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Beekeeping: Sustainable Livelihoods and Agriculture Production in Nepal

Kedar Devkota

Abstract

Nepal has tremendous opportunities on the beekeeping due to the richness in the honeybee's species and the availability of plenty pasture diversity. There exist four native honeybee's species *Apis florea*, *Apis dorsata*, and *Apis laboriosa* are open nesting and *Apis cerana* halfway domesticated types. The beekeeping practices and production of the honey have been increased during the 10 years. Along with this, the natural honey export was also increased in recent years. The beekeeping in Nepal contributes to the economics boost up of the rural and marginalized landless farmers. Besides the economic contribution from the bees' products, beekeeping enhances the pollination services assuring the crop yields and helping to maintain the natural biodiversity from the Terai to the high Himalayans. Beekeeping gives the mutual benefits to both beekeeper and the crop farmers on the economic returns from the selling of the bee products and beehives and also increases the yields of the pollination-dependent crops by ensuring the efficient pollination services. These perspectives of beekeeping enhance the livelihoods of the farmers through the sustainable practices of beekeeping.

Keywords: beekeeping, diversity, economic benefit, livelihoods, pollination

1. Introduction

Beekeeping has been in practice from an ancient time in Nepal. It is one of the potential sectors to generate the employment and increase the income for the people in Nepal. Beekeeping is landless and marginalized based farming provides the economic, nutritional, and ecological benefits.

Beekeeping in the Nepal carried the tremendous potentiality due to the distribution of high diversified bee flora [1–3] and suitable climatic condition for honeybee diversity [4]. Although Apiculture contributes a very small fraction (less than 1%) to Agricultural Gross Domestic Product (AGDP), beekeeping has been considered as a high value income-generating agriculture activity in Agricultural perspective plan (APP), and it has also been mentioned in the tenth plan. The topographical, climatic, and floral varieties spell heaven for beekeeping in Nepal [5]. Five of the world's seven species of honeybee *Apis laboriosa* S., *Apis dorsata* F., *Apis florea* F., and *Apis cerana* F., and one exotic honeybee *Apis mellifera* L. are found from the plain to the high Himalayan in Nepal. The traditional log hives as well as modern beehives were in practices to keep the bees. Especially, the rural farmers from the

Himalayan regions kept the *A. cerena* in the traditional wooden log hives whereas the urban farmers from the lowland Terai kept both the *A. cerena* and *A. mellifera* on the modern beehives. The farmers in Nepal kept the bees to meet the demand of honey in the local, national, and international markets and also for the pollination in some crops like Oilseed crops, Buckwheat, and fruit crops to increase the yield. The bee species plays crucial role in the conservation of biodiversity by pollinating wild flowers in the entire region, and the species for ecotourism development and income generation in the poor, rural, and landless people in Nepal [6]. It helps to enhance agricultural productivity and conserves biological diversity and ecosystem through ensured pollination services [7]. Despite the huge benefits of beekeeping both in the term of economic and ecological aspects, the quantity and quality of honey production over a period of time was satisfactory may be due to the insufficient management of practices and lack of the training [8]. Beekeeping is very important to increase the productivity of the crops and increase the income of the farmers in the Nepal. In this context, the objectives of the study were to figure out the beekeeping situation by exploring the data on the number of hives, honey production and export situation through the electronic sources and the authorized government organizations.

2. Material and methods

This the theoretical work based on the secondary data and literature available about the beekeeping in Nepal. The secondary data on the beehives number and honey production were taken from the Centre for Industrial Entomology Development (CIED), Ministry of Agriculture and Livestock Development, Government of Nepal and the data on the export of honey were taken from the Trade and Export Promotion Center (TEPC), Ministry of Industry, Commerce and Supplies, Government of Nepal. The data were gathered and coded in the MS-Excel. The trend analysis on the different years, number of hives, production and the export situation was carried out using the ggplot in R program [9].

