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Study the costs and returns in honey production in the Nainital district of Uttarakhand

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Abstract
Indian agriculture sector accounts for 17.32 per cent of India's gross domestic product (GDP) in financial year 2017-18 and provides employment to more than half of the total workforce of the country. Agriculture not only means the cultivation of land for crop production but also includes practices of allied activities such as livestock, poultry, beekeeping, sericulture etc. Beekeeping (or Apiculture) is one of such activities. Beekeeping is an agro based seasonal activity. It is currently one of the most widespread agricultural allied activities carried out throughout the world. Originally honey bees were mainly reared in traditional nets, bamboo holes, crevices of walls, wooden log, forest trees etc. and honey was extracted through crude method of squeezing the combs which resulted into destruction of bee colonies and deterioration of the quality of honey produced. At current time India ranks first in terms of number of beehive stocks followed by China in the World. The average annual production of honey worldwide was about 1.8 million MT during 2016-17. In Uttarakhand, beekeeping forms an integral part of small holder farming system and plays a significant role as source of additional cash income in subsistence farming. For different beekeeper categories the total cost incurred on beekeeping practices per unit hive was assessed. The share of fixed cost was 22.34 per cent, 21.13 per cent and 22.15 per cent in case of small, medium and large beekeepers, respectively. The share of variable cost to the total cost per hive was 77.66 per cent, 78.87 per cent and 77.84 per cent in case of small, medium and large beekeepers, respectively. An examination of returns from a unit hive led to the conclusion that 87.02 per cent of total income was obtained from honey production alone. Raise bee colonies constituted 10.19 per cent of total return while wax contributed about 2.88 per cent of the gross return. The return from a unit kg of honey was Rs. 83.97 and net return per hive over total cost was Rs. 199.65. The input to output ratio was 1.12. The contribution of honey to the gross return was maximum in case of small beekeepers followed by large beekeepers (87.19 per cent) while minimum for medium beekeepers (85.54 per cent).

Keywords: Gross domestic product, fixed cost, variable cost, output input ratio, net return

Introduction
India is primarily an agriculture-based country and its economy largely depends upon agriculture. Indian agriculture sector accounts for 17.32 per cent of India's gross domestic product (GDP) in financial year 2017-18 and provides employment to more than half of the total workforce of the country. Agriculture not only means the cultivation of land for crop production but also includes practices of allied activities such as livestock, poultry, beekeeping, sericulture etc. Beekeeping (or Apiculture) is one of such activities. It is defined as the scientific method of conservation and rearing of bees for the production of honey and other important hive products such as bee-wax, royal jelly, propolis and bee-venom. Breeding of bees for sale and use for pollination in certain crops are other important subsidiary uses. In India only five honey bee species are found viz. *Apis dorsata* (Rock bee), *Apis florea* (Dwarf bee), *Tetragonula iridipennis* (Dammar or Stingless bee), *Apis cerana indica* (Indian hive bee), *Apis mellifera* (European or Italian bee). The first four are indigenous, while latter one has been introduced from abroad and successfully established in late sixties (1960). For commercial beekeeping in Indian conditions *Apis mellifera* is more suitable, as its production performance is much better than the other species and is less prone to swarming and absconding. Beekeeping is an agro based seasonal activity. It is currently one of the most widespread agricultural allied activities carried out throughout the world. Apiculture and agriculture are interdependent and thus cannot run in isolation as both have mutual benefits from each other. Honey bee pollination services have been reported to increase the yields and quality of many important cultivated crops, owing to which beekeeping has emerged as an important component for sustainable development of agriculture and horticulture. Total area of bee dependent crops in India is around 55 million hectares and 200 million colonies are needed

to meet this, while at present only 1.8 million colonies are present (NBB 2017). Hence there is huge potential for the beekeeping in India.

