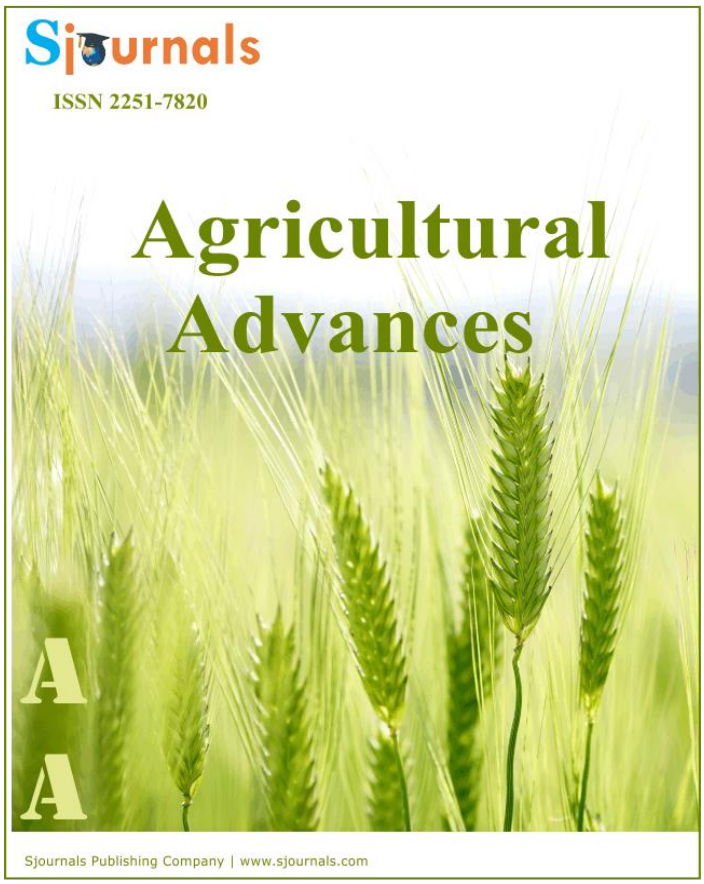

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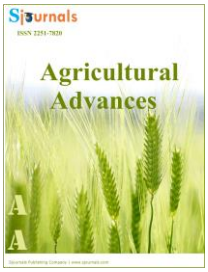

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Original article

Assessment of beekeeping constraints in lowland of Bale zone southeast Oromia regional state, Ethiopia

Temaro Gelgelu Desha[a,*] and Amare Biftu Bosat[b]

[a]*Oromia Agricultural Research Institute (OARI), Sinana Agricultural Research Center (SARC), Apiculture Research Team, Po.Box 208, Bale Robe, Ethiopia.*

[b]*Oromia Agriculture Research Institute (OARI), Sinana Agricultural Research Center (SARC), Agricultural Extension Research Team, Po.Box 208, Bale Robe, Ethiopia.*

*Corresponding author: temage581@gmail.com

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ABSTRACT

The study was conducted in lowland of Bale districts including Dello menna, Sewena and Goro Southeast Oromia Regional State Ethiopia with objective to assess constraints of beekeeping development. Different data collection techniques of studies were used. Using both purposive sampling and random sampling method were employed. Using purposive sampling, 130 household was used in study area. Analysis of data collection was PRA tools included problems ranking matrix and pair-wise comparisons and Focus Groups Discussion (FGD). Trend of beekeeping and honey yield were decreasing. Most of beekeepers were practiced traditional beekeeping by using local knowledge and a local material was constructed bee hive due low productivity. Beehive colonies 4-7 with averagely own per household headed with percentage 24% of traditional beehives. According to importance of constraints beekeeping were prioritized in lowland of Bale such as gap of knowledge, lack of full package bees, unwisely use of Agro-chemical, shortage of bee forage, shortage of water, pests and predators and diseases. Bee forage species were plenty in the study area. There was important afforestation, integrated cross-fertile of indigenous knowledge and training to mitigate constraints of beekeeping and intervention could be needed. For bee diseases in the study area further investigation strongly recommended.