3. Results and discussion

3.1 History of beekeeping in Nepal

Beekeeping is a cultural heritage in Nepalese community, practiced from an ancient time as honey hunting has been dated back to thousands of years [10]. It is reported that little honeybee (*Apis florea*), rock bee (*Apis dorsata*), Asian bee (*Apis cerana*), and largest honeybee (*Apis laboriosa*) were native honeybees found in Nepal [11]. The exotic honeybee, European bee (*Apis mellifera*) was introduced in Nepal in 1994. Although, the scientific beekeeping in Nepal was initiated in 1989 with the introduction of moveable comb hive of native bee *Apis cerana*, however, commercialization of modern beekeeping geared up with the introduction of high yielding exotic honeybee *Apis mellifera* [12].

In 1980, Beekeeping Development Section (BDS) was formed for the development and extension of the apiculture under Nepal Agricultural Research Council (NARC) with mandated to conduct research on various aspects of applied entomology including industrial entomology [7]. Until 1990, *A. cerana* was the only one managed honeybee and was flourished throughout the country. Then after, *A. mellifera* was imported in large scale replaced the native bee *A. cerana* from the Terai region upto the mid-hills. *A. cerana* now remains with the farmers from the

hilly and mountain regions areas like Dhading, Humla, Jumla, Jajarkot, Kaski, Lamjung, Lalitpur, etc. *A. mellifera* has not arrived in these areas due to road and transportation inaccessibility, and also difficulties in the management practices such as keeping the colonies warm, feeding sugar, and migrating to low hill areas in winter season [1].

3.2 Statistics of beekeeping

Honeybees in Nepal are characterized through greatly variations based on the altitude and topography. More than 50,000 Nepalese households are involved in beekeeping, rearing 125,000 beehives and producing about 1100 t of honey per year [13], in which, 29.86% of honey produced from *A. cerana*, 39.19% from wild honeybees and 33.93% from *A. mellifera*. The honey produced from the *A. cerana* (rear in the traditional wooden loghives), *A. dorsata*, and *A. laboriosa* can be considered as organic, since the bees forages on the natural forests of remote areas in Nepal, where usage of pesticides and agrochemicals are considerably zero. There is rich tradition of beekeeping in different villages of Nepal, which is associated with genetic diversity of *A. cerana*, availability of bee forage plants, and a wealth of indigenous knowledge associated with wild honeybee harvesting. Although, Nepalese people have been rearing honeybees for many years, the scientific and commercial approach to beekeeping has been in practice fairly a decade ago. Therefore, modern commercial beekeeping is still in nascent stage.

In scenario of beekeeping industry, in Nepal, the honeybee industry includes 5700 registered beekeepers operating 55,000 hives. A hive is home to 25,000–70,000 bees, depending on the species [14]. The number of beehives, including those from non-commercial keepers was 280,000 in the 2017/2018 fiscal year, twice as many as 10 years ago, 2009; those hives produced 5500 tonnes of honey, more than six times the yield from 10 years ago [15].

From the data [14], the number of the beehives is increasing from 140,000 in 2009 to 280,000 in 2018. Similarly, as the number of hives increases, the honey production was also increasing during the 10-years period, which is shown in **Figure 1**.

The number of the beehives increased slowly from the year 2009 to 2013. After 2013, the number of beehives increased in higher rate as compared to the before. Likewise, the amount of the honey production was declined sharply in the year 2011, then after it starts to increase. The increase in the honey production as compared to the number of beehives was not satisfactory in the last 2–3 years.

3.3 Market scenario of honey

Honey is one of the important nutritive food produce of the bee containing various kinds of sugar, protein, free amino acids, minerals, trace elements, enzymes, and vitamins with a fairly high caloric value [16]. The production of the other products like wax, pollen, and royal jelly is not in practice in Nepal. Nepal is the only country in the world, where honey is produced between the ranges of 70 and 4200 m above the sea level. Honey produces in the Nepal are of multi floral and unifloral origin with a high medicinal value. The honey produced are of chiuri (Indian butter tree), mustard, buckwheat, rudilo (*Pogostomone spp*), sunflower, and fruits. The *A. mellifera* honey is produced in the Terai region, while *A. cerana* is very common in the hilly and mountain regions of Nepal. About 70% of the honey produced in Nepal comes from wild flora, which is by definition organic.

