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Research article

Current status of modern bee keeping technology adoption in selected districts of Arsi Zone of Oromia Region, Ethiopia

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Honey and beeswax production was started in ancient time by using traditional bee hives. Currently Ethiopian government started to change the traditional beekeeping system by transitional and box hive through training, demonstration and scaling up of the technology to increase production of honey and beeswax. Adoption modern beekeeping technologies by producer farmers are very important to increase production and productivity of honey and beeswax. This study was conducted in selected districts of Arsi Zone to assess the current status and determines factors of modern beekeeping technology adoption. About 47.5% of the beekeepers were considered as modern beekeeping technology adopters based on the definition of adoption. The determinant factors of the technology adoption were training on modern beekeeping, awareness level, extension contact, market problem on modern beekeeping technologies and availability of protective closes. The determinant factors were significantly affect adoption of the technology at $p<0.05$). Based on the respondents response the price of modern hive and accessories were very high which is not affordable by beekeeper farmers. Adoption of beekeeping technology was not statistically significant at $p>0.05$) among the study districts and other socio-demographic information of the beekeepers.

Keywords: beekeeping, adoption, determinant factors of adoption Arsi Zone

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INTRODUCTION

Traditional beekeeping was started before 5000 years back and the Hieroglyphs of ancient Egypt refers to Abyssinia (the former name of Ethiopia) as the source of honey and beeswax. Thus Abyssinia has been known for its beeswax export for centuries during when other items were not exportable(Gezahegne, 2001).Based on the CSA 2016/17 report a total of about 5.92 million hives is estimated to be found in the rural sedentary areas of Ethiopia. From this total hives, the greater part (96.46 percent) is reported to be traditional and the remaining 3.54% were modern and transitional types. Ethiopia is one of, the leading honey producer 23.6% in Africa and is one of the ten largest producers 2.1% of the world production (Kassaye, 1990; Gebiso, 2015). The total honey production is estimated about 47.71 million kilograms of which the greater portion is harvested from

traditional hives (CSA, 2016/17).

Despite the long tradition of beekeeping in Ethiopia, having the highest bee density and being the leading honey producer as well as one of the largest bee waxes exporting country in Africa, the share of sub sector in the GDP has never been commensurate with huge number of honey colonies and the country's potential for beekeeping. Productivity has always been low and relatively low export earnings. Thus, the beekeepers in particular and the country in general is not benefiting from the sector (Gezahegne, 2001; Nuru, 2002)

In addition to the above mentioned problems, low productivity with the mean production per hive ranges from 5 - 6 kg compared to modern beehives which has average production of 15 - 20 kg/hive and even more (HBRC,2004). Based on central statistics, (2016/17) report, Oromia Region having large share of honey production of the country, with about 48% of total country's production, the regional government disseminated considerable number of modern (box) hives to farmers which are produced by different regional agricultural mechanization research centers and different private microenterprises starting from 2001.

Arsi zone is one of the 17 zones of the region with high potential of honey and bees wax production and one of the Zones where there was dissemination of modern beekeeping technologies with no information about the determinant factors and status of adoption of the technologies. Determination of the factors of adoption of modern beekeeping technology helps to intervene on the factors which hinder modern beekeeping technology adoption in the study areas. There for this study was initiated to identify the determinant factors of adoption and utilization beekeeping technologies in Arsi Zone.

RESEARCH METHODS

Study areas

The study was conducted in selected districts of Arsi zone, South-Eastern part of Oromia Regional State. Arsi zone is one of the 22 zones of the Oromia National Regional State. It is located in the southeastern part of the country. It is also situated between 6˚45'N to 8˚58'N latitude and 38˚32'E to 40˚50'E longitude (EIDP.2002). It is characterized by mixed farming system. The mean annual temperature of the Zone ranges between 20˚C - 25˚C in the low land and 10˚C -15˚C in the central high land (Oromia agricultural office, 2012). It is also known for its surplus production and knows as wheat-belt of Ethiopia (Gebremariam, 1992).

