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Beekeeping practices in four districts of tigray region, northern Ethiopia

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***Target audience:** Ministry of Agriculture, Researchers, Apiculture Professionals*

Abstract

A survey was carried out on beekeeping practices in four districts (Degua-Timben, Hawzen, Saesiea-Tsaeda-Emba and Atsib-Wemberta) of Tigray Region, Northern Ethiopia. Data were obtained from 164 beekeepers by using pre-tested, structured questionnaire on demographic characteristics and honey production practices. Beekeeping was dominated by male (91.46%). Higher proportion (56.71%) of the respondents used traditional hive, while 22.56% worked with modern hive only and 20.73% were practicing both. The overall average number of traditional and modern hives per respondent in the study area was 7.45 and 3.20, respectively. Majority (76.22%) of the respondents practiced supplementary feeding of bee colonies, with 72.56% who fed bees in March to May. Annual honey production per traditional hive was significantly ($p<0.05$) higher in Saesiea-Tsaeda-Emba (11.42±1.77 kg), Atsib-Wemberta (10.55±0.84 kg) and Hawzen (10.15±1.36 kg) than what was realized in Degua-Timben (7.88±1.40 kg), while honey production per modern hive was significantly ($p<0.05$) higher in Atsib-Wemberta (35.33±2.20 kg) and Hawzen (33.05±1.94 kg) districts than what was realized in Saesiea-Tsaeda-Emba (23.22±1.81 kg). The overall production of honey per hive (modern and traditional) was significantly ($p<0.05$) higher in Atsib-Wemberta (23.69±2.22 kg) and Hawzen (22.34±2.89 kg) districts than Saesiea-Tsaeda-Emba (14.56±2.12 kg).

Key words: *Beekeeping; Hive; Honey production; Tigray*

Description of Problem

Beekeeping is an important agricultural and traditionally well-established household activity in almost all parts of Ethiopia (1). Owing to its varied ecological and climatic conditions, the country is home to some of the most diverse flora and fauna in Africa, making it highly suitable for sustaining a large number of bee colonies. The country has about 10 million bee colonies and over 800 identified honey-source plant (2). It is estimated that the country has a potential to produce 500,000 tons of honey per year. The recent production, however, is only 48.71 million kilograms of honey (3). This shows that the country is producing less than 10% of its potential.

Ethiopia is having a high bee density and leading honey producer as well as one of the largest beeswax exporting countries in Africa. The share of the sub-sector in the gross domestic product (GDP) has never been commensurate with the huge numbers of honeybee colonies. Productivity has always been low, leading to low utilization of hive products domestically, and relatively low export earnings. Thus, the beekeepers in particular and the country in general are not benefiting from the sub sector (4).

Tigray is one of the best honey producing regions in the country. The region's agricultural resource base,

favorable climate and its botanical resources can support large numbers of bee colonies. Tigray honey is derived almost entirely from wild bees, and no chemicals are used in any part of its production and processing. The region is known for its white honey, which has low moisture content and a distinct aroma. In domestic market, Tigray honey has higher average price due to superior quality than honey produced in other parts of Ethiopia (5). Tigray Region is believed to have huge potential for beekeeping activities so far there is no or very less compiled and reliable information are available on honey production system in the study area. Therefore, this study was conducted to assess the beekeeping practices in four districts of Tigray region of northern Ethiopia.

Materials and Methods

Description of Study Area

The study was conducted in four selected districts of Tigray region namely Degua-Timben (South-east zone), Saesiea-Tsaeda-Emba, Hawzen, Atsib-Wemberta and (Eastern zone) (Fig. 1). Tigray is located at the northern limit of the central highlands of Ethiopia. The land form is complex composed of highlands (in the range of 2300-3200 meters above sea level (m.a.s.l), low land plain (with an altitude range of 500-1500 m.a.s.l), mountain peaks as high as 3935 m.a.s.l) and high to moderate relief hills (1600-2200 m.a.s.l). Thus Tigray has diversified agro-ecological zones and niches each with distinct soil, geology, vegetation cover and other natural resources. The climate is generally subtropical with an extended dry period of nine to ten months and maximum effective rainy season is 50 to 60 days. The rainfall pattern is predominantly uni-modal (June to early September). Exceptions to the rainfall pattern are areas in the southern zone and the highlands of the eastern zone, where there is a little shower during the months of March to mid-May. Considering rainfall, atmospheric temperature and evapo-transpiration of more than 90 percent, the region is categorized as semi-arid (6).

