was 5.6±1.49kg, 11.9±3.15kg and 10.8±2.91kg, respectively. There was ($p<0.05$) no variations in the five representing kebeles in honey yield/hive/year in traditional, transitional and frame hives. Beekeepers of the study area sold the honey at the nearby market (92%) and major marketing place (8%). According to the respondents, they mostly sold the honey to consumer (64%) and tej house (28%). The most important constraints of beekeeping in the study kebels were lack of Absconding (1st), Lack of training (2nd), Pests and predators (3rd), Lack of extension services (4th), Agro-chemicals (5th), Lack of cooperative (6th), Swarming (7 th) and Lack of beekeeping equipment (8th) Lack of bee colonies (9th), Lack of good market (10th), Drought (11th) and Shortages of bee forages (12th). In order to address the skill gap on honey production system and post-harvest handling of hive products practical training on bee and bee products management should be given.

Keywords: Beekeepers; Constraints; Honey Production; Hives.

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1. Introduction

Beekeeping is an important component of agriculture and rural development program of many countries. It helps to provides security in nutrition, economy and ecology. Besides, it does not compete with other resources in the farming system, it is income generation activity and supplement annual income for the beekeepers through sell of bee Products (honey, wax and bee colonies) (Atsbaha et al., 2015). Ethiopia, having the highest number of bee colonies and surplus honey sources of flora; it is the leading producer of honey and beeswax in Africa. Ethiopia produces about 24000 tons of crude honey per year, thus shares 24% of Africa and 2% of world's honey production. This makes the country 1st in Africa and 10th in the world (Adebabay et al, 2008). Currently, more than 7000 species of flowering plants are estimated to be found in the country, of which most of them are honeybee plants (Girma, 1998).

Among many factors, availability of potential flowering plants and ample sources of water for bees are the two major parameters for an area to be considered as potential honey production (Adebabay et al., 2008). In this regard, there are over 7000 species of flowering plants existing in Ethiopia and these mainly comprise natural trees, forage plants, horticultural and cultivated crops (EARO, 2000). However, not all of these are useful to honeybees, and even those that provide bee forage vary in their value to beekeeping. There are also variations in the utility of a species depending upon the climate, soil and other factors in the place of its occurrence.

Honeybee production system study is important to identify problems and come up with research findings relevant to the problems and to formulate appropriate development plan. Hence, assessment of production system, identifying and prioritizing the available constraints and suggesting possible interventions areas, were the first steps towards any development planning in any fields and also in the apiculture sub-sector. Moreover, farming system approach to research and development was recognized as the most appropriate method used to describe, diagnose and gain knowledge of the technologies and factors affecting production at farm level. Therefore, the objective of this study was to assess the honey production system, constraints and opportunities in five selected kebeles of Hawassa city Administration

2. Materials and Methods

Study Area: This study was conducted in Hawassa city administration of Southern Nations, Nationalities and People Regional State, located 270 km South of Addis Ababa.

Study Design: Cross-sectional types of studies were conducted to collect data using questionnaire survey, observation and group discussion. The sampling units were households keeping honey bees. Beekeepers in the five kebeles represented the study population.

Sampling Procedure and Sample Size Determination: The sampling units were households keeping honeybee colony. The sample size required for the study was determined by the formula recommended by Arsham (2007) for survey studies

$n=0.25/SE2$

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With the assumption of 5% standard error, a total of 100 households were sampled. A purposive sampling procedure were applied for the study, a total of five kebeles namely H/ wondo, Gemeto Galle, Finch wuha, Tulu and Alamura were selected based on honey bee production potential and accessibility. Finally, 20 households owning bee colony were purposively selected from each kebeles that make a total sample size of 100 households.

Data collection: Information about the type of hives used, the number of bee colonies owned, the purpose of keeping honey bees, the marketing system of honey, the rate of absconding and swarming and harvesting and processing of hive products and major constraints of beekeeping were collected through interviews using a semi structured questionnaire. To identify opportunities of honeybee production in the study area a group discussion were made with model beekeepers, kebele leaders and woreda experts.

Statistical analysis: All collected data were entered into Microsoft Excel 2007 and descriptive statistics such as mean, standard error; frequency, percentage and one way ANOVA were used to analyse the data using SPSS (version 23).

