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Assessment of Beekeeping Knowledge among Farmers in Haryana

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HIGHLIGHTS

- Beekeeping significantly enhances rural livelihoods by increasing income and supporting sustainable agricultural practices.
- Literacy and education positively influence the adoption of modern beekeeping practices and honey production efficiency.
- Beekeeping supports biodiversity conservation and sustainable rural livelihoods with minimal capital investment.

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ABSTRACT

The Indian economy, heavily reliant on agriculture, faces challenges due to increasing population pressure and declining landholding sizes, pushing farmers to diversify their income sources. Beekeeping, requiring minimal capital investment and leveraging natural resources like nectar and pollen, emerges as a viable alternative. This study, conducted in Kaithal, Kurukshetra, and Karnal districts of Haryana, aimed to assess farmers' knowledge of beekeeping practices. A total of 150 respondents were surveyed using structured interviews and secondary data sources. The results revealed that most beekeepers had a moderate to high knowledge of various aspects of beekeeping, including honey production, bee flora, and biological aspects. Socio-economic factors such as age, education, social participation, and media exposure significantly influenced knowledge levels. Beekeeping not only enhances crop productivity through pollination but also offers employment opportunities, making it an essential strategy for rural development. The study emphasizes the potential of beekeeping in uplifting smallholder farmers and mitigating the limitations of traditional agriculture.

INTRODUCTION

The Indian economy is deeply rooted in agriculture; with over 60 per cent of the population relying on it as their primary source of livelihood. But as a result of growing population pressure and industrialisation, the amount of land held per person is steadily declining. Consequently, it has become increasingly challenging for landless, marginal, and small farmers, as well as unemployed individuals, to fulfil their family's domestic needs. Under such circumstances, farmers have to adopt for some other to uplift their income. Among the enterprises in agricultural sector, bee farming is one of that smart agricultural enterprise that requires minimal capital investment as compared to other related activities (Mishra et al., 2024). Additionally, it does not require any additional raw material as same is provided by the nature in the form of nectar and pollen. Anybody with technical skills and enthusiasm can engage in this type of entrepreneurship, regardless of their age, gender, level of education, or ownership of land (Kumar et al., 2022). In addition to producing honey and other valuable bee products (such as wax, royal jelly, propolis, pollen, venom, etc.), honey bees (Hymenoptera: Apidae) play a more significant ecological role as the most reliable and effective pollinators of flowering plants and trees, which increases crop productivity (both quantitatively and qualitatively) and maintains plant diversity. In agricultural crops, about ninety per cent of pollination is being carried out by the bees only, and

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result in about thirty-three per cent increase in total production of agricultural and fruits crops and India occupies sixth position among the top ten honey producing countries in the world (Kumar & Patel, 2019). Beekeeping is an excellent source of employment for the rural unemployed youth and currently approximately 2,50,000 farmers in India are employed through beekeeping (Kumar et al., 2022). Moreover, honey bees significantly enhance the yield of agricultural and horticultural crops through effective pollination, while also improving the quality of the produce.

Beekeeping plays a crucial role in diversifying and increasing the income of Indian smallholder farmers and landless youth. Given the challenges posed by depleting natural resources and the reduced profitability of traditional agriculture, nutrition sensitive agriculture like beekeeping holds great potential to uplift the economy of Indian farmers (Mishra et al., 2024). The introduction of the honey bee species Apis mellifera to India has revolutionized the beekeeping industry, sparking a remarkable "honey revolution" across the country. In Haryana, successful beekeeping with this exotic species began in 1987, and today, it has become a thriving enterprise, providing livelihoods to many.

METHODOLOGY

The current research was carried out in the meticulously selected Kaithal, Kurukshetra and Karnal districts of Haryana in 2023 utilizing an ex-post facto research design. The districts were chosen on purpose because of its abundant and varied bee keeping, which are perfect for scientific bee rearing. From Kaithal district, fifty respondents were selected at random from the villages namely Machheredi, Kharkara, Riwad, Kakeri, Salempur, Bata and Deohra whereas from Kurukshetra district fifty respondents were selected randomly from the villages namely Charuni Jattan, Ghararsi, Barna, Jhandheri, Thanesar and Shahbad and from Karnal district fifty respondents were selected randomly from the villages namely Budheri, Santri, Khera, Seir, Gheer and Choura. Thus, 150 farmers constituted the respondents to the study by simple random sampling technique.