1. Introduction

Ethiopia has a longstanding beekeeping practice and endowed with huge apicultural resources and it has been an integral part of other agricultural activity, where about one million households keep honeybees. More than 5.15 million hived honeybee populations are found in the country (Adgaba et al., 2014). Beekeeping is regarded to Agric. Ext. Rural Dev. be an agricultural venture with little or no land except a space to stand or hang hive; very little labor, almost no capital and most of the other inputs are considered to be locally available (Rubio, 2001). The ideal climatic conditions and diversity of floral resources allow the country to sustain around 10 million honeybee colonies, of which 7 million are kept in local beehives by farmers, and the remaining exist in the forests as wild colonies. This makes the country to have the highest bee density in Africa (Ayalew, 2001; Nuru, 2002).

Apiculture is one of the agricultural sub-sectors that most suit the rural poor for income generating and also contributes significantly to income diversification in livelihood enhancement. It is exceptional sustainable as the activity has no impact on environment and rather it stabilizes fragile areas and help in reclaiming degraded lands and increases biodiversity. Moreover, the contribution of beekeeping in poverty reduction, sustainable development and conservation of natural resource have been recognized and well emphasized by the government and other stakeholders. Beekeeping is an important activity that practiced by communities living close to forest and in lowland areas.

However, the constraints of beekeeping development including such as unwisely agro-chemical application, shortage of bee forage, honey predators and pests, gap of knowledge, diseases, shortage of beekeeping equipment (full package), migration and absconding are known to great influence of beekeeping development constraints in particularly lowland of Bale. In many part of the world, the investigation of research is under way to develop means of strategy to combat constraints of beekeeping developments. But the research of beekeeping infant stage and no investigation has been made on assess beekeeping of technological gap constraints in low land of Bale zone. Hence, in order to mitigate the constraints of beekeeping, it is very crucial to identify the problems of beekeeping in lowland of Bale. Therefore, the objective of this investigation was to identify beekeeping constraints and to prioritize constraints of beekeeping activities.

2. Materials and methods

2.1. Description of the study area

The study was conducted with objective to assess beekeeping constraint in lowland of Bale in 12 May- 15 April 2015. The study was conducted in lowland of Bale zone, Oromia Regional State which is located in southeastern part of Ethiopia within 7°, 00'N and 39° 45'E and 7°, 30'N and 39°, 30'E of latitude and longitude, respectively (Ethiopian Mapping Authority, 1988). The investigate focuses on lowland of Bale zone districts which includes Goro (6 4459.99N and 40^0 34' 59.99E' latitude and longitude respectively with 2267m altitudes), Dellomenna (06^0, 24'N and 39^0 50' latitude and longitude respectively with 1278 m altitudes) and Sewena (07^0, 02'N and 39^0, 27'E of latitude and longitude, respectively with 2386 m altitudes) districts. The study area rages from lowland to high lands which represent different agro-ecologies of Bale with altitude range of 500 to 4377 m above sea level. The annual minimum and maximum temperature of the area extends from 2 to 20°C for high land (Williams, 2002) and 26 to 40°C for lowlands (RLDHMO, 2009).

2.2. Sampling methods and sample size

The study was employed both purposive and random sampling methods to select districts and rural kebeles. These districts were included Dellomenna, Sewena and Goro were selected based on accessibility, potential of honeybee, agro-ecological zone and possess of honeybee beekeepers in the study area. The study of the rural kebeles namely Bili Akiya, Chopi and Gomgoma were selected purposively from Goro, Sewena and Dallo Manna districts, respectively. Random sampling method was employed to select one rural kebeles (Keku, Dolcha and Wabaro) from each of the three districts mentioned above. Subsequently, the selected rural kebeles were visited and discussions held with their respective expert of district, development Agents (DAs) and local leaders. With guidance of DAs and local leaders to select 15-20 beekeepers composed of various age categories from both male headed and female headed housed holds for participatory Rural Appraisal (PRA) discussions with Key informants in the study area.