Sampling and data collection

Both multi-stage and purposive sampling techniques were employed, where four districts and three Peasant Associations were purposively selected based on their apiary potentials and previous history of distribution of modern beekeeping technology by the help of agricultural experts. Ten beekeepers from each PAS which makes the total respondents of 120 were selected randomly for interview. Adopters and none adopters were identified based on the available beekeeping technology at their apiary site. Beekeepers were categorized as adopters if they have at least one modern beekeeping technology other than traditional hive.

Primary data were collected from beekeepers through interview by pretested structured and semi-structured questionnaire. Both quantitative and qualitative data were collected on basic information of the beekeepers on livestock holding, beekeeping practice, Availability of protective clothes and beekeeping equipment, honey bee pests and diseases, availability of bee forage, pre and post-harvest hive product management and amount of honey produced.

Data management and analysis

Raw data was managed in Microsoft excel spread sheet and analyzed by using SPSS version 20. Descriptive statistics were used to analyze the quantitative data. Chi-square test was used to identify the association of the independent variables with dependent one. A binary logistic regression model was used to identify the determinants of modern beekeeping technology adoption in this study and ranking technique was used to determine the preferred types of technology by users and to identify and prioritize the major beekeeping constraints and pests and disease.

Definition of independent and dependent variables and hypothesis

Age of respondents (Age): It is hypothesized that age negatively affects adoption.

Educational background: categorical 0 = illiterate, 1 = literate

Credit use: use of credit can solve problem of capital shortage for the investment and is expected to enhance adoption of the modern beehives and accessories (dummy; 1 = user and 0 otherwise). In this case since the credit from government bodies is ear tagged for agricultural inputs like chemical fertilizer and seed, only credit utilization from other sources was considered

Number of local beehive: this variable is also expected to have positive impact on adoption probability of the technology assuming as farmers saw the little

advantages from local hive they may think of improving their advantage from the beekeeping activity (continuous count).

Sex of respondents: being female is assumed to expose to different cultural discrimination from large society and excluded from different extension services and have negative impact on adoption probability (dummy; 1 =male and 0 = female)

Awareness on modern beekeeping technologies: it is dummy variable; 1 = yes 0 otherwise

Land size (farm yard in ha): unless beekeeping activity is not commercialized so far the farmers are expected to practice apiary in their farm yard/house stead and as the farm yard size increases it is expected to have more probability of adoption (continuous).

Livestock holding (TLU) is expected to have either negative or positive impact

Participation on demonstration of modern beehives (it is dummy variable; 1 = yes 0 otherwise): it is hypothesized that it has positive effect.

Total Income: it is the sum of all income in birr that a beekeeper gets from sale of crop, livestock, and honey and other nonfarm sources. It is continuous variable measured in Ethiopian birr.

Absconding of bees: it is dummy variable 1=yes, 0, otherwise the beekeeping activity depends on the adaptation and presence of bees in the hive particularly box hive after transferring from traditional hive. So absconding is one of the determinant factors for adoption of improved beekeeping technologies.

Beekeeping experience: continuous variable which can affect adoption positively

Extension service: it is dummy variable 1=yes no=o otherwise extension service can help by providing information on modern beekeeping technologies positively affect for adoption

Training on beekeeping technologies: it is a dummy variable 1-yes 0 otherw**ise**

Adopter of beekeeping technology: adoption was divided in to two as individual adoption as the farmer's decisions to incorporate a new technology into the production process and the aggregate adoption as the process of diffusion of a new technology within a region or population (Feder, *et al*.1985) sited by Gebiso, (2015).In our case adopter of beekeeping technologies were defined as beekeepers who have at least one modern beekeeping technologies for the honey production. The aggregate beekeeping technology adoption by the study districts can be seen.

