

Factors affecting adoption of beekeeping and associated technologies in Kamrup (rural) district, Assam state, India

Abstract

Apiculture is a way of life and management of caring of bees in a scientific way. Beekeepers should not only think that the only product in beekeeping is honey whereas products like pollen, propolis, wax, royal jelly and venom, the queen, the beehives and the apicultural materials are other products that constitute it. To improve the fabrication and productivity of beekeeping, it is important to adopt improved beekeeping technologies. In this present study, separate open pre-structured questionnaire survey for both beekeepers and non-beekeepers were used. To assess the socio demographic characteristics, types of hives, average production per hive, colonization rate, hive baiting, inspection, cleaning and protection, and constraints faced in beekeeping, location and form in which hive products are marketed, factors affecting adoption of the beekeeping, beekeeping equipment availability in different sources, and major pests and predator. It was observed that majority of the beekeepers lacked of working with capital. So, they do not produce the best quality honey product, either they sell it directly or in comb form. Due to the attack of pest, predator and diseases, and other internal and external constraints, the productivity of hives is not significant compared to their potential in the study region.

Keywords: apiculture, beekeepers, constrains, honey, technologies, questionnaire

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Introduction

In almost all part of the country, beekeeping is a well-established household activity. But, this sub sector has not satisfactorily benefited much to the nation as well as to the beekeepers, traders, exporter and processors. Due to existence of many constrains, the honey sub sector fabrication and productivity is very low and its contribution to country economy is much lower than it's prospective. Even if the intervention of the government to minimize the sub sector constrains is taken as a good practice, the beekeeper's are not still producing the amount what they are supposed to produce, Gidey & Mekonen.¹

Technical advancement of modern technologies and its application in modern livestock production has satisfied the basic needs of the rural people. But, the improvement of their living standards is still challenging, despite their technological advancement, Kugonza.² In the past, sufficient attention was not received to consider beekeeping as important livestock agriculture, Matanmi.³ In many countries it has been encouraged as a major rural development engine, (Bees for Development, 2000). The practice of beekeeping not only has intrinsic health benefits (nutritional value), but also requires few inputs and capitalize on already supply of pollen and nectar from the crop they pollinate.⁴

In most cases, beekeeping has remained traditional and never rewarding. Because of this, the yield of honey and other hive products have been constantly the same over the past years. It did not exceed 45kg per modern hive per year and not more than 7kg from traditional hive per year. Due to very weak market (major constraint) of this sub sector leads to low contribution to the country's economy. As well the traditional beehives are not contented for sanitation and high level of production, Gidey & Mekonen.¹ In less developed countries,

beekeeping is considered as an emerging agricultural practice for the rural inhabitants mainly due to its economic benefits from its products, Kugonza.²

The products obtained from the sub sector are still low as compared to its potential, although thousands of tons of honey are produced every year. To increase the yield and to improve the quality, the Tigray Government introduced modern beehives and Kenya top bar beehives and accessories. However, most smallholders could not increase their production because of relatively expensive equipment's to buy.⁵ This research lay emphasis to identify and explore the internal, external, social, managerial and administrative affecting factors of adoption and associated technologies in Kamrup district (Rural) of Assam, India.

General objective

The general objective of the study is to assess the affecting factors of beekeeping in Kamrup district (Rural).

Specific objective

- To identify the specific affecting factor that confronts beekeeper.
- To assess the perception of beekeeper towards their beekeeping in the study area.
- To explore the impact of the identified affecting factors for beekeeper.
- To give beekeeper awareness about ecological profile.
- To give important recommendation for the improvement of beekeeping performance.

Strategic objective

To reduce the direct and indirect affecting factors of beekeeping and promote the improvement of beekeeping.

Materials and methods

Study area

Deuduar is a mid-sized village located in the district of Kamrup in the state of Assam in India. It has a population of about 3,500 persons living in around 300 households. It is situated almost 30km away Guwahati. The 31 national highways go through middle of this village. Geographic location: 26°20'42"N- 26°34'51" N latitude and 91°43'35" E- 91°72'64" E longitude.

