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## Adoption of apiary farming as new emerging enterprise in Anjaw district of Arunachal Pradesh

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### ABSTRACT

**Abstract:** The increasing population of India alarming all of us to how we can provide the sufficient food for all of them and how we can provide the employment for the young generation. The Apiary enterprise will become the alternative for those people who need the employment. The study was conducted in two blocks and four villages of Anjaw district of Arunachal Pradesh state to identify the socio-economic and personal factors affecting adoption of improved Apiary practices. The data collected from 120 respondents selected randomly revealed that the personal variable namely age, education, social participation, utilization of sources of information, mass media exposure, annual income, family type, land used, land holding, knowledge level and socio economic status correlated significantly with adoption of improved Apiary practices at 0.01 level of probability. While correlate the age with the extent of adoption was negative but significant and the size of land holding was found to be negative and non-significant. The statistical tests using multiple regression analysis revealed that among the variable studied, only Education, family type, Social participation, Mass media exposure, Extension contact and the knowledge level were found to exhibit positively significant contribution towards adoption gain of Apiary enterprise at 1 percent level of probability.

**Keywords:** Apiary farming, Adoption of improved practices, Socio-economic factors, Anjaw district, Extension contact

### Introduction

The increasing population of India has posed two formidable challenges before the planners namely Employment generation for about 35 crore people of the age group between 20 to 40 years, and Provision of sufficient and nutritious food to all. Agriculture is the biggest private enterprise in our country as 60 per cent of the population live in rural area and depend on agriculture and allied enterprises like Poultry, Goatery, Piggery and Mushroom etc.,

Apiary Industry, in its own humble way can contribute to this endeavour by providing part-time employment to about a million people, producing valuable food like Honey worth crores of Rupees and the most important, increasing the crops yields substantially through pollination of various agricultural and horticultural crops that are dependent on insects for pollination. Apiary, a rural cottage industry is highly suitable for India considering its gigantic agricultural pedestal and its role in providing rural employment particularly to small and marginal farmers. Although it's labour intensive, but it will give high return too. It can also provide the employment to whole family including women. It can also be the solution to bring to a standstill to the migration of rural people towards the urban area (Phadke, 2008) [1]. Fruit, vegetables or seed production from 87 of the leading global food crops is dependent upon animal pollination. Only 15% of these crops are serviced by domestic bees while 80% are pollinated by wild bees and other wild organisms. Honey collection from wild Honey bee colonies is a traditional industry in India. It is estimated that 70 to 80 per cent of the total Honey production of India comes from wild honey. About 100 million Kg. of honey worth about Rs. 200 crore is annually collected from wild Honey bee colonies. Further, India is the largest bee diversity country. India produces about 70,000 tones of Honey every year of which 25-27,000 tones is being exported to more than 42 countries. Products of Honey are used in different. Indian Council of Agricultural Research have estimated that India needs minimum 70 lakh honeybee colonies to pollinate 12 major crops which are dependent on insects like Honeybees for pollination as against this bare need we have just 15 lakh bee colonies. Here the question is raised that there are so many cost effective practices which have been developed to increase the production of honey and it is essential to disseminate the technologies in the new areas. In this direction, joint efforts of the state organization and ICAR RC for NEH Region AP centre, Basar was carried out by the way of training and exposure visits to motivate the farmers for adopting Honey production as enterprise. All these activities warrant better extension and extension support to motivate them to increase area in Apiary production and to increase the productivity of the Honey and their bi-products. Socio-economic characteristics of growers directly influence the extent of adoption, production and productivity in Honey production. Therefore in the present study, efforts have been made to identify the extent of adoption

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of modern Apiary practices among the Honey producers and investigate the socio-economic and personnel characteristics of Apiary unit holders with improvised Honey production technologies.