It is an important means of economic development in rural areas, since it provides employment, income generation, ecological balance and human nutrition. Honey production is the major aim of beekeeping industry. Honey is the most important primary product both from the quantitative and economic point of view and has been used by mankind for many years as a source of food, medicine and for cultural ceremonies (Cartland, 1970; Mcinerney, 1990 & Molan 1999) [2, 3, 5]. Originally honey bees were mainly reared in traditional nets, bamboo holes, crevices of walls, wooden log, forest trees etc. and honey was extracted through crude method of squeezing the combs which resulted into destruction of bee colonies and deterioration of the quality of honey produced. These practices have been replaced by the modern beekeeping practices introduced from western countries in which bees are reared in movable frame bee hives (Langstroth, Newton, and Bis) of wooden boxes. Besides the hives, the beekeepers need equipments and implements like the hive stand, nucleus box and smoker. The industry also needs equipments and machinery for handling and processing of honey, bees wax, for manufacture of comb foundation sheets, and for other operations. Modern beekeeping is based on heavy use of equipments and honey processing plants which results in higher efficiency and also ensures the quality of produced honey. India has vast potential for beekeeping due to diversity in availability of flora and fauna. At current time India ranks first in terms of number of beehive stocks followed by China in the World. The average annual production of honey worldwide was about 1.8 million MT during 2016-17. There are 15 countries in the world which account for 90 per cent of the world honey production and export led by China, producing nearly 7 lakh MT and has 12.3 per cent shares in total world export during 2016-17 (Ministry of Agriculture, China). European Union is the largest importer of honey followed by North America. During the year 2016-17, India has produced a total of 95,000 MT of honey, out of which 45537.99 MT of natural honey was exported to other countries of the world and earned a foreign exchange of US$ 84.23 million (India Stat, 2018). The major export destinations of honey export for India are Bangladesh, United States of America, United Arab Emirates, Morocco and Saudi Arabia. Of the total production of honey in India about 61 percent was contributed by four States viz. West Bengal, Uttar Pradesh, Punjab and Bihar (NBB, 2016) [6]. The per capita consumption of honey in India during 2015-16 was only 38 grams as compared to 1800 grams in Germany during similar year. In Uttarakhand, beekeeping forms an integral part of small holder farming system and plays a significant role as source of additional cash income in subsistence farming. The credit for popularizing beehives and modern beekeeping in Kumaon and other parts of Northern India goes to Mr. R.N. Mutoo as he established bee Centre at Jeolikote, Nainital. The central Government has taken certain positive initiatives and launched National Mission for overall development of beekeeping in North Eastern and Hilly State of the country (HMNEHS). Thus, there is a wide scope for beekeeping as a remunerative enterprise in Uttarakhand. Total number of beekeeping units in India is about 2.5 Lakh out of which only about 8,700 units are in Uttarakhand (3.48 per cent) producing 2500 MT of honey in 2016-17. Nainital, Haridwar, Pauri and Pithoragarh are the important honey producing districts in Uttarakhand.

The findings of the study would explore the fact about costs and returns in honey production in the Nainital district of Uttarakhand.

Methodology

This study was conducted in the Nainital district of Uttarakhand. This district accounted for maximum number of beekeepers rearing *Apis mellifera* (200) and highest production of honey (396 MT) among all districts of Uttarakhand in 2016-17 (Rajkiya Moan Palan Kendra, Jeolikote). The study is based on both primary as well as secondary data. The primary data were collected from the sample beekeepers by personal interview method pertaining to year 2017-18, using a pre-tested structured survey schedule designed for the study. Secondary data was collected from various published and un-published sources such as records of Khadi Village Industries Commission, Haldwani; Krishi Vigyan Kendra, Nainital; Rajkiya Moan Palan Kendra, Jeolikote; National Bee-Board, Dehradun, etc. Nainital district is comprised of eight blocks out of which Bhimtal and Ramnagar blocks were selected purposely for the study on the basis of potentiality for beekeeping. A list of beekeepers of both the blocks registered with National Bee Board having more than 10 hives was obtained from Rajkiya Moan Palan Kendra (RMPK), Jeolikote. As most of registered beekeepers were rearing *Apis mellifera* species through migratory beekeeping practices, 30 migratory beekeepers from each block were selected randomly from the list and in all 60 beekeepers were included in the sample for detailed analysis. These beekeepers were classified into three categories: small beekeepers (10 to 70 bee colonies), medium beekeepers (71 to 140 bee colonies) and large beekeepers (above 140 bee colonies). To estimate the cost of and returns from honey production, data related to expenses on different components of beekeeping and returns from sale of honey and other by-products were analysed using the simple descriptive statistical tools. In the present study cost and returns were estimated for the unit hive.

