Journal of Agricultural Biotechnology and Sustainable Development

Volume 6 Number 6 October, 2014
ISSN 2141-2340

Academic Journals

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Journal of Agricultural Biotechnology and Sustainable Development

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Vol. 6(6), pp. 60-66, October, 2014
DOI 10.5897/JABSD2014.0232
ISSN 1996-0816 © 2014
Article Number: 21B0A8448244

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Journal of Agricultural Biotechnology and Sustainable Development

Full Length Research Paper

Survey on honey production system, challenges and Opportunities in selected areas of Hadya Zone, Ethiopia

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Received 11 September, 2014; Accepted 9 October, 2014

The study was carried out in Hadiya zone to asses honey production systems, challenges and opportunities in the study area. A total of 196 farmers were selected randomly and interviewed using semi-structured questionnaires. The result shows most (90.7%) of the beekeepers in the study area have owned only traditional beehives. The average honey yield from traditional, transitional and frame hive was 3.04 ±0.92, 4.9±1.12 and 8.2±2.62 kg/year/hive respectively. There was significance difference (P<0.05) in honey yield per hive/year from traditional hives while there was no significant difference observed (P>0.05) transitional and moveable frame hive between Woredas. Pesticides and herbicides application, shortage of bee forage, presence of pests and predators and shortage of water were found to be the most important constraints of beekeeping in the study area. Despite all the constraints, there is a great potential to increase the production and quality of honey in the district. Strong extension and technical intervention, proper pesticides application, establishing beekeepers cooperative and enhancing bee forage plantation through introducing multi-purpose trees should be encouraged to increase honey production and income of beekeepers in the study area.

Key words: Beekeepers, colony, challenges, honey production.

INTRODUCTION

Beekeeping is an important agricultural activity in Ethiopia. Owing to its varied ecological and climatic conditions, the country is home to some of the most diverse flora and fauna in Africa. This diversity makes it highly suitable for sustaining a large number of bee colonies (Adgaba, 2007). The country has the largest bee population in Africa. According to CSA (2012/2013) about 5.21 million hives is estimated to be found in the rural sedentary areas of the country. From this total hives, 870,544 and 65,961 beehives are from Southern Nations, Nationalities and hadya zone respectively.

This makes the country one of the largest honey producers and the third largest beeswax producer worldwide. Ethiopian honey production accounts for approximately 2.5% of world production and 21.7% of African honey production (MoARD, 2007). Beekeeping is an environment friendly activity that can be integrated with agricultural practices like crop production, animal husbandry, horticultural crops, conservation of natural resources and it is non-farm business activity that has immense contribution to the economies of segments of the society and to a national economy as a whole (Beyene and Phillips, 2007).

Beekeeping research carried out in the country is though hopeful but did not cover to describe and document the apicultural resources and associated

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constraints of the sector for its proper intervention and utilization to specific potential regions (Chala et al., 2012). Although, Hadya zone is endowed with diversified type of vegetation and horticultural crops and expected to be potential for beekeeping activities so far there is no researchable information on honey production system, opportunities and constraints in the area. Therefore; production system study is important to identify problems and come up with appropriate development plan for an area (Edessa, 2002). Therefore, this study was designed to assess honey production systems, challenges and opportunities of the study area.

MATERIALS AND METHODS

Description of the study area

The study was conducted in two woredas of Hadya zone (Lemo and Analemo), Southern Nations, Nationalities and People Regional State (SNNPRS). Hadya Zone is located at a distance of 232 km from Addis Ababa capital city and 212 km from Hawassa regional city. The astronomical location of Hossana is 7°30' longitude to the North and 37°48' latitude to the East. The average annual temperature and rainfall ranges from 15.1 to 20°C and 1001 to 1200 mm respectively.

Sampling techniques

A purposive sampling procedure was applied for the study woredas. Based on honeybee colonies potential of the study areas 16 representative kebeles, 8 from each woredas were selected using random sampling techniques.

