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Comparative Performance of Honey Production from Two Different Bee Hives in Bangladesh

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Abstract

The study was conducted in three districts viz., Sirajgonj, Gazipur and Satkhira during the mustard, litchi, and mangrove blooming period, respectively during 2015-2016 and 2016-2017 cropping seasons to study honey production efficiency of traditional hive and poly super hive. The study was carried out in paired plot design. Fourteen boxes were used in each setup, among them seven were traditional hive and seven were poly super hive. In Ullapara of Sirajganj district during 2015-16 poly super hive yielded the highest (17.03 kg hive^{-1}season^{-1}) honey. In 2016-17 (mustard) the highest honey was harvested from poly super hive operated at Tarash (18.63 kg hive^{-1}season^{-1}) and the lowest honey yielded in poly super hive at Shahjadpur. At Kapasia of Gazipur during 2015-2016 (litchi) the poly super hive produced the highest (20.46 kg hive^{-1}season^{-1}) honey yield cropping season and the lowest (20 kg hive^{-1}season^{-1}) was in Kaliganj (Gazipur district). On the other hand, during 2016-2017 it was observed that in poly super hive produced the highest (14.92 kg hive^{-1}season^{-1}) honey operated in Gazipur Sadar and the lowest (13.93 kg hive^{-1}season^{-1}) was in Kaliganj. In Satkhira during 2015-16 cropping season (mangrove) the poly super hive gave the highest (14.92 kg hive^{-1}season^{-1}) honey yield and it was obtained from Tala and the lowest (14.65 kg hive^{-1}season^{-1}) honey was yielded and it obtained in Kaliganj. Again during cropping season 2016-17 poly super hive produced the highest (12.5 kg hive^{-1}season^{-1}) honey and it was from Tala and the lowest (11.45 kg hive^{-1}season^{-1}) in Munshiganj. There was significantly less honey production was recorded in traditional bee hives than the poly super hive. During 2016-17 season honey production was higher than 2015-16 season at Sirajganj. However, opposite result was observed at Gazipur and Satkhira.

Keywords: Bee hives, honey production, performance, Bangladesh.

1. Introduction

Bee keeping is an important sub sector of agriculture and honey bees are the most crucial pollinator of agricultural crops and more than 80% of agricultural crops are more or less dependent on bee pollination (Klein *et. al.*, 2007). Though there are many type of bee products present in the bee hive i.e. honey, beeswax, pollen, propolis, royal jelly, bee venom etc., beekeepers only harvest honey and very little amount of wax from the bee hives in Bangladesh. Beekeepers do not collect pollen, propolis and other bee products from bee hive due to lack of available technology and inputs (Hossain, 2017).

In Bangladesh beekeeping is done in traditional single boxes where broods of honey bee and honey remain in same box, and during honey harvest broods of bee are damaged which is unhygienic and not scientific. On the other hand, bee management in wooden boxes encourages pest and diseases of honey bee, and therefore, using poly hive super box is effective to reduce pest and diseases of bee. However, it is clear that there is an urgent need to improve beekeeping sector not only for honey and other bee products production but also to attain food security of Bangladesh. The expectancy of beekeeping and especially honey production in Bangladesh is effulgent if handled with care in a scientific way. On the other hand, most of the beekeepers are migratory for keeping their colony productive. But, migratory beekeeping is very challenging and sometimes very struggle some due to transport dependence and there is no security system for beekeepers while shifting their bee colonies to explore floral sources.

Sher-e-Bangla Agricultural University (SAU) apiary is improved with different type of bee boxes and bee stocks. Research and development program is in progress at SAU apiary. Honey, Pollen and Propolis yield were increased in comparison to our traditional beekeeping method in three sites of Sirajgonj, Gazipur and Shatkhira (Sunderland area) districts. Appropriate carbohydrate based food sugar syrup ratio was fixed for maintaining bee hive in the dearth period. Natural pollen feeding effect was also observed in the dearth period. Different pests and diseases identification are ongoing in the field. Additionally, Beekeepers are reporting non-productive queens and drones which could be an effect of inbreeding depression. For improving stocks and lesser the chance of inbreeding depression a permanent bee breeding centre is inevitable to be added with SAU bee research system. However, Bees stocks are maintained at SAU apiary for queen breeding and drone breeding purposes.