In Nepal, honey is also classified according to bee species, harvesting season, and geographical location. The average annual honey productivity of *A. dorsata*,

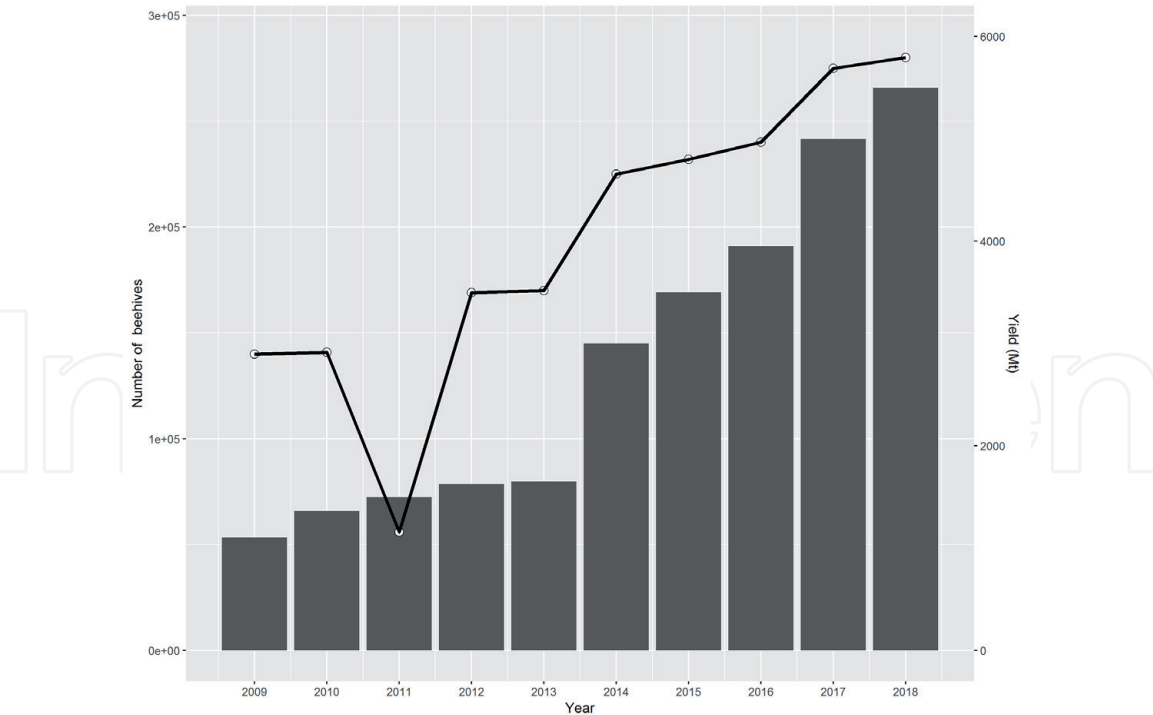


Figure 1.
Scenario of the number of beehives and the production of honey (mt) from 2009 to 2018.

A. cerana, *A. florum*, *A. laboriosa*, and *A. mellifera* L. is 5–5, 8–15, 1–5, 20–100, and 20–50 kg of honey per hive per year, respectively [17].

In recent years, the consumption of honey in Nepal has increased, particularly in the major cities and urban areas. The honey production depends on the availability of floral resources but it is presumed that approximately 1000–1500 metric tons per annum would be produced. However, around 50% of the honey is sold out in the national and international market, whereas the rest are consumed at village or district level [10]. The total annual domestic demand for honey is estimated to be about 300–350 tons. It is estimated that if honey consumption increased by 100 g per capita, then total demand for honey in the domestic market would be about 2800 tons per year [17].