The households were selected by giving equal chance from a list of farmers which participate in beekeeping activity of the rural kebele in their respective area. Single household respondent was used as sampling unit in this study. Finally, to compromise the representative-ness of the sample for the study 15% of the households among the total bee keeper in each of the sample kebeles were selected using random sampling method for interview and successive data collection. A total of 196 sample households were interviewed by well trained enumerators using a semi-structured questionnaire.

Methods of data collection

The study used both primary and secondary data to come up with reliable information on honey production system, opportunities and major constraints of the selected potential areas. Primary data were collected on the following aspects: socio-economic demographic data, current practices and placement of bee colony, types of hives, honey yield, inspection of honeybee colonies, honey harvesting, major honeybee flora, honey storage practices, opportunities and major constraints of beekeeping. Secondary data were used to select potential localities based on number of honeybee colonies and honey production acquired from woredas Agricultural Offices and zonal office of agriculture.

Statistical analyses

All collected data were entered into Microsoft Excel 2007 and descriptive statistics such as mean, frequency, percentage and one way ANOVA were used to analyze the data using SPSS (version 16.0 software of statistical analysis).

RESULTS AND DISCUSSION

General characteristics of respondents

The general characteristics associated with beekeeping households respondents are distributed by sex, age, marital status, and educational status are presented in Table 1. The majority of the respondents (93%) were male while the remaining (7%) were female. This is in line with Addis and Malede (2014) who reported that 97.5% of the interviewed beekeepers were male and only 2.5% were female. Moreover, this very limited number of female participation agrees with Tessega (2009) who states that only 1.7% were female. Similarly Hartmann (2004) reported that in Ethiopia traditionally beekeeping is men's job. So, we can say that few women are participated in the beekeeping job in the area. As a result, women are not economically empowered through beekeeping.

The majority age of the beekeepers in the study area ranges between 40 to 49 years (37.6%). This result showed that people in the most productive age is actively engaged in beekeeping activities. This result agrees with Chala et al. (2013) who report that mean age of the respondents was 40.47 years. Of the total households interviewed, 96.8% are married. This agrees with Tessega (2009) who stated high percentages of the respondents (97.5%) were married.

Concerning to level of education, the highest percentage (51.9%) of the respondents had higher primary level of education and 27.2% of those interviewed beekeepers had not attended any formal or informal education. The rest were at different stages of education ranging from reading and writing skills to completion of secondary school (Table 1). Gichora (2003) noted that for more advanced beekeeping, one should have a good grasp of bee biology and behavior of bees for better colony management. Moreover, for illiterate people there is a need of intensive training and persuading of beekeepers before distributing movable frame hives. Therefore, according to the result of this study the (27.2%) in the district limits the effectiveness of formal training programs and requires more emphasis to be placed on practical demonstration of essential concepts especially in improved beekeeping. This shows that traditional beekeeping practices are based on informal opportunities and an individual's level of formal education does not matter as most of the beekeepers in this study are uneducated people. This is in line with Gichora (2003) who noted the insignificant role of level of education in the traditional beekeeping.

Current practices and placement of bee colony

Most respondents (60.3%) replied that they have got their colonies by catching swarms and the rest obtained from their parents and buying (Table 2). This is in line with

Table 1. Characteristics of the Sample Households in bee keeping.

Category	Variables	Anlemo woreda (n=75)	Lemo woreda (n=121)	Overall (N =196)
Sex	Male	89.3%	96.7%	93%
	Female	10.7%	3.3%	7%
Age (yrs)	< 30	2.7	2.5	2.6
	30 -39	45.3	23.1	34.2
	40-49	38.7	36.4	37.55
	>50	13.3	38	25.65
Marital status	Married	98.7	95	96.85
	Single	1.3	0.8	1.05
	Widowed	-	0.8	0.4
	Divorced	-	3.3	1.66
Education	Cannot read and write	42.7	11.6	27.15
	Can read	2.7	19.0	10.85
	Primary	46.7	57	51.85
	Secondary edu and above	8.0	12.4	10.2

Table 2. Source and placement of bee colonies.

