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Animal Production

Beekeeping in southern foothills of Bhutan: honey production, farmers' preference and constraints

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ABSTRACT

The objectives of the study were to understand the traditional and improved honey production methods under farmers' condition and evaluate farmers' preference for the methods. A field survey was conducted in Dunglagang and Patshaling *gewogs* under Tsirang *dzongkhag* and Jigmecholing *gewog* under Sarpang *dzongkhag*. Data were collected from 91 beekeepers. All sampled *gewogs* practiced beekeeping with both traditional and improved hives. Honey production from improved hives was significantly higher than the traditional hive. Beekeepers preferred improved hive over traditional hive because of higher honey production, easy to clean and extract honey, and less colony death. It was apparent that the improved movable frame hive with proper colony management was more promising for enhancing quality and quantity of honey than the traditional hive. Bee absconding, swarming, pest and predator were primary constraints faced by beekeepers in the study area.

INTRODUCTION

Beekeeping with local honeybees (*Apis cerana*) is an important activity in the foothills of Bhutan. Honey of *Apis cerana* fetches good price due to its medicinal properties to cure common ailments. Generally, beekeeping system is grouped as traditional, intermediate and improved system (Gentry 1982). In Bhutan, the beekeeping system is mostly traditional. However, recent studies by Tamang and Gurung (2015) have found both traditional and improved hive systems in five southern districts of Bhutan. Bhutan has tremendous scope for commercial beekeeping and honeybees have been found to aid pollination of diverse agri-horticultural crops and wild flora (Sivaram 2012). Therefore, creating awareness among the people might help to expand beekeeping activities and benefit crop production.

Tamang (2007) reported that the traditional method of beekeeping with *Apis cerana* in the southern foothills of Bhutan produced honey just sufficient for home consumption and treatment of common ailments. Sivaram (2012) also reported the similar scenario. In 2006, with the support from the International Centre for Integrated Mountain Development (ICIMOD), Bhutan introduced the improved hive technology, formed farmers' group, provided skills development trainings, and supplied beekeeping equipment to beekeepers. Despite all these efforts to modernize beekeeping system in the country, there is still no clear description of overall honey production system in the sub-tropical region of Bhutan. Therefore, a study was conducted in two *dzongkhags* (districts) with the objectives to understand the traditional and improved honey production at farmers' level, evaluate farmers' preference for honey production method, and identify constraints to beekeeping.

MATERIALS AND METHOD

Study area, sampling technique, and sample size

The study sites were beekeeping areas of Dunglagang and Patshaling *gewogs* (blocks) under Tsirang *dzongkhag* and Jigmecholing *gewog* under Sarpang *dzongkhag*. The beekeeping potential *gewogs* were purposively selected for the study since the improved movable frame hive technology was first introduced in these *gewog*s. The number of respondents included 40 members from *Jigmecholing Sibjam Gongphel* group, 31 members from *Dunglagang Sibjam Gonphel* group, and 17 members from Patashaling beekeeping group.

Data collection

The data were collected from both primary and secondary sources. Based on the information obtained from secondary source, a semi-structured questionnaire was designed and pre-tested for its consistency and applicability. The questionnaire gathered both qualitative and quantitative primary data on household socio-economic characteristics, honey production potentials, and constraints of beekeeping. The secondary data was collected from various literatures including reports, books, journal papers, statistics, unpublished documents, and online references.

Data analysis

Data was compiled and processed in Microsoft Excel and statistical analysis was carried out using Statistical Package for Social Science (SPSS) version 20. Descriptive statistics and inferential analysis were used for analyzing data and interpreting results. T-test and one-way ANOVA were used to analyze quantitative data and test differences between

variables. Correlation analysis was carried out to check relationships among the variables.

RESULTS AND DISCUSSION

Bee flora and crops grown

All respondents in all *gewogs* cultivated rice, maize, millet, buckwheat, mustard, vegetables and fruit trees. These crops were sources of nectar and pollen for bees. Respondents in all *gewogs* also cultivated cardamom and oranges as their main sources of income. Large fields of oranges and cardamom contribute as excellent pastures for the honeybees (Sivaram 2012). Some of the important wild bee flora in and around the vicinity of all *gewog*s were *Castanopsis tribulodes*, *Bombax ceiba*, *Termnalia alata*, *Rhododendron falconeri Brassica campestris*, and *Emblica officinalis*.