Result and Discussion

Cost structure of honey production

The cost has been divided into two components i.e. fixed and variable cost and observations have been taken for small, medium, and large beekeepers depending upon their size of operation. The components of fixed cost were depreciation value for equipment and amount of interest on the present value of fixed assets used in beekeeping and in addition to this fee for permission of forest land use right. The variable cost was computed by considering the value of variable resources used per hive and the interest on working capital. The Table 1 shows the parameters considered and items adapted for calculating the cost of honey production.

The table shows that on overall basis average total cost of honey production per hive was Rs. 1727.82. Out of which overall fixed and variable cost were Rs. 376.44 and Rs. 1351.36 which account for 21.79 per cent and 78.21 per cent of the total cost of honey production, respectively. This indicate higher proportion of variable cost to the total cost.

Among different beekeeping categories table depicts that total cost per hive for small, medium and large beekeepers was Rs. 1741.69, Rs. 1766.23 and Rs. 1693.69, respectively. The result suggests that larger beekeepers have incurred lowest cost per hive than others. This signifies that concept of economies of scale is involved in beekeeping business in the area.

Table 1: Cost structure per hive per household for the beekeepers in Nainital District (Rupees/hive)

Cost Items		Beekeepers category			
		Small	**Medium**	**Large**	**Overall**
		Fixed cost			
Forest land use right		7.06 (0.41)	5.84 (0.33)	6.25 (0.37)	6.20 (0.36)
Depreciation of fixed asset		225.49 (12.95)	210.96 (11.94)	214.55 (12.67)	214.72 (12.43)
Interest on fixed asset capital @ 10% p.a.		156.5 (8.99)	156.4 (8.86)	154.55 (9.13)	155.52 (9.00)
Total fixed cost		389.05 (22.34)	373.20 (21.13)	375.35 (22.15)	376.44 (21.79)
		Variable cost			
Cost of foundation sheet		27.28 (1.57)	40.90 (2.26)	37.29 (2.20)	36.91 (2.14)
Cost of sugar syrup		454.82 (26.11)	447.86 (25.36)	400.37 (23.64)	425.93 (24.65)
Labour cost	Hired	81.24 (4.66)	95.67 (5.42)	112.52 (6.64)	101.78 (5.89)
	Family	273.55 (15.71)	230.18 (13.0)	182.04 (10.75)	213.03 (12.33)
	Sub total				
Labour cost	Hired	81.24 (4.66)	95.67 (5.42)	112.52 (6.64)	101.78 (5.89)
	Family	273.55 (15.71)	230.18 (13.0)	182.04 (10.75)	213.03 (12.33)
	Sub total	354.79 (20.37)	325.80 (18.45)	294.56 (17.39)	314.81 (18.22)
Migration expense Transportation Site Land rent	Transportation	241.00 (13.84)	260.00 (14.72)	280.00 (16.53)	266.98 (15.45)
	Site rent	71.56 (4.19)	80.55 (4.56)	85.60 (5.05)	81.73 (4.73)
	Guard salary	60.52 (3.47)	71.65 (4.06)	88.06 (5.20)	78.00 (4.51)
	Travelling	24.00 (1.38)	20.35 (1.15)	19.00 (1.12)	20.20 (1.17)
	Accommodation	28.55 (1.64)	31.00 (1.76)	37.00 (2.18)	33.55 (1.94)
	Sub total	425.63 (24.44)	487.69 (27.61)	499.66 (29.50)	484.78 (28.06)
Honey storage container	1.31 (0.08)	0.55 (0.03)	0.40 (0.02)	0.59 (0.03)	
Medicine	13.00 (0.75)	12.89 (0.73)	11.70 (0.69)	12.33 (0.71)	
Miscellaneous and unforeseen expenses	10.00 (0.57)	10.00 (0.57)	10.00 (0.59)	10.00 (0.58)	
Interest on working capital @ 10% for six months	65.81 (3.78)	68.19 (3.86)	64.36 (3.80)	66.01 (3.82)	
Total variable cost	1352.64 (77.66)	1393.03 (78.87)	1318.34 (77.85)	1351.36 (78.21)	
Total cost	1741.69 (100.00)	1766.23 (100.00)	1693.69 (100.00)	1727.82 (100.00)	
Total production (kg)	17.35	20.76	20.06	19.95	
Cost of production of honey (Rs./kg)	90.61	72.78	73.62	75.36	
Cost of production of wax (Rs./kg)	244.83	216.36	223.13	226.19	
Cost of raising a unit of bee colony frame	101.69	99.17	97.24	99.47	

