Study on Beekeeping and Profit Investment Cost Analysis in Nakhon Pathom Province

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Abstract. *In this study, effects of feeding periods and feeding methods on bee population and honey yield were investigated. Apiculture was done three boxes, six frames each. The 40% (w/v) sucrose syrup was fed to bees for 21 days and harvest honey once. It was found that syrup feeding with 1,500 mL syrup in tray everyday feeding, once a day gave honey after roast 1,353.28 mL per month per box. The viscosity was 5,350 cP and the sweetness was 110 ◦Brix. Physical honey quality was surveyed from sample people's opinion, in Nakorn Pathom, Thailand. The satisfaction levels in taste and color were 73.3, 79.8 and 86.3%, respectively.*

Beekeeping profit analysis on three years started by 8 hives, 6 frames each in the first year, increase to 24 hives and 72 hives in year two and year three respectively, was as following: The first year investment cost was 47,464.80 baht with loss 19,595.20 Baht, the second year investment cost was 73,694.40 baht with loss 9,680.80 baht and the third year investment cost was 209,531.20 baht with profit 31,614.40 baht.

Keywords:

Apiculture, Feeding of honey bee, Compensation analyze and Payback period

1. Introduction

Nowadays beekeeping industry in Thailand has continuously expanded. From bee farm registration statistics in year 2009, there are 50 provinces where the bee cultures were operated. The highest fraction of operated farms was in the northern part which was 89.38% among the whole country. The second highest was the northeastern part which was 4.42% and following by the central part which was 3.40% then the last was the southern part which was 2.80%.[1] There were 206,412 bees hives contributed from 1,558 farms. The honey productivity was more than 10,000 tons, royal jelly 400 tons, wax 300 tons and bee pollen 800 tons.[2] Most of the products were consumed within the country, the least (25%) was exported. Currently, honey and bee product abroad markets has expanded to Europe which about higher demand of honey and bee products. However, most beekeeping industries are still grouped only in some provinces of the northern part. [3] The highest numbers of farm were from the provinces of Chiang Mai, Chiang Rai, Lampoon and Prae. This has led to insufficient supply.

Therefore, there should be a study for occupation, possibly in the central part. The research team, thus, carried out the study on profit analysis, cost investment and how to increase productivity, so that it is the information marketing beekeeping as occupation and educational level for higher productivity development including promoting the beekeeping to be an alternative occupation.

This research studied on beekeeping and collect data for cost and profit analysis and on how to increase honey, because Nakhon Pathom (NP) province is quite an arid area unsuitable for beekeeping, therefore, it feeds to increase feeding by giving them extra syrup in order that the honey received would be at high gravity and able to be sold. The tray laid on a frame which could be put inside the hive. The floatable material was put in the tray for comfortable to eating of bee. (Fig.1A) The 2nd hive was done by using a wooden box which was the same size as frame laid in parallel position.

Fig. 1 Method of feeding, by using two liter plastic tray laid on a frame. (A), a wooden box which was the same size as frame laid parallel inside. (B) and plastic bottle was punched at the lid and was put upside down to drop the syrup. (C)

2. Experimental

2.1 Material Typing

This study used Apismellifera, ligustica was known as the Italian bees. This strain is very adaptable in different kinds of the environment [4].

The experimental scenarios were held and tested at the Faculty of Engineering and Industrial Technology, Silpakorn University, Nakorn Pathom province during November to April due to being the best blooming period.

2.2 Method

2.2.1 Syrup feeding volume and period

The study was focused on 3 types of hives of the bees with different periods of syrup feeding within 3 days. The total volume of 40% (w/v) sugar solution used to feed the bees was 1,500 mL. The feeding time was 4-5 pm every day. The feeding volume of the 1st hive was 500 mL/day, the 2nd hive was 750 mL for the day 1 and the day 3. The 3rd hive, was 1,500 mL for the day 1. The whole period for the test was 21 days. The honey combs were harvested by using the knife. The whole caps were removed and put in the honey extractor. The honey was removed by centrifuge force using method provided in [4], and measured by using a cylinder. The number of bees was counted from the photographs.