## Methodology

The study was conducted in Anjaw district of Arunachal Pradesh, where apiculture has emerged as a potential rural enterprise and a number of farmers have adopted beekeeping at their own level. The district was selected purposively considering the prevalence of apiary practices, availability of basic infrastructure for honey production, accessibility to technical support from ICAR and line departments, proximity to the district headquarters, and availability of markets for the sale of honey and other hive products. Among the four blocks of the district, namely Hayuliang, Hawaii-Walong, Changlangam and Manchal, Hayuliang and Manchal blocks were selected purposively based on the prevalence of apiary activities and availability of practising farmers. From these two selected blocks, four villages were selected randomly. Subsequently, 30 practising apiculture farmers were selected randomly from each selected village, constituting a total sample of 120 respondents. Since the study examined the existing adoption behaviour of farmers without manipulation of the independent variables, an **ex-post-facto research design** was adopted. Primary data were collected through personal interviews, direct observations, informal discussions and interactions with farmers. A structured interview schedule was developed in accordance with the objectives of the study, relevant literature and consultation with experts, and was used for data collection. The extent of adoption of improved apiary practices was assessed against 10 recommended practices related to honey production and associated hive products. Information was also collected regarding farmers' access to information, mass-media exposure, extension contact, marketing support, economic motivation, knowledge level and constraints encountered in the adoption and management of apiary enterprises. The major constraints related to technical guidance, availability of inputs, marketing support, informa-

tion access and interpersonal communication were also documented. The collected data were coded, tabulated and subjected to appropriate statistical analysis, including frequency, percentage, correlation and multiple regression analysis. The extent of adoption of improved apiary practices was considered the dependent variable ( $Y$ ), while age ( $X_1$ ), education ( $X_2$ ), family size ( $X_3$ ), landholding ( $X_4$ ), social participation ( $X_5$ ), utilisation of information sources ( $X_6$ ), mass-media exposure ( $X_7$ ), extension contact ( $X_8$ ), economic motivation ( $X_9$ ) and knowledge level ( $X_{10}$ ) were considered independent variables. Multiple regression analysis was used to estimate the contribution of the selected independent variables to the variation in the extent of adoption of improved apiary practices.

The regression model was expressed as  $Y = a + b_1X_1 + b_2X_2 + b_3X_3 + \dots + b_{10}X_{10}$ , where  $Y$  represents the extent of adoption,  $a$  denotes the intercept, and  $b_1$  to  $b_{10}$  represent the partial regression coefficients of the respective independent variables.

## Results and Discussion

### *Socio-economic profile of practising farmers*

The socio-economic characteristics of the respondents provide an important background for understanding their participation in apiculture and adoption of improved beekeeping practices. As presented in Table 1, the largest proportion of respondents (68.3%) belonged to the 36–60 years age group, followed by 20.0 per cent below 35 years and 11.6 per cent above 60 years. Thus, the respondents were predominantly in the middle and relatively mature age groups. The concentration of practising farmers in this age category may indicate that apiculture was being undertaken largely by farmers with considerable experience in farming and household decision-making. However, age alone cannot be taken as evidence of greater risk-taking or adoption capacity; its influence on adoption is better understood in conjunction with education, knowledge, extension contact and other explanatory variables.

**Table 1.** Age of the respondent ( $N = 120$ )

| Sl. No | Age of the respondents (years) | Frequency ( $f$ ) | Percentage (%) |
|--------|--------------------------------|-------------------|----------------|
| 1      | Below 35 years                 | 24                | 20.0           |
| 2      | 36-60                          | 82                | 68.3           |
| 3      | Above-60 years                 | 14                | 11.6           |

**Table 2.** Education status of the Apiary respondents: ( $N = 120$ )

| Sl. No | Education               | Frequency ( $f$ ) | Percentage (%) |
|--------|-------------------------|-------------------|----------------|
| 1      | Illiterate              | 30                | 25.0           |
| 2      | Can read and write only | 12                | 10.0           |
| 3      | Primary only            | 10                | 8.3            |
| 4      | Secondary level         | 37                | 30.8           |
| 5      | Higher secondary level  | 24                | 20.0           |
| 6      | College degree          | 07                | 5.8            |

### *Educational status*

The educational profile of the respondents is presented in Table 2. The largest proportion (30.8%) had education up to the secondary level, followed by 25.0 per cent who were illiterate and 20.0 per cent who had completed higher secondary education. Another 10.0 per cent could only read and write, 8.3 per cent had primary-level education and 5.8 per cent possessed a college degree. Thus, the respondents represented a heterogeneous educational background, with a considerable proportion having limited formal education. Education is potentially important in apiculture because improved beekeeping involves understanding technical recommendations, interpreting infor-

mation and following management practices. However, the contribution of education to adoption should be assessed statistically rather than inferred solely from its distribution in the sample.

**Family type:** Table 3 indicates that 76.6 per cent of the respondents belonged to joint families, whereas 23.3 per cent belonged to nuclear families. The predominance of joint families may provide a relatively larger family labour pool for activities associated with apiary management. Nevertheless, the present frequency distribution does not by itself establish that family type resulted in higher adoption. Its actual contribution to adoption is more appropriately examined through correlation and regression analysis.