The total fixed cost incurred per hive in the case of small, medium and large beekeepers was Rs. 389.05, Rs. 373.20 and Rs. 375.35 contributing 22.34 per cent, 21.13 per cent and 22.15 per cent of the total cost, respectively. It shows that fixed cost per hive was higher for small apiary followed by large apiary whereas minimum for medium apiary. The major reason for this cost difference was misallocation and underutilization of the resources resulting in advantage for the medium and large beekeepers over the small beekeepers. Additionally, most of the small apiaries had bought costlier items than the medium and large beekeepers which resulted in higher depreciation and higher present value. It was also found during investigation that the medium and large beekeepers have even utilized the equipment after the completion of their average expected life. Thus, the depreciation and present value of that equipment was negligible. It was more frequent in the case of medium beekeepers that resulted in lowest annual depreciation**.**

The variable cost incurred in running an apiary were migration expenses, comb foundation sheets, sugar syrup, medicines, labour, miscellaneous expenses etc. The variable cost for small, medium and large apiary was estimated to be Rs. 1352.64, Rs. 1393.03 and Rs. 1318.34 which was about 77.66 per cent, 78.87 per cent, and 77.85 per cent of total cost,

respectively. Thus, the share of the variable cost in the total cost of honey production was lowest for large beekeepers followed by small and medium beekeepers.

The share of various components in the variable cost differs categorically. In the case of small beekeepers, sugar syrup used as supplement feed had largest weightage among the variable cost items accounting for 26.11 per cent of the total cost, while for medium and large apiary migration expenses was the most expensive variable component claiming 27.61 per cent and 29.50 per cent of the total cost, respectively. The migration expenses were highest for large apiary and lowest for the small apiary because average number of migrations was highest for medium beekeepers followed by large and small beekeepers.

At overall level cost incurred on the migration was Rs. 484.78 and its contribution was highest in the total variable cost as compared to other variable inputs. Out of the overall total cost incurred on the migration at aggregate level, the transportation (15.45 per cent) had highest proportion followed by apiary site rent (4.73 per cent) to the overall total cost. The cost incurred on care taker of bee colony for protection from theft and vandalism is 4.51 per cent of migration cost. The beekeepers also spend on accommodation while they temporarily reside on the site for management and honey harvest during honey flow season. The share of this temporary residence contributes nearly 1.94 per cent while 1.17 per cent of the total cost goes for the travelling expenses. These patterns of cost incurred during migration remain same for all the categories with very little variation.

The cost incurred on sugar syrup at aggregate level was 24.65 per cent of total incurred cost. Among categories this proportion was highest for small apiary while lowest for large apiary. It was found that cost incurred on supplement feed requirement decreases with increase in numbers of hives. There were various reasons for this difference in the proportion of sugar syrup in the total variable cost. Firstly, the large and medium beekeepers purchased sugar in large quantity. So, sugar was available at lower price. Secondly, the migration also had a significant influence on requirement of supplement feed as during migration flora is available and therefore the need of supplement was decreased.

The next major component of variable cost was human labour. In this case, small beekeepers had incurred maximum labour expenses of Rs. 354.79 followed by medium and large beekeepers. This was because of the underutilization of man power in case of small apiary indicating that the small beekeepers could maintain more number of hives with the same man power. Further it was observed that the hired labour proportion was increasing with increase in the hive size owned while for imputed family labour converse holds true. This was because the large and medium beekeepers required more labour for loading and unloading of beehive as the average number of migration was more. In addition to this, they also had hired labour for honey extraction purpose.

