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Construction of knowledge test and measurement of beekeepers knowledge about beekeeping practices under NHM

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Abstract

Beekeeping is an important component of agriculture and rural development programmes in many countries. The role of beekeeping in providing nutritional, economic and ecological security to the rural communities at the household level is an additional income generating activity. This, being a non-land-based activity, does not compete with other resource demanding components of farming systems (FAO, 1990).National Horticulture Mission was launched in the country in May 2005 as a centrally sponsored scheme to promote holistic growth of the horticulture sector through an area based regionally differentiated strategies. Beekeeping vocation is popular under this scheme in Kota district of Rajasthan. The present investigation was undertaken to determine the actual knowledge level of Beekeepers about scientific beekeeping practices under NHM. To find out the knowledge level of beekeepers a knowledge test was constructed. The present study was undertaken in Kota district of Rajasthan. Total 151 beekeepers from 41 villages of three panchayat samities were interviewed for data for the study. The study indicated that majority of the beekeepers (98.01 per cent) had high knowledge level about recommended scientific beekeeping practices. It was concluded that beekeepers with MPS 88.08 had high knowledge level about extraction of honey.

Key words: *knowledge, beekeeping, NHM*

1. Introduction

Beekeeping can add to the livelihoods of many different sectors within a society including villages and urban traders, carpenters who make hives and stands, tailors who make veils, clothing and gloves and those who make and sell tools and containers (Bradbear, 2003). Beekeeping has the potential to help many people increase their income and their crop yields.Beekeeping is emerging as a very successful agricultural practice for rural area based people in less developed countries mainly due to its economic benefits from the products of this practice (Kugonza 2009).A centrally sponsored scheme called NHM in which Government of India contributes 85 per cent and 15 per cent is met out by the State Governments. Main objectives of Mission are:

a) Enhance horticulture production, improve nutritional security and income support to farm households.
b) Promote, develop and disseminate technologies for horticultural development through seamless blending of traditional wisdom and modern scientific knowledge.
c) Create employment generation opportunities for skilled and unskilled persons, especially unemployed youth.

The success of any rural development programme depends on level of knowledge about the programme and knowledge provided through programme because knowledge is one of the important component of behaviour of human beings. Once knowledge is acquired, it produces changes in the thinking process of an individual which would lead to further changes in the mental aptitude and results into high adoption of recommended beekeeping practices easily and quickly.

Keeping in view the study "Construction of knowledge test and measurement of beekeepers knowledge about beekeeping practices under NHM "was undertaken with specific objectives:

i. To develop a standardized test for measuring the knowledge of beekeepers of NHM about beekeeping practices.
ii. To measure the level of knowledge of beekeepers about scientific beekeeping practices under NHM.

2. Methodology

2.1 Locale of the research and selection of respondents

The present study was based on ex-post-facto research design and covered Kota district of Rajasthan to give comprehensive picture of adoption of beekeeping practices. The state of Rajasthan consists of 33 districts, of which, Kota is the district where beekeeping profession is being ventured in 4 panchayat samities. Out of five panchayat samities, Ladpura, Sangod and Sultanpur were selected for investigation as these possessed considerable populations of beekeepers. Total 41 villages were included for the present investigation on the basis of population of beekeepers. The beekeepers were limited in number for the year 2007-08 (151). Therefore, the study was conducted interviewing the whole population of the beekeepers who had undergone beekeeping in all of the villages of selected panchayat samities during the year 2007-2008. The size of the sample comprised total 151 beekeepers.

A standardized knowledge test was constructed for collection of data from the beekeepers. The face-to-face interview technique was employed to obtain factual response from the respondents.

2.2 Construction of knowledge test

Construction of appropriate research tool is important step in any research endeavor. In any type of research there is a need of tool with the help of which each objective under question can be achieved. Keeping in view the sample and objectives of the study, the personal interview schedule for beekeepers were prepared for data collection.

The personal interview technique was preferred over the others because this technique provides a direct situation where in the interviewer has an opportunity to explain the purpose and significance of the study, clarify points, remove doubts, uncertainties and motivate respondents to answer questions carefully and truthfully. Further, there is also surety of getting cent-percent response of the interviewee. An interview schedule was constructed to collect the required information from the respondents related to various scientific practices of beekeeping of NHM.

A knowledge test was developed to assess the level of knowledge of respondents as a result of NHM. An effort has been made to develop a standardized test which could be useful in measuring the level of beekeepers' knowledge regarding beekeeping practices of NHM in scientific manner.