The honey production improvement is a primary target for increasing yield of honey at different condition in Bangladesh from its present level. Keeping in view of the above facts, the present investigation was undertaken to assess the honey production efficiency in different hive setup viz., traditional wooden bee boxes and poly super hive (Langstroth) and to study the foraging behaviour changes in different districts viz., Gazipur, Sirajganj and Satkhira.

2. Materials and Methods

The studies were carried out during 2015-17 cropping season. The hive products production and honey collection efficiency of *Apis mellifera* L. was studied in Sirajgonj, Gazipur and Satkhira districts. Three upazillas i.e., Ullapara (Site 1), Shahzadpur (Site 2) and Tarash (Site 3) were selected for Sirajgonj district for the study. Similarly Gazipur Sadar (Site 1), Kapasia (Site 2) and Kaligonj (Site 3) upazillas were selected for Gazipur districts. Likewise Munshigonj (Site 1), Kaligonj (Site 2) and Tala (Site 3) upazillas were selected in sundarban areas of Satkhira district. The duration of study was 01 November 2015 to 30 May 2017. Peak mustard flower blooming period (Sirajgonj), litchi blooming period (Gazipur) and mangrove plants blooming period (Satkhira) were selected for data recording in these areas. Data collection of the predetermined parameters and the analysis of data was performed to measure the efficiency of honey bee in different types of hives.

The study was carried out in paired plot design. Flowers of Gewa, Kewra, Bain, Poshur and some other trees of sundarbon in Satkhira district were considered. Mustard in Sirajgang district and the litchi flower in Gazipur district were chosen. Fourteen hives were used for the study among them 7 were wooden hives and 7 were poly super hives.There were two different treatment viz., traditional wooden hive (Plate 1a) which was made by the local carpenter and Poly super hive (Plate 1b) which was made with food grade plastic (ApiMaye plastic) imported from Turkey. The honey was collected by using honey extractor. The collected honey was weighed by using weight scale.

a. Both tradition hive and poly super hive

b. Poly super hive

Plate 1. Plates showing a. both traditional hive and poly super hive, b. Poly super hives.

Data was analyzed using MSTAT-C computer program. Data was transformed following appropriate methods before ANOVA. Standard error calculated by MSTAT-C and plotting bars and boxes in R i386 3.4.0 (R Gui-32 bit) were performed.

3. Results and Discussion

3.1 Foraging behaviour of A. mellifera on Mustard flower

Honey bee forages on mustard flower to collect nectar and pollen. Data was observed from the morning 9:00 hour to afternoon 16 :00 hour. It was found that number of bees m^2min^{-1} was highest (13) at 12 :00 and 13:00 hours of day whereas the lowest (5) number of bees m^2min^{-1} was observed at 16:00 hours of day (Table 1). Average number of bees m^2min^{-1} was low in the morning and it reaches the peak over the time and from 14:00 hours of day bee foraging declined (Table 1).

Similar pattern of honey bee foraging was observed in terms of number of flowers visited min^{-1} (Table 1). The highest number of flowers visitedmin^{-1} of honey bee was observed from the morning 9:00 hour to 16:00 hour. It was found that number of flowers visited min^{-1} was the highest (25) at 12:00 and 13:00 hours of day whereas the lowest (10) number of flowers visited min^{-1} was observed at 9:00 hours of day (Table 1). Average number of flowers visited min^{-1} was low in the morning and it reaches the peak over the time and from 14:00 hours of day bee foraging started declining significantly. From this Table it is concluded that foraging efficiency i.e., number of bees m^2min^{-1} and number of flowers visited min^{-1} was lower in the morning and afternoon but at noon it was higher.

