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ECONOMICS OF BEEKEEPING WITH *APIS CERANA INDICA* AND *A. MELLIFERA* IN RUBBER SMALLHOLDINGS OF KERALA

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A comparative study on the economics of *Apis cerana indica* F. and *A. mellifera* L. was carried out in the rubber smallholding sector on the basis of a sample survey covering 24 beekeepers identified from six different locations. It was found that beekeeping with *A. cerana indica* yielded honey in the range of 2 to 17 kg per hive per year during a period of 11 years from 1988 while *A. mellifera* yielded 5 to 60 kg per hive per year in a period of six years from 1993. A comparative analysis of the cost and income indicated that the cost of maintenance of *A. mellifera* was almost four times more in 1994, 1995 and 1996, 3.5 times more in 1997 and 3.4 times more in 1998 than that of *A. cerana indica*. The income from *A. mellifera* was eight, ten, five, three and four times more in 1994, 1995, 1996, 1997 and 1998 respectively than that of *A. cerana indica*. However, inconsistency has been observed in the honey yield from both types of apiaries and the profitability of beekeeping due to various factors such as weather, bee forage plants, diseases to bees and the vigour of the colonies. At current prices, culturing of *A. mellifera* was found to be more profitable than *A. cerana indica*. However, for the marginal and small beekeepers *A. cerana indica* is more suitable due to lower initial investment. *A. mellifera* requires higher initial investment and suits more to large organised beekeepers.

Key words : *Apis cerana indica*, *Apis mellifera*, Beekeeping, *Hevea brasiliensis*.

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INTRODUCTION

Indigenous *Apis cerana indica* F. and recently introduced *A. mellifera* L. have been domesticated in rubber plantations. Rubber plants form a potential nectar source in South India particularly in Kerala and some parts of Tamil Nadu and Karnataka (Jayarathnam, 1970; Suryanarayana, 1983). Mature rubber tree secretes nectar from its extrafloral nectaries present on the petiole, bud scales and on the lower surface of the leaf lamina (Thankamma and George, 1968). The nectaries are active 20-25 days after refoliation and coincide with flowering which normally occurs during February to April. Bees are not pollinators of rubber but are nectar gatherers. Nectar flow continues for 2-3 months, as refoliation occurs in an over-lapping pattern in mature rubber trees. Nectar flow is adversely affected due to rains during the flow period and leaf shedding consequent to powdery mildew disease.

A. cerana indica bees have been used for beekeeping from the 1930s in rubber plantations (Singh, 1962). *A. cerana indica* bee colonies in the rubber growing areas of Kerala, Tamil Nadu and Karnataka were affected by a contagious viral disease during 1991 which annihilated about 90 per cent of the colonies by the end of 1992. The disease was identified as 'Thai sac brood viral disease' (TSBV) (Jacob *et al.*, 1992). The recurrence of the TSBV disease thereafter led to the collapse of the beekeeping industry in the southern states. The Central Bee Research and Training Institute (CBRTI), Indian Council of Agricultural Research (ICAR) and some voluntary agencies have been introducing the exotic *A. mellifera* bees in the southern states from 1993-94 (Mathew, 1993), in the light of its successful introduction in Punjab, Haryana, Himachal Pradesh and Jammu and Kashmir in 1962 (Naim, 1988). Through the CBRTI and ICAR coordinated research projects, large scale trials were carried out in Kerala, Tamil Nadu and Karnataka during 1993-97 by individual beekeepers. The introduction of the exotic bees was not successful initially due to factors such as shortage of nectar and pollen during May to December, predation by bee hunting birds and high cost involved in establishing and maintaining the colonies (Suryanarayana, 1996 a, b; Chandran *et al.*, 1995). The main objective of the present study is to analyse comparatively the physical and financial performance of the two species under rubber smallholding conditions.

MATERIALS AND METHODS

The primary data required for the study were collected through a field survey conducted among the rubber smallholdings, in which the sample consisted of 10-55 bee colonies of *A. cerana indica* during 1988-1998 and 8-24 colonies with *A. mellifera* during 1993-1998 (from eight colonies in 1993 to 24 colonies in 1998). Time series data on yield, cost and returns were collected for 11 (1988-98) and 6 (1993-98) years for *A. cerana indica* and *A. mellifera* respectively. The study was initiated in 1993 and back data for the period 1988-92 were collected with maximum precision. Thereafter the performance and other details of the types of bees were monitored on an yearly basis. The size of each colony was maintained as 6 frames for *Apis cerana indica* and 10 frames for *Apis mellifera*. The data were collected only from such hives for this study.