Pacharia is a medium size village located in Hajo, Kamrup district of Assam. It is located 11km towards East from district headquarter Goraimari, 11km from Sualkuchi, 15km from state capital Dispur. The place is the border of the Kamrup district and Kamrup metro district. Geographic location: 26°23'94"N latitude and 91°62'36"E longitude. Maniary village is located in Kamalpur Tehsil of Kamrup district. It is situated 15km away from sub district headquarter Kamalpur and 18km away from district headquarter Amingaon. Geographic location: 26°11'06"N latitude and 91°83'36"E longitude. Gerua village is located in Hajo Tehsil of Kamrup district. It is situated 5km away from sub-district headquarter Hajo and 35km away from district headquarter Amingaon. Geographic location: 26°19'24"N latitude and 91°64'16"E longitude (Figure 1).

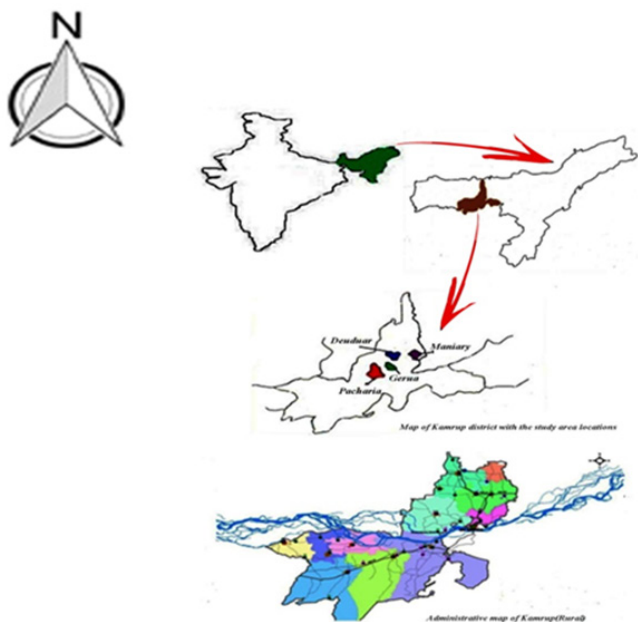


Figure 1 Map of the study area.

Sample selection and sampling technique

Randomly and purposively 60 farmer households from four villages viz, Deuduar, Borka, Pacharia, and Gerua in Kamrup District (Rural) were selected to respond to a (structured) standard questionnaire. During sampling 10 adopter's (active participant's) and 10 non-adopter's (never carried out beekeeping) households were selected.

Data collection

Direct observation: The survey initiated on November 2016. In the area of Kamrup (Rural) district, four villages (sites) were visited as Deuduar village, Borka village, Pacharia village and Gerua village, where the beekeeper used to practice beekeeping in their small household. Some farmer at Deuduar village used to hunt the bee colony from the nearby hills which are covered by bee colony. Very less farmer in Kamrup (Rural) district make the profession of beekeeping. Most of the bee colonies were found along their own made hive in these villages. The size of the hive, area of the hive, plantation in nearby bee hive, affecting factors in hive, protective measure, ecological profile were observed. Bee colonies are best studied during winter season, because in the summer they migrate to the other distance places.

Indirect observation: During the survey interviews were conducted following an open pre-structured questionnaire to obtain information about affecting factors of beekeeping, ecological condition, protective measure, productivity, marketing of productivity etc.

Results

Results section provides an overview of the beekeeping practices and the affecting factors of adoption of beekeeping and the respondents in Kamrup (Rural) district based on the questionnaire survey results and data observed. The respondents sometimes include more than one data. Thus, in this part sometimes data are not mutually exclusive. Table 1 & Table 2 provide the socio demographic characteristics, apiary characteristics and the socio-ecological, administrative and managerial affecting factors in beekeeping.

Table 1 Socio demographic characteristics of beekeeper in Kamrup (Rural)

Variables (n=40)	(% of beekeeper location wise			
	Maniary	Pacharia	Deuduar	Gerua
Gender of beekeeper				
Male	100	100	100	100
Female	0	0	0	0
Age group				
18-28	30	20	40	30
29-39	50	60	50	40
40-50	20	20	10	30
Education level				
Primary	40	60	50	40
Secondary	60	40	50	60
Experience in beekeeping				
1-5	40	20	30	60
6-10	40	50	50	40
11-15	20	30	20	0
Sources of capital for beekeeping				
Savings	60	60	70	70
Government	20	20	20	20
Financial institution	20	20	10	10

Table 2 Socio demographic characteristics of beekeeper in Kamrup

	Sources of household income			
	Maniary	Pacharia	Deuduar	Gerua
Paddy	70	60	50	60
Vegetables	30	60	40	40
Bananas	20	30	30	20
Dairy	10	20	20	20
Potato	40	40	30	30
Beekeeping	20	10	10	10

In the Kamrup (Rural) district, 100% of the beekeeper owned Langstroth hive (Table 3). Due to low cost and high colonization rate, traditional hives were popular and productive, but Langstroth hives were the most productive due to their superior design in yielding good quality honey and wax.