Table 1. Foraging behaviour of *A. mellifera* on Mustard flower

Day hours	**9:00**	**10:00**	**11:00**	**12:00**	**13:00**	**14:00**	**15:00**	**16:00**
No. of bees m^2min^{-1} (average)	8±0.036	9±0.03	11±0.02	13±0.145	13±0.02	8±0.002	6±0.031	5±0.073
No. of flowers visited min^{-1} (average)	10±0.01	17±0.02	21±0.06	25±0.039	25±0.06	21±0.04	18±0.03	12±0.04

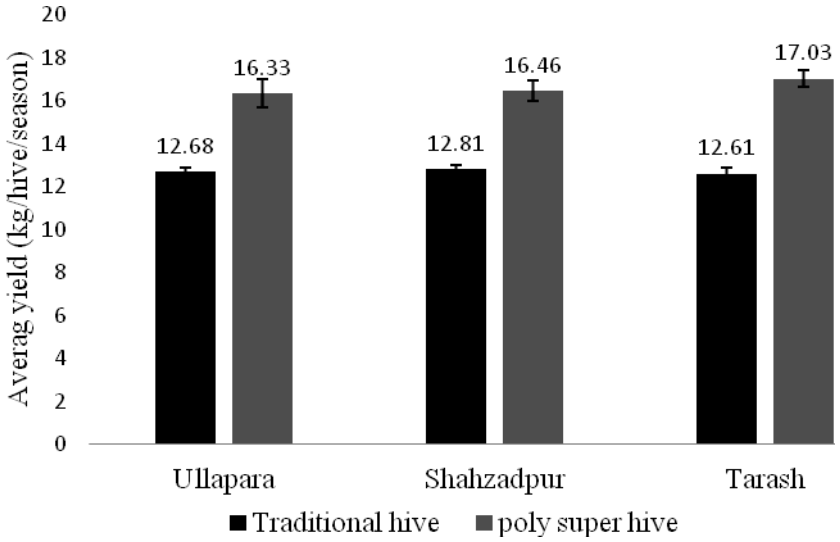

Figure 1. Honey yield hive^{-1} in three different locations of Sirajgonj during 2015-2016.

3.2 Honey yield hive^{-1} in three different locations of Sirajgonj district

Three different sites of Sirajgonj district were abundant of bee nectar during the mustard flowering period. In traditional bee hive the harvested honey was lower than poly super hive. It was observed that in the poly hive super the highest (17.03 kg hive^{-1}season^{-1}) honey yield was obtained from Ullapara and the lowest (16.33 kg hive^{-1}season^{-1}) honey yield was harvested from Tarash using poly hive super (Fig. 1).

There was considerable honey yield in traditional bee hives and it was lower from the modern poly super hives. The highest honey yield harvested with traditional bee hives from Shahjadpur and that was 12.81 kg hive^{-1}season^{-1} in 2015-2016. There is a significant variation in traditional hives from the poly super hive (Fig 1). Getachew *et al.* (2015) examined four bee types of bee hives: namely improved frame hive (Zander model), Kenya Top Bar Hive (KTB), Ethio-ribrab hive and traditional log hives under environmental condition of Bonga, southwest Ethiopia and observed the honey yield performances. The overall average annual honey yield performance clearly revealed both improved frame hive (30.09 ± 2.69 kg hive^{-1}) and Ethio-ribrab hive (29.22 ± 2.69 kg hive^{-1}) were significantly higher ($p < 0.0001$) than KTB hive (15.71 ± 2.22 kg hive^{-1}) and traditional log hive (15.36 ± 0.86 kg hive^{-1}).

On the other hand, the highest honey yield was harvested from poly super hive at Tarash, Sirajganj and that was 18.63 kg hive^{-1}season^{-1} in 2016-2017 and the lowest honey yield with poly hive super was in Shahjadpur. There was a significant variation between traditional bee hives and the poly hive super (Fig 2). Al-Ghamdi *et. al.* (2017) carried out a study on 182 beekeepers using cross sectional survey and employing a random sampling technique. The study indicated that honey productivity of modern hives were 72% higher than that of traditional hives.