**Table 3.** Family type of the respondent in study area ( $N = 120$ )

| Sl. No | Family Type    | Frequency (f) | Percentage (%) |
|--------|----------------|---------------|----------------|
| 1      | Joint family   | 92            | 76.6           |
| 2      | Nuclear family | 28            | 23.3           |

**Social participation**

The distribution of respondents according to social participation is presented in Table 4. More than half of the respondents (55.0%) had a high level of social participation, while 25.0 per cent had a medium level and 20.0 per cent had a low level. The relatively high level of social participation suggests that many respondents were connected

with social groups and community activities. Such interaction may facilitate the exchange of information and experiences among farmers and may provide opportunities for learning about improved apirary practices. The strong association between social participation and adoption observed in the subsequent analysis further indicates the relevance of social interaction in the study context.

**Table 4.** Social participation among the respondent ( $N = 120$ )

| Sl. No | Social participation | Frequency (f) | Percentage (%) |
|--------|----------------------|---------------|----------------|
| 1      | Low                  | 24            | 20.0           |
| 2      | Medium               | 30            | 25.0           |
| 3      | High                 | 66            | 55.0           |

Table 5 presents selected socio-economic and psychological characteristics of the respondents. With respect to landholding, 55.8 per cent of the respondents belonged to the medium landholding category (5–10 ha), followed by 27.5 per cent with holdings up to 5 ha and 16.6 per cent with holdings exceeding 10 ha. Thus, medium landholders constituted the largest group in the study population. Since apiculture requires comparatively limited land area in relation to conventional crop production, its adoption may be relevant even among farmers with relatively smaller holdings. With respect to annual income, 52.5 per cent of the respondents were placed in the below-poverty-line category as defined in the study, followed by 32.5 per cent in the low-income category and 15.5 per cent in the medium-income category. The predominance of respondents in the lower-income categories highlights the potential relevance of apiculture as a supplementary livelihood activity. However, the income classification and reference period should be verified against the original survey schedule before publication. The knowledge distribution shows that 55.8 per cent of the respondents had a low level of knowledge about scientific bee-keeping practices, while 28.3 per cent had medium and 15.8 per cent

had high knowledge. The predominance of low knowledge indicates a substantial scope for strengthening technical training and advisory support related to colony management, seasonal management, disease and pest control, queen rearing, bee toxicity and other improved practices.

**Communication variables of the honey bee producer**

The communication profile of the respondents is presented in Table 6. Among the information sources, apirary demonstrations were reported as a frequently used source, with 49.1 per cent of respondents using them most often and 31.6 per cent often. Farmers' meetings, farmers' fairs and frontline demonstrations/On-Farm Trials also constituted important sources of information. Television was another relevant mass-media source, with 32.5 per cent of respondents reporting it as a most-often-used source and 52.5 per cent as an often-used source. In contrast, newspaper use was comparatively limited, with half of the respondents reporting that they never used newspapers. This pattern may reflect differences in accessibility and suitability of communication channels in remote rural areas.

**Table 5.** Socio Economic Variables and Psychological variables

| Sl. No | Socio Economic Variables      | Frequency (f) | Percentage (%) |
|--------|-------------------------------|---------------|----------------|
| 5.1    | Area and Land Holding         |               |                |
| 1      | Small farmers upto 5 ha.      | 33            | 27.5           |
| 2      | Medium holding 5-10 ha.       | 67            | 55.8           |
| 3      | Big holding above 10 ha.      | 20            | 16.6           |
| 5.2    | Annual Income                 |               |                |
| 1      | Below poverty line (< 12,000) | 63            | 52.5           |
| 2      | Low (Rs.12,000 to20,000)      | 39            | 32.5           |
| 3      | Medium (20,000 to 25,000)     | 18            | 15.5           |
| 5.3    | Knowledge level               |               |                |
| 1      | Low (14.34)                   | 67            | 55.8           |
| 2      | Medium (14.34-26.37)          | 34            | 28.3           |
| 3      | High (above26.38)             | 19            | 15.8           |