The Nepalese honey market was extended to the India, UAE, Japan, South Korea, Thailand, USA, and Bangladesh. The imported honey is processed and provided to the other parts of the world [18]. According to [19], industrialized countries such as China and Argentina produce the honey at low unit cost, and export to the world market. However, Nepali beekeepers are unlikely to produce honey at prices that can compete with these major producing countries even though they are of varied resources. The price and volume of Nepali honey is not competitive compared to honey from its neighboring countries and supply of honey is also not consistent. This makes Nepali honey noncompetitive for mass market.

It is estimated that in the honey sector, an important proportion of the exports is happening via informal channels not reflected in official statistics. The key export markets for Nepalese honey are China, Malaysia, India, Japan, European countries, and the USA. Nepal exported 378 tons of processed and unprocessed honey in the fiscal year 2016/17, a majority of which was exported to China and India that accounted for a value of over Rs. 67 million [20]. The trends of the production and exports of the natural honey were shown in **Figure 2**.

This figure showed that the export of the natural honey was lowest in the year 2012–2014. Then after, it increased sharply in the year 2016. In the year 2017, it showed decreasing trend of export. The production of trends is increasing since

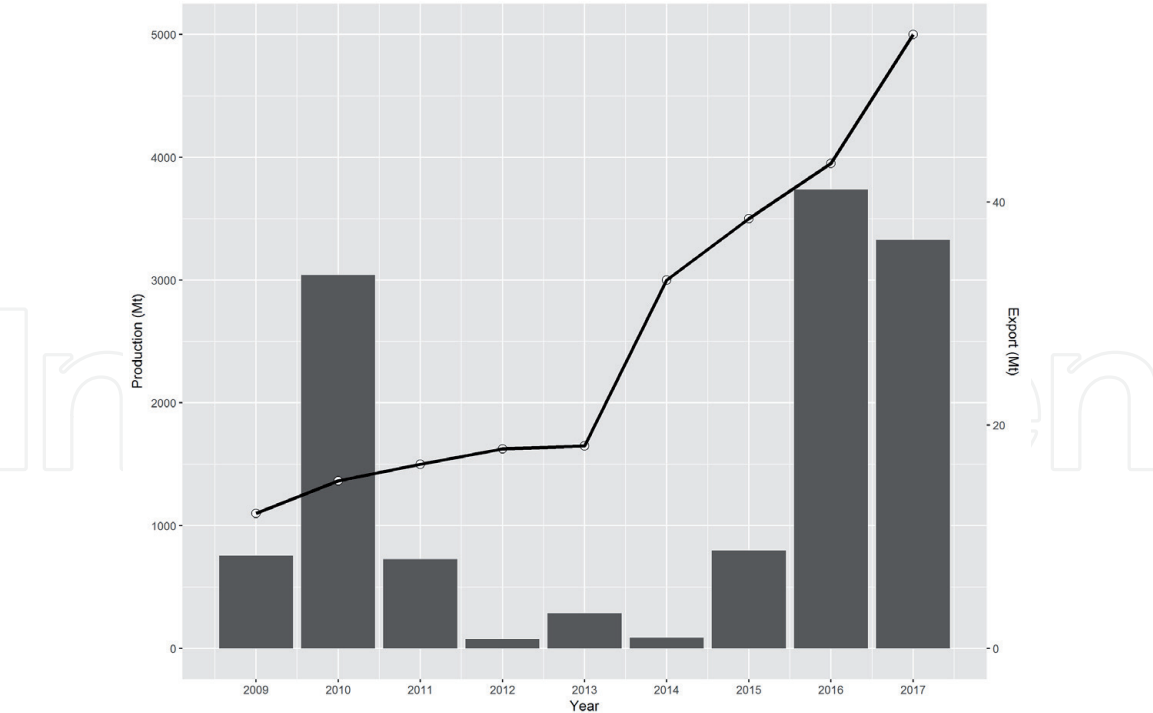


Figure 2.
Situation of the production and export of honey from 2009 to 2017.

the beginning of 2009, which shows the higher potentiality of the honey export from the Nepal.