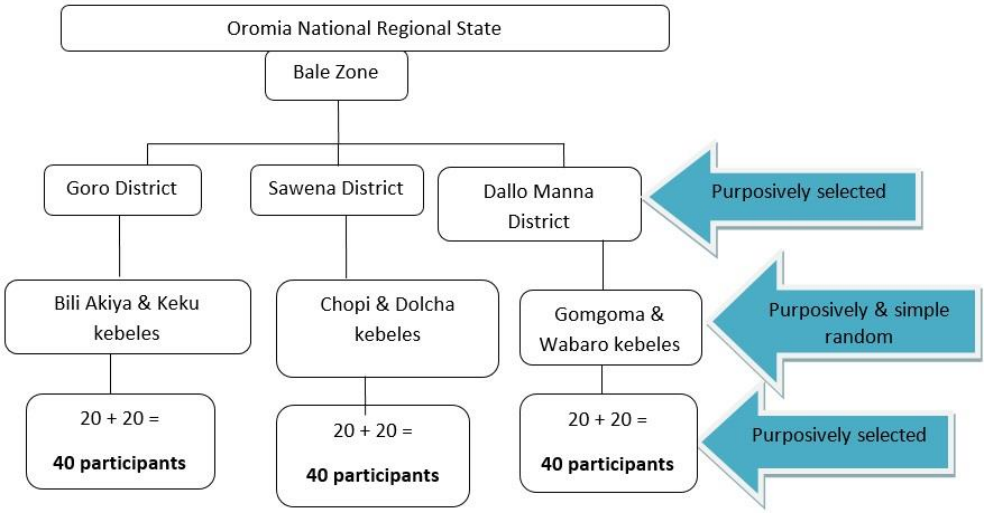

Fig. 1. Sampling procedure of the study.

2.3. Tools of data collections and analysis

For this study data collections tools were used both quantitative and qualitative research techniques. Primary data was collected using PRA tools such as problems ranking matrix and pair-wise comparisons, transect walks and trend relationship and perceptions analysis during assessment. Moreover, in-depth Focus Groups Discussion (FGD) with discussants and personal observations were also employed to generate primary data in the study area. Secondary data was also collected from various relevant published document and district of livestock and Resource of Fishery development offices.

The paired comparison of beekeeping constraints were identified and used to evaluate the degree of constraints beekeeping certain prioritized according their importance (Martin, 1995). According to discussants were reported that the constraints of beekeeping ranking based on their prioritized and given the highest number (7) for beekeeping constraints which the most problem in the study area and the lowest number (1) for least beekeeping constraints in the study area.

A total of six FGDs were conducted; once at each sampled kebeles of the respective district in order to record the views and perceptions of participants. In the case of in-depth FGD, there were interactive discussions with discussants and intensive note taking by the researchers. A total of 130 individuals/discussants (85 male and 45 female) participated in the discussions, as shown in the table below.

Table 2
Lists of focused discussion participants.

		Number of participants		
Districts	**Kebele**	**Male**	**Female**	**Total**
Goro	Bili Akiya	12	9	21
	Keku	17	5	22
Sawena	Chopi	18	10	28
	Dolcha	13	9	22
Dello Menna	Gomgoma	7	6	13
	Wabaro	18	6	24
	Total	85	45	130

3. Results and discussion

3.1. Trends of beekeeping and constraints in the study area

The trend of beekeeping and honey yield has been decreasing in the study area due to deforestation, lack of bee forage and indigenous knowledge transfer gap to the new generation. This result was agreement with

previous reported in Eastern zone of Tigray region (Yetimworke et al., 2015). Therefore, there is a need for afforestation, integration and cross-fertilization of indigenous and formal knowledge to make this business enterprise sustainable. There are various beekeeping constraints that are highly contributed to low productivity. There was high potential of beekeeping in lowland of Bale in the study area. FGD result revealed that in the study area there is high potential of beekeeping even if the productivity is still under potential. FGD result revealed that most of the beekeepers are practicing traditional beekeeping by using indigenous knowledge and equipment made locally materials that result in low production and productivity. The average percentage of traditional beehives own beekeepers from the household head in the study area were about 24% while the average number of traditional beehives for those who owned was five per household.

The constraints of beekeeping were prioritized by FGD using problem ranking matrix and pair wise comparison techniques as shown in the table 1 below in the study area.The paired comparison of beekeeping constraints were identified and used to evaluate the degree of constraints beekeeping certain prioritized according their importance (Martin, 1995). According to discussants were reported that the constraints of beekeeping ranking based on their prioritized and given the highest number (7) for beekeeping constraints which the most problem and the lowest number (1) for least beekeeping constraints in the study area. The FGD result were revealed that knowledge gap were the most common constraints of beekeeping were followed by lack of full package beekeeping technologies, Shortage of bee forage, pests and predators and shortage of water and diseases were found in the study area (Table 1). Hence, these constraints of beekeeping practices were affected production of honey in the study area. Therefore, there is a need for afforestation, integration with indigenous knowledge and formal knowledge to make this beekeeping development enterprise sustainable and also it is a need for intervention of beekeeping extension in lowland of Bale. This result was in line with previous reported other authors (Tessega, 2009; Haftu and Gezu, 2014; Bekele et al., 2017).