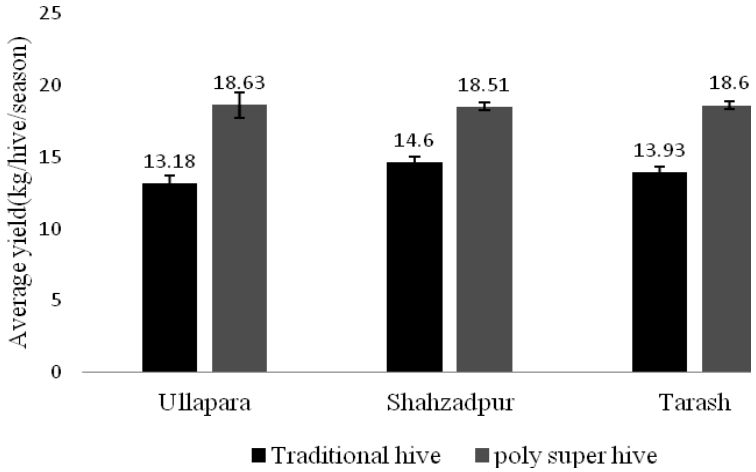

Figure 2. Honey yield hive^{-1} in three different locations of Sirajgonj during 2016-2017.

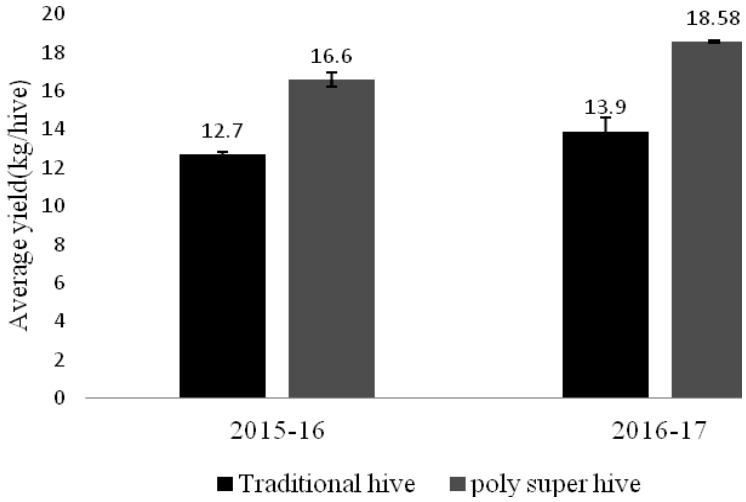

Figure 3. Yearly comparison of honey yield in Sirajganj district.

3.3 Year comparison

There was significant comparison that expressing honey yield between two successive years and in between traditional hive and poly super hive (Fig. 3). Figure 3 showed that in Sirajganj traditional bee hives operated in both seasons (2015-2016 and 2016-2017) yielded within the range of 12-14 kg hive^{-1}season^{-1} of honey whereas in Sirajganj poly hive super showed within the range of 16 to over 19 kg hive^{-1}season^{-1} . It was significantly expressing the lower capability of traditional bee hives than the poly super hive. On the other hand, in both cases year difference produced dissimilar data rather than equal contribution of honey yield (Fig. 3). Weldemariam (2015) performed a survey to collect information on the quality and productivity of modern (framed) hives which have been introduced at different years and the highest honey yield (31.5kg hive^{-1}) was record during the 2013 while the minimum (19.59kg hive^{-1}) was in 2009.

The probable reasons might be due to the variation of environmental factor (temperature, wind, RH etc) in two successive years which resulted difference in honey bee population and honey production in these years.

3.4 Honey yield hive^{-1} in three different locations of Gazipur

In traditional bee hive the harvested honey was lower than the poly super hive. It was observed that in the poly super hive the highest (20.46 kg hive^{-1}season^{-1}) honey yield was obtained from Kapasia and the lowest (20.11 kg hive^{-1}season^{-1}) honey yield was harvested in Kaliganj using poly super hive (Fig. 4).