Variables	Anlemo woreda (%) N= 75	Lemo woreda (%) N= 121	Overall (%) N= 196
From parent	1.3	-	0.65
Catching swarms	38.7	81.8	60.25
Buying	13.3	9.1	11.2
From parent and catching swarms	9.3	5.0	7.15
Catching swarms and buying	36.0	-	18
Parent and buying	1.3	4.0	2.65
Placement of hive			
Back yard	80.0	44.6	62.3
Under the eaves	18.7	35.5	27.1
Back yard and under the eaves	1.3	13.2	7.25
under the eaves and hanging near homestead	-	5.8	2.9
under the eaves and hanging on forest	-	0.8	0.4

Addis and Malede (2014), who noted that 49.2% of the beekeeper started by catching swarms. Moreover, Tesfaye and Tesfaye (2007) reported that about 70% of respondents have got their bee colonies by trapping swarms. From this result, one can conclude that catching swarm is the main sources of honeybee colonies in the study areas.

Most (62.3%) beekeepers in the study area kept their hives around their homestead (back yard) (Table 2) and 90.7% owned traditional hives (Table 3). This indicates that the adoption rate of improved technology (modern bee hive) is very low. This might be because of the cost of constructing and purchasing of modern 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 and skill training although yield better quality and quantity honey. Moreover, Tesfaye and Tesfaye (2007) reported almost all beekeeping practices are traditional and only little intervention was made with improved beekeeping practices due to lack of appropriate honey processing materials, Lack of bee equipments (like modern hives, casting mold, frame wires) and lack of skilled manpower. However, the present result disagree with Tesfaye and

Table 3. Types of bee hive.

Types of hive	Anlemo woreda (%)	Lemo woreda (%)	Overall (%)
Traditional only	92.0	85.1	90.7
Traditional and transitional	1.3	1.7	0.4
Traditional and movable frame	6.7	12.4	8.5
All types of hives	-	0.8	0.8

Table 4. Beehive inspection frequency of beekeepers.

Inspection frequency	Anlemo woreda (%)	Lemo woreda (%)	Overall (%)
Frequently	37.3	50.4	43.9
Some times	61.3	46.3	53.8
Rarely	1.3	3.3	2.3

Tesfaye (2007) who reported that about 97.6% of the respondents in Adami Tulu put their hives on a branch of tree and the rest at back yard.

Inspection of honeybee colonies

The majority (53.8%) of the respondents replied that they inspect hives some times (Table 4).This is in line with Tessega (2009) who reported that 46.7, 20.6 and 7.5% of respondents inspect internally rarely, every month and every fifteen days respectively. However, Tesfaye and Tesfaye (2007) reported that 53.5% of respondents (beekeepers) visit their bees every day while 30.2% of them visit their bees at every three days and the rest visit their bees to check if the hive was occupied with bees and at least during honey harvesting seasons. About 60.2% of the interviewed beekeepers in study area believe that visiting the apiary and hive during rainy season causes diseases. For this reason, during rainy seasons the apiary is covered with grasses which may intern serve as a hiding place of pests of honey bee.

Honey bee forage of the study area

According to this study some important local honeybee plants (trees, shrubs, herbs and cultivated crops are known as a source of nectar and pollen in the study area, namely Girawa *(Vernonia amygdalina)*, Wanza (*Cordia africaca),* Wyira *(Olea Africana)*, Meche *(Guizotia scabra),* Bahirzaf *(Eucalptus spp),* dogma (*Syzygium guineese)*, Bisana (*Croton machrostachyus)* are some examples.