Honey production from traditional and improved hives

There was no significant difference in the number of hives between traditional and improved hives for all three *gewog*s (Table 1). However, the number of both traditional and improved hives differed significantly between *gewogs*. Patshaling and Jigmechholing *gewogs* had a significantly higher number of beehives than Dunglagang *gewog*.

Honey production from traditional hive ranged from 1.62 to 2.37kg hive^{-1}. Tamang and Gurung (2015) also reported similar honey production of 1.66kg hive^{-1} from traditional hive in Bhutan. However, honey production from traditional hive from all three *gewogs* was much lower than the average honey production of 7.7kg loghive^{-1} and 7.4kg wallhive^{-1} in Chitwan, Nepal (Pokhrel 2009). Honey production per improved hive was in the range of 3.55 to 4.33kg hive^{-1}, which is also lower than the average production of 8.1kg improved hive^{-1} in Chitwan, Nepal (Pokhrel 2009). Similarly, the honey production from all *gewogs* was slightly lower than the production of 5.10kg from a movable frame (Tamang and Gurung 2015). In this study, the low honey production could be due to poor health and small size of the colony, lack of forage, harsh weather, pests, and predators. The other explanation could be the poor management at farmers' level.

There was a significant difference in honey production between traditional and improved hives (Table 1). The overall honey production from improved hive was significantly higher by about two-folds than the traditional hive. This is because in improved hive, both internal and external inspections can be done as and when required, and super can be added for excess honey production, whereas in traditional hive, internal inspection is difficult and addition of super is not possible. Further, the honey from improved hive is extracted with the extractor ensuring more honey yield. But in traditional hive, honey is extracted manually by hand squeezing method, which is less efficient than the honey extractor. Improved hive under proper management can produce more honey of high quality compared to traditional hive. The greater honey production from improved hive in this study agrees with the finding of Gebremichael and Genremedhin (2014) that improved box hive is superior in quantity and quality of honey besides other desirable characteristics such as better swarm control, hive durability, and convenient to inspect and manage hives.

Hive preference and its advantage

Figure 1 shows farmers' preference for bee hive. Generally, over 84% of farmers preferred improved hive, about 10% preferred traditional hive, and less than 6% preferred both improved and traditional hives. Within *gewogs*, the result showed that 100% of the respondents in Pasthaling *gewog* preferred improved hive, followed by 90% in Jigmecholing *gewog* and 84.6% in Dunglagang *gewog*. Similar farmers' preference for improved box hive has been reported in Atsbi Wemberta district, Ethiopia. The greater preference for improved hive is mainly due to higher honey yield (Woodja 2011). Further, according to respondents, the preference for improved hive in all three *gewogs* is because clean honey can be extracted easily, hives are more durable, and more quantity of honey can be extracted compared to traditional hive. On the other hand, there are some respondents who preferred traditional hive because it is easy to manage and can tolerate cold weather.

Trend of traditional hive use

There was a general increase in the number of both traditional and improved hives in all three *gewogs* over the last four years (Figure 2). The increase in hive number could be due to better price offered for honey and growing interest of the beekeepers to expand bee farm. The increasing trend could also be attributed to continuous awareness programs and influences by promising benefits associated with improved hive compared to traditional hive. The training of farmers to improve skills could also have enhanced knowledge and confidence on beekeeping.

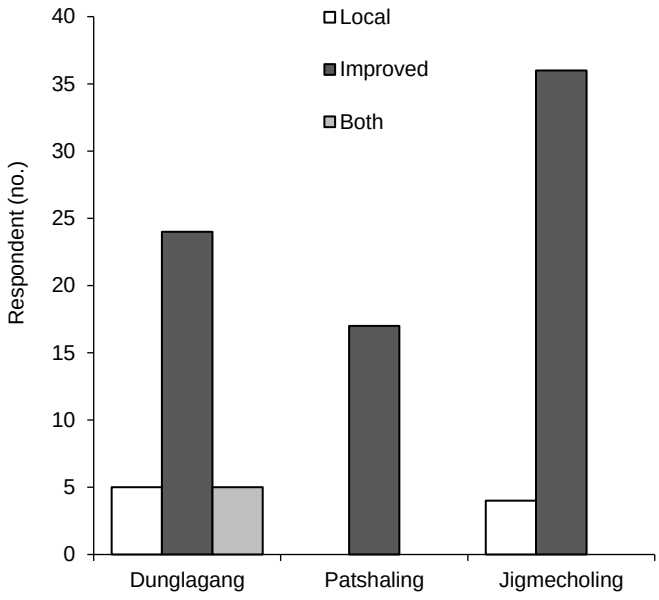

Figure 1 Farmers' preference for different types of bee hives.