$N = 120$

Figures in the parenthesis indicate the percentages

**Table 6 :Distribution of the Honey bee producer on the basis of communication variables**

| Sl. No                         | Communication Variables |            |           |           |
|--------------------------------|-------------------------|------------|-----------|-----------|
| 6.1 Source of information used |                         | Most often | Often     | Never     |
| 1                              | Newspaper               | 22(18.3)   | 38(31.6)  | 60(50.0)  |
| 2                              | Apiary Demonstrations   | 59 (49.1)  | 38 (31.6) | 23 (19.1) |
| 3                              | Farmers meeting         | 43 (35.8)  | 61 (50.8) | 26 (21.6) |
| 4                              | FLD/OFT                 | 37 (30.8)  | 58 (48.3) | 25 (20.8) |
| 5                              | Farmers fairs           | 49 (40.8)  | 57 (47.5) | 14 (11.6) |
| 6                              | Television              | 39 (32.5)  | 63(52.5)  | 20 (16.6) |
| 6.2 Extension Contact          |                         |            |           |           |
| 1                              | Anchal Samati Memembr   | 42(35.8)   | 48 (40.0) | 30 (25.0) |
| 2                              | Gram Bhura              | 43(35.8)   | 41 (34.3) | 33 (27.5) |
| 3                              | Agril. Assistant        | 22 (18.5)  | 77 (64.5) | 21 (17.5) |
| 4                              | Agril. Supervisors      | 39 (32.5)  | 49 (40.8) | 32 (26.6) |
| 5                              | Agril. Officer          | 63 (52.5)  | 36 (30.0) | 21 (17.5) |
| 6                              | District Agril. Officer | 51(14.1)   | 52 (42.5) | 17 (43.5) |
| 7                              | Agril. Scientist        | 57 (47.5)  | 43 (35.8) | 20 (16.6) |

Adoption of apiary as economic venture: Table 7 presents the extent of adoption of selected improved apiary management practices. The highest adoption level was recorded for extraction, processing and storage of honey (89.7%), followed by beehive products (78.6%), bee-rearing management (71.6%), biology of honey bees (67.3%) and artificial queen-rearing techniques (66.6%). Adoption was comparatively lower for bee toxicity management (27.0%), seasonal management (44.3%), honey and crop production (53.4%), apiary equipment and its use (57.8%), and bee disease, pest and enemy management (59.2%).

The composite adoption score was reported as 61.56 per cent, indicating that a considerable proportion of the recommended practices had not yet been fully adopted.

The correlation analysis presented in Table 8 revealed that age had a negative and significant association with the extent of adoption of im-

proved apiary practices ( $r = -0.67$ ), whereas landholding showed a negative but non-significant relationship ( $r = -0.13$ ). Education, family type, social participation, annual income, knowledge level, mass media exposure and extension contact were positively and significantly associated with adoption. Among these variables, the strongest positive associations were observed for mass media exposure ( $r = 0.93$ ), social participation ( $r = 0.92$ ), extension contact ( $r = 0.91$ ), annual income ( $r = 0.85$ ) and knowledge level ( $r = 0.82$ ). The findings indicate that adoption was associated more closely with respondents' communication, social and knowledge-related characteristics than with landholding. These relationships suggest the importance of strengthening information dissemination, extension contact and knowledge-building interventions for improving the adoption of recommended apiary practices. Similar relationships have been reported by Kashev *et al.* (1992) [2].

**Table 7: Adoption with respect to selected management practices**

| Sl.No | Category                                    | Adoption among respondent (%) |
|-------|---------------------------------------------|-------------------------------|
| 1     | Bee Behaviour                               | 61.7                          |
| 2     | Biology of Honey                            | 67.3                          |
| 3     | Apiary equipment and their use              | 57.8                          |
| 4     | Bee rearing management                      | 71.6                          |
| 5     | Seasonal management(Summer and Winter)      | 44.3                          |
| 6     | Bee disease , pest and enemies management   | 59.2                          |
| 7     | Honey and crop production                   | 53.4                          |
| 8     | Artificial queen rearing technique          | 66.6                          |
| 9     | Bee toxicity                                | 27.0                          |
| 10    | Extraction, processing and storage of Honey | 89.7                          |
| 11    | Beehives products                           | 78.6                          |