Even though there are different types of bee plants available in the area, there is still shortage of bee food in the district especially during the dry seasons. 60 % of the beekeepers pointed out that bee forages become declining as compared with the past due to deforestation and expansion of cultivated lands in the area. Karan et al. (2013) reported that depleting floral resources has reduced the beekeeping potentials.

Honey yield and management

In the present study there was significance difference ($P<0.0015$) in honey yield per hive/year from traditional hives while there was no significant difference ($P>0.05$) in transitional hives and moveable frame hive between the two woredas (Table 5). The present result was below the result reported by Addis and Malede (2014) and Chala et al. (2013) that states the average honey yield per year/colony was 7.20±0.23, 14.70±0.62 and 23.38±0.73 kg for traditional, transitional and moveable frame hives, respectively. Furthermore, the results of the current study, also below the average amount of honey harvested from traditional, top bar and frame hive were 8.94, 10.66 and 15.56 kg per hive respectively Tessega (2009).

This indicates that the studied area is below the line of productivity what the beekeeping industry can perform. Honey yield decreasing in the present study might be due to lack of using improved bee hives, pests and predators and poor management. Similarly, a result reported by Tessega (2009) in Bure district 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.

Honey can be harvested once or twice, while in some cases even three times in a year largely depending on the availability of bee forage. It was reported that any production obtained in the remaining periods of the year would be left as food for the colony to strengthen it for the next harvest.

Table 5. Honey yield and price in the study area.

Variables	Woreda	Mean+SE	Overall mean	P- value
Honey yield /hive/year from traditional hive	Lemo Anlemo	3.46 ± 0.9 2.62 ± 0.099	3.04 ± 0.915	0.000***
Honey yield /hive/ year from transitional hive	Lemo Anlemo	5.33 ± 0.88 4.5 ± 0.5	4.9 ± 1.12	0.537NS
Honey yield /hive/ year from modern hive	Lemo Anlemo	9.86 ± 1.01 6.5 ± 0.65	8.2 ± 2.61	0.192NS
Price of crude honey/kg	Lemo Anlemo	70 ±1.02 81.27±2.91	75.6 ± 1.8	0.000***
Honey lose due to chemical(kg/beekeeper/ year)	Lemo Anlemo	8.08 ± 0.81 5.26 ±0.37	6.67 ± 0.59	0.007**
honey lose due to chemical(ETB/ beekeeper/ year)	Lemo Anlemo	507.83 ± 51.10 540.62 ±39.66	524.23± 45.38	0.644

*** Significant at P<0.001, ** Significant at P < 0.01, NS = Non- significant at P>0.05.

This research result was in line with Tessega (2009) reported honey harvested once or twice, and in some cases even three times in Burie district. None of the beekeepers of the study area collect crude beeswax. According to the respondents all interviewed beekeepers did not harvest beeswax because of lack of knowledge or awareness (39.2%), about the product, lack of beeswax market (21.5%), lack of processing skill (20.8%) and lack materials (18.5%). As a result no one has benefited from the product except using it for oiling 'elee' (materials used for local injera making).

Storage (packing) practices of honey

Even though the majority (75%) of the households do not store honey primarily because of high demand for cash but some farmers keep some amount for different purposes. Beekeepers sell the largest proportion of their honey during harvest at low price mainly to meet their demand for cash for social obligations (Beyene and Phillips, 2007).

As reported by the sample respondents, 59% of the sample beekeepers used plastic containers (Table 6). Other beekeepers still use traditional containers such as gourd and tin to store honey. However, Rivera et al. (2007) reported that most of the farmers (90.7%) store honey in clay pots until consumption or sale. Farmers use traditional containers which are technically not appropriate storage facilities as they result in quick crystallization, fermentation of honey, changing of general appearance and taste of honey (Tesfaye and Tesfaye, 2007).