Table 1 Average number of beehives and honey production per hive during season.

	Number of hives			Honey production (kg hive^{-1})		
Gewog	Traditional	Improved	*Sig.*	Traditional	Improved	*Sig.*
Dunglagang	2.00 ± 1.72	2.00 ± 1.61	ns	2.37 ± 1.46	4.33 ± 2.15	*
Patshaling	9.00 ± 8.22	7.00 ± 6.84	ns	1.62 ± 1.05	3.71 ± 1.46	**
Jigmecholing	7.00 ± 6.69	7.00 ± 5.33	ns	1.80 ± 1.16	3.55 ± 2.00	**
Sig.	***	***		ns	ns	

*p≤0.05, **p≤0.01, ***p≤0.001, ns: non-significant

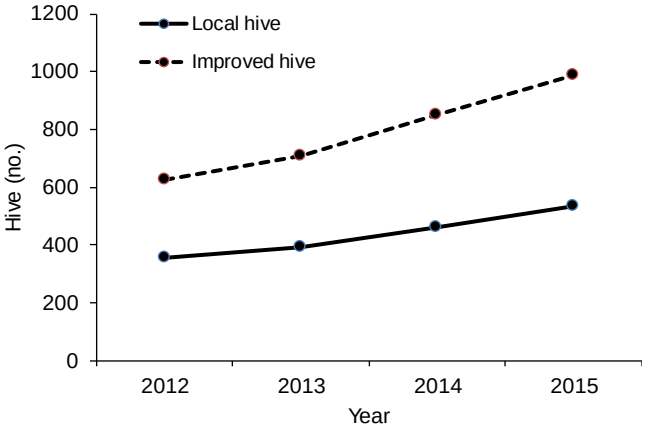

Figure 2 Trends in number of hive over four-year period.

Table 2 Swarming incidence in different *gewogs*.

	Months			
Gewog	Mar-May	Sept-Nov	Oct-Jan	Jan-Mar
Dunglagang	88.2%	11.8%	0.0%	0.0%
Patshaling	94.1%	0.0%	0.0%	5.9%
Jigmecholing	0.0%	0.0%	2.5%	87.5%

Honey extraction method

The type of honey extraction methods practiced by beekeepers is presented in Figure 3. Over 53% of beekeepers used squeezing and draining method, 4.4% used honey extractor (improved method), and 41.8% used both methods. Tamang and Gurung (2015) also reported that majority of beekeepers used squeezing and draining method of honey extraction.

Squeezing and draining method is mentioned as one of the oldest methods to extract honey. Respondents in all three *gewog*s perceived it as a convenient method compared to honey extractor (improved method). Moreover, it is cheaper compared to the extractor. It can be extracted easily by hand squeezing. However, squeezing and draining method has certain limitations. It takes more time compared to extractor and some of the respondents shared that it is difficult to get clean honey due to presence of comb in small quantities. The findings support that of Tamang and Gurung (2015) who reported that poor quality of honey was due to presence of combs, dirt, and debris. In addition, it also reduces the size of the colonies and in the process, most of the brood are killed.

The honey extractor was used less in all three *gewogs*. This is because only few number of extractors was distributed by the government to the farmers' group in the initial period. The extractor was used on a rotational basis. However, few respondents in all three *gewogs* bought the extractor on their own. Honey extractor is convenient, saves time, gives optimum output, and it is easy to use for extracting clean honey. On the other hand, some of the respondents in all three *gewogs* perceived honey extractor as unaffordable. Moreover, most of the respondents lacked skills on using honey extractor.