RESULT AND DISCUSSION

Socio-demographic characteristics of the beekeepers in the study areas

The socio-demographic information of the beekeeper farmers participated in this study are described under (Table 1). The majority 95% of the respondent beekeeper farmers were male which is still the participation of females in the beekeeping activities is very low. Based on the respondents response since the major beekeeping activities are practiced at night when females afraid of darkness and phobia of stings from bees. All most all 97% of the beekeeper farmer have one of the livestock species other than bees. There is no specialized agricultural practice in the study areas. Regarding land holding only 6.7% of the beekeepers have no land for agricultural practice except home land for residence and back yard beekeeping. The majority 95% of beekeeper farmers in the study areas were Muslims and Orthodox Christian which the proportion of 57.5%and 37.5% respectively and the remaining 5% of the beekeepers were followers of catholic and protestant. Some 26.7% of beekeeper farmers were unable to read and write which were considered as illiterate. Only 6.7% of the respondents were single and the majority of them married. The total numbers of bee hives with honey bee colonies and total honey production by hive type were described in table below. The average honey production in box, transitional and traditional hives was 42, 7.9 and 6.9 kg/hive respectively. The result of average honey production in traditional hive was above the national average (CSA, 2016/17). Based on the beekeeper farmers response, the majority 27/41(65.9%) of modern beekeeping equipment and accessories were purchased in the market and the remaining 35.1% given by livestock agency, research centers and NGOS

Table 1. Socio-demographic characteristics of the beekeeper farmers

Parameters		**Total number %**
Sex	Male	114/120 (95%)
	Femal	6/120 (5%)
Livestock ownership	Yes	116/120 (96.7)
	No	4/120 (3.33%)
Land ownership	Yes	112/120 (93.33%)
	No	8/120 (6.7%)
Religion of the beekeeper	Orthodox Christian	45/120 (37.5%)
	Protestant	3/120 (2.5%)
	Muslim	69/120 (57.5%)
	Catholic	3/120 (2.5%)
Education level	Illiterate	32/120 (26.7%)
	Literate	88/120 (73.33%)
Marital status	Single	8/120 (6.7%)
	Married	112/120 (93.33%)
Ownership of beekeepers	**Mean**	**Standard deviation**
Land ownership in hectare	1.9	1.2
Family size	7.74	3.9
Honey bee colony ownership		
Traditional hive	3.33	7.1
Transitional hive	0.52	1.58
Box hive	2.43	8.5
Hive types	**Total number of hives with colonies**	**Average honey production in kg /hive**
Box hive	292	42
Transitional hive	62	7.9
Traditional hive	399	6.9
Source of beekeeping technologies		
Market	27/41(65.9%)	
Livestock agency	3(7.3%)	
Research centers	7(17%)	
NGOS	4(9.8%)	

Table 2. Ownership of beekeeping accessories in the adopters and none adopters of modern beekeeping technologies

Beekeeping accessories	**Adopter (57) %**	**Non adopter(63) %**
Personnel protective close	28(49%)	1(1.5%)
Smoker	21(36.8%)	1(1.5%)
Bee veil	25(43.9%)	2(3.2%)
Hand glove	22(38.6%)	5(7.9%)
Boots	26(45.6%)	7(11%)
Uncapping fork	8(14%)	0
Bee brush	16(28%)	0
Queen excluder	18 (31.6%)	0
Queen cage	5(8.8%)	0
Honey extractor	10(17.5%)	0
Sieve	2(3.5%)	0
Casting mold	3(5.3%)	0

Modern beekeeping technology adoption

Modern beekeeping technologies were defined as any beekeeping technologies (modern, hives, transitional hives and the accessories) other than traditional hive. The beekeeper that have at least one of the modern beekeeping technologies were considered as adopter. Based on this definition, out of 120 beekeepers interviewed 57 (47.5%) were adopters of modern beekeeping technologies and the remaining 63(52.5%) of them were non adopters. Regarding box hive adoption 48/120 (40%) of the beekeepers were using the hive during interview. Out of the total respondents interviewed 54(45%) were experienced use of modern box hive but 6/54(11.11%) discontinued using modern box hive because of lack of bees wax, absconding of the colony after transferring from traditional hive to box hive and in availability and high cost of modern beekeeping technologies including accessories. The result is different from the research report of Gebiso, (2015) who report 6.8% dis adopted due to various reasons and box hive adoption of 22%. The adoption and dis adoption percentage of our study result was high compared with Gebiso result. This result indicated that the beekeepers adoption rate increased through time on the use of the technology and as the same time dis adoption also increased because of the absconding of honey bee colonies during transferring from traditional hive to box hive, lack of accessories aggravated with high cost of modern beekeeping technologies.