A planned interview schedule designed especially for the study and direct observation techniques helped get primary data. The government, sectors, and gramme panchayats' official records provided secondary data. The dependent variable, knowledge of the respondents regarding beekeeping, was employed using the approach outlined by (Boora et al., 2023). Scores of 2, 1, and 0 were assigned to full, partial, and no knowledge, respectively. Knowledge quotients were calculated from raw scores to gauge the overall knowledge level. Thus, after computing the individual knowledge quotient scores, the respondents were categorized into three groups. The relationship between two categorical variables of such independent variables and knowledge level was checked by implementing a non-parametric test of chi-square value and coefficient of contingency estimation to draw a conclusion.

RESULTS

Beekeepers' knowledge about different aspects of beekeeping

The results depicted in Table 1 depicts knowledge of beekeepers of different districts in general aspects of beekeeping. The results revealed that majority of the beekeepers possessed highly knowledge about water needs of bee and identification of bees in the general aspects of beekeeping. In management aspects, the majority of farmers have high knowledge about best season for bee keeping and protection of boxes from robbing whereas in honey production aspects, majority had high knowledge about exclusion of queen bee and about extraction of honey. In the case of bee flora aspects of beekeeping, majority of farmers had high knowledge about maize as a good source of flora and about honey bees collect enough nector during the month of January. Regarding bee breeding aspects, majority had knowledge about maximum number of eggs were laid by queen bees and young queen lay a greater number of eggs than old queen. In case of biological aspects, majority of farmers had high knowledge about life cycle of honey bee and about body parts of honey bees.

Level of knowledge of beekeeping among farmers of Haryana

The data in Table 2 clearly revealed that nearly maximum number of the respondents (46%) demonstrated a moderate level of knowledge about beekeeping, while approximately two-fifths (38%) exhibited a high level of expertise, and 16% had limited knowledge in the field.

Socio-economic variables and level of knowledge of bee keeping in different districts

The data in Table 3 depicts that association between level of knowledge of beekeeping among farmers of Haryana and independent variables namely age, social participation, mass media exposure and socio-economic status were found highly significantly associated at chi-square value of 19.949, 20.318, 13.860 and 14.376 respectively. Analysis clearly revealed that level of education was found significantly associated with level of knowledge at chi-square value of 13.594 whereas, the independent variables namely caste, subsidiary occupation, size of landholding, type of family, size of family and annual income were not found significantly associate with level of knowledge.

DISCUSSION

The study reveals some remarkable trends in the knowledge of beekeeping among farmers in the Kaithal, Kurukshetra, and Karnal districts of Haryana. A reasonable proportion of the respondents, ranging from moderate to high, represent a growing awareness of potential supplementary livelihood sources in such practices. The findings are in line with (Kumar et al., 2020) However, variations in knowledge levels among farmers suggest the influence of factors such as education, social exposure, and prior experience in agricultural enterprises. One key relationship highlighted in the study is the positive correlation between education and beekeeping knowledge. Farmers with higher education levels tend to adopt modern techniques and manage their enterprises more effectively. This is in line with the findings of Yusuf et al., (2017) & Kumar et al., (2019), which indicated that higher education levels have a positive effect on the adoption of modern beekeeping practices. Also, age and experience in beekeeping are directly proportional to the level of knowledge acquired, and thus hands-on involvement would increase learning as is supported by Patel et

Table 1. District wise percentage of beekeepers' knowledge about different aspects of beekeeping (n=150)