The overall expense on total labour cost was Rs. 314.81 out of which Rs. 213.03 were spent on family labour and rest Rs. 101.78 on hired labour. Higher imputed value of family labour shows that the bee colonies were looked after by the beekeepers themselves and labour was hired casually only when needed.

The proportion of cost of comb foundation sheet at aggregate level was only 2.14 per cent of the total cost. It mainly depended on the number of new bee colonies generated. The share of comb foundation sheet cost in the total cost was 1.57 per cent, 2.26 per cent, 2.20 per cent for the small, medium and large beekeepers, respectively.

Honey storage container is needed for storage of harvest honey. The capacity of a container ranges from 22-24 kg. The average cost incurred on honey container per hive was quite low (i.e. Rs. 0.59) which was depending upon the level of production. As hive production was more in the case of medium apiary the cost incurred on the storage container was also high. The traders and processors purchased honey in the containers and subsequently returned the cost of container to beekeepers. Thus, the beekeepers had to bear only the cost of storage container for the honey that was retained for the off season, household consumption and for the honey sold directly to the consumer.

Another variable cost component was cost on medicines for the management of diseases and predators infestation. It was observed that cost on medicines decreases with increase in hive size. The proportion of the cost incurred on the medicines in the total cost for, small, medium and large apiary was 0 .75 per cent, 0.73 per cent and 0.69 per cent of the total cost, respectively. The overall cost incurred on medicine was Rs. 12.33 per hive which happened to be 0.71 per cent of the total cost. Further the interest on variable cost contributed about 3.78 per cent, 3.86 per cent and 3.80 per cent of total cost for small, medium and large beekeepers categories. At aggregate level the contribution of interest was 3.82 per cent. The miscellaneous expenses consisted of expenses on maintenance of equipments, rent for honey extractor etc. which shared on the average 0.58 per cent of total cost. These results indicate that medium beekeepers go for higher variable expenses to increase their returns.

Further at aggregate the cost incurred to produce per kg of honey and wax was Rs. 75.36 and Rs. 226.19 while among categories cost incurred was maximum for small beekeepers while minimum for medium beekeeper's category. The probable reason for this was higher production per hive and in addition to this advantage of economies of scale medium beekeepers.

On overall basis cost incurred on raising a unit of bee colony frame was Rs. 99.47. In case of large beekeepers minimum cost (Rs. 97.24) was incurred to raise a bee frame while maximum for small beekeepers.

Returns from beekeeping

The beekeepers in the area got returns from the sale of honey, wax and bee colonies. Honey is the main product of beekeeping industry. The returns from other bee products such as royal jelly, propolis and bee pollen were unexplored as beekeepers did not focus to extract them due to the lack of knowledge, technological advancement and proper marketing channel. The returns mainly depend on level of production. The result related to returns per hive has been presented in Table 2.

It is clearly seen from the table that at aggregate level out of total gross returns, 87.02 per cent contributed from sale of honey and 10.19 per cent of sale of bee colonies. Same result was found in the study of Kaura (2011). The remaining 2.88 per cent of gross return was from the sale of wax. Categories wise analysis reveals that the total returns from sale of honey for the medium apiary was highest Rs. 1745.34 while it was lowest for the small apiary of Rs. 1605.97 and for large apiary, Rs. 1651.27. The proportion of returns from sale of honey in the gross return was 85.54 per cent, 87.19 per cent and 90.26 per cent for medium, large and small apiary,

respectively.

The gross returns from honey were further categorized on the basis of flora they utilized like mustard, litchi, forest and eucalyptus + mustard. Honey from flora of apple, jamun, peach etc. came in others category. Among them the share of the mustard honey at aggregate level was maximum (37.90 per cent) in terms of the value of the honey. It was followed by the forest, litchi, eucalyptus and others. Similar trend of share of returns from mustard honey was also found in medium and large apiary categories. But in the case of small apiary, the quantity and value received from the forest honey was highest which was followed by mustard, litchi and eucalyptus + mustard honey. This was because some of the small beekeepers avoided migration for mustard flora and were residing in their native district which was rich in forest / timber flora. In case of large apiary, the share of mustard honey was 41.10 per cent of the gross return from beekeeping, being maximum amongst all. The proportion of mustard honey in gross returned from beekeeping was 36.85 per cent and 27.40 per cent for medium and small apiary, respectively.