Table 3 Types of hive, average production per hive and colonization rate

Variables (n=40)	Proportion (%) of beekeeper			
	Maniary	Pacharia	Deuduar	Gerua
Types of hive				
Langstroth	100	100	100	100
Production per hive(Kg)				
Honey	2-3	3	2.5-3	2-3
Colonized hive	100	100	100	100

In Kamrup (Rural) district, 90% of the beekeepers inspect the colonized hives at least once or twice per week, ensuring the hive arrangements, position, and are intact, in case predators, pest or unfavourable weather have disturbed them. 5-10% of the beekeepers inspect the hive regular basis but it gives the bees stress. Beekeepers mostly checked the hive arrangement in inspection. They also checked the honey deposition, colonization of the hive and the presence of pest, predator and diseases. 80-100% of the beekeepers do the cleaning of apiary once in a month and the rest of the farmers do the cleaning two times in a month. The beekeepers in the study area are experienced, so they know how the security of the bees is ensured. To protect the hive from pest attack beekeepers place the hives at high level. They make the protective measure at home. Cleaning of the beehive includes slashing, sweeping and cleaning inside the hives (Table 4).

The main constraints in apiary are lack of equipment for improved hives, hive tools and harvesting gears (Table 5). Most of the farmers practice beekeeping through hiring the equipment from the fellow farmers. Bad weather and pests causes the major damage in the study sites. Due to changing weather and reduced in flowering pattern makes the harvest less. Heavy rains destroyed the hives too.

Table 4 Hive baiting, inspection, cleaning and protection

Variables(n=40)	Proportion of beekeeper (%) in the study area			
	Maniary	Deuduar	Pacharia	Gerua
Are bee hives usually baited?				
Yes	90	90	80	100
No	10	10	20	-
Types of hive bait used				
Bees wax	70	80	80	90
Cattle dung	30	20	20	10
Inspection frequency of colonized hive				
Daily	10	-	-	10
1-2 times aweek	90	90	90	80
Once a month	-	10	10	10
What is checked at inspection?				
Hive arrangement	60	50	60	60
Honey deposition	10	10	10	10
Colonization	10	10	10	10
Disease and pest presence	20	30	20	20
Apiary cleaning frequency				
Once a month	90	100	90	80
Twice a month	10	-	10	20
How the security of the bees is ensured?				
Fencing the apiary	30	20	30	10
Putting the hives at high level	70	80	70	90

Table 5 Constraints faced in beekeeping in the study area

Variables (n=40)	Proportion of beekeeper (%)			
	Maniary	Deuduar	Pacharia	Gerua
Lack of equipment	60	60	50	60
Bad weather	20	20	20	20
Pests and diseases	30	30	30	30
Labour shortage	10	10	10	10
Inadequate skill and knowledge	20	30	20	20
Low price in market	40	40	30	40

In Kamrup (Rural) district, Honey is the major marketable product of beekeeping. Most beekeeper used to market the honey in

a semi refined form, i.e. after comb pressing and followed by sieving resulting in removal of most of the wax and other impurities. Some of the beekeeper also markets it in comb form. They usually used to market the products at local shop and also at home as per ordered (Table 6). Sometimes they increased the rate as the demand increase. Several factors are found to be affecting the adoption of beekeeping as reported by both adopter's and non-adopter's. Most serious factors effecting adoption of beekeeping are a) Bee phobia i.e. aggressive behaviour of bees to sting, b) Lack of start-up capital, c) Inadequate skills, and d) Lack of safety equipment's. Limiting factors for both the beekeepers and prospective beekeepers is the inadequacy of skills and knowledge in bee farming (Table 7) (Table 8).