Different aspects of knowledge	Full knowledge	Partial knowledge	No knowledge	Mean Score
General aspects				
Identification of queen, worker, drone and Italian honeybees	92(61.33)	27(18.00)	31(20.67)	2.40*
Drone bees are fatter than worker bees	33(22.00)	97(64.67)	20(13.33)	2.08
Worker bee is sharp	110(73.33)	15(10.00)	25(16.67)	2.56*
Drone bees do not harvesting	102(68.00)	28(18.67)	20(13.33)	2.48*
Water is important for bees	120(80.00)	15(10.00)	15(10.00)	2.70*
Guarding of boxes by workers bees	96(64.00)	25(16.67)	29(19.33)	2.46*
Identification of Indian honey bees	35(23.33)	90(60.00)	15(16.67)	2.00
Collection of pollen by worker bees	85(50.00)	35(23.33)	30(20.00)	2.36*
Number of queen bees in a colony	109(72.67)	21(14.00)	20(13.33)	2.59*
Swarming of bees during April	83(55.33)	36(24.00)	31(20.67)	2.34*
Sugar present in honey	26(17.33)	104(69.33)	14(09.34)	2.01
Season for increasing of boxes	102(68.00)	24(16.00)	24(16.00)	2.48*
Age of worker bees	25(16.67)	96(64.00)	29(19.33)	1.97
Monsoon season for bees	90(60.00)	30(20.00)	30(20.00)	1.80
Preference of domestic bees for comb making	85(56.67)	35(23.33)	30(20.00)	2.36*
Knowledge of nectar collected by bees	109(72.66)	21(14.00)	20(13.34)	2.59*
Types of honeybees	83(55.33)	36(24.00)	31(20.67)	2.34*
			Overall Mean score 2.32	
Management aspects				
Sugar syrup feeding to boxes	31(20.67)	92(61.33)	27(18.00)	2.02
Packing of boxes during winter	33(22.00)	97(64.66)	20(13.34)	2.08*
Robbing problem	15(10.00)	110(73.33)	25(16.67)	1.83
Checking of boxes during summer	28(18.67)	102(68.00)	20(13.33)	1.98
Optimum time to start beekeeping	15(10.00)	120(80.00)	15(10.00)	2.00
Checking of boxes during winter	25(16.67)	96(64.00)	29(19.33)	1.96
Placement of boxes during winter	29(19.33)	91(60.67)	30(20.00)	1.92
Protection of boxes from robbing	85(56.67)	36(24.00)	29(19.33)	2.37*
Benefits of winter packing	21(14.00)	109(72.67)	20(13.33)	2.01
Hive tool	36(24.00)	83(55.33	31(20.67)	2.03
Best season for bees	104(69.33)	26(17.33)	14(09.34)	2.52*
Giving feed to boxes during offseason	20(13.33)	107(71.33)	23(15.34)	1.98
Optimum number of boxes to start beekeeping	24(16.00)	98(65.33)	28(18.67)	1.97
Time to giving feed to colonies	25(16.67)	96(64.00)	29(19.33)	1.90
Robbing during rainy season	27(18.00)	92(61.33)	31(20.67)	1.97
Method used to decrease the population of drones	33(22.00)	97(64.67)	20(13.33)	2.08*
Row to row distance	25(16.67)	110(73.33)	15(10.00)	2.06*
Box to box distance	28(18.67)	102(68.00)	20(13.33)	2.05*
			Overall Mean score 2.04	
Honey production aspects				
Extraction of honey	93(62.00)	27(18.00)	30(20.00)	2.35*
Queen excluder	87(58.00)	34(22.67)	29(19.33)	2.38*
Maturity of honey	31(20.67)	99(66.00)	20(13.33)	2.07
Production of honey	43(28.67)	75(50.00)	32(21.33)	2.05
Benefits of queen excluder	100(66.67)	30(20.00)	20(13.33)	2.53*
Freezing of honey	27(18.00)	100(66.67)	23(15.33)	2.04
Wax production	31(20.67)	99(66.00)	20(13.33)	1.87
Purity of honey	20(13.33)	105(70.00)	25(16.67)	1.83
Consumption of honey by bees for production of wax	38(25.33)	92(61.33)	20(13.34)	2.05
			Overall Mean score 2.13	
Bee flora aspects				
Migration of boxes	89(59.33)	32(21.33)	29(19.34)	2.40*
Whether bees destroy the flowers	15(10.00)	35(23.33)	100(66.67)	1.36
Availability of flora for bee during March-April	83(55.34)	33(22.00)	34(22.66)	2.32*
Importance of pollen or bees	21(14.00)	110(73.33)	19(12.67)	2.01
Things collected by bee from flowers	36(24.00)	85(56.66)	29(19.34)	2.04
Maize as a good source of flora	105(70.00)	25(16.67)	20(13.33)	2.56*
Honey bees collect enough nector during January	102(68.00)	30(20.00)	18(12.00)	2.55*
Which crop produce more honey	22(14.66)	96(64.00)	32(21.34)	1.93
Pollen collected by worker bees	30(20.00)	95(63.33)	25(16.67)	2.03
			Overall Mean score 2.13	

Table 1 contd....