English and English (1961) defined knowledge as a body of understood information possessed by an individual or by a culture. Knowledge is totality of understood information possessed by an individual. A knowledge test has been defined by Bloom *et. al.* (1955) as a test which refers to those behavior and test situation which emphasized the remembering by the recall of ideas, material or phenomena. For the purpose of present study knowledge was operationalised as the amount of information possessed and understanding of the respondents regarding beekeeping of NHM. The procedure followed for development of the said test is described below:

(a) Collection of items:

The content of knowledge test is composed of questions, called items. Items for the test were collected from different sources such as literature, field extension personnel, relevant specialists and personal experience. They had liberty to add/ delete or modify any of the items. After considering the opinion of the experts, 92 items were selected covering all the knowledge aspects of beekeeping venture. Items selected were according to the level of knowledge and understanding of the respondents and level of technology of the area. The items were edited and drafted in such a way that each item highlights only one idea and does not have any ambiguity. All the items were having logical sequence.

(b) Item analysis

Item analysis was done in line with the technique, which yielded three kinds of information viz index of item difficulty, index of item discrimination and index of item validity. The index of item difficulty indicated the extent to which an item was difficult while the index of item discrimination was to find out whether an item really discriminates well informed farmers from a poorly informed once. The index of item validity provided the information on how well an item measured or discriminated in agreement with rest of the test. The 92 items were administered to 30 identical respondents. The respondents for administering the items were randomly selected and were not included in the sample for final study. Each statement had two response categories either correct or wrong. Each correct answer was given 'I' score while wrong answer was awarded '0' mark. Thus total score

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secured by all individual respondents on 92 items for correct answer was the knowledge score. The score obtained by 30 identical respondents were arranged in descending order and divided into six groups i.e. 5 respondents in each group. The groups were named as G_1, G_2, G_3, G_4, G_5 and G_6. The range of score obtained by the respondents of six groups has been given in Table 1.

For the purpose of item analysis, the middle two groups G_3 and G_4 were eliminated keeping four extreme groups with high and low scores.

The data pertaining to the correct response for all the items in respect of these four groups were tabulated for calculating the difficulty and discrimination indices

Table 1: Range of scores obtained by the 30 respondents

Group	Scores out of 92	Respondents
G_1	81 to 77	5
G_2	76 to 69	5
G_3	68 to 61	5
G_4	60 to 58	5
G_5	57 to 50	5
G_6	49 to 43	5

An example of the calculation of difficulty and discrimination indices is presented in Table 2. Selection of items for final format of the knowledge test was done based on the following criteria:

(i) Item difficulty index-P

The index of item difficulty was worked out as the percentage of the respondents answering an item correctly. The assumption in this item index of difficulty was that the difficulty is linearly related to the level of respondent's knowledge about beekeeping of NHM. When a respondent answers an item, it was assured that the item was less difficult then his ability to cope with it. In this study with this assumption, the items with P values ranging from 30 to 80 were considered for final selection of the knowledge battery. It was calculated by following formula:

$$P_i = \frac{n_i}{N_i} \times 100$$

Where,

P_i = Difficulty index in percentage of the i^{th} item.

n_i = Number of respondents giving correct answer to i^{th} item.

N_i = Total number of respondents to whom the i^{th} item was administered *i.e.* in the present case.

(ii) Calculation of discrimination index:

Item discrimination index indicates the ability of the item to differentiate the well informed respondents from the poorly informed ones. The $E^{1/3}$ formula was used in the present study for calculating the discrimination index. The formula used was as follows:

$$E^{1/3} = \frac{(S_1 + S_2) - (S_5 + S_6)}{N/3}$$

Where,

$E^{1/3}$ = Discrimination index of item.

S_1, S_2, S_5, S_6 = the frequency of correct answers in groups G_1, G_2, G_5 and G_6 respectively.

N= total number of respondents in the sample of item analysis; here it was 30.