2.2.2 Syrup feeding method

The study was on three hives. The syrup volume was fixed at 1,500 mL per 3 days; the 40% syrup was feeding at 4-5 pm for 21 days. The experiment was done in duplicate. The 1st hive was fed by using two liter plastic tray laid on a frame which could be put inside the hive. The floatable material was put in the tray for comfortable to eating of the bees. (Fig.1A) The 2nd hive was done by using a wooden box which was the same size as frame laid parallel inside and put the floatable material for bee to simply eating. (Fig.1B) The 3rd hive was fed using a 2 liter- plastic bottle as a syrup container. The lid of the plastic bottle was punched and the bottle was put upside down to drop the syrup. (Fig.1C) The honey was harvested and measured the volume using a cylinder. The number of bees was counted from photographs.

2.2.3 Analysis

The analysis was assumed that the price of beekeeping, hive of 8 frames was fixed at 1,500 baht each, the sugar price was 18.50 baht/kg., the honey price was 110 baht/kg. and the minimum wage in Nakorn Pathom province was 300 baht/day [5].

2.2.3.1 Factors affecting honey production

The volume, quality of honey and number of bees were analysed according to the syrup feeding volume and period, and syrup feeding method. The honey volumes from each study were compared. The chosen method was that suitable for bees rearing. Honey sweetness was measured using hand refract meter and the viscosity was measured using Brookfield viscometer. The standard sweetness, viscosity and volume were the means of those from three commercial honey: Vechapong honey, Thailanna and Chitrada Garden Palace. The Thai honeys tested conformed to the international honey standards [6].

2.2.3.2 Satisfaction Test

The Satisfaction test for the honey has considered physically; including taste, smell and color by using the questionnaires. There were 200 people in Nakorn Pathom province that attended the test and gave opinions.

2.2.3.3 Cost and profit analysis

Investment cost and profit on beekeeping were analysed in terms of profit, Payback period (PB), Net Present Value (NPV) method, Internal Rate Return (IRR) and Benefit (B/C) ratio. The analysis was done on the beekeeping of the year 1 and profit calculation of the years 2 and the year 3.

3. Results and Discussion

There were some factors involved in this study, which were the increment of amount of honey, increasing rate of number of bees, honey quality, cost and profit analysis. The results are presented and discussed as follows:

3.1 Effect of Feeding Volume and Feeding Period

Three different feeding periods were tested every day; following the method proposed in Section 2.2. It was found that the average honey volume of the 1st hive was 1,375 mL, which was the highest volume compared with the 2nd and the 3rd hive (925 mL and 800 mL, respectively), shown in Table 1.

Table 1 Honey amount from the 1st, 2nd and 3rd hive with different feeding period of time

Hive number	Amountaverageofhoney (mL)
1	1,375
2	925
3	800

The number of bees (for all types of the feeding periods) was gradually increased with the increasing progress of the testing time. The numbers from the 1st hive reached the highest value as shown in Fig. 2. The results also showed that the honey production was highly correlated to the number of workers in the hive [7].

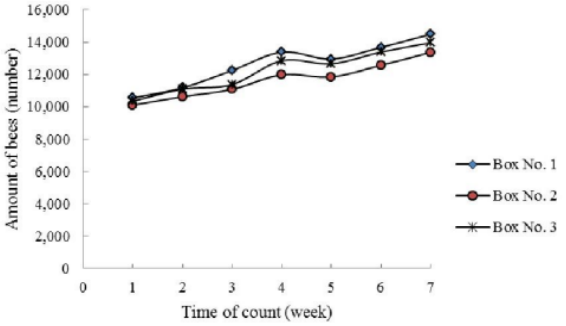

Fig. 2 Number of bees in the 1st, 2nd and 3rd hives with different feeding periods of the time during 7 testing weeks

The quality of honey was tested and determined by using average viscosity and sweetness. The average viscosity of the 1st, 2nd and 3rd hives was 2,031, 1,874 and 1,770 cP, respectively, while the average sweetness was 107.0, 96.0 and 83.5, respectively, as shown in Table 2. When compared with the standard values (averaged from three commercial honey products; Vechapong, Thailanna and Chitrada gradient palace, all types of the hives could not provide good quality of honey as the standard required.