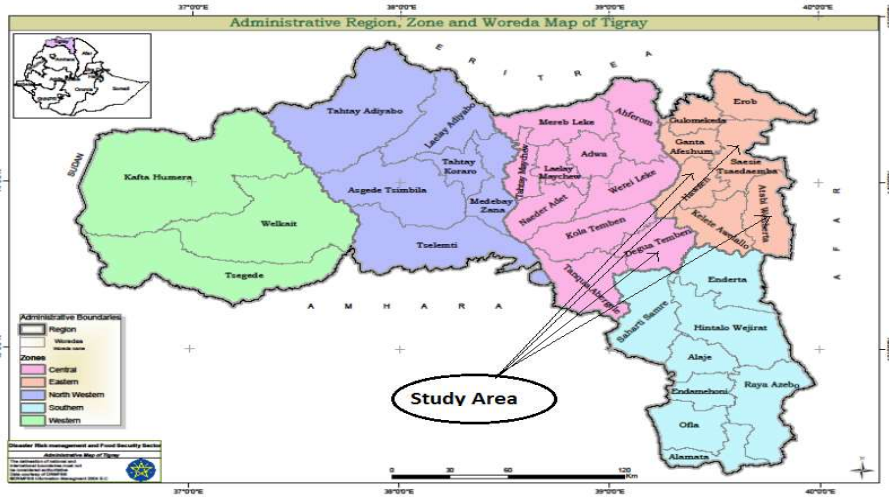

Figure 1: Map of the study area (6)

Sampling Techniques, Data collection and Analysis

A cross-sectional purposively sampling was done and the data on demographic characteristics of households and honey production system were obtained by using pre-tested, structured questionnaire and visual assessments of the beekeepers in the study area. A total of 224 questionnaires were distributed with 73.21% (164) response rate. Data from 164 beekeepers were analyzed using Statistical Packages for Social Sciences (7) version 19. Descriptive statistics was used for the qualitative data, while analysis of variance was employed for quantitative data. Means were separated using least square significant difference whenever they were statistically significant at P=0.05.

Results and Discussion

Demographic Characteristics of the Respondents

Beekeepers involved in honey production had mean age of 40.38 years. Out of the total 164 respondents, 91.46% of the respondents were male, whereas 8.54% were female. Among the sample respondents, 22.56% were illiterates. Majority (65.24%) of the respondents were from 1st - 4th Grade group. Only 1.83% respondents had above 9th grade. Majority (78.05%) of the respondents were trained by getting beekeeping extension services while 21.95% did not get any training and they were dealing mainly with traditional hive (Table 1).

Table 1: Demographic characteristics of beekeepers from four Ethiopian Tigray region districts (N=164)

Demographic indicators	No of respondents (%)
Sex	
Male	150 (91.46%)
Female	14 (8.54%)
Marital status	
Single	6 (3.66%)
Married	147 (89.63%)
Divorced	4 (2.44%)
Widower	7 (4.27%)
Educational status	
Illiterate	37 (22.56%)
1st-4th Grade	107 (65.24%)
5th-8th Grade	17 (10.37%)
Above 9th Grade	3 (1.83%)
Training for beekeeping	
Trained	128 (78.05%)
Not trained	36 (21.95%)

Honey Production System

Hive characteristics

All interviewed beekeepers engaged in either modern or traditional beekeeping methods or both. A larger proportion (56.71%) of the respondents had only traditional hives, 22.56% of them were working only with modern hive while

20.73% of the respondents had both traditional and modern hives. The study indicates that more than half of the respondents were doing beekeeping business on small scale as 68.90% of them had <10 hives on their farm. Only 24.39% and 6.71% of respondents had 11-20 and >20 hives, respectively (Table 2).

Table 2: Hive characteristics and honey colony sources in study area (N=164)

Hive characteristics	**No of respondents (%)**
Types of hive	
Traditional	93 (56.71%)
Modern	37 (22.56%)
Both (Traditional and Modern)	34 (20.73%)
Number of hives	
Below 10	113 (68.90%)
11-20	40 (24.39%)
Above 20	11 (6.71%)
Source of Bee colony	
From parents only	41 (25.00%)
Buying only	38 (23.17%)
Catching swarm only	32 (19.51%)
More than one source	53 (32.32%)

Source of bee colony is an important input to start as well as expand the apicultural business. Precisely 25.00% of the respondents received the bee colony from their parents only, 23.17% of the respondents bought the bee colony. About 19.50% of the respondents got bee colony by catching swarms only while 32.32% of the respondents got bee colony from more than one source (Table 2).

Traditional beekeeping was dominant in the study area. High cost of modern hives and accessories might be the plausible cause for this in the study area. Dominance of traditional beekeeping was also reported in nine districts of west, southwest, and North Showa zones of Oromia regional state (Ethiopia) (8) and in Southwest parts of Ethiopia (9).