3. Results and Discussion

3.1. Purpose of Keeping Honey Bees and Source of Foundation Colony

The main purpose of keeping honey bees were for both income and household consumption, only for income generation and only for home consumption according to their importance. According to the respondents the main source of the foundation colony were catching swarm (80%) and gift from parents (20%) (Table 1). Similarly, Nebiyu Yemane and Messele Tayere (2013) reported that the main purposes of keeping bees were source of income and consumption in Gamo Gofa zone of SNNP region. Most of (40%) the beekeepers of the study area preferred traditional hives over Transitional and traditional (20%) and modern hives (14.1%). This is mainly because of the cost of constructing and purchasing of modern and transitional hives and due to lack of harvesting and processing equipment's to use modern and improved hives. Similarly, Mahari (2007) in eastern Tigray reported that modern beekeeping productions require more expensive establishment cost, accessories, (further cost) and skill training although yield better quality and quantity honey

Table 1: Purpose of keeping, source of foundation colony and hives owned

Variables	**H/ wondo,**	**Gemeto Galle,**	**Finch wuha,**	**Tulu**	**Alamura**	**Total**
	(N=20)	(N=20)	N=20	N=20	N=20	N=100
	%	%	%	%	%	%
Purpose						
Only for income generating	40.0%	20.0%	60.0%	20.0%	20.0%	32.0%
Only for home conception	40.0%	80.0%	40.0%	40.0%	80.0%	56.0%
For both income and HH consumption	20.0%	0.0%	0.0%	40.0%	0.0%	12.0%

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Source of foundation colony						
swarm catching	100.0%	80.0%	80.0%	80.0%	60.0%	80.0%
gift from parents	0.0%	20.0%	20.0%	20.0%	40.0%	20.0%
Types of hive owned						
only traditional	20.0%	30.0%	20.0%	20.0%	35.0%	40.0%
only Transitional and traditional	20.0%	30.0%	60.0%	40.0%	25.0%	20.0%
only Traditional and frame hive	20.0%	20.0%	0.0%	0.0%	0.0%	8.0%
All the three types of hives	40.0%	20.0%	20.0%	40.0%	40.0%	32.0%

3.2. Placement of Hives and Beekeepers Preference of Hives

Most (90%) of the Beekeepers in the study area kept the traditional bee hives at the back yard of the house, 10 % kept inside a simple shed built for hive placement. Most of (74.4%) the beekeepers of the study area preferred transitional hives over traditional (11.5%) and modern hives (14.1%) (Table 2). Most (90%) of the Beekeepers in the study area kept the traditional bee hives at the back yard of the house. According to kerealem (2005) most beekeepers of Amaro wereda kept their bee colonies by hanging on trees near homestead and in forest areas.

Table 2: Hive placement and preferred type of hives

Variable	**Percentage**
Hive placement	
Back yard of the house	90%
Inside a simple shelter	10%
Preferred hives by the beekeepers	
Traditional	11.5%
Transitional	74.4%
Frame /modern hive	14.1%

3.3. Honey Bee Flora

Table 3: Major Bee forage plants and their flowering period in the study area

Common Name	**Scientific Names**	**Flowering periods**	**Number of days on flowering**	**Potential source (pollen/nectar)**
Buna	*Coffee Arabica*	January-Feb	Ten days	Nectar
Avocado	*Persea America*	Sept-Dec	Twenty-five days	Pollen &nectar
Mango	*Mangifra indica*	Sept-Dec	Fifteen days	Pollen
Bisana	*Coroton macrostachy*	September	Ten days	Pollen
Bokolo	*Zea mays*	Jun –August	Fifteen days	Pollen

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wanza	*Cordial africana*	August – November	ten days	Pollen
Timatim	*Lycopersicon esculentum*	year round	Five days	Pollen and nectar
Mech	*Guizotia scabra*	Sept-October	One month	Pollen
Birbera	*Millettia ferruginee*	*January-April*	Twenty days	Pollen and nectar
Papay	*Carica papaya*	Sept-Nov	Twenty day	Pollen and nectar

