

Research Article**BENEFIT-COST ANALYSIS OF APICULTURE ENTERPRISE: A CASE STUDY OF JUTPANI VDC, CHITWAN, NEPAL****K. H. Devkota**

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ABSTRACT

A survey study was conducted to study the benefit-cost analysis of apiculture enterprise in Jutpani VDC, Chitwan district. Data were collected by interviewing randomly selected 18 beekeepers for sample survey. Benefit : Cost (BC) ratio of apiculture was computed by including and excluding the revenue obtained from colony selling. Only 61.11% of beekeepers sold bee colonies for earning income. The study revealed that BC ratios of apiculture were 2.41 and 1.58 in the case of inclusion and exclusion of the income received from the colony selling, respectively. It showed that apiculture industry was running in profit in both cases. In the former case, the BC ratio ranged from 0.97 to 6.22 and about 88.88% beekeepers were in profit. The BC ratio in the later case ranged from 0.43 to 3.41 and about 77.77% beekeepers were in profit. The number of colonies ranged from 2 to 54 with an average of 21.33 colonies per bee farm. In the former case, average annual income was Rs. 70758.33 (US\$ 969.29 approximately) per farm and Rs. 49588.31 (US\$ 679.29 approximately) in the later case. Likewise, the average income per colony per annum was Rs. 3317.31 (US\$ 45.44) and Rs. 1777.65 (US\$ 24.35 approximately) in the former and later case, respectively.

Key words : Apiculture, benefit-cost ratio, beekeeper**INTRODUCTION**

Agriculture plays a vital role in economic development of Nepal as over 80% people are engaged in this sector contributing 39 % of country's GDP (CBS, 2003; WB, 2003). In the recent years, apiculture has also been one of the important income generating activities among farmers in Nepal. The total estimated numbers of honeybee colonies are 7500, of which the number of *A. mellifera* and *A. cerana* colonies are 5500 and 2000, respectively (Neupane, 2002).

To make any industry successful, it requires raw materials, manpower, and market. Apiculture requires nectar and pollen as raw materials. Chitwan has 142422 ha of forest area, which is 63.9% of its total area. Forest is popular for its diversified flora, which supplies abundant nectar and pollen for bees. Market area is also being expanding in recent years. Considering good future scope of apiculture industry, residents of Chitwan are attracted to commercializing apiculture industry. The average production of honey is estimated 35 kg per hive in the district (DADO, 2001). Exotic honeybee, *A. mellifera* F. first introduced in 1994 and distributed to farmers of Jutpani and Pithwa VDCs has become popular in the plains of Chitwan. Out of 500 *mellifera* farmers in the country 250 farmers are in Chitwan with 5,500 colonies of *mellifera* and 150 tons of honey production (DADO, 2001; Neupane, 2002). However, sufficient study has not been done to see the economic impact of apiculture, and therefore, this study was carried out to evaluate the profitability of the apiculture enterprises.

MATERIALS AND METHODS

The study was carried out in Jutpani VDC, Chitwan, Nepal during October 2001 to April 2002. Out of total 2176 household in this VDC, 60 households were involved in *Apis mellifera* beekeeping. Among them, 49 beekeepers had the membership of "Jutpani Mellafera Mauri Palan Samuha" of which 36 %, i.e. 18 beekeepers were randomly selected for sample survey. Primary data were collected by interviewing the selected beekeepers and field observations. Benefit-cost analysis was applied as an appropriate tool to evaluate the apiculture enterprises- the cost and benefit sides was separately computed and the cost side divided the benefit side to compute the B-C ratio. The cost items were grouped into two categories, i.e. i) fixed costs and ii) variable costs. To find out the total cost (TC), total fixed cost (TFC) was added to total variable cost (TVC). Likewise, average cost (AC) was obtained by adding average fixed cost (AFC) and average variable cost (AVC) as $TC = TVC + TFC$, and $AC = ATC + AVC$. Where, $AC = TC/\text{No. of colonies}$.