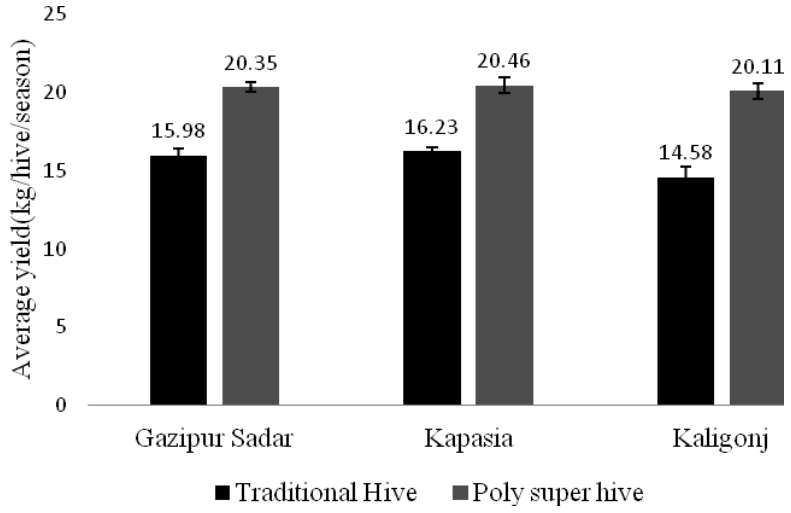

Figure 4. Comparison of honey yield during 2015-16 litchi flowering season in three locations of Gazipur.

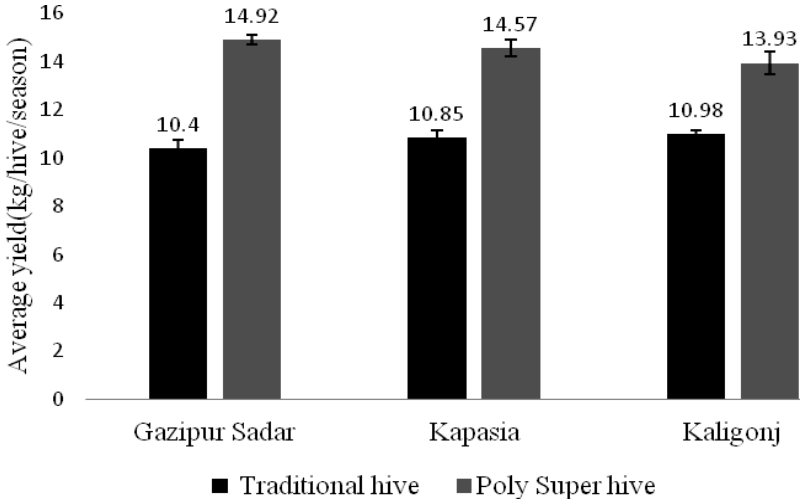

Figure 5. Comparison of honey yield during 2016-17 litchi flowering season in three locations of Gazipur.

There was considerable low yield found in traditional bee hives and it was significantly differed from that of modern poly super hives. The highest honey yield was harvested from traditional bee hives from Kapasia, Gazipur and that was 16.23 kg hive^{-1}season^{-1} (Fig. 4). Gebremedhn and Estifanos (2013) conducted a study to familiarize alternative new technology, Kenyan top bar hive (KTBH) with Modern beehive (MH) under farmers' condition. There was significant difference between modern and Kenyan top bar hive in honey yield. The potential productivity of the modern hive (22.8 kg hive^{-1}) was higher than the KTBH (17.8 kg hive^{-1}). In Bangladesh, honey yield from the modern hive (25.7 kg hive^{-1}) was significantly higher than the Kenyan top bar hive (17.8 kg hive^{-1}).

During 2016-17 litchi flowering period in three different sites of Gazipur district the traditional bee hive produced lower quantity of honey than the poly super hive. It was observed that in the poly super hive the highest (14.92 kg hive^{-1}season^{-1}) honey and it was obtained from Gazipur Sadar and the lowest (13.93 kg hive^{-1}season^{-1}) honey yield was recorded in Kaliganj using poly super hive (Fig. 5). There was considerable yield in traditional bee hives and it was significantly lower from the modern poly super bee hives. The highest honey yield harvested from traditional bee hive located at Kaliganj, Gazipur and that it was 10.98 kg hive^{-1}season^{-1}. Wongsiri *et al*. (2012) carried out a study on the organic honey in the kingdom of Thailand. The average annual honey production of a traditional bee hive was 3-5 kg year^{-1}, while that of a modern hive was 5-20 kg year^{-1}.

3.5 Year comparison

There was significant variation in honey yield within two successive years and in between traditional hive and poly super hive (Fig. 6). Figure 6 showed that in Gazipur, both of the traditional hive had honey yield within the range of 11-16 kg hive^{-1} whereas in poly super hive had honey yield ranged from 14 to over 20 kg hive^{-1}. It was observed that traditional hive produced lower amount of honey than the poly super hive. On the other hand, in both the year the honey yield was dissimilar.