Survey conducted in the study kebeles showed that the cultivated and natural honey flora potential of the area makes it very favorable for beekeeping. Naturally growing plants occupies quite large in variety proportions than cultivated crops (Amsalu, 1996). The major honey flow season of study area is from October to November and the minor flow season is from April to May, and it depends upon the availability of bee forage that in return depends on the amount of rainfall. According to the respondents, thirty-eight plant species were recognized as major honeybee forage source. This variation in vegetation characteristics of the areas could be potentially suitable for effective distribution of honey production. This result was in agreement with Challa (2010) and Alemtsehay (2011) showing presence of perennial crops, herbs and natural tree

3.4. Swarm Prevention and Absconding of Honey Bee Colony

According to the present result the frequency of absconding of honey bee colonies in the study area were every season (60%), every year (28 %) and once in two years (12 %). According to the beekeepers of the study area incidence of swarming occurred when there is enough availability of honey bee forages particularly during the months of September to October. The respondents replied that they do swarm control mechanism by swarming return back to the colony (56%), removal of queen cell (16%) and cutting of combs (28%) (Table 3). A result reported by Tessega (2009) indicated that the most widely used method of controlling reproductive swarming by beekeepers of Bure district of Amhara region were removal of queen cell, killing queen of the swarm and reuniting of honeybee colony to its mother, supporting and use large volume of hive as colony increase.

Table 3: Frequency of swarming, absconding and control methods

Variables	**H/ wondo,**	**Gemeto Galle,**	**Finch wuha,**	**Tulu**	**Alamura**	**Total**
	N=20	N=20	N=20	N=20	N=20	N=100
Occurrence of absconding						
Yes	80.0%	80.0%	60.0%	100.0%	40.0%	72.0%
No	20.0%	20.0%	40.0%	0.0%	60.0%	28.0%
Frequency of absconding						
Every season	80.0%	60.0%	80.0%	40.0%	40.0%	60.0%
Every year	20.0%	20.0%	20.0%	40.0%	40.0%	28.0%
Once in two years	0.0%	20.0%	0.0%	20.0%	20.0%	12.0%

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Frequency of swarming						
Every season	100.0%	80.0%	60.0%	0.0%	60.0%	60.0%
Every year	0.0%	0.0%	40.0%	60.0%	20.0%	24.0%
Once in two years	0.0%	0.0%	0.0%	40.0%	20.0%	12.0%
Swarm control						
Return back to the colony	100.0%	40.0%	60.0%	60.0%	20.0%	56.0%
Removal of queen cell	0.0%	40.0%	0.0%	20.0%	20.0%	16.0%
Cutting of comb	0.0%	20.0%	40.0%	20.0%	60.0%	28.0%

3.5. Trends of Honey Yield and Amount Harvested in Different Hives Type

Most of (60%) the respondents in the study area responded that the honey yield is decreasing over the years. while (28% and 12%) of the respondents replied that the honey yield is increasing and remain constant over the years respectively. Similarly, a result reported by Nebiyu etal., (2013) in Gamo gofa area indicated that honeybee products production was in a decreasing trend due to shortage of bee forages, drought, pesticides and herbicide application, lack of water and poor management in order of importance. According to the present result the only hive product harvested and utilized by beekeepers of the study area were honey.

During harvesting they mainly use Enset fiber (qacha) as a smoking material. None of the beekeepers in the study area strain the harvested crude honey. Their main reasons for not straining were due to the reduction in the amount of honey after harvesting (60%), lack of knowledge on how to strain crude honey (24%) and lack of straining materials (26%) (Table 4). Most of the beekeepers said they harvest honey one times per hive per year at the beginning of October. The present result indicated that the average amount of honey harvested per hive per year from traditional hive, transitional and modern hive was 5.6±1.49kg, 11.9±3.15kg and 10.8±2.91kg, respectively. There were no yield variations among the five kebeles in honey yield/hive/year from three hives ($p<0.05$) (Table 4). The result is in line with Gidey et al (2011) that the honey yield of traditional hive was significantly lower than frame hives. Similarly, Challa et al (2011) also explained that there was significant difference between traditional (7.2kg) and frame (23.72kg) hives in his study area. This variation in productivity in traditional and frame might be attributed due to the suitability of the frame hive for management (hive inspection, hive.

spurring) and the highest emphasis given by governmental (TBOARD) and non-governmental institutions (GIZ) in the study areas. The amount of honey harvested from traditional hive in the study area was 17.6% higher than the national average yield (5.6 kg) and the result was 5.4 % less than the amount of honey (6.2 kg) harvested from traditional hive reported by Workneh et al., (2007) in West, South West and North Shewa zones.