In the benefit side, all the benefit items were studied and evaluation of apiculture industry was made. The benefit-cost ratio was computed by using the formula $B/C = TR/TC = (B_1 + B_2 + B_3) / (C_a + C_b)$. There are many variables like number of bee colonies, beehives, artificial diet, and other cost items and revenue items. The cost and revenue (benefit) items were grouped as follows:

Total cost (C) = Ca + Cb, where Ca (1-8) is fixed cost and Cb (9-13) is variable cost	
Cost items:	C_b = Variable cost, i.e. $C_9 + C_{10} + \dots + C_{13}$
C_a = Fixed cost, i.e. $C_1 + C_2 + \dots + C_8$	C_9 = Supplement feeding
C_1 = Purchasing cost of Bee colony	C_{10} = Drugs
C_2 = Cost of Bee hive	C_{11} = Comb foundation
C_3 = Cost of Hive tool	C_{12} = Transportation
C_4 = Cost of Smoker	C_{13} = Labor
C_5 = Cost of Honey extractor	Benefit items:
C_6 = Cost of Bee veil	Total benefit (B) = $B_1 + B_2 + B_3$, where, B_1 = benefit from honey,
C_7 = Cost of Uncapping knife	B_2 = benefit from wax and
C_8 = Cost of Stand	B_3 = benefit from colony sale

The fixed cost was calculated by dividing their original cost by the number of years of life expectancy of the equipments (Table 1).

Table 1. Life expectancy of equipments used in beekeeping

SN	Tools	Durability (years)
1	Bee	10
2	Bee hive	10
3	Hive tool	10
4	Smoker	5
5	Honey extractor	5
6	Bee veil	3
7	Uncapping Knife	5
8	Stand	10

RESULTS AND DISCUSSION

Fixed costs

Fixed costs are the costs of the bee farm, which do not vary with level of output. Fixed cost considered in this study and their percent of share to the total cost is presented in Table 2.

Table 2. Share of fixed cost components

SN	Items	Cost/colony/year (Rs)	Percent
1	Bee colony	175.00	61.36
2	Bee hive	95.56	33.37
3	Hive tool	0.29	0.10
4	Honey extractor	3.63	1.27
5	Smoker	0.22	0.08
6	Bee veil	1.84	0.64
7	Uncapping knife	2.36	0.82
8	Stand	6.32	2.22

It is evident from the table that bee colony incurred the largest proportion, i.e. 61.36% of the total fixed cost. Then, beehive and stand were found contributing 33.5 and 2.22%, respectively. The cost of the beehive and stand was also high because each bee farm individually needed these tools. But other tools, like smoker, bee veil, honey extractor etc. could be shared with others. With the increase of number of bee colonies the cost of these items gradually decreased. Thus, the contribution of honey extractor, uncapping knife, bee veil, hive tool and smoker to the total cost was found as 1.27, 0.82, 0.64, 0.10 and 0.08%. Hive tool and smoker cost was very

low because many beekeepers of the study area did not possess hive tool and smoker. Beekeepers borrowed these tools from their friends free of cost. Another reason of low cost was that life expectancy of these items was also longer, i.e. 5-10 years.

Variable costs

Cost incurred in labor, supplement feeding, comb foundation, drugs, and transportation were considered as variable cost of apiculture industry (Table 3).