The average number of traditional hives per respondent was highest in Atsib-Wemberta district (10.23) followed by Saesiea-Tsaeda-Emba (7.94), Degua-Timben (6.85) and Hawzen (5.65). The average number of modern hives per respondent was also highest in Atsib-Wemberta district (4.43) followed by Hawzen (3.78), Degua-Timben (3.30) and Saesiea-Tsaeda-Emba (1.77). The overall average number of traditional and modern hives per respondents in the study area was 7.45 and 3.20, respectively (Table 3).

Table 3: Hive type used by the beekeepers from four Ethiopian Tigray region districts

District	Number of respondents	Number of hive				Average number of hive
		Traditional		Modern		
		Total	Average	Total	Average	
Saesiea-Tsaeda-Emba	48	381	7.94	85	1.77	9.71
Degua-Timben	40	274	6.85	132	3.30	10.15
Hawzen	46	260	5.65	174	3.78	9.43
Atsib-Wemberta	30	307	10.23	133	4.43	14.67
Overall	164	1222	7.45	524	3.20	10.65

The average number of hives (traditional and modern both) per respondent was highest in Atsib-Wemberta District (14.67) followed by Degua-Timben (10.15), Saesiea-Tsaeda-Emba (9.71) and Hawzen (9.43) (Table 3).

More than two-third of the respondents were small scale producers and had less than ten hives. Also, traditional beekeepers were having more number of hives than modern beekeepers in the study area. This might be due to high cost of modern hives and accessories than that of traditional one. Mean number of traditional and modern hives per respondent was reported to be 7.75 and 3.73 in Burie District of Amhara Region of Ethiopia (10), which was in line with the present study. Previous study also reported 4-18 number of traditional hives in nine districts of west, southwest, and North Showa zones of Oromia regional state (Ethiopia) (8).

Source of bee colonies in the study area were from parents, buying and catching swarm. More than 92% of bee colony source by capturing swarm in Filtu District, Liben Zone, Somali Regional State, Ethiopia (11). Study reported 88.8% of bee colony source by capturing swarm in Asgede Tsimbla district, Northern Ethiopia (12), which was not in line with present finding. This might be due to different agro-ecological region of study area. Study reported 25.0% and 22.5% of bee colony source by buying and gift of parents, which is in line with present study (10).

A large proportion (51.3% and 58.6% with traditional and modern hives, respectively) of the respondents kept their colonies around their homestead (back yard) mainly to enable close supervision of colonies. Minority (17.7% and 15.6% with traditional and modern hives, respectively) of the respondents kept their colonies under the eaves of the house whereas others (8.5% and 25.8% with traditional and modern hives, respectively) kept their colonies inside the house. Besides, 22.5% of traditional bee colonies were kept hanging on the tree branches (Table 4). Hanging hives on tree branches might be due to accessibility of bee forages. Similar pattern of beehive placement was also reported in Asgede Tsimbla district of Northern Ethiopia (12) and Burie District of Amhara Region of Ethiopia (10), respectively.

Table 4: Hive installation in four Ethiopian Tigray region districts

Placement of bee hives	Traditional	Modern
Back yard	51.3 %	58.6 %
Hanging on the trees near home	22.5 %	-
Under the eaves of the house	17.7%	15.6 %
Inside the house	8.5 %	25.8 %

Supplementary feeding of honey bee colony

Honeybees face starvation due to lack of forage during unfavorable season. To overcome the problem, supplementary feed is required for the honeybees. In this study, it was found that 76.22% of the respondents provided supplementary feed. Respondents provided supplementary feed mainly during March to May (72.56%) followed by December to February (19.51%), June to August (4.88%) and September to November (3.05%) (Table 5).

Table 5: Supplementary feeding of honey bee colony used by beekeepers in Ethiopian Tigray region districts (N=164).

Parameters	No of respondents (%)
Supplementary feeding	
Yes	125 (76.22%)
No	39 (23.78%)
Supplementary feeding	
March to May	119 (72.56%)
June to August	8 (4.88%)
September to November	5 (3.05%)
December to February	32 (19.51%)
Feed ingredients	
Sugar syrup	90.40%
Honey and water mixtures	72.00%
Besso (barley flour syrup)	52.00%
Shiro (beans soup)	44.80%
Other	24.00%

Among the supplementary feeds, sugar syrup was used for feeding bees by the majority (90.40%) of positive respondents followed by honey and water mixtures (72.00%), Besso (barley flour syrup) (52.00%), shiro (beans soup) (44.80%) and other (24.00%) (Table 5).

Supplementary feeding was common practice by majority of the respondents particularly during dry season (March to May) when there was lack of natural forage for the bees in the study area. Shortage of bee forage caused the honeybee colony to abscond to areas where resources were available for their survival. Lack of forage during adverse climate has been reported to be the main problems that may cause absconding (13). Some respondents also practiced supplementary feeding in other seasons. This problem might be related to the reduction of forest coverage from time to time for timber making, construction, firewood and expansion of agricultural lands (14).