From the survey of the four sites in Kamrup (Rural) district it is found that lake of equipment is the highest rated constraints in beekeeping (Table 9). Wide range of accessories and equipment's were enlisted including protective clothes, cage (queen catcher), containers, brush, smokers, etc. these can be either homemade or sometimes available in the local market. 80% of the beekeeper uses homemade beekeeping equipment (materials) made by themselves, 38% equipment from the market and the 30% of the materials provided by the government. Based on beekeepers opinion, locally made equipment's (materials) are of poor quality and the beekeeper's rarely uses the protective clothes during extraction.

Table 6 Location and form in which hive products are marketed

Variables (n=40)	Proportion of beekeeper (%) in the study area			
	Maniary	Deuduar	Pacharia	Gerua
Where hive products are sold?				
Locale shop	70	80	60	80
At home	30	20	40	20
What is done to honey harvested?				
Sell	80	80	80	80
Home consumption	20	20	20	20
Factors considered in setting sell price				
Current price	30	40	30	30
Quantity harvested	20	20	10	20
Demand	50	40	60	50
Form in which the products are marketed?				
Semi refined honey	90	70	90	100
Comb honey	10	30	10	-

Table 7 Factors affecting adoption of the beekeeping (%)

Variables	Beekeeper (n=10)				Non-beekeeper(n=5)			
	Maniary	Deuduar	Pacharia	Gerua	Maniary	Deuduar	Pacharia	Gerua
Factors affecting adoption								
Fear of the bees	40	40	40	40	30	20	30	20
Lack of start of capital	60	70	60	60	70	70	80	70
Inadequate skills	20	30	20	20	40	40	30	30
Lack of safety equipment	40	40	40	40	30	30	20	40
Government help needed								
Provision of startup capital	50	50	60	50	70	70	70	60
Training of beekeeper	100	100	100	100	90	90	100	90
Provide strengthen extension service	70	80	70	70	85	80	80	80
Ensure price control of products	30	20	20	20	20	30	20	20

Table 8 Factors affecting adoption of new beekeeping technologies

Variables (n=40)	Respondents found in the study area (%)			
	Maniary	Deuduar	Pacharia	Gerua
Level of income	70	70	70	70
Information about the technology	60	55	60	60
Cost of technology	65	65	60	60
Technicalities involved	30	25	35	30
Return from the technology	30	20	30	30
Adoption by neighbor	20	15	25	20

Table 9 Beekeeping equipment availability in different sources (%)

Equipment type	Homemade	Market	Provided by government
Hive	65	5	30
Gloves	-	70	30
Protective clothes	-	70	30
Water sprayer	75	25	-
Queen catcher	85	15	-
Queen excluder	100	-	-
Knife	-	100	-
Bee wax	60	40	-
Honey extractor	90	10	-
Honey container	85	15	-

Pests attack is the major problem for beekeeping in the study sites. Pests mainly affected the beehive are- termites, red ants and the vermin (Table 10). Considerably, beekeeping is one of the least labour intensive farming activities. But during swarming, beehive construction, honey extraction and colonisation, highest labour is needed. Like the shortage labour, inadequate skill and knowledge of beekeeper is also a major problem. So, the training is necessary for beekeeping. In the Kamrup (Rural) district all the beekeepers are trained except one or two.

Table 10 Percent of major pests and predator

Major pests and predator	Attack percent
Red ants	25
Termites	20
Vermin	10
Wax moth	12.5
Beetles	7.5
Spider	7.5
Lizards	10
Birds	7.5

Discussions

Based on the questionnaire survey result and observation, this section provides an overview of the beekeeping practices and factors affecting adoption of beekeeping in Kamrup (Rural) district. In this section, the discussions are presented comparing the similar studies in the other places. Similar studies were made towards the understanding of the internal, external, social, managerial and administrative affecting factors of adoption of beekeeping and associated technologies. Some of the similar studies are: Mujuni, et al.⁶ Department of Agricultural Production, School of Agricultural Sciences, College of Agricultural University and Environmental sciences, Makerere University, Uganda has done the study on the “Factors affecting the adoption of beekeeping and associated technologies in Bushenyi District, Western Uganda”. During their survey in Bushenyi District, Western Uganda the results revealed that majority (95%) of the farmers were male. More than 75% of the farmers were aged 30 years and above and the majority had attained formal education with 17.5% being tertiary education

graduates. Most farmers (37.5%) in Bushenyi had less than 6 years of beekeeping experience while 15% had an experience of over 16 years. In this present study it is seen that 100% of the beekeepers were male, not even a single female adopted beekeeping. Approximately 50 % of the beekeepers were aged 30 years and above and majority had attained formal secondary education (55%). Most of the farmers (40%) in Kamrup (R) had 6-10years of experience while 17.5 % had an experience of 15 years and above. Constraints in both the research are with close conformity, revealing phobia for bee stings, starting capital and hive equipment, inadequate knowledge and skills.