3.4 Source of livelihood

The average landholding of small-scale farmers in Nepal is just 0.03 ha and many have less than 6 months of food security. Food security is not possible without income security; honey production through beekeeping could be a useful avenue for improving economy. Poor, marginal, and even landless farmers can benefit from beekeeping to support their livelihoods as it can be started even with limited resources giving income and supplying nutrition to them [21]. Beekeeping provides hundreds of families the chance to earn enough to provide for themselves, lifting them out of poverty for good. Honey sector is considered as one of the income-generating activities for resource poor farmers including women, youth, and under-employed sections of the community. Beekeeping is increasingly recognized as a market for numerous employment opportunities in the rural and urban areas of the Nepal. Beekeeping is also recognized as the gender-inclusive activity, where women also participate in the honey harvesting and collecting process. Over 500,000 farmers are directly or indirectly involved in beekeeping [22].

In the 15 years period of beekeeping history, the average price of honey from the *A. mellifera* has risen from about Rs 65 per kg to Rs 500 and for the honey from *A. cerena* risen to Rs 1200 per kg [23]. Beekeeping is critical for local development as it typically requires minimal investment, generates diverse products, can occur without land ownership or rent, and provide flexibility in timing and locations of activities.

Beekeeping could be the important agribusiness options to the landless and small-holder farmers in order to sustain their livelihood. Beekeeping being as a profitable business earning good income makes more people to engage for their sustainable livelihoods [24]. Beekeeping is attractive business and high proportion of the annual income is secured from beekeeping activities for many farmers in

the world. It helps in diversification of source of incomes for rural communities that help minimize the demands of land and pressure on forests. It requires little capital input, so it does not compete with other aspects of the farm system for the scarce resource [19]. Beekeeping has gained much attention as a means of raising the productivity of farm systems in the developing world. Beekeeping can also form the basis for gaining and transmitting knowledge about ecological processes [25]. Beekeeping can contribute to the pollination services, assuring crop yields, and can also be used to strengthen the livelihoods through commercialization to increase economic revenue. Beekeeping contributes to the provision of pollination services, assuring crop yields, and helping maintaining plant biodiversity in natural ecosystems. Honeybee pollination has been reported to increase seed production in oilseed, rapeseed, and sunflower seed, as well as the oil content in the seed, and beekeeping activity provides benefits in terms of employment, pollination of crops, and conservation of biodiversity [26].

3.5 Beekeeping for the crop production

The ecological importance of bees in crop pollination and the preservation of the biodiversity of both flora and fauna are unquestionable. Pollination is a valuable ecosystem service for the production of fruits, vegetables, nuts, cotton, and oilseed crops among many other agricultural crops [27].

Bees and other pollinators make important contributions to agriculture. Generally, the insect pollination contributes 35% of global yield of the agricultural production of 87 of the leading food crops worldwide [28]. The pollination-dependent crops seem to be five times more valuable than those that do not need pollination [29]. Honeybees are the single most important insect pollinator species for the diverse crop yield, both quantitatively and qualitatively [30].

The loss of insect pollinators has greater potential consequences on human food production directly through reduced crop yields. In these contexts of pollinator's declines, beekeeping contributes to the provision of pollination services, assuring crop yields and helping maintaining plant biodiversity in natural ecosystems [27].

Honeybees are the most efficient pollinators for the self-incompatible and cross-pollinated crops, which ensure the pollination services by maintaining the abundance of the pollinators during the flowering period [31]. The self-pollinated crops may also produce higher yields with good quality seeds showing their hybrid vigor without any alteration in the innate properties of fruits and seeds [7]. As managed insects, honeybee colonies are less vulnerable to several pressures affecting wild pollinators [32], thus can provide alternative insurance in case of wild pollinator losses, and effective service provision where wild pollinator populations are sub-optimal. The value from the crop pollination by the honeybees is much higher than the value of all the hive products.