Table 2 Calculation of difficulty and discrimination indices of knowledge items

Item no. in the initial list	Frequencies of correct answers.				Total freq. of correct answers $S_1+S_2+S_3+S_4+S_5+S_6$	Percentage of respondents giving correct answers (P_i)	$E^1/3$ Discrimination index
	S_1	S_2	S_5	S_6			
Honeybee and their castes							
6	**5**	5	4	2	*24	80	0.4
10	**3**	2	1	1	*10	33.33	0.3
Selection of apiary site							
12	**2**	3	4	3	*18	60	-0.2
14	**3**	4	1	3	*13	43.33	0.3
Honeybee feeding							
21	**1**	1	1	1	*6	20	0
27	**4**	5	4	2	*24	80	0.3
Equipments and appliances							
29	**3**	1	0	1	*13	43.33	0.3
31	**4**	4	1	3	*17	56.66	0.4
Beekeeping management							
49	**3**	4	4	4	*18	60	-0.1
55	**5**	5	5	1	*23	76.66	0.4

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However, an illustration of the method of calculating these indices appears above in Table 2 wherein the difficulty and discrimination indices for items: 6 and 10 of honeybee and their castes, 12 and 14 of selection of apiary sites, 21 and 27 of honeybee feeding, 29 and 31 of equipments and appliances and 49 and 55 of beekeeping management have been calculated.

*The column indicates total frequency of correct answers, indicating those of G_3 and G_4 which were eliminated.

For example, substituting the value for item no. 6 of honeybee and their castes of the table of illustration given above, the value arrived at is:

$$P_6 = \frac{n_i}{N_i} \times 100$$

$$= \frac{24}{30} \times 100$$

$$= 80$$

$$E^{1/3} = \frac{(S_1 + S_2) - (S_5 + S_6)}{N/3}$$

$$E^{1/3} = \frac{(5+5) - (4+2)}{30/3}$$

$$= 0.4$$

(c) Final selection of items for test

Two criteria viz., item difficulty and item discrimination index were considered for selection of items in the final format of the knowledge test. When a respondent passed an item, it was assumed, as Coombs (1950) described, that the item was less difficult than the individual's ability to cope with it. For the purpose of present study, the item with difficulty index ranging from 30 to 80 and discrimination index ranging from 0.2 to 0.6 were retained for final selection for inclusion in the knowledge test. After final selection of items on the basis of difficulty and discrimination index, total 38 items out of 92 items were incorporated in the final format of the interview schedule for administration to the sample of beekeepers.

(d) Reliability of the test

Reliability of the test is tested byRulon formula, its provide reliability of the whole test and estimate reliability coefficient on the basis of proportion of error variance in total variance of the test. Test is divided in to two equal halves. Each examinee has one obtained score on odd numbered items and another subtotal score on even numbered items. A simple difference between two subsets scores were the idea of error of measurement and error variance.

Formula: $r_{tt} = 1-\sigma^2d/\sigma^2T$

Where:

r_{tt}= reliability coefficient

σ^2d = variance that is, standard deviation squared of the difference between two half scores for each examinee.

σ^2T = variance or square of the standard deviation of the total score.

Total score for an examinee is the sum of his score on the two halves of the test.

Where:

$\sigma^2d = (1/N\sqrt{N}\sum d^2-(\sum d)^2)$

$\sigma^2T = (1/N\sqrt{N}\sum T^2-(\sum T)^2)$

$\sigma^2d = 1.113$

$\sigma^2T = 5.174$

So, $r_{tt} = 1-1.113/5.174$

$= 1-0.2151$

r_{tt}= 0.7849

(e) Validity of the test

Biserial correlation was used for the test items validation when the criteria of validity is regarded as internal consistency, that is the relationship of total score to a correct/ incorrect responses to any given items. Keeping this in view, with the help of formula used by Guilford (1965), the significance of the biserial correlation for each of the items was calculated and tested by using the formula given by Guilford (1965). The items found significant at 5 per cent level of significance were retained in the final format of the knowledge test.

Following formula was used:

$$\text{Biserial correlation (rbis)} = \frac{Mp - Mq}{\sigma t} \times \frac{pq}{y}$$

Where,

Mp= Mean of x value for higher group in dichotomized variable.

Mq= Mean of x value for lower group in dichotomized variable.

P= Proportion of cases in higher group.

q= Proportion of cases in lower group.

y= Ordinate of the unit normal distribution curve with surface equal to 1.0 at the point of division between segments containing p and q proportion of the cases.

$$\sigma t = \sqrt{\frac{\Sigma x^2}{n} - \frac{(\Sigma x)^2}{n}}$$

Where,

σt = Standard deviation

$\sum x^2$ = Sum of square of the responses of respondents

$\sum x$ = Sum of values of the responses for all the items

n= No. of respondents.