Similarly, Bunde & Kibet⁷ Chuka University, Department of Business Administration and Moi University, dept. of Economics has also studied about the “Socio-economic factors influencing adoption of modern beekeeping technologies in Baringo country, Kenya”. The purpose of this study was to determine factors that affect the adoption of modern Bee Keeping Technology in Baringo County. The study specifically investigated the levels of modern bee keeping technologies, challenges facing modern bee keeping farmers, the level of household income from bee keeping in comparison with other farm enterprises and socio-economic factors that influence the adoption of modern bee keeping technologies. The researcher adopted a combination of cluster, purposive and random sampling technique. The sample size was 294 bee keeping farmers. The questionnaires were used for gathering primary data. The data gathered was analyzed using descriptive statistics such as frequency, means and percentages with the aid of SPSS (IBM Statistics19).

Using these methods researcher revealed the results that bee keeping was practiced by 29.9% of the respondents and 70.1% farmers do not practice. The results indicated that majority of the household head were males 79.9% while 20.1% were females. The age distributions of the respondents were 20.7% were within the age of 18-25 years, 20.1% within 26-30 years, 20.4% are between the ages of 31-45 and 29.9% aged 36-40, while 8.2% are above 40 years. It was found that 33.8% of the respondents could not read and write. The main challenges being were lack of bee keeping materials, extension support, and lack of capital among other challenges. The results showed that the adopters mean age was smaller than the non adopters. The modern bee keeping farming contributes significantly to household income. Like the above studies Monga & Manocha⁸ Krishi Vigyan Kendra, Panchkula (Haryana) India has done the research on adoption and constraints of beekeeping in Haryana. Belie T,⁹ Ayalew^{10,11} and Edessa¹² studied about the major constraints in the beekeeping. In similar way, Beyene & Verschuer¹³ Adami Tulu, Agricultural research center, Ethiopia and Van Hall Larenstein University, Netherland have completed the study on the topic “Assessment of constraints and opportunities of honey production in Wonchi district South west Shewa zone of Oromia, Ethiopia. Their survey is not in agreement with this present research revealing the usage of traditional, transitional and modern hives technologies respectively, on the contrary farmers in Kamrup (R) use Langstroth hives.

Similar studies had done by Mujuni et al.⁶ in the different places such as Bushenyi district, Western Uganda, Baringo Country (Kenya), Panchkula (Haryana) and in the Wonchi District, South West Shewa zone of Oromia, Ethiopia. In this research contradiction findings were found in all the locations, which revealed results are not same. In this study area beekeeping activity is 100% male activity. In other places also beekeeping was dominated by males but a small percentage of female members also participated. In the Kamrup (Rural) district,

farmers used Langstroth hives. They have not attained traditional beekeeping. But in the Bushenyi district, Baringo Country and in Haryana both the traditional and modern beekeeping is adopted. In the Wonchi district farmers adopted traditional, transitional and modern bee hives. All the beekeepers in the Kamrup District are formally educated. In the other study areas, a small percentage of beekeepers were illiterate. In this study young aged beekeepers are very less but in Haryana, young and educated members have got more preference.

Conclusion

In case of constraints in beekeeping all the locations have mostly similar constraints such as lack of equipment, pest and predator attack, bad weather, lack of credit, inadequate skill and knowledge, fear for the bees, lack of starting capital to by hives and equipment, level of income, information about the technology, technicalities involved etc. Beekeepers from the different areas have major constraints of lack of equipment and pest and predator attack. In all areas beekeeping is the major source of household income, but in Kamrup (Rural) district beekeeping is not the primary source of household income. They mostly depend on paddy cultivation as a main source of income among the farmers.

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Conflict of interest

Authors declare there is no conflict of interest in publishing the article.

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