The technology adoption by study districts are described under the (Table 3) below. The adoption and utilization of modern beekeeping technologies were not statistically significant at $p<0.05$). The adoption of modern beekeeping technologies were very low in Yiteya District than the rest .It is because of the effect of mechanized farming system of wheat production and indiscriminate application of agrochemicals. The producer farmers complaining about absconding and colony decline which could be because of application of agrochemicals in this District.

Table 3. Beekeeping technology adoption by district

Districts	Adoption of modern beekeeping technologies		Total
	Adopter (%)	None adopter %	
Digelutijo(Sagure)	16(50)	16	32
Lemubilbilo(bekoji)	16(53.33)	14	30
Tiyo	16(51.6)	15	31
Yiteya	9(33.33)	18	27
Total	57(47.5)	63	120
X^2 2.8 and p-value 0.4			

From the listed hypothesize factor for beekeeping technology adoption, only training on beekeeping technology, awareness creation, extension contact, market problem and availability of protective close were the major determinant factors of adoption of modern beekeeping technology. It is statistically significant at $p<0.05$)(**table 4).**

Half of the beekeepers have access to extension contact. The frequency of Extension contact of the beekeepers ranges from one to three times per year. The majority 30/60=50% of the respondents have the chance of to getting extension contact two three times per year and the remaining 50% get from once per year. From 44/120 (**36.7%)** beekeepers getting training, 50% of them get training on overall beekeeping management, chefeka hive construction and plantation of bee flora. Regarding the methods of training, 79.5% were given by both practical and theoretical and the remaining 20.5% of the training were given by group discussion.

Table 4. Association between different categorical variables and dependent variables

Determining factors	Adopter	Non -adopters	Total	X^2	p-value
Sex				0.02	0.9
Male	3	3	6		
Female	54	60	114		
Education level				0.8	0.4
Illiterate	13	19	32		
Literate	44	44	88		
Access to credit				0.9	0.3
Yes	0	1	1		

Table 4. continues

No	57	62	119		
Beekeeping training				5.4	0.02**
Yes	27(47.3%)	17(27%)	44		
No	30	46	76		
Experience sharing				1.3	0.3
Yes	33	30	63		
No	24	33	57		
Having Protective closes				21	0.001***
Yes	28(49%)	7(11%)	35		
No	29	56	85		
Absconding				0.2	0.6
Yes	48	51	99		
No	9	12	21		
Awareness on modern beekeeping technology				21	0.001***
Yes	51(89.5%)	32(50%)	83		
No	6	31	37		
Marital status				0.02	0.9
Married	53	59	112		
Single	4	4	8		
Extension contact				3.3	0.07*
Yes	33(58%)	26(41%)	59		
No	24	37	61		
Types of beekeeping				1.5	0.2
Backyard	44	54	98		
Under the roof	13	9	22		
Market problem				9.9	0.001***
Yes	24(42.1%)	15(23.8%)	39		
No	33(57.9%)	48	81		

Major constraints of beekeeping production

Modern beekeeping technology adopters were given a chance to list the major production constraints and ranking with proportional piling were done to prioritize the constraints. Beekeeper farmers mentioned more than fifteen production constraints. Based on the results of the proportional piling high cost of beekeeping materials, lack of modern beekeeping skills and indiscriminate application of agrochemicals were ranked 1st, 2nd and 3rd respectively. The major constraints are described under (**Table 7)** below. Our result is similar with Abebe et al (2014) and Mulualem and Teklemedhn, (2018).