Thus, in light of the above criteria described above, 38 items were finally selected, which formed final format of the knowledge test. The final format is

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given as under knowledge test about beekeeping practices.

Questions

(A) Honeybee and their castes

i. Name at least two tasks of a worker.
(i) (ii)

ii. How the bees communicate to the hive bees about new food sources?
(i) (ii)

iii. How many eggs a queen lays on an average in a day?
(i) (ii)

(B) Selection of apiary site

i. What is the appropriate time to start beekeeping?
(i) (ii)

ii. What is the favourable temperature for honey bee?
(i) (ii)

(C) Honeybee feeding

i. What is the food of queen?
(i) (ii)

ii. What is the food of bees at the time of shortage of flowering or dearth period?
(i) (ii)

iii. How much areas the bees cover for foraging?
(i) (ii)

iv. Name at least one substance collected by foragers for the colony.
(i) (ii)

(D) Equipments and appliances

i. Name the modern hive used for beekeeping.
(i) (ii)

ii. How many frames should be there in a box/ hive?
(i) (ii)

iii. Which type of wire is used in frame for fitting the wax sheet of comb?
(i) (ii)

iv. Name the equipment used for honey extraction.
(i) (ii)

v. Name at least one type of container used for the storage of honey to maintain its quality.
(i) (ii)

(E) Beekeeping management

i. While inspecting the colonies, what should be the colour of the uniform?
(i) (ii)

ii. What is the method of introducing new queen to the queenless colony?
(i) (ii)

iii. How many days are required to develop a queen?
(i) (ii)

iv. How to identify the good health and condition of workers?
(i) (ii)

v. What is swarming?
(i) (ii)

vi. Name one reason due to which swarming occurs.
(i) (ii)

vii. Name at least two methods of controlling natural swarming.
(i) (ii)

viii. At what season robbing occur the most?
(i) (ii)

ix. How to control the robbing?
(i) (ii)

x. Name at least one method of requiring.
(i) (ii)

xi. Name at least one improved method of making the colony strong.
(i) (ii)

xii. What is supersedure?
(i) (ii)

xiii. When supersedure process occurs?
(i) (ii)

xiv. Name at least one cause due to which absconding occurs.
(i) (ii)

(F) Enemies and diseases of Honeybees

i. Name one method to control the wax moth by apiary management.
(i) (ii)

ii. How to prevent the empty frames of wax moth attack?
(i) (ii)

iii. Name at least one disease of adult bees.
(i) (ii)

iv. Name at least one chemical used for controlling the acarine disease in adult bees.
(i) (ii)

v. What is the suitable time for chemical control measures?
(i) (ii)

(G) Migration of honeybees

i. What is the first step during migration of the bees for more than 1 km distance?
(i) (ii)

ii. Name at least one important precaution, to be taken while migrating.

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iii. How to prevent the hive parts from slipping / shifting while traveling during migration?

(H) Extraction of honey

i. How to identify that honey bee hives are ready to harvest honey?
(i) (ii)

ii. Enlist at least two uses of the honey.
(i) (ii)

Method of scoring knowledge

The final knowledge test had 8 major Items and each major item contained sub -items relating to beekeeping venture. Test contained total 38 items. Equal weightage was given to each item. For correct answer '1' score was assigned and '0' for wrong answers. Thus knowledge test was ready for administering to the actual respondents. The knowledge index was calculated on the basis of following formula

Knowledge index= $\frac{X_1 + X_2 + X_3 - - - - - X_n}{N} \times 100$

Where,

X_1, X_2, X_3……X_n are the correct answers of nth items.

N= maximum score possible.

Mps of all the respondents' scores were computed for classifying the knowledge level in different categories. Based on arbitrary method (Chauhan 1994) three levels of knowledge of farmers were categorized under low, moderate and high. The categorization was done according to following consideration:

Table 3: Categorization of respondents on the basis of their knowledge level

S.No.	Category	Criteria
1	Low	≤30
2	Moderate	31-50
3	High	≥51

Frequency and percentage of respondents in each category were calculated. To determine the extent of knowledge, mean per cent score for each statement was also worked out and ranked accordingly.

3. Results and Discussion

Based on a standardized knowledge test developed by investigator, level of knowledge of beekeepers about scientific beekeeping practices under NHM was measured.