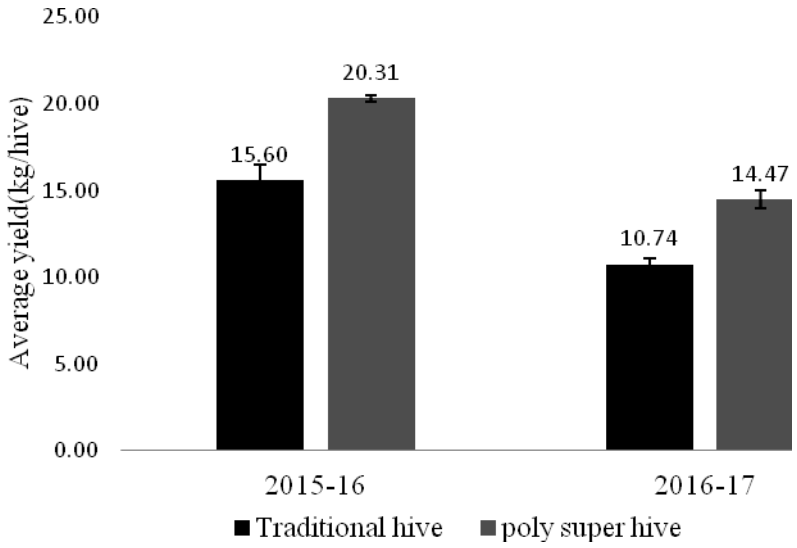

Figure 6. Gazipur litchi location honey yield comparison year basis.

Probable reasons of these variations of honey yield in two different year might be due to environmental factors (temperature, wind, RH etc) flower and bee population in two successive years.

3.6 Honey yield hive^{-1} in three different locations of Sathkhira

Three different sites of Satkhira district near Sundarban were abundant of bee nectar during the pick period of various flowers in Sundarban. In traditional bee hive the harvested quantity of honey was lower than that of poly super hives. It was observed that in 2015-16 the poly super hive had the highest (14.92 kg hive^{-1}season^{-1}) honey yield and that was obtained from Tala and the lowest (14.65 kg hive^{-1}season^{-1}) honey yield was obtained from Kaliganj using poly super hive (Fig. 7).

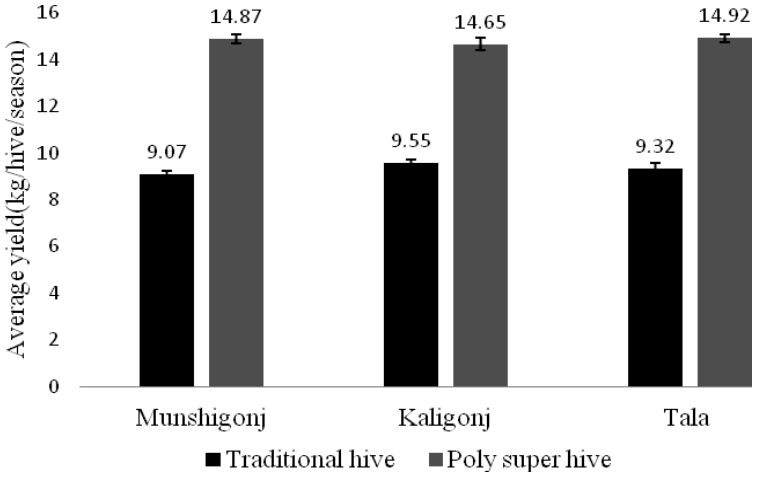

Figure 7. Honey yield hive^{-1} in three different locations of Sathkhira during 2015-2016.