Both domesticated honeybees species *Apis cerana* and *Apis mellifera* are being utilized for pollinating fruits, vegetables, oilseeds, and cereals crops. Pollination by honeybees increases fruit set, enhances fruit quality, and reduces fruit drop in apple, peach, plum, citrus, kiwi, and strawberry. Reports have also indicated an increase in fruit juice and sugar content in citrus fruits. The beekeeping has higher advantages in the crop production; however, integration of managed crop pollination as a component of agricultural development strategies is missing.

3.6 Future prospects and potential of beekeeping

Beekeeping and honey production in Nepal is still under development stage. Due to the climatic suitability and being a more profitable business, many farmers from

different regions start beekeeping with a small-scale investment to attain the sustainable. Along with the honey, bee products like bee wax, pollen, royal jelly, and queen bee production could also fetch the income for the farmers, which motivated them toward the beekeeping. It is estimated that the floral resources in the country can support over 1 million of beehives with production potential of 10,000 tons of honey annually [33]. The Nepalese honey demand is ever increasing in the international market. Due to this, the Nepal government has prioritized the honey and bee product as high value product [34]. Various ecotypes of indigenous honeybees have enriched Nepal with the excellent potentials for exploiting them for the production of various variable beehive products. There is tremendous scope to produce royal jelly, bee venom, and bee pollen in commercial scale in Nepal and export to foreign countries.

The honey along with other hive products such as propolis, royal jelly, and bee venom are poorly known to Nepalese beekeepers. Therefore, along with low-cost honey production technology with proper beekeeping management, disease, and pest control, research on other hive products, and their harvesting, and processing techniques are also needed [35].

There is an increasing demand for the Nepalese honey in international markets specially based on the honeybee species floral sources thereby indicating a huge potential for beekeeping in Nepal. Beekeeping can be started with very low investment, so that, even the poorest person can go for it with very little support. Thus, the beekeeping enterprise is very useful medium for the alleviation of poverty in Nepal.

A study conducted in Chitwan district [26] showed that beekeeping practices can improve the farmers' livelihood and also have great importance on the pollination, which helps to boost up the agricultural production in the country. The available resources in the country are favorable for production of honey, beeswax, and other bee products [10]. The woodland and natural vegetation managed in the national park and community forests are also providing the suitable conditions for the development of beekeeping. There is strong potential for the production of organic honey as chemical pesticides use is very low. The presence of the wild honeybees hanging in the high mountain and the domesticated honeybees in the wooden log hives managed by existing indigenous knowledge in beekeeping and honey hunting ensures potential for developing bee watch eco-tourism.

4. Conclusion

The varied diversity of ecological zones in Nepal, from the plains to the mountains favors the beekeeping. The beekeeping has been increased during a decade and the competitive market opportunities exist in the honey and honey products from the Nepal developed the domestic and international markets and reaching growing consumer not only in Nepal, but also large adjacent markets in India and China fetching good prices. The price of the honey was increased around 10 times during the 15 years period of beekeeping. Thus, beekeeping helps to earn the income and provides the self-employment opportunities to the poor and rural people, helping in the poverty eradication. Along this, bees are the major pollinator, which increases the crop yield that helps to attain the agricultural sustainable goals and creates the ecological balances by conserving the biodiversity. Beekeeping sectors show the high-growth potential of small enterprises with a holistic service offering, seeking to enable product, process, and business model innovation, thereby accelerating their growth and job creation and providing the pollination services increasing the crop yields. We can conclude that a new perspective relationship between

beekeeping and crop pollination, emphasizing that pollinator deficit can be mitigated through beekeeping, which enhances the livelihoods of farmers through greater crop yields and economic benefit received by selling bee products.

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