Table 1
Beekeeping constraints identified and ranked according to their importance in the study area.

Constraints of beekeeping		R1	R2	R3	R4	R5	R6	Total	Rank
1	Knowledge gap	7	7	7	7	7	7	42	1st
2	Beekeeping equipment	6	6	6	6	6	5	41	2nd
3	Use of agro-chemicals in the area	5	3	4	2	3	3	20	4th
4	Shortage of water	4	4	5	3	2	2	20	4th
5	Shortage of bee forage	3	5	2	4	5	6	25	3rd
6	Pests and predators	2	2	3	5	4	4	20	4th
7	Diseases	1	1	1	1	1	1	6	5th

R= Respondents of FGD.

As shown above Table 1 result were indicated that it is a need of intervention mechanism to mitigate constraints of beekeeping practices in the study area were suggested by discussants such as improving extension services, training on knowledge, skill and attitude, modern bee equipment and transitional beehives easily construct from locally available materials with full package, planting bee forage, providing water and supplementary feed at apiary site. Wisely use of agro-chemical during inactive time of bees, inside feeding and protecting bees in the hives, exchange of information during agro-chemical application. For shortage of water, water harvesting, pond excavation and spring water development to provide water at apiary site. And also for bee forage shortage was suggested that afforestation, area closure, cultivation of improved bee forage at apiary site and cultivating spices crops at apiary site. The pest and predators were suggested to protect fencing the apiary site with corrugated iron and wire mesh, hanging the hives, using ash and oil and frequently inspect bee hives. Constraints of bee diseases were recommended bee management practice, frequently inspection, apiary site sanitation, smoking traditional medicinal plants, further investigation strongly recommended.

3.2. Management of beekeeping constraints in the study area

As result of FGD revealed that the beekeepers in the study area using different management aspect as local their indigenous knowledge practices beekeeping in the backyard and in the forest area keeping beehives. According to discussants said that the beekeepers of local area before hanging beehives for catching swarm and

protecting pests or diseases occurrence have been smoking bark of *Plectranthus puberulentus* and dry of *Euphorbia candelabrum* L. These materials used as to attract bee swarm and also used as traditional medicinal plant fumigants to protect pests or diseases occurrence in the study area. FGD result indicated that beekeepers in the study area bee colonies managed or protected from predators and pests like honey badger and ants by using iron corrugated on stems of trees. Beekeepers have been keeping beehives on trees hanging in two ways in the forest their bee colonies it has been calling *Pendulum hive (Rarrassoo)* in Afan Oromo on branch of trees in local area (Figures 1). Beekeepers were harvesting honey by climbed height trees by rope for hanging beehives on trees to smoke and threw hive with bees to the ground (Figure 2). During interviewed were made with discussants observed that beekeepers were kept beehives at backyard and forest hanging beehive by rope on highest trees. However, beekeeping activities the simplest technology adopted easily, it is not labor required, less capital, piece of land, no competition for land and other resource and also done by all groups of age and sex. Discussants were responded that honey stored in container of fertilizers bag, tin container and plastic containers local called bakore were used in the study area of local market one of the problems bee product handling were observed during PRA. As result of discussants were revealed that high demand of honey as used home consumption, medicinal and attractive local price of market.

Fig. 1. Source of figures, own survey May, 2015.

Fig. 2. Climbing of tall trees by this rope, source of photo own survey May, 2015.

3.3. Bee forage species and seasonal bee flowering

Some major of bee forage species were listed by FGD result in the study area of Bale lowland. According to discussants, these major bees forage species were discussed with major honey harvesting and minor honey harvesting time the followed (Table 3.) As result of discussants were revealed that the main season of honey flow in Goro area is from June to August and December to February. The lowland of Sewena and Dellomenna districts also having own different season of honey production major and minor honey harvesting were reported by discussants in the study area. The main honey harvesting season of Sewena district from August to September and December to February major and minor honey production season respectively. And also lowland of Dellomenna district the main season of honey harvesting from December to February and June to July major and minor honey production seasons respectively. Migration and absconding of bee colonies are common in the study area during dearth period to search flowering plants and water and other challenges of bee colonies were reported discussants ants, pest and predators. However, As result of FGD were revealed that bee colonies come back to their home steady area or to their area during active season of flowering bee forage plants during start blooming.