Table 3. Share of variable cost components

Items	Cost/colony/yr(Rs)	Percent
Supplement feeding	213.15	25.91
Drugs	13.65	1.64
Migration cost	72.75	8.84
Comb foundation	163.33	18.85
Labor	359.80	43.73

US\$ 1 = Nepalese Rs. 75 approximately

It was clear that the labor cost incurred the largest proportion of the TC, i.e. 43.73%. Supplement feeding and comb foundation contributed 25.91 and 19.85%, respectively. Supplement feeding was given during the shortage of floral resources. The study revealed that 94.44% farmers were supplying supplement feeds, like sugar, soybean powder and milk powder and using drugs to control bee pests. Drug included acaricides (for controlling mites) and some medicines to control diseases. Over half of the beekeepers (55.56 %) transferred their bee colonies to other places when honey sources depleted in the local area. Cost of migration and drug was 8.84 and 1.64% of the total variable cost. Most of the beekeepers did their work themselves. If additional manpower needed they took help of other family members (women and even of their children) and utilized their family members. Most of the beekeepers were marginal farmers and they were involved in agricultural works only for 3-4 months a year. Thus, they were utilizing their spare time and generating their income through this occupation. The cost of individual bee farm is presented in Table 4.

Table 4. Cost of individual bee farm

Bee farm	No. of bee colonies	Fixed cost (Rs)	Variable cost (Rs)	Total cost (Rs)	Average cost/colony/year (Rs)
1	40	11792.00	35420.00	47187.2	1179.23
2	45	12042.00	43693.65	55735.65	1238.54
3	20	5685.00	18734.40	24419.40	1220.97
4	54	15549.84	50558.58	66108.42	1224.23
5	25	7122.00	15192.00	22313.78	892.55
6	30	8801.1	29837.1	38638.2	1287.94
7	35	9920.05	38174.5	48094.55	1374.13
8	13	3751.02	11284.39	15035.41	1156.57
9	15	4284.75	15139.5	19424.25	1294.95
10	6	1702.68	3915.3	5617.98	936.33
11	12	3422.52	9197.4	12619.92	1051.66
12	40	11572	42080.8	53652.8	1341.32
13	7	1928.99	4671.8	6600.79	942.97
14	6	1699.02	3533.76	5232.78	872.13
15	9	2438.01	6519.51	8957.62	995.28
16	12	3628.92	9321.84	12950.64	1079.22
17	13	3622.97	10818.34	14441.31	1110.85
18	2	587	1396	1965.00	982.50

Revenue (Benefits)

Honey, wax and colony selling were recorded as the main revenue sources of apiculture industries in the

study area. In addition, apiculture also contributed to ecological, environmental and other socio-economic fields, which was difficult to assess these types of benefits due to time and budgetary constraints. Thus, this study included only income obtained from honey, wax, and colony selling (Table 5-6).

Table 5. Income of individual beekeepers

Bee farm	No of bee colony	Honey (Rs)	Wax (Rs)	Bee colony sale (Rs)	Total revenue (Rs)	Avg. revenue/colony/yr (Rs)
1	40	84000	1400	-	85400	2135.00
2	45	108000	1600	80000	189600	4213.00
3	20	55000	2000	51250	108250	5412.50
4	54	222000	3700	8750	234450	4341.66
5	25	36000	600	42000	78600	3144.00
6	30	120000	2200	21000	143200	4773.33
7	35	60000	1000	70000	131000	3742.85
8	13	15000	200	5250	20450	1573.07
9	15	12000	200	7000	19200	1280.00
10	6	6480	80	-	6960	1093.33
11	12	12000	300	-	12300	1025.00
12	40	95000	2400	19600	117000	2925.00
13	7	10920	600	-	11520	1645.71
14	6	4320	100	1200	5620	936.66
15	9	12000	200	-	12200	1355.55
16	12	5400	200	75000	80600	6716.66
17	13	15000	300	-	15300	1176.92
18	2	2400	-	-	2400	1200.00

Table 6. Revenue from apiculture

Items	Revenue/colony /yr (Rs)	Contribution to revenue (%)
Wax	45.00	1.45
Honey	2063.50	66.55
Bee colony	992.32	32.00

Table 6 showed that honey contributed the highest to the total revenue, which was 66.55%. The second important item of revenue was bee colony selling, which contributed 32%, however, only 61.11% beekeepers were involved in colony selling. Wax was found the lowest income item of apiculture, which contributed only 1.45% of its total income.