In Tigray, land degradation and removal of vegetation cover are very high (15). The principal bee flora for beekeeping has become seriously degraded in the course of time. The bees and the plants they depend on, like all renewable natural resources, are constantly under threat from lack of knowledge and appreciation of these endowments (16). The elimination of good nectar- and pollen-producing tree species in many areas makes it difficult to maintain bee colonies without feeding (17). The supplementary feeds mainly included sugar syrup, honey and water mixtures, besso (barley flour syrup) and shiro (beans soup) in the study areas. In addition to supplementary feeding, planting bee forage and to leave some amount of honey un-harvested for the subsequent dry period was also required to prevent absconding as well as to get the intended honey yield. Supplementary feeding by 58.3% of the respondents was reported in Burie District of Amhara Region, Ethiopia (10). To mitigate the shortage of feed for their bee colonies, respondent's planted bee forages around their apiary.

Honey harvesting

The amount of honey yield per bee hive per year for modern as well as traditional bee hives varies significantly ($p<0.05$) among four districts, which in most cases is determined by the existences of plenty pollen and nectar source plants and the level of management and input.

Table 6: Honeybees colony yield per year (Kg) in modern and traditional hives in Ethiopian Tigray region districts (N=164).

District	No of respondents	Mean (kg) ± S.D.		Overall Mean (kg) ± S.D.
		Traditional	Modern	
Saesiea-Tsaeda-Emba	48	11.42±1.77[a]	23.22±1.81[a]	14.56±2.12[a]
Degua-Timben	40	7.88±1.40[b]	28.60±0.55[b]	19.05±2.03[b]
Hawzen	46	10.15±1.36[a]	33.05±1.94[c]	22.34±2.89[c]
Atsib-Wemberta	30	10.55±0.84[a]	35.33±2.20[c]	23.69±2.22[c]

Means in a column with different superscripts are significant different at p= 0.05.

Annual production of honey per traditional hive was significantly ($p<0.05$) higher in Saesiea-Tsaeda-Emba (11.42±1.77 kg), Atsib-Wemberta (10.55±0.84 kg) and Hawzen (10.15±1.36 kg) than Degua-Timben (7.88±1.40 kg) (Table 6). The production of honey per modern hive was significantly ($p<0.05$) higher in Atsib-Wemberta (35.33±2.20 kg), Hawzen (33.05±1.94 kg), Degua-Timben (28.60±0.55 kg) than Saesiea-Tsaeda-Emba (23.22±1.81 kg). The overall production of honey per hive (modern and traditional) was significantly ($p<0.05$) higher in Atsib-Wemberta (23.69±2.22 kg), Hawzen (22.34±2.89 kg) and Degua-Timben (19.05±2.03 kg) than Saesiea-Tsaeda-Emba (14.56±2.12 kg), which recorded least production of honey per modern hive among the four districts (Table 6).

The difference in honey production among four Districts under present study was possibly due to seasonal bee management skills and flowering potential of the area. Honey yield of about 8-15

kg/hive and 20-30 kg/hive from the traditional and modern hives, respectively reported in Tigray Region, northern Ethiopia (15). Study reported 13 kg and 30 kg of honey per hive, respectively from traditional and modern hives in Eastern Tigray Region of northern Ethiopia (18). The mean honey harvested from traditional and modern hive in Jimma Zone of Ethiopia was reported to be 9.5±2.8 kg and 23±7.8 kg (19). All these findings agree with the results of present study. Different workers reported lower mean honey yield per hive from different parts of Ethiopia. Mean honey yield of 5.22±0.042 kg/hive and 15.2±2.52 kg/hive from the traditional and modern hives reported respectively in Wonchi district South West Shewa Zone of Oromia, Ethiopia (14). Average amount of honey harvested from traditional and modern hive were 8.94 kg and 15.56 kg per hive, respectively was reported in Burie District of Amhara Region, Ethiopia (10). The most probable cause of the difference from current study might be due to difference in geographical location, availability of apicultural forage and bee colony management. In a study conducted in southwestern Nigeria showed higher honey yield in modern hive was attributed to abundance of apicultural resources like pollen and nectar in mango canopy than other studied tree species (20).

Conclusion and Applications

1. Traditional beekeeping activity was dominant in the study area due to high cost of modern hive and accessories as well as lack of skills to work with modern hive.
2. Modern hives give higher annual honey production than traditional hives.
3. Supplementary feeding was practiced to overcome the problem of absconding and migration of honeybee during drought period, which occurred due to land degradation, and removal of vegetation cover.
4. Conservation of natural vegetation, introducing such as fruit crops, animal fodder, integrating with traditional cropping systems and introducing apicultural plants are recommended for increase in productivity of bee colonies in the study area.

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Conflict of Interests

The authors declare that they have no conflict of interests.

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