The overall average share of return from sale of litchi honey in the total returns was 14.32 per cent. In different categories of apiary, the contribution of returns from litchi honey in the total returns was 17.35 per cent, 15.12 per cent and 14.47 per cent for the small, medium and large apiary, respectively. The small beekeepers had higher proportion as compared to large and medium beekeepers from the sale litchi honey even though highest quantity of the litchi honey was sold in case of medium beekeepers. This was primarily because the small beekeepers sold larger portion of the honey to the consumers directly as compared to their counterparts. The honey from the jungle source also showed the similar trends. The proportion of value from sale of forest honey to total return 33.21 per cent, 25.52 per cent, 22.49 per cent for small, medium, large apiary, respectively. It shows decrease in contribution through jungle honey in terms of value with increase in apiary size. The overall return from sale of forest honey in the gross return from beekeeping was 25.44 per cent.

Table 2: Return structure per hive per household for the beekeeping in Nainital Districts (In Rupees/ hive)

Items		Beekeepers category							
		Small beekeepers		Medium beekeepers		Large beekeepers		Overall	
Products		Quantity (kg)	Value (Rs.)	Quantity (kg)	Value (Rs.)	Quantity (kg)	Value (Rs.)	Quantity (kg)	Value (Rs.)
1. Honey	Mustard	6.17	487.39 (27.40)	9.55	751.86 (36.85)	9.62	778.41 (41.10)	9.27	730.39 (37.90)
	Litchi	2.95	308.63 (17.35)	3.32	308.54 (15.12)	2.81	273.79 (14.45)	3.02	275.99 (14.32)
	Jungle	5.97	590.63 (33.21)	6.02	520.84 (25.52)	5.41	426.08 (22.49)	5.57	489.66 (25.44)
	Eucalyptus+sarson	1.74	154.79 (8.70)	1.66	141.67 (6.94)	2.11	166.25 (8.77)	1.89	158.08 (8.20)
	Others flora	0.52	64.53 (3.63)	0.21	22.40 (1.09)	0.11	6.70 (0.35)	0.20	23.20 (1.20)
	Subtotal	17.35	1605.97 (90.26)	20.76	1745.34 (85.54)	20.06	1651.27 (87.19)	19.95	1677.32 (87.02)
2. Wax		0.15	37.50 (2.10)	0.24	60.00 (2.94)	0.23	57.50 (3.03)	0.22	55.66 (2.88)
3. Bee colonies (No.)	Off season	1.25	125.00 (7.02)	1.75	175.00 (8.57)	1.55	155.00 (8.18)	1.58	158.00 (8.19)
	On season	0.05	10.00 (0.56)	0.30	60.00 (2.94)	0.15	30.00 (1.58)	0.19	38.53 (1.99)
	Sub total	1.30	135.00 (7.59)	2.05	235.00 (11.51)	1.70	185.00 (9.76)	1.77	196.53 (10.19)
Gross return from beekeeping (Rs./hive)		1778.47 (100.00)		2040.34 (100.00)		1893.77 (100.00)		1927.47 (100.00)	
Returns from per kg honey		92.56		84.07		82.32		83.97	
Net return from beekeeping over total cost (Rs./hive)		36.78		274.16		200.08		199.65	
Net return from beekeeping over variable cost (Rs./hive)		425.83		647.09		554.18		576.11	
Input- output ratio		1.02		1.16		1.12		1.12	

Eucalyptus + Mustard flora honey had overall return from the sale of honey of Rs. 158.08 which accounted for 8.20 per cent of total returns from beekeeping. Among the categories, in case of large beekeepers it contributed maximum share to the gross return from beekeeping with value of Rs. 166.25 which accounted for 8.77 per cent. The contribution of other flora honey on the average was very less only up to 1.20 per cent of the total value of returns. In case of different categories the share of revenue from the other flora honey in total returns from beekeeping ranged from 0.35 per cent to 3.63 per cent.