Benefit-cost ratio

Benefit-cost ratio was computed both excluding and including the benefit from colony selling (Table 9-10).

Table 7. Benefit-cost ratio of apiculture (including benefit from bee colony)

FC	VC	TC	TR	NR(TR-C)	B-C(TR/TC)
285	832.97	1121.19	2703.5	1582.31	2.41

FC=Fixed cost, VC= Variable cost, TR= Total revenue, NR= Net revenue, B-C = Benefit-Cost ratio

In Table7, the fixed costs, variable costs, total costs, total revenue, and net revenue were Rs 285, 832.97, 1121.19, 2703.5 and 1582.31, respectively, and benefit-cost ratio was 2.41. Thus, it revealed that apiculture industry was running in profit. Benefit-cost ratio of individual bee farm (including revenue from bee colony) is presented in Table 8.

Table 8 indicated that all the beekeeping farms except two (9 and 11) had cost benefit ratio of more than one; indicating 88.88% bee farms running in profit. The cost-benefit ratio ranged from 0.97 to 6. Among the beekeeping farms, 33.33% had B-C ratio more than 3. The maximum benefit obtained from beekeeping was Rs.

6716.66/colony/year (farm number 16). Nearly 44% farms had profit obtaining more than Rs. 2200/colony/year. Only about 61.11% beekeepers in Jutpani were involved in the selling of bee colony (Table 5). Thus, the B-C ratio excluding revenue from colony selling was computed separately (Table 9 -10). Table 9 showed that the fixed costs, variable costs, total costs, total revenue, and net revenue were Rs 285, 832.97, 1121.19, 1777.65 and 631.79, respectively, and benefit-cost ratio was 1.58. Thus, the study revealed that apiculture industry was running in profit even in the case of excluding the revenue from colony sale. Benefit-cost ratio of individual farm is presented in Table 10.

Table 8. Cost-benefit ratio of individual bee-farm (including revenue from bee colony)

SN	Colony (No)	FC	VC	TC	TR	NR	B-C(NR/TC)
1	40	294.18	885.05	1179.23	2145.00	955.77	1.81
2	45	267.60	970.97	1238.54	4213.00	2474.46	3.40
3	20	264.25	940.72	1220.57	5412.50	4191.97	4.43
4	54	287.96	936.27	1224.23	4314.66	3094.43	3.52
5	25	284.88	607.68	892.55	3144.00	2251.44	3.48
6	30	293.37	944.04	1287.94	4773.33	3485.39	3.52
7	35	283.43	1090.70	1374.13	3742.85	2368.72	2.73
8	13	288.54	868.03	1156.57	1573.07	416.50	1.36
9	15	285.65	1009.30	1294.95	1280.00	-14.95	0.98
10	6	283.78	652.55	936.33	1093.33	156.69	1.16
11	12	285.21	766.45	1051.66	1025.00	-26.00	0.97
12	40	289.30	1052.02	1341.32	2925.00	1583.68	2.18
13	7	275.57	667.40	942.97	1645.71	702.74	1.74
14	6	283.17	588.96	872.13	936.66	64.53	1.07
15	9	270.89	724.39	995.28	1355.55	360.27	1.36
16	12	302.41	776.82	1079.22	6716.66	5637.43	6.22
17	13	278.69	832.18	1110.85s	1176.92	66.05	1.05
18	2	293.50	698.00	982.50	1200.00	217.50	1.22

FC=Fixed cost, VC= Variable cost, TR= Total revenue, NR= Net revenue, B-C =Benefit-Cost ratio

Table 9. Benefit-cost ratio of apiculture (excluding revenue from colony selling)

FC	VC	TC	TR	NR(TR-C)	B-C(TR/TC)
285	832.97	1121.19	1777.65	656.46	1.58

FC=Fixed cost, VC= Variable cost, TR= Total revenue, NR= Net revenue, B-C = Benefit-Cost ratio

Approximately 10,000 *Apis mellifera* bee colonies are in Chitwan and average productivity is 8.1 and 28.7 kg/colony/yr in hill and plain, respectively (Pokhrel, 2006). The average honey yield of poor mountain households (of Jumla, Kaski and Dadeldhura districts) in Nepal through *Apis cerana* beekeeping is 34.6 kg/household (Gurung, 2005). A successful beekeeper in Kaski has been able to earn NRs. 55,000(US\$775) in the year from selling bee colonies and queens (Gurung, 2005).