### Multiple regression analysis

Multiple regression analysis was employed to determine the individual contribution of the nine selected independent variables to the variation in adoption of improved apiary practices. The coefficient of determination ( $R^2 = 0.794$ ) indicates that the variables included in the model jointly explained 79.4 per cent of the variation in adoption, while the remaining 20.6 per cent was attributable to other factors not included in the model. The overall  $F$ -value (68.32) indicates a statistically significant regression model, subject to confirmation from the corresponding degrees of freedom and  $p$ -value. Based on the reported  $t$ -values, education, knowledge level, mass media exposure and extension

contact show statistically significant contributions to adoption at the reported level. However, the significance notation for family type and social participation in the original table should be verified against the corresponding  $t$ -values and degrees of freedom before publication. Similarly, the negative regression coefficient reported for education despite its positive correlation with adoption, and the value reported as -821 for knowledge level, should be checked against the original regression output for possible transcription or scaling errors. The regression results should therefore be finalized only after verification of the original statistical output. The findings are broadly comparable with those reported by Ramdasi (1998) [3] and Anchule (2000) [4].  $R^2$  value = 0.794  $F$  value = 68.32 \*\*significant at 1 percent level

| Correlates           | Coefficient of correlation (r) | Regression coefficient ( $B_i$ ) | 't' value |
|----------------------|--------------------------------|----------------------------------|-----------|
| Age                  | -0.67*                         | -0.001                           | -0.074    |
| Education            | 0.73*                          | -3.28                            | 6.28**    |
| Family type          | 0.64*                          | 0.217                            | 1.62**    |
| Land holding         | -0.13                          | -0.030                           | 0.864     |
| Social participation | 0.92**                         | 0.217                            | 1.88**    |
| Annual Income        | 0.85**                         | -0.009                           | 0.053     |
| Knowledge level      | 0.82**                         | -821                             | 4.92**    |
| Mass media exposure  | 0.93**                         | 0.181                            | 3.873**   |
| Extension contact    | 0.91**                         | 0.132**                          | 2.985**   |

### Analysis of variance

The coefficient of determination ( $R^2$ ) was **0.794**, indicating that the nine independent variables included in the analysis collectively explained **79.40 per cent of the variation in the composite adoption score for improved apiary practices**. The remaining 20.60 per cent of the variation may be attributable to other factors that were not included in the present investigation. The relatively high explanatory power of the model indicates that the selected variables collectively made a substantial contribution to explaining differences in the adoption of improved apiary practices among the respondents.

### Conclusion

The findings indicate that the selected socio-personal, communication and behavioural characteristics were associated with the adoption of improved apiary practices. Among the variables examined, education, social participation, mass-media exposure, family type, extension contact and knowledge level emerged as important contributors to adoption. The findings suggest that farmers possessing greater educational exposure and knowledge, maintaining regular contact with extension sources and participating more actively in social organisations were relatively more inclined towards adopting improved apiary practices.

The respondents also perceived apiculture as a potentially remunerative rural enterprise, indicating scope for its promotion as an additional livelihood activity in the region. In view of the observed role of social participation, farmers interested in apiculture may be encouraged to form or join producer groups, cooperatives or other collective organisations to facilitate access to technical information, inputs, training, processing and markets.

The findings further underline the importance of strengthening extension support for the promotion of improved apiary practices. Extension personnel should be equipped with adequate technical knowledge and communication skills and should employ participatory approaches, practical demonstrations and need-based advisory services. Regular technical guidance, timely access to quality inputs and locally appropriate apiculture technologies can help farmers address production-related difficulties and improve the sustainability of apiary enterprises. A coordinated extension strategy involving training, demonstrations, farmer groups and continuous advisory support may therefore facilitate wider dissemination and adoption of improved apiculture practices in the region.

The findings indicate that selected socio-personal, communication and behavioural characteristics were associated with the adoption of improved apiary practices. Education, social participation, mass-media exposure, family type, extension contact and knowledge level

emerged as important variables in the analysis. The results highlight the relevance of farmers' educational and knowledge base, social interaction and access to extension and communication channels in promoting improved apiculture practices.

The respondents perceived apiculture as a potentially remunerative enterprise, indicating its scope as an additional livelihood option in the region. Collective approaches such as producer groups, cooperatives and other farmer organisations may facilitate access to technical information, quality inputs, training, processing facilities and markets. The findings also underscore the need to strengthen extension support for apiculture development. Extension agencies should provide technically sound, need-based and locally relevant advisory services through practical demonstrations, hands-on training, farmer-group approaches and regular follow-up. Particular attention should be given to seasonal hive management, pest and disease management, bee toxicity, queen rearing, and other practices showing relatively lower adoption. A coordinated extension strategy integrating training, demonstrations, communication media, input support and market linkages would provide a systematic framework for promoting improved apiary practices in the study area.

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