Table 5. Major constraints of modern beekeeping technology adoption

No	Beekeeping constraints in study areas	Number and Percent (%)	Rank
1	Lack of beekeeping materials	89/120 (74.2 0)	4th
2	Low-quality of beekeeping materials	13/120 (10.8)	13th
3	High cost of beekeeping materials	94/120 (78.3)	1st
4	Honey bee diseases, pests and predators	88/120 (73.3)	5th
5	Reduction of honey bee colony	34/120 (28.3)	11th
6	Shortage of honey bee colony	66/120 (55)	6th
7	Indiscriminate application of agrochemicals	90/120 (75)	3rd
8	Lack of extension support	59/120 (49.2)	7th
9	Absconding of honey bee colonies	47/120 (39.2)	9th
10	Death of honey bee colonies	7/120 (5.8)	15th
11	Draught	53/120 (44.2)	8th
12	marketing problems for hive products	25/120 (20.8)	12th
13	Lack of beekeeping skill	93/120 (77.5)	2nd
14	Lack of credit facility	35/120 (29.2)	10th
15	Lack of land	8/120 (6.7)	14th

CONCLUSION AND RECOMMENDATIONS

Nearly half of the beekeepers were considered as adopters. The adoption differences among the three districts were not statistically significant. Honey production from traditional hive is the common practice. High cost of the modern beekeeping technology and indiscriminate application of agrochemicals and lack of knowledge on beekeeping management are the major challenges to adopt modern beekeeping technology in the study areas. The majority of beekeepers buy modern beekeeping technologies from the market with high price. Awareness and knowledge on beekeeping technologies, extension contact, market problem and availability of protective closes were the major determining factors for adoption and beekeeping technology dissemination in the study areas. Policy intervention on the application of pesticides and agrochemicals, and availing modern beekeeping equipment should be in place to increase adoption of modern beekeeping technologies in the study areas. Formal training and awareness creation on modern beekeeping technology management practice should be in place to increase adoption of box hives.

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Competing interest

The authors declared that no any computing interest regarding this manuscript.

REFERENCES

Abebe Jenberie Wubie, Amssalu Bezabeh, Kefelegn Kebede (2014) . Floral phenology and pollen potential of honey bee plants in North-East dry land areas of Amhara region, Ethiopia IOSR Journal of Agriculture and Veterinary Science (IOSR-JAVS). 7(5):2319-2380.

Ethio-Italian Development Project (2002) Atlas of Arsi Zone. Arsi Agricultural and Rural Development Bureau, Assela,Ethiopia.

Feder, L., Just, R.E. and Zilberman, O (1985) . Adoption of Agricultural Innovation in Developing Countries: A Survey.Economic Development and Cultural Change, 32: 255-298. http://dx.doi.org/10.1086/451461

Federal democratic republic of Ethiopia central statistical agency agricultural sample survey 2016/17 [2009 e.c. volume ii report on livestock and livestock characteristics 585 statistical bulletin 585 Addis Ababa April 2017.

Gebiso T (2015) .Adoption of Modern Bee Hive in Arsi Zone of Oromia Region: Determinants and Financial Benefits, Agricultural Sciences, 6: 382-396. http://www.scirp.org/journal/as http://dx.doi.org/10.4236/

Gebremariam, H. (1992) Availability and Use of Seed in Ethiopia. Program Support Unit, Canadian International Development Agency (CIDA), Addis Ababa

Gezahegne, T (2001). Marketing of honey and beeswax in Ethiopia: past, present and perspective futures. In: Proceedings of the third National Annual Conference of the Ethiopian Beekeepers Association (EBA), Addis Ababa, Ethiopia. Pp, 78- 88.

Holeta Bee Research Center (2004). Beekeeping Training Manual. Holeta, Ethiopia.

Kassaye, A (1990). The Honeybees (Apis Mellifera) of Ethiopia. A Morphometric Study. M.Sc. Thesis, Agricultural University of Norway, As, Norway.

Mulualem Ambaw and Teklemedhn Teklehaimanot (2018). Characterization of beekeeping production and marketing system and major constraints, in selected districts of Arsi and West Arsi zones of Oromia region in Ethiopia. Journal of Entomology and Zoology Studies, 6(2): 2408-2414.

Nuru, A (2002) . Geographical races of the honeybees (Apismellifera-L.) of the Northern Regions of Ethiopia. PhD dissertation.Rhodes University, Department of Zoology and Entomology,South Africa. Pp, 265

The National Regional Government of Oromia, Bureau of finance and Economic Development—Regional Statistics (2012). http://www.oromiabofed.org/