Khadka (1999) conducted a study in seven VDCs in sub-urban area of Lalitpur district of Nepal and cost-benefit of exotic bee (*Apis mellifera*) has been found ranging from 0.66 to 1.06, and the average B/C ratio of exotic and local bees is 0.66 and 0.48, respectively. It shows the average B/C ratio is less than one. The main reason of low productivity was lack of bee food resources, lack of proper management, lack of technical and medical service, high cost of fixed input, and inadequate training. Improvement in these aspects are necessary to make the apiculture more profitable.

Gurung (2005) reported that one beekeeper was able to sell NRs.40,000(US\$563) worth of honey in one season with very little cash investment in Dadeldhura district of Nepal. Among the beekeepers in Alital, Dadeldhura, average income from *Apis cerana* beekeeping was approximately NRs 4,152 (US\$56), more than one-third of the total annual cash income from farm activities. Where as mountain women from all over the country use traditional method of beekeeping and produce about 2 to 3 kg of honey per year from each colony.

Introducing modern techniques one can produce 15 kg of honey, which give them income of Rs.3,000 per year from each colony (Maskey,1992).

Table 10. Benefit-cost ratio of individual bee-farm (excluding revenue from bee colony)

Bee farm	Colony (No)	FC	VC	TC	TR	NR	B/C ratio (TR/TC)
1	40	294.18	885.05	1179.23	2135.00	955.77	1.81
2	45	267.60	970.97	1238.54	2435.55	1197.01	1.96
3	20	284.25	940.72	1220.57	2850.00	1629.03	2.33
4	54	287.96	936.27	1224.23	4179.62	2955.39	3.41
5	25	284.88	607.68	892.55	1464.00	571.45	1.64
6	30	293.37	944.04	1287.94	4073.33	2785.39	3.16
7	35	283.43	1090.70	1374.13	1742.85	368.72	1.26
8	13	288.54	868.03	1156.57	1169.23	3.66	1.01
9	15	285.65	1009.30	1294.95	813.33	-481.62	0.62
10	6	283.78	652.55	936.33	1093.33	157.00	1.16
11	12	285.21	766.45	1051.66	1025.00	-26.66	0.97
12	40	289.30	1052.02	1341.32	2435.00	1093.68	1.81
13	7	275.57	667.40	942.97	1645.71	702.74	1.74
14	6	283.17	588.96	872.13	736.66	-135.47	0.84
15	9	270.89	724.39	995.28	1355.55	360.27	1.36
16	12	302.41	776.82	1079.22	466.66	-612.56	0.43
17	13	278.69	832.18	1110.85s	1176.92	66.05	1.05
18	2	293.50	698.00	982.50	1200.00	217.50	1.22

FC=Fixed cost, VC= Variable cost, TR= Total revenue, NR= Net revenue, B-C = Benefit-Cost ratio

CONCLUSIONS

Benefit-cost ratio of apiculture enterprises was found 2.41. It showed that about 88.88% bee farms were running in profit. The average income per bee farm per annum was Rs. 70758.33 and the average income per colony per annum was Rs. 3317.31, which was a good source of income especially for the rural people. Marketing facilities, awareness to the farmers, timely loan facilities in reasonable interest, reduction in use of pesticides, plantation of floral plants, development of floral calendar etc. are suggested activities for development of apiculture in the area.

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