Constraints to beekeeping

The number of absconding incidences by *gewog* is presented in Figure 4. Jigmecholing *gewog* experienced a maximum number of absconding cases. In general, over 92% of respondents witnessed absconding and migration problems. In Asgede, Ethopia, due to absconding, an annual maximum loss was estimated to be about US$ 28,875 to 54,831. The causes were pests and predators, drought, shortage of feed and forage (Yirga 2011). Pradeepa and Bhat (2014) also supported the view that absconding is generally either due to disturbance to colony or depletion of resource. However, some of the respondents in Jigmecholing *gewog* believed that the use of chemicals, pests, and predators are reasons for absconding. Studies, however, show that it is the characteristic of honeybee, especially *Apis cerana*, *Apis mellifera* and *Apis florae* to abscond, migrate and swarm (Saville and Acharya 2001).

Swarming is a natural phenomenon by which new honeybee colonies are formed due to queen bee leaving the colony with a large group of worker bees. Swarming remains as a challenge for the beekeepers. All respondents found the incidence of swarming in their apiary. About 93% responded that swarming occurs every year and about 4% responded that it occurs only once in two years. In all three *gewogs*, swarming occurred in different seasons. In Dunglagang and Patshaling *gewogs*, swarming was reported to occur from March to May. However, in Jigmecholing *gewog*, maximum swarming occurred from January to March (Table 4). The difference could be because of topography, climate condition, and flowering season of diverse crops. In order to prevent swarming, some of the respondents in all three *gewogs* shared that they destroy the queen cell, harvest honey, and add super. Koetz (2013) asserts that *Apis cerana* swarm frequently compared to *Apis mellifera* and precautions should be taken to minimize it.

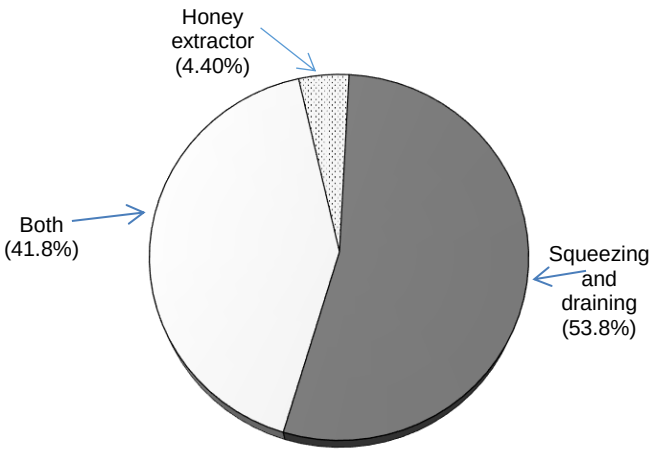

Figure 3 Proportions of beekeepers practicing different methods of honey extraction.

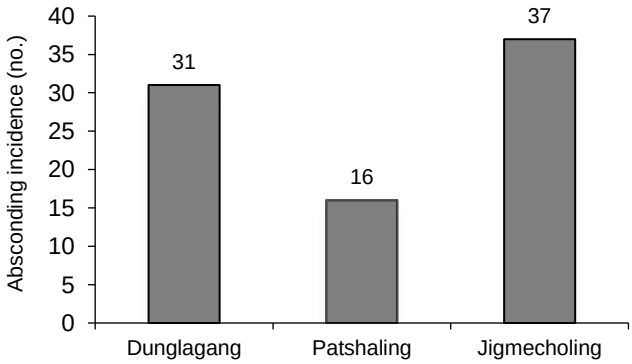

Figure 4 Number of absconding incidence in different *gewogs*.

CONCLUSIONS

Beekeeping with traditional and improved hiving system are two main methods identified to manage honeybees in all three *gewogs*. In all *gewogs*, the majority of respondents prefer improved hive because clean and higher quantity of honey can be produced, hives are more durable, more quantity of honey can be extracted, and the bees are not killed while harvesting

compared to traditional hive. Therefore, promotion of improved hives and training on its optimal utilization are needed in all beekeeping potential areas in the country.

The average honey production per hive in traditional and improved method is 2.68±0.99kg and 5.41±1.67kg, respectively. In all *gewogs*, the number of hives, both traditional and improved, are increasing over the years, indicating growing interest of farmers to take up and expand the beekeeping activity.

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