Table 4: Trends of honey yield bee, hive products harvesting and processing in the study area

Variables	**H/wondo,**	**Gemeto Galle,**	**Finch wuha,**	**Tulu**	**Alamura**	**Total(N=100)**
Trends of honey yield						
Decrease	80.0%	60.0%	80.0%	40.0%	40.0%	60.0%

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Increase	20.0%	20.0%	20.0%	40.0%	40.0%	28.0%
Remain constant	0.0%	20.0%	0.0%	20.0%	20.0%	12.0%
Reason for not straining honey						
Amount of honey will be reduced	60.0%	80.0%	60.0%	0.0%	60.0%	60.0%
Lack of knowledge	0.0%	0.0%	40.0%	60.0%	20.0%	24.0%
Lack of material	40.0%	0.0%	0.0%	40.0%	20.0%	26.0%

Table 5: Honey yield from traditional, transitional and modern hives

Variable	woredas	Mean±SD	Lower Bound	Upper Bound	Min	Max	P-value
Honey yield /hive/yr from traditional hive	H/wondo	6±1.58	4.036	7.963	4.00	8.00	Ns
	G/galle	5±0.70	4.122	5.878	4.00	6.00	
	Finchwuha	6.2±1.3	4.581	7.818	5.00	8.00	
	Tulu	6.4±2.3	3.541	9.258	3.00	9.00	
	Alamura	4.8±0.83	3.761	5.838	4.00	6.00	
	Total	5.6±1.49	5.064	6.296	3.00	9.00	
Honey yield /hive/yr from transitional hive	H/wondo	13±2.23	10.223	15.776	10.00	16.00	Ns
	G/galle	13±4.08	8.725	18.874	8.00	17.00	
	Finchwuha	10.2±2.16	7.508	12.891	8.00	13.00	
	Tulu	10.6±2.19	7.879	13.320	8.00	14.00	
	Alamura	12.2±4.08	7.125	17.274	8.00	17.00	
	Total	11.9±3.15	10.657	13.262	8.00	17.00	
Honey yield /hive/yr from modern hive	H/wondo	9.6±3.36	5.426	13.773	6.00	15.00	Ns
	G/ gale	10±2.73	6.599	13.400	7.00	14.00	
	Finchwuha	11.6±2.60	8.362	14.837	8.00	14.00	
	Tulu	12±3.87	7.191	16.808	8.00	17.00	
	Alamura	10.8±2.28	7.968	13.631	8.00	14.00	
	Total	10.8±2.91	9.596	12.003	6.00	15.00	

*Significant at P<0.05, NS- Non- significant

3.6. Marketing of Honey

Beekeepers of the study area sold the honey at the nearby market (92%) and major marketing place (8%). According to the respondents, they mostly sold the honey to consumer (64%) and tej house (28%). Sometimes they also sold to retailers (Table 6). According to the present result the average price of 1 kg of crude honey is 120 birr which is ranged from 100 to 140 birr.

Table 6: Honey Marketing in the study area

Variables	H/wondo,	Gemeto Galle,	Finch wuha,	Tulu	Alamura	Total(N=100)
Selling place						
Nearby market	100.0%	80.0%	100.0%	100.0%	80.0%	92.0%
Major marketing place	0.0%	20.0%	0.0%	0.0%	20.0%	8.0%

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Major customers						
Tej house	0.0%	60.0%	40.0%	20.0%	20.0%	28.0%
Retailers	0.0%	20.0%	0.0%	0.0%	20.0%	8.0%
Consumers	100.0%	20.0%	60.0%	80.0%	60.0%	64.0%
Mean price of 1 kg crude honey	116Et.birr	112 Et.birr	126 Et.birr	112Et.birr	114 Et.bir	116 Et.birr

3.7. Major Constraints of Beekeeping

The most important constraints of beekeeping in the study kebels were lack of Absconding (1st), Lack of training (2nd), Pests and predators (3rd), Lack of extension services (4th), Agro-chemicals (5th), Lack of cooperative (6th), Swarming (7 th) and Lack of beekeeping equipment (8th) Lack of bee colonies (9th), Lack of good market(10th), Drought(11th) and Shortages of bee forages (12th) (Table 7). According to SOS-Sahel-Ethiopia (2006) the major constraints in Ethiopia are lack of beekeeping knowledge, shortage of trained manpower, shortage of beekeeping equipment, pests and predators and inadequate research and extension services to support apiculture development programmers.