Table 2 Viscosity and sweetness of honey from different feeding period of time

Hive number	Viscosity(cP)	Sweetness (◦Brix)
1	2,031	107.0
2	1,874	96.0
3	1,770	83.5
Standard*	5,570.0	111.0

The study on the feeding periods was found that, for all the feeding types, the feeding with amount of 500 mL seemed to be the most suitable number since it gave the highest honey volume compared with the other periods. Moreover, the amount of bees continuously increased significantly. However, viscosity of the produced honey of the 1st period was still lower than the standard; even having better viscosity compared to the others.

3.2 Feeding Method

The study was done on 3 types of the hives; where each type was fed by different feeding methods according to the method mentioned in Section 2.2, as shown in Figs. 1A, 1B and 1C. The feeding amount for all the feeding types was fixed at 1,500 mL per 3 days, the feeding time was 4-5 pm. The test results were shown in Table 3. It could be concluded from Table 3 that the 1st hive gave the highest value of average honey volume of 1,425 mL. Therefore, this method is one of the most widely used feeding techniques for the bees in farms [8]. On the other hand, the feeding techniques by putting in wooden boxes (the 2nd hive) and feeding in plastic bottles (the 3rd hive) gave lower amount of the honey; with the honey volume of 1,325 and 1,225 mL, respectively.

Table 3 Average honey amount from different feeding methods; the 1st hive: in trays, the 2nd For hive: wooden boxes and the 3rd hive: in punched Bottles.

Hive number	Amountadverageofhoney (mL)
1	1,425
2	1,325
3	1,225

Fig. 3 shows number of bees for different types of feeding methods (see Fig.1A, 1B and 1C). It can be seen from Fig. 3 that the number of bees for all feeding methods was gradually increased with the increasing progress of the observing time. However, the number of bees for the 1st hive was the highest, while other hives had similar numbers of bees.

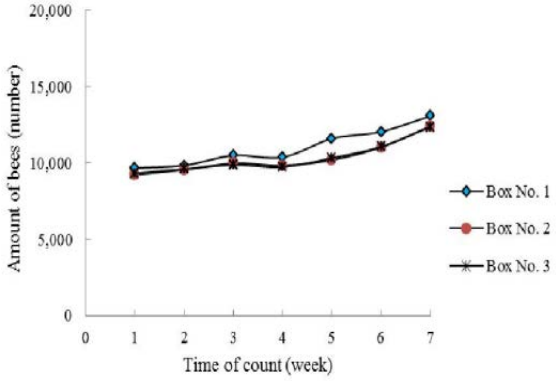

Fig. 3 Bee numbers in hive1, 2 and 3 with different syrup feeding methods for 7 weeks

Regarding the quality of the honey received from different types of feeding methods mentioned in previous Section. The average viscosities for particular 1st, 2nd and 3rd feeding types were 2,141, 1,874.5 and 1,873.5 cP, respectively. The viscosity of the honey for all of the feeding types was still lower than standard value (5,570 cP). Similar results to the sweetness, all the feeding methods gave lower level of sweetness (99.5, 95.0 and 94.5 ◦Brix for the 1st, 2nd and 3rd methods); but only slight different from the standard (111.0 ◦Brix).

Table 4 Viscosity and sweetness of honey from different syrup feeding methods and from market

Hive number	Viscosity (cP)	Sweetness (◦Brix)
1	2,141.0	99.5
2	1,847.5	95.0
3	1,863.5	94.5
Standard*	5,570.0	111.0

It could make the conclusion from the previous results regarding the feeding methods that by feeding the bees in trays would give higher amount of honey due to higher number of bees, as well as, better quality in terms of viscosity and sweetness. This is the reason why this method seems to be the most famous method used for the bee farms.

Table 5 shows satisfaction study according to the honey products under these investigated feeding periods and methods. The results showed that both different types of feeding periods and methods seemed not to effect on the quality of the honey. In fact, the honey under tests has golden-yellow color and soft sweet smell similar to that of the natural (wild) honey [9], as far as, the floral sources are the same.