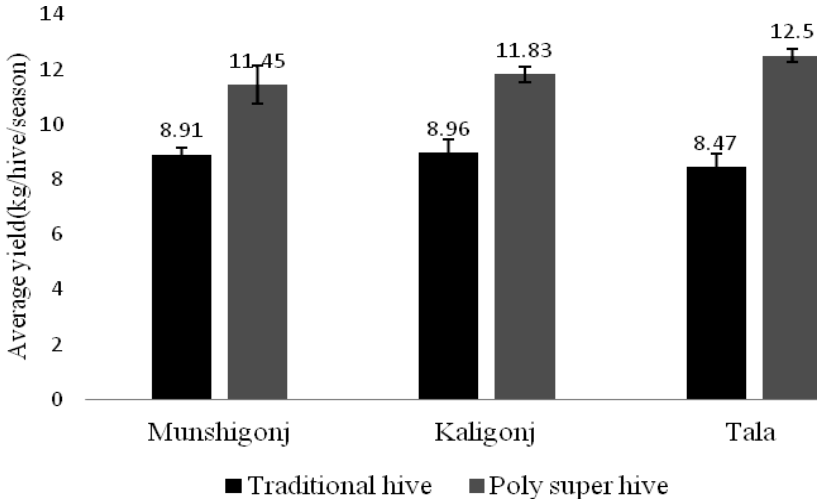

Figure 8. Honey yield hive^{-1} in three different locations of Sathkhira during 2016-2017.

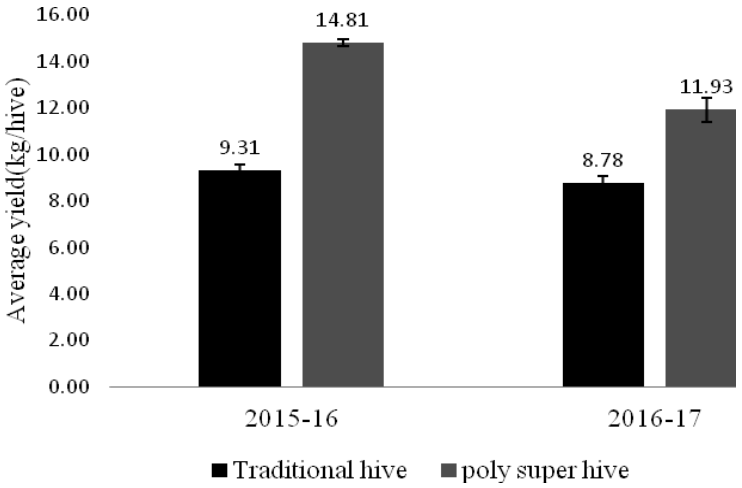

Figure 9. Yearly comparison of honey yield in Sundarban multifloral source.

On the other hand, in 2016-17 the poly super hive produced the highest (12.5 kg hive^{-1}season^{-1}) honey yield and that was obtained from Tala and the lowest (11.45 kg hive^{-1}season^{-1}) honey yield was obtained in Munshiganj using poly super hive (Fig. 8).

There was considerable yield in traditional hives and it significantly differed from the poly super hives. The highest honey yield harvested from the poly super hive and the quantity was 14.92 kg hive^{-1}season^{-1} from multi floral source in 2015-16.

In figure 9 showing the difference of honey yield at a glance using two different types of bee hives. There was also significant change in honey production between two successive years.

4. Conclusions

It was found that at 11:00 and 13:00 hours of the day the bee foraging was higher in comparison to other hour of the day in mustard flower and 10:00 and 12:00 hour of the day in litchi flower. In the year 2015-16 the poly super hive produced the highest (17.03 kg hive^{-1}season^{-1}) quantity of honey and was obtained from Ullapara and the lowest (16.33 kg hive^{-1}season^{-1}) in Tarash of Sirajgonj district. The highest quantity of honey was harvested from poly super hive at Tarash and that was 18.63 kg hive^{-1}season^{-1} in 2016-2017 and the lowest was observed at Shahjadpur. In year 2015-16 the poly super hive produced the highest quantity (20.46 kg hive^{-1}season^{-1}) honey and that was obtained from Kapasia and the lowest (20 kg hive^{-1}season^{-1}) honey harvested from Kaliganj. During 2016-17 traditional bee hive produced lower quantity of honey than that of poly super hive. In 2015-16 the poly super hive had the highest (14.92 kg hive^{-1}season^{-1}) honey yield and that was obtained from Tala and the lowest (14.65 kg hive^{-1}season^{-1}) was in Kaliganj. In 2016-17 the poly super hive produced the highest (12.5 kg hive^{-1}season^{-1}) honey yield and that was obtained from Tala and the lowest (11.45 kg hive^{-1}season^{-1}) yield was in Munshiganj.

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