Different aspects of knowledge	Full knowledge	Partial knowledge	No knowledge	Mean Score
Bee enemies' aspect				
Protection of bees from ants	33(22.00)	97(64.67)	20(13.33)	2.08*
Damage of wax moth	40(26.66)	78(52.00)	32(21.34)	2.05
Damage of varroa mite	50(33.33)	85(56.67)	15(10.00)	2.23*
Damage of green sparrow	62(41.33)	48(32.00)	40(26.67)	2.14*
Season of incidence of wax moth	31(20.67)	93(62.00)	26(17.33)	2.03
Control measures for varroa mite	27(18.00)	98(65.33)	25(16.67)	2.01
Incidence of wax moth	38(25.33)	89(59.33)	23(15.34)	2.04
Thaisac brood disease of bees	55(36.67)	36(24.00)	59(39.33)	1.99
			Overall mean score 2.07	
Bee breeding aspects				
Young queen lay a greater number of eggs than old queen	99(66.00)	20(13.33)	31(20.67)	2.45*
Purchasing of bee sand young mated queen	101(67.33)	34(22.67)	15(10.00)	2.57*
Swarming by young queen	47(31.33)	85(56.67)	18(12.00)	2.19
Laying worker bees	38(25.33)	94(62.67)	18(12.00)	2.13
Laying of eggs by queen bee	34(22.67)	78(52.00)	38(25.33)	1.97
Maximum number of eggs laid by queen bees	119(79.33)	10(06.67)	21(14.00)	2.65*
Age of queen bee	102(68.00)	23(15.33)	25(16.67)	2.44*
Mating of queen bee by drones	22(14.67)	89(59.33)	39(26.00)	1.88
Number of eggs queen lays per cell	36(24.00)	89(59.33)	25(16.67)	2.07
Method of queen rearing	45(30.00)	67(44.67)	38(25.33)	2.04
			Overall Mean score 2.23	
Bee biology aspects				
Rearing of queen from eggs	47(31.33)	87(58.00)	16(10.67)	2.20
Rearing of worker bee from eggs	45(30.00)	85(56.67)	20(13.33)	2.16
Rearing of drone from eggs	45(30.00)	80(53.33)	25(16.67)	2.13
Life cycle of honey bee	95(63.33)	35(23.33)	20(13.34)	2.43*
Body parts of honey bees	76(50.66)	56(37.33)	18(12.00)	2.38*
			Overall mean score 2.26	

Figures in parentheses denote percentage; Responses were multiple

Table 2. Level of knowledge of beekeeping among farmers of Haryana (n=150)

Level of knowledge	Frequency
Low (76-126)	24 (16.00)
Moderate (127-177)	69 (46.00)
High (178-228)	57 (38.00)

Figures in parentheses denote percentage

Table 3. Association between socio-economic variables and knowledge of bee keepers in different districts of Haryana

Socio-economic variables	Chi-Square value (χ^2)	Coefficient of contingency (C)
Age	19.949**	0.343
Caste	3.959	0.160
Level of education	13.594*	0.288
Subsidiary occupation	9.879	0.249
Size of land holdings	10.323	0.254
Type of family	1.632	0.104
Size of family	9.663	0.246
Annual family income	3.825	0.158
Social participation	20.318**	0.345
Mass media exposure	13.860**	0.291
Socio-economic status	14.376**	0.296

al., (2015), who noted that experience in agricultural enterprises develops practical skills. Social involvement, which involves membership in farmers' groups and mass media, strengthens knowledge. In this regard, it seems that community-based activities and the dissemination of information play an important role in findings of (Raina et al., 2017; Kumari & Singh, 2022) concerning the role of community-based initiatives and mass media in the dissemination of information. Findings are in line with other previous research indicating that beekeeping contributes to the rural livelihoods and biodiversity conservation substantially (Chauhan et al., 2020; Kumar et al., 2022). A generalization that can be derived from the data is that beekeeping is perceived as a low-investment, high-benefit enterprise. Farmers widely acknowledge its role in enhancing crop productivity through pollination, which aligns with studies by Gill et al., (2015) & Meena et al., (2017), which emphasize the ecological importance of bees. Exceptions to this generalization include farmers in remote areas who lack adequate resources, as noted by Ramesh et al., (2020). Although the study's findings broadly align with existing literature, there is disagreement on the degree of institutional support needed. Contrary to studies that propose reliance on heavy government subsidies (Khan et al., 2018), this study proposes community-led approaches and training programs as more viable alternatives.

CONCLUSION

Beekeeping holds great promise to improve the livelihoods of Indian farmers, especially in Haryana, where knowledge levels of beekeepers are moderate to high. Ecological and economic benefits associated with this enterprise include crop productivity enhancement, income diversification, and employment opportunities. The age factor, education level, and social participation are all important determinants of knowledge acquisition, suggesting that targeted training programs and awareness campaigns should be part of the efforts. However, with all these benefits, problems such as limited resources and technical know-how remain. Thus, government support for beekeeping, technical training, and community-based initiatives can help overcome the mentioned challenges. Beekeeping represents a sustainable, low-investment enterprise that can play a significant role in rural economic development and environmental sustainability.

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