Wax is an important by product in beekeeping. The average market price for the bee wax was worked out to be Rs. 250. The amount of wax produced for small, medium, and large beekeepers was 0.15 kg and 0.24 kg and 0.23 kg, respectively. Further it was found that the quantity of wax obtained was mainly depended on the amount of honey produced. The quantity of wax produced per hive was highest for the medium apiary and lowest for the small beekeepers. The quantity of the wax produced at overall level was 0.22 kg only.

From the economical point of view wax contribute 2.89 per cent in total gross return was and had the value of Rs. 55.66. Among different categories of beekeepers it was observed that the medium beekeepers has received maximum value share of Rs. 60 from wax which about 2.94 per cent. While the large beekeepers has maximum proportion of 3.0 per cent to their

relative gross return from beekeeping with value of Rs. 57.60. The small beekeepers had lowest returns from wax among all categories both in value and proportion with value of Rs. 37.5 and proportion of 2.11 per cent of the gross return.

Beekeepers also enhance their returns through sale of bee colonies. The sale of bee colonies by the beekeepers was mainly done during the off-season while some sold colonies at the onset of season. The price of bee colonies both varied from Rs. 100- 200 depending upon time of sale. At overall level share through sale of bee colonies in total return was 10.19 per cent. Which comprised 8.19 per cent and 1.99 per cent contributions from the sale of bee colonies during the off-season and the onset of season, respectively. For small, medium and large beekeepers the proportion of off season and on season was (7.02 per cent, 0.56 per cent), (8.58 per cent, 2.94 per cent) and (8.18 per cent, 1.58 per cent), respectively.

Further it was analyzed from the table that the gross return from sale of per kg of honey at aggregate level was Rs. 83.97. Among beekeeping categories it was highest for the small beekeepers followed by medium and large beekeepers i.e. Rs. 92.56, Rs. 84.07, and Rs. 82.32, respectively. The reason for higher gross return realized by small beekeepers was that small beekeepers sold higher proportion of their honey directly to the consumers after manual processing for which they got higher prices.

The net return from unit hive to the total cost was Rs. 199.65. It was highest in case of medium beekeepers about Rs. 274.16 while lowest for small beekeepers observed to be Rs. 36.78 only. It was due to less contribution of by products in returns and diseconomies of scale in case of small beekeepers. But it was found maximum in case of large farmers in study of Singh and Shekhon (2014). The overall gross returns over variable cost for the beekeepers per hive were Rs. 576.11. Among different beekeeping categories the medium beekeepers had maximum gross returns over total cost (Rs. 647.09) followed by large beekeepers (Rs. 554.18). The input output ratio was 1.12 at aggregate level which indicates that on an investment of rupee one beekeepers get Rs. 1.12 in return. The input to output ratio was highest for medium beekeepers i.e. 1.16 and lowest for small beekeepers i.e. 1.02. Thus, it was seen that medium beekeepers were having more profits and had high economic feasibility in comparison to the others.

This depicts that beekeeping was a remunerative enterprise in the area. It also shows the potential of beekeeping to be taken as additional income generating enterprise with crop farming.

Conclusion

For different beekeeper categories the total cost incurred on beekeeping practices per unit hive was assessed. The share of fixed cost was 22.34 per cent, 21.13 per cent and 22.15 per cent in case of small, medium and large beekeepers, respectively. The share of variable cost to the total cost per hive was 77.66 per cent, 78.87 per cent and 77.84 per cent in case of small, medium and large beekeepers, respectively. Major constituent of variable cost component were same as the aggregate level. Production cost of a unit kg of honey was maximum for small beekeepers. An examination of returns from a unit hive led to the conclusion that 87.02 per cent of total income was obtained from honey production alone. Raise bee colonies constituted 10.19 per cent of total return while wax contributed about 2.88 per cent of the gross return. The return from a unit kg of honey was Rs. 83.97 and net return per hive over total cost was Rs. 199.65. The input to output ratio was 1.12. The contribution of honey to the gross return was maximum in case of small beekeepers followed by large beekeepers (87.19 per cent) while minimum for medium beekeepers (85.54 per cent). The trend was reverse in case of contribution from sale of bee colonies. The share of income from sale of bee wax was found to be increased with increase in apiary size. The input to output ratio was maximum for medium beekeepers followed by large beekeepers.

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