Trends of honeybee products production in the study area

The majority of the respondents (86.4%) observed decreasing trend of bee products. On the other hand, 10.25 and 3.4% of the respondents replied that bee products in the given years have constant and increased trends respectively (Table 7). This result agrees with Tessega (2009) who stated that honeybee products production in Bure district was in a decreasing trend due to shortage of bee forages, drought, pesticides and herbicide application, lack of water and poor management. In the present study the decreasing trend in honeybee products could be due to pesticides and herbicide application, drought and lack of bee forage, due to decrease in the number of bee colonies and lack of using improved bee hives.

Constraints for beekeeping in the study areas

Each beekeeper involved in the study was requested to prioritize the challenges of beekeeping. Accordingly, the most important constraints of beekeeping in the study areas were shortage of bee forage, pesticides and herbicides application, pests and predators and shortage of water were found to be the top challenges for beekeeping in the area, and the detailed result is summarized in Table 8. This result agrees with Yirga et al. (2012) reported that bee pests and predators, absconding and shortage of bee forage were the major constraints affecting the honey sub sector in asgede

Table 6. Containers used to store honey.

Variables	Anlemo woreda (%)	Lemo woreda (%)	Overall (%)
Earthen pot	16	7.4	11.7
Tin	2.7	-	1.4
Plastic container	56	62	59
Earthen pot and tin	-	0.8	0.4
Gourd and animal skin	1.3	-	0.7
Earthen pot and plastic container	22.7	13.2	18
Earthen pot, tin and plastic container	-	16.5	8.3

Table 7. Trend of honey yield in percent.

Trend of honey yield	Anlemo woreda (%)	Lemo woreda (%)	Overall (%)
Increase	2.7	4.1	3.4
Stable	14.7	6.6	10.65
Decrease	82.7	89.3	86

Table 8. Major Constraints identified by respondent beekeepers in the study area.

Constraints	Lemo woreda (%)	Rank	Anlemo woreda (%)	Rank
Shortage of bee forage	30.6	3	53.3	1
Shortage of water	35.5	4	38.7	4
Absconding	15.7	8	34.9	6
Pests and predators	38.8	1	46.7	2
Pesticides and herbicides application	52.1	2	33.3	3
Death of colony	32.2	6	29.3	7
Migration	26.4	7	32.0	8
Swarming	36.4	5	22.7	5
Storage facilities	66.9	9	73.3	9

tsimbla district, Northern Ethiopia. SOS-Sahel-Ethiopia (2006) reported that the main 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 programmes.

Opportunities for beekeeping

Some of the opportunities for beekeeping in the study area include:

(i) Availability of many numbers of local bee hives and suitable environment with different agro ecology.
(ii) Currently the government is promoting self-contained plan to create modern hives with low cost by using locally available materials and organizing beekeepers co-operatives at grass-root level and connect them with local carpenters who produce modern bee hive with low cost.
(iii) Farmers willingness to improve beekeeping practices in the area,
(iv) Although there is shortage of bee food during dry season, there are many varieties of flowering plants during wet seasons which used as bee food,
(v) The current high market demand for bee products

Conclusions

Generally the most widely used type of beekeeping in the study area is traditional using local hives. The most important constraints of beekeeping in the study area were found Pesticides and herbicides application, shortage of bee forage, Pests and predators and shortage of water. In the area despite the presence of different constraints and challenges, there are high potentials and opportunities to maximize the out puts of

the resource to improve the livelihoods of the communities in a sustainable ways, as the current government plan to develop apiculture as one of the strategies to reduce poverty, high demand for hive products and the establishments of beekeepers co-operatives at grass-root level.

Conflicts of Interest

The authors have not declared any conflict of interest.

ACKNOWLDEGEMENTS

Authors would like to thank Wachemo University for providing us fund. We would like to express our thanks to the Lemo and Anlemo Woreda Agricultural offices for their assistance during data collection. Lastly we would also like to express our thanks to beekeepers in the study area for their willingness to give us all the valuable information.

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