Annual establishment cost was accounted as the sum of interest on fixed capital investment (12%) and depreciation estimated through straight line method. ,The fixed capital included bee hives, bee stand and bee colony (4 frames for *A. cerana indica* and 5 frames for *A. mellifera*, which are maintained more or less permanently), honey extractor, bee veil, bee net and comb foundation sheet (only for *A. mellifera*). The maintenance cost consisted of material and labour expenses and interest on working capital (6%). The materials required were for artificial feeding *viz.*, sugar, bengal gram and yeast used for the preparation of sugar syrup and pollen substitutes and the inputs for mite and disease control. The labour cost was calculated per hive per year for the two types on the basis of the total man hours spent.

The returns from beekeeping by the sale of honey, wax and colonies were also estimated. All the cost and return factors were calculated on the basis of the relevant yearly figures. The costs and returns were compared and the viability of the enterprise

Table 1. **Honey yield (kg) per hive at different locations during 1988-1998 from *A. cerana indica***

Year	Location						Mean	Sample size (colonies)
	A	B	C	D	E	F		
1988	10	12	17	15	14	10	13	55
1989	11	10	11	9	17	14	12	32
1990	11	16	12	12	17	16	14	38
1991	10	8	9	12	11	10	10	24
1992	5	10	9	10	9	11	9	15
1993	2	3	2	2	0	3	2	12
1994	4	2	2	3	6	7	4	10
1995	3	6	4	4	6	7	5	14
1996	6	7	5	4	8	6	6	18
1997	7	8	4	7	10	6	7	21
1998	12	10	6	11	8	7	9	28

A : Ullanadu, B : Kadanad, C : Edanadu, D : Muttuchira, E : Monippally, F : Chittarickal.

was checked using benefit cost ratio (BCR). The break even yield, the threshold level below which the beekeeper will face absolute loss, was also worked out.

RESULTS AND DISCUSSION

The results indicated that the mean honey yield of *A. cerana indica* was the highest in 1990 (14 kg per hive) and least in 1993 (2 kg per hive). The annual honey yield ranged from 2 to 17 kg per hive from 1988 to 1998 (Table 1). The slide in yield since 1992 was due to the epidemics of TSBV disease. The honey production increased after 1994 showing partial recovery from TSBV disease. Jacob *et al.* (1992) reported that 90 per cent of the Indian colonies were affected by TSBV disease in Kerala, Tamil Nadu and Karnataka. The *A. mellifera* colonies have produced honey ranging from 5 to 60 kg per hive per year from 1994 to 1998. The annual production of honey increased during this period with an average of 39 kg per hive in 1998 but there was a sharp decline to 18 kg per hive in 1997 (Table 2). This was due to unseasonal rain and high incidence of powdery mildew (*Oidium heveae*) disease on the source (rubber) trees which reduced nectar secretion.

Table 2. **Honey yield (kg) per hive at different locations during 1993-98 from *A. mellifera***

Year	Location						Mean	Sample size (colonies)
	A	B	C	D	E	F		
1993	0	0	0	0	0	0	0	8
1994	5	8	6	5	9	15	8	10
1995	30	15	24	30	14	55	28	11
1996	40	40	35	16	19	60	35	16
1997	15	17	19	19	18	20	18	22
1998	38	51	47	42	32	24	39	24

A : Ullanadu, B : Kadanad, C : Edanadu, D : Muttuchira, E : Monippally, F : Chittarickal.

Table 3. **Cost benefit analysis of beekeeping with *A. cerana indica***

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
Cost/hive (Rs)											
Establishment (fixed capital)	144	173	197	233	249	293	307	361	396	444	472
Maintenance	13	13	14	14	16	19	24	21	22	26	26
Labour (working capital)	111	111	233	133	166	166	177	198	199	221	221
Interest on working capital	7	7	9	9	11	11	12	13	13	15	15
Total	275	304	352	388	441	489	520	595	630	706	734
Income/hive (Rs)											
Honey	208	216	280	220	225	60	160	250	360	490	648
Wax	50	50	30	30	37	0	0	0	45	50	50
Sale of colony	0	120	120	160	160	0	0	0	300	400	400
Total	258	386	430	410	422	60	160	250	705	940	1098
Net income/hive	-17	82	77	21	-19	-429	-360	-345	75	234	364
BCR	0.94	1.27	1.22	1.06	0.96	0.12	0.31	0.42	1.12	1.33	1.50
Break even yield (kg/hive)	-	7.44	10.1	9.02	-	-	-	-	4.75	3.65	3.94