In Table 6, honey quality between studied and standard commercial honey products was compared in terms of viscosity and sweetness. It can be seen that the honey products under studied had significantly lower viscosity than the standard, while the sweetness was only slightly different. In addition, the studied honey would also not reach the quality of commercial honey products. However, after roasting them at 40ºC for 8 days, the viscosity and sweetness became increased close to the standard values, as shown in Table 6.

Table 5 Satisfaction of sample people groups in Nakhon Pathom on the honey, from 200 questionnaires

Factor	Satisfaction		
	Satisfied (%)	Indifferent (%)	Unsatisfied (%)
Taste	73.3	16.3	10.4
Oder	79.8	15.8	4.3
Color	86.3	7.8	5.9

Table 6 Viscosity and sweetness of honey from the study compared with commercial honey

Honey	Sweetness (°Brix)	Viscosity (cP)
Honey before roasting	100.38	2,074.75
Honey after roasting	110.00	5,350.00
Standard*	111.00	5,570.00

3.3 Investment Cost and Profit Analysis

Investment cost and profit on beekeeping were analysed based on profit, Payback period (PB), Net Present Value (NPV) method, Internal Rate Return (IRR) and Benefit/Cost (B/C) ratio. The analysis was done on the beekeeping at the 1st year and profit calculation at the 2nd year and the 3rd year; having the results as shown in Table 7 and Table 8, respectively.

It can be seen from Table 7 and 8 that:

(1) The required investment for the 1st year with 8 hives was 22,820 + 24,644.80=47464.8 baht, while gave income by 27,869.60 baht and hence, gave loss of 19,595.20 baht for the first year. If investing 24 hives

(2) for the 2nd year, the income would be 83,608.80 baht, while the investment cost was 73,694.40 baht; therefore, getting loss of only 9,680.80 baht.

(3) With another 24 hives in the 3rd year, the income would be 250,862.40 baht, while investment cost was 209,531.20 baht and give profit of 31,614.40 baht.

In summary, the payback period was 2 years 3 months based on calculation proposed in [10]. The NPV was 22,847.69 baht, which was more than zero, indicated that investment earning would worth the investment at the 3rd year. The IRR was 39% indicated that the investment would possibly cover the expense. The B/C was 2, which was more than 1, indicated that this investment was capable to made profit.

Table 7 Investment and profit analysis of 3 years beekeeping

Compensation investment	Resultswere compared		Financial analysis
	Decision criteria	Results	
1.Payback Period; PB	3 year	2 year 3 month	payback period was 2 years 3 month, which was less than the project period of 3 years.
2. Net Present Value method;NPV	NPV > 0	22,847.69 baht	NPV was more than zero, indicated that investment earning would worth the investment at the year of 3.
3. Internal Rate of Return; IRR	IRR=6.75%	39.02 %	IRRwas more than MAR of Financial institution indicate that investment possibly cover the expense
4. Benefit Cost ratio; B/C ratio	B/C > 1	2.00	B/c ratio more than 1, indicated that this investment was capable to made profit.

Table 8 compensation investment analysis

List	0 year	1st year	2nd year	3rd year
1. Revenue from the sale honey.	-	27,869.6	83,608.8	250,826.4
2. Charges of honeycomb	4,500	2,500	8,000	24,000
3.The cost equipment	18,320	3,600	11,500	25,540
4. The cost of food in beekeeping	-	8,906	26,718	80,154
5. The labor cost	-	8,438.8	25,316.4	75,949.2
6. The other expenses	-	1,200	2,160	3,888
Include	22,820	3,224.8	9,914.4	41,295.2
Total	-22,820	-19,595.2	-9,680.8	31,614.4

4. Conclusion

The study of beekeeping to observe suitable factors to increase honey found that with the 40% (w/V) sucrose syrup feeding materials and with 500 mL each day with feeding in trays would give the highest amount of honey. The number of bees increased with the time. Physical honey quality was surveyed via the questionnaires for 200 Nakorn Pathom province people, which showed insignificant different between the studied and commercial honey products. The payback period was 2 years 3 months, which showed possibility of getting benefit for 3 year investment.

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