Table 3
List of bee forage plant species, plant form, and flowering time in lowland of Bale based on PRA and during observation of field.

No.	Botanical science	Family name	Local name	Plant form	Flowering period	Location
1	*Acacia senegal (L) Wild*	Fabaceae	Saphansaa	Tree	May-July	Dello-menna
2	*Cordia africana L.*	Boraginaceae	Waddeessaa	Tree	November-January	Dello-menna
3	*Syzygium guineense (Wild.) DC.*	Myrtaceae	Baddeessaa	Tree	December-February	Dello-menna
4	*Dalbergia commiphoroides Bak.f.*	Fabaceae	Calcalaa	Shrub	October-November	Dello-menna
5	*Acacia mellifera*	Fabaceae	Bilala	Shrubs	May-July	Dello-menna
6	*Croton macrostachyus* Hochst	Euphorbiaceae	Bakkannisa	Tree	May-July	Dello-menna
7	*Glycine max(L).Merr*	Fabaceae	Sisinaa	Herb	June-July	Dello-menna
8	*Guizotia abyssinica L*	Asteraceae	Nuugii	Herb	June-July	Dello-menna
9	*Eucalyptus camaldulensis Dehnh*	Myrtaceae	Baargamoo	Tree	June-July	Dello-menna
10	*Mangifera indica L.*	Anacardaceae	Maangoo	Tree	June-July	Dello-menna
11	*Agave sisalana L.*	Agavaceae	Algee/Qaaca	Tree	June-July	Dello-menna
12	*Annona muricata L*	Annonaceae	Giishixaa	Tree	June-July	Dello-menna
13	*Papea capensis Eckl. &Zeyh*	Sapindaceae	Biiqqaa	Tree	May-July	Dello-menna
14	Acacia seheyal L.	Fabaceae	Laaftoo	Tree	August-September	Sewena
15	*Acacia mellifera*	Fabaceae	Bilaala	Herba	August-September	Sewena
16	*Euphorbia burgeri* Boiss	Euphorbiaceae	Ciiraa	Shrub	August-September	Sewena
17	*Agave sisalana Perr.ex Engl..*	Agavaceae	Algee/Qaaca	Tree	August-September	Sewena
18	*Acacia tortilis (Forssk.) Hayne*	Fabaceae	Dhadachaa	Tree	August-September	Sewena
19	*Croton macrostachyus* Hochst	Euphorbiaceae	Bakkannisa	Tree	October-November	Goro
20	Coriander sativum L	Apiaceae	Dimbilaala	Herb	November-December	Goro
21	*Nigella sativa L.*	Ranunculaceae	Absuda gurraacha	Herb	November-December	Goro
22	*Withania somnifera (L) Dunal*	Solanaceae	Hunzoo	Herb	October-November	Goro
23	*Guizotia scabra*	Asteraceae	Hadaa	Herb	October-November	Goro
24	*Vernonia amygadalina*.Del	Asteraceae	Eebichaa	Shrub	May-June	Goro
25	*Agave sisalana L.*	Asparagaceae	Algee/Qaaca	Tree	May-June	Goro
26	*Zea mays* L.	Pocaeae	Boqqolloo	Herb	November-December	Goro
27	*Euphorbiaceae tirucalii* L	Euphorbiaceae	Anaannoo	Shrub	May-June	Goro
28	*Plectranthus puberulentus*	Lamiaceae	Barbarisa	Herb	August-September	Goro

4. Conclusion

Focus group discussant (FGD) of study area of the lowland of Bale was identified and prioritized major constraints of beekeeping activities. According to importance of beekeeping constraints in the study area were gap of beekeeping knowledge, lack of beekeeping full package, pest and predators, shortage of bee forage, unwisely application of Agro-chemical, shortage of water and diseases. Migration and absconding are common in the study area. A trend of beekeeping activities in the study area has been decreasing from time to time. Beehive colonies 4-7 with averagely own per household headed with percentage 24% of traditional beehives. The major bee forage species were identified with flowering season. There was important afforestation, integrated cross-fertile of

indigenous knowledge and training to mitigate constraints of beekeeping and intervention could be needed. For bee diseases in the study area, further investigation is strongly recommended.

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