The establishment cost (fixed capital) per hive was worked out as Rs. 144 in 1988 and Rs. 472 in 1998 for *A. cerana indica* whereas it was Rs. 946 in 1993 and Rs. 1004 in 1998 for *A. mellifera* (Table 3). The maintenance cost was worked out to be Rs. 13 in 1988 and Rs. 26 in 1998 for *A. cerana indica* whereas it was Rs.498 in 1993 and Rs. 675 in 1998 for *A. mellifera*. The labour cost was Rs.111 in 1988 and Rs. 221 in 1998 for *A. cerana indica* whereas it was Rs. 552 in 1993 and Rs. 737 in 1998 for *A. mellifera*. The total cost of *A. cerana indica* increased from Rs. 275 in 1988 to Rs. 734 per hive in 1998, while the total income ranged from Rs. 258 to Rs. 1098 per hive during the period. A BCR above one was obtained in 1989, 1990, 1991, 1996, 1997 and 1998 indicating economic viability. The total cost of maintaining *A. mellifera* was worked out to be Rs. 2176 in 1994 to Rs. 2501 per hive in 1998. While the total income was Rs. 1240 and Rs. 4108 per hive respectively. According to the cost benefit analysis, beekeeping with *A. mellifera* was profitable in 1995, 1996, 1997 and 1998 (Table 4).

A comparative analysis with regard to cost and revenue indicated that the cost of *A. mellifera* is 3.93 times more in 1995, 3,8 times more in 1996, 3.51 times more in 1997 and 3.41 times more in 1998 than *A. cerana indica*. The income of *A. mellifera* was 9.78 times more in 1995, 4.71 times more in 1996, 2.72 times more in 1997 and 3.74 times more in 1998 than *A. cerana indica* (Table 5).

The profitability of beekeeping depends on the various cost factors and variations in prices of the income components. Higher establishment and maintenance cost and lower bulk price of honey, wax and colonies may lead to loss in beekeeping. Beekeeping is mainly carried out by family labour with minimum use of hired labour. At 1998 prices, the break

Table 4. **Cost benefit analysis of beekeeping with *A. mellifera***

Year	1993	1994	1995	1996	1997	1998
Costs/hive (Rs.)						
Establishment (fixed capital)	946	903	1062	1074	970	1004
Maintenance	498	611	540	585	690	675
Labour (working capital)	552.75	589.60	663.30	663.30	737	737
Interest on working capital	63.05	72.04	72.20	74.90	85.62	84.72
Total	2059.80	2175.64	2337.50	2397.20	2482.62	2500.72
Income/hive (Rs.)						
Honey	0	320	1400	2100	1260	2808
Wax	0	45	45	100	50	50
Sale of colony	0	875	1000	1125	1250	1250
Total	0	1240	2445	3325	2560	4108
Net income	0	-936	107.50	927.80	77.38	1607
BCR		0.57	1.05	1.31	1.03	1.64
Break even yield (kg/hive)	0	-	25.85	19.54	16.89	16.68

even honey yield of *A. cerana indica* was 3.94 kg and that of *A. mellifera* 16.68 kg per hive (Tables 3 & 4).

Though the yield and profitability of the two species showed inconsistent trends, in normal years *A. mellifera* apiaries were found to be more profitable compared to *A. cerana indica*. But the higher investment requirements and uncertainty over yield make it less attractive in the rubber smallholding sector. Any lack of attention or vagaries of weather can sharply reduce the yield of *A. mellifera* causing loss to the entrepreneurs. From 1996 onwards, *A. cerana indica* colonies have shown a trend of revival from TSBV disease. Suryanarayana (1996 a, b) also reported the revival of the Indian bees in the southern states. The suggestion of Tan and Binh (1996) to promote *A. cerana indica* in rural households with low investment capacity and *A. mellifera* in beekeeping organisations or individuals who can invest larger sums is substantiated by the results of this study.

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Table 5. **Year-wise cost and income estimate (Rs./hive) of *A. cerana indica* and *A. mellifera***

Year	1994		1995		1996		1997		1998	
	Cost	Income	Cost	Income	Cost	Income	Cost	Income	Cost	Income
A. indica	520	160	594	250	630	705	706	940	734	1098
A. mellifera	2176	1240	2338	2445	2397	3325	2483	2560	2500	4108
Ratio between *A. mellifera* to *A. indica*	4.18	7.75	3.93	9.78	3.80	4.71	3.51	2.72	3.41	3.74

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