Table 7: Major Constraints of beekeeping in the study area.

Constraints	**Respondents rank (n= 100)**												**Index**
	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	11th	12th	
Absconding	45	0	1	6	1	11	0	1	6	1	10	3	0.138(1st)
Lack of training	14	4	4	3	0	10	4	4	4	15	1	1	0.131(2nd)
Pests & predators	2	6	11	3	1	2	6	21	1	2	16	2	0.121(3rd)
Lack of extension services	2	1	19	5	4	3	11	4	1	1	1	29	0.118(4th)
Agro-chemicals	2	1	0	1	55	3	0	3	2	8	0	2	0.108(5th)
Lack of cooperative	3	13	4	1	1	1	2	3	0	1	1	0	0.098(6th)
Swarming	0	0	1	2	2	2	1	8	11	1	1	2	0.069(7th)
Lack of equipment	22	0	1	1	1	2	1	2	8	0	1	0	0.056(8th)
Lack of bee colonies	12	0	0	1	20	0	0	6	1	8	0	7	0.052(9th)
Lack of good market	0	0	1	0	0	0	0	0	0	1	2	10	0.046(10th)
Drought	9	0	45	2	0	33	0	0	8	1	6	4	0.039(11th)
Shortages of bee forages	0	0	2	2	2	1	22	0	1	0	6	1	0.023(12th)

3.8. Opportunities of Beekeeping: Some of the Opportunities which were Identified in the Study Area were

- Availability of potential flowering plants, ample sources of water for bees.
- The government has increased its attention to develop the apiculture subsector as one of its strategies for poverty reduction and diversification of export commodities.

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- Farmers of the study area currently obtaining beekeeping training by the bureau of Agriculture, Selam business group.
- Availability of farmers having indigenous knowledge and skills who are motivated to adopt improved technologies and undertake beekeeping intensively.
- The availability of queen rearing technology for increasing the honey bee colony number so as to increase the honey production.
- Currently there is a high market demand for crude honey for domestic consumption and export by different customers and organizations.
- With relatively low startup costs and minimum land requirements, bee-keeping offers high potential for outreach programmers for safety net beneficiaries.
- Cooperative-based production schemes offer opportunity for the landless and youth on communal lands.

4. Conclusion and Recommendation

In general, the most widely used type of beekeeping in the study area is traditional using local hives with the objective of income generation and home consumption. Beekeepers of the study area prefer transitional hives over improved hives due to the high yield, ease of management and it is not need extra equipment. From the study it was understood that the honey yield is decreasing from time to time due to climate change. The most important constraints of beekeeping in the study area were lack of beekeeping Absconding, Lack of training , Pests and predators , Lack of extension services , Agro-chemicals, Lack of cooperative , Swarming, Lack of beekeeping equipment , Lack of bee colonies, Lack of good market, Drought and Shortages of bee forages. However, the study area has huge opportunities and potentials so as to boost the honey and wax production.

In view of the study findings, the following recommendations are suggested:

- Women should be encouraged to participate in modern beekeeping through availing supports like training, credit services and modern beekeeping technologies by GOs, financial institutions and NGOs.
- To improve the low level of technological input utilization and capital shortage credit provision needs to be facilitated to supply improved bee-hives, honey processing materials and other beekeeping equipment.
- In order to address the skill gap on bee colony management and post-harvest handling of hive products practical training on bee and bee products management should be given.
- To exploit the existing opportunities and potentials of the district, more efforts should be put to create awareness of people on beekeeping.
- To improve the gap in extension service delivery and inadequate skills of extension agent in the study area. Practical oriented training should be given for development agents in improved beekeeping.

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*Corresponding author.
E-mail address: negash.dinku@ yahoo.com