Perusals of data in Table 4 revealed that majority of the respondents (98.01 per cent) were from high level of knowledge category, while 1.99 per cent could be placed under moderate level. There was no one who reported low level of knowledge about scientific beekeeping in the study area.

Table 4: Knowledge levels of beekeepers(n = 151)

S.N.	Category	f (%)
1.	Moderate (31 to 50)	3(1.99)
2.	High (≥ 51)	148(98.01)
	Total	**151(100)**

F=frequency, Figures in the parentheses show the per cent.

Thus, it could be concluded from the Table 4 that majority of beekeepers possessed high level of knowledge about scientific beekeeping practices.

The present findings are line with the findings of Tapre (2003) who found that 77.14 per cent beekeepers had high level of knowledge, while 14.29 per cent had medium level of knowledge about beekeeping. Similar findings are also reported by Reddy (1991) about sericulture technology.

Aspects wise knowledge level of beekeepers

Table 5 vividly corroborates that from among the major practices, the beekeepers had maximum knowledge of extraction of honey (MPS 88.08) which was placed at first position in the rank hierarchy by them. It was followed by migration of honeybee, beekeeping management, honeybee feeding and enemies and diseases of honeybees which were granted II, III, IV and V ranks with MPS 83.88, 78.05, 77.48 and 76.68, respectively. However, the beekeepers possessed good knowledge of equipment and appliances (MPS 73.64), honeybee and their castes (MPS 70.20) and selection of apiary site (MPS 66.55) which were placed at VI, VII and VIII positions respectively by them.

Table 5: Aspects wise knowledge of beekeepers regarding scientific beekeeping practices

n = 151

S.N.	Sub aspects	MPS	Rank
1.	Honeybee and their castes	70.20	7
2.	Selection of apiary site	66.55	8
3	Honeybee feeding	77.48	4
4	Equipments and appliances	73.64	6
5	Beekeeping management	78.05	3
6	Enemies and diseases of Honeybees	76.68	5
7	Migration of Honeybees	83.88	2
8	Extraction of honey	88.08	1

While pooling all the major practices together the extent of knowledge possessed by the selected beekeepers was found to be 76.99 per cent. The

present findings are similar to the findings of Bogale (2009).

4. Conclusion

NHM has been proved to be effective for beekeepers as 148 (98.01 per cent) possessed higher knowledge regarding scientific beekeeping practices. Extraction of honey, migration of honeybee, beekeeping management, honeybee feeding, enemies and diseases of honeybee and equipments and appliances were scientific beekeeping practices about which beekeepers had high knowledge.

References:

[1] Bloom, S.S., Engelhard, M., Furst, E., Hill, W. and Krathwal, D.R. 1955. Taxonomy of Educational Objectives: The congnitive Domain. Orient Longmans, New York.

[2] Bogale, S. 2009. Indigenous knowledge and its relevance for sustainable beekeeping development: a case study in the Highlands of Southeast Ethiopia.*Livestock Research for Rural Development***21**: 184.

[3] Bradbear, N. 2003. Beekeeping and Sustainable livelihoods. Agricultural Support Systems Division, Food and Agriculture Organization of the United Nations, Rome.

[4] Chauhan N.B. 1994. A study on peasantry modernization in Dungapur district of Rajasthan. Ph.D. thesis submitted to RajasthanAgriculturalUniversity, Bikaner, Rajasthan.

[5] Coombs, C.H. 1950. The concept of reliability and homogeneity. Educational Psychological measurement 10: 33-39.

[6] English, H.B. and English, A.C. 1961. A comprehensive dictionary of psychological and psychoanalytical terms. Longmans Green and Co., New York.

[7] FAO 1990. Agricultural Services Bulletin 68/6 Food and AgricultureOrganisation of the United Nations Rome, *Beekeeping in Africa.*

[8] Guilford, J.P. 1965. Fundamental statistics in psychology and education, New York. Mc.Grawhill book Co. inc: 317-319

[9] Kugonza, D.R. 2009. Beekeeping: Theory and Practice, Kampala: Fountain Publishers, 282 pp.

[10] Reddy, S. 1991. Awareness and use of sericulture technology by the farmers. *Journal of Maharashtra Agricultural University*,**18**: 159-160.

[11] Tapre, S.A. 2003. Evaluation of Beekeeping Vocation. M.Sc. Thesis submitted to Dr. Panjabrao Deshmukh Krishi Vidhyapeeth, Akola, Maharashtra.