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Adoption, Knowledge and Association in Relation to Indegenous and Scientific uses of Neem (*Azadirachta indica, A.Juss.*) in Junagadh District of Gujarat State in India

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ABSTRACT: *Indigenous knowledge is the asset of India and it is high time now to exploit it. Neem constitutes an important part of this treasure. The use of various parts of neem tree in various ways can give better returns, mainly in agriculture and health care sector. Neem tree is recognized as "*Kalpavriksha*" because all parts of neem and its products are very useful in agriculture, industries, medicines and in many other fields. To understand existing status of this tree among farmers, it was realized to examine the level of awareness of rural farmers regarding this tree to know the existing place of neem tree among them. With this back ground in mind, the present study was undertaken with objectives: To access the indigenous and scientific knowledge level of the farmers' towards different uses of neem, To determine the extent of adoption of farmers' regarding uses of neem and To ascertain the association between the characteristics of farmers' and their level of knowledge about uses of neem. Samples of 100 respondents were personally interview with the help of structured scheduled to measure knowledge and adoption about indigenous and scientific usages of neem. Majority of the respondents were found with 73.00 per cent of the respondents had medium level of knowledge, Practice wise knowledge of the farmers like usages of neem tree (ranked first), Adoption level of majority of the respondents were found with 69.00 per cent of the respondents had medium level of adoption.*

Keywords: *Adoption, Association, Indigenous, Knowledge, Neem and Scientific*

INTRODUCTION

Neem (*Azadirachta indica, A.Juss*) belongs to the family *Meliaceae*. It is a hardy, quick growing, evergreen tree. Fresh neem leaves and flowers come in March- April. The lifespan of tree is more than two centuries. It is naturally distributed on Shivalik hills of Uttar Pradesh and hillock of Deccan, in Karnataka and adjoining states. Neem is bitter in taste due to the presence of "*Triterpenese*" or "*Limonoids*". The most important bioactive substance of neem is "*Azadiractin*". The neem tree grows on almost all type of soils and wide range of climate. Neem (*Azadirachta indica* A Juss.) tree formally known as *Melia azadirachta* belonging to the family Meliaceae is known for thousands of years in the Indian sub-continent by different names such as Indian lilac or Margosa tree. The first indication that neem was being used as a medical treatment was about 4500 years ago that is around the time of Harappa and Mohenjo-da-ro civilization. The excavations found several therapeutic compounds including neem leaves, gathered in the ruins. Apart from this, in the Charak Sanhita (Approx. 500 BC) and Shusruta Sanhita (Approx 300BC) that are known as the foundation of the Indian system of natural healing-Ayurveda, have mentioned the wide range of uses of neem for treating wide range of diseases and symptoms. Thus, it has been a part of rout in of Indian culture since long.

To see the area and distribution of the tree, it is the native species of Indo-Burma region. Still it is found in the countries like Indonesia, Sri Lanka, Thailand, Malaysia and some African countries also. In India it is found naturally occurring on the Shivalik hills of Uttar Pradesh and hillocks of Deccan in Karnataka and adjoining states. Except these locations, neem is generally found growing around backyards, along roads and field bunds, in and around villages than in forests. The current population of neem is estimated at 16-18 million trees with major population in the state of UP (50.5 per cent) followed by Tamilnadu (11.24 per cent), Rajsthan

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(7.65 per cent) Maharashtra (6.32 per cent),West Bengal (5.50 per cent), Gujarat (4.72 per cent) and Karnataka (4.49 per cent) (Singh, 2OO3).

In spite of versatile uses of neem, this tree has been ignored since long. It is said that India is poor by economic condition but rich by experienced based indigenous knowledge. This indigenous knowledge, the treasure of India can benefit the Indian economy as well as it can help in improving lifestyle of rural people. Moreover, farmers of India are considered as the path giver of a society for indigenous uses of natural materials available around them. They play a key role in treasuring the cultural heritage and also succeeding it to the next generation. Looking to the wide scope in this field, it was felt necessary to recall this indigenous and scientific knowledge about uses of neem as well as its level of adoption among rural farmers.

MATERIALS AND METHODS

To understand real picture we need to examine the existing knowledge and adoption level of the rural people about various uses of neem. With this consideration, the present study was conducted in Junagadh District of Gujarat State. The study regarding neem was not conducted in this area before and thus; it is an untouched area in this regard. This study was conducted by using an *ex post facto* research design. (Kerlinger, 1969). Two talukas viz., Mendarada and Keshod were selected randomly from Junagadh district of Gujarat State. Ten respondents were selected randomly from each selected village (Table 1). Total one hundred respondents were selected from the selected villages by random sampling method.

Table 1
Taluka and Village Vise Distribution of the Respondents

Sr. No.	*District*	*Talukas*	*Villages*	*Respondents*
1.	Junagadh (Gujarat state)	Mendrada	1.Araniyana	10
			2. Seemasi	10
			3. Barvala	10
			4. Nonjanvav	10
			5. Khorasa	10
		Keshod	1. Dhrabavad	10
			2. Sitari	10
			3. Dhandhavada	10
			4. Magharwada	10
			5. Derwan	10
		Total		100

Knowledge: For measurement of knowledge of respondents about uses of neem the teacher made test was used. The respondents were asked whether they know particular use of different parts of neem used or not, for each and every type of uses, total numbers of respondents were calculated accordingly those who know that practice. A unit score was given to correct and zero to incorrect response. The total score obtained by individual respondent for all the statements was calculated. Then, with the help of mean and standard deviation, the respondents were categorized about the organic farming practices.

Adoption: Extent of adoption is the degree to which a respondent has actually adopted different uses of neem. The responses obtained from 30 experts were analyzed and the average score for each practice was calculated (Table 2). By summing up average score for each practice (as decided by Jury) the total adoption score for individual respondent was calculated. The respondents were grouped into three categories based on viz., low adoption (below Mean – S.D.), medium adoption (between Mean ± S.D.) and high adoption (above Mean + S.D.). The total adoption score for all practices was 100.

For measuring the adoption of different parts of neem used in as various Practices, the adoption index was developed in using adoption quotient developed by Chattopadhyay (1974) with slight modification.

$$AQ. = \frac{\Sigma(e_1 / P_1)W_q + \Sigma(e_2 / P_2)W_2 + ... + \Sigma(e_n / P_n)W_n}{W \times N} \times 100$$

Where,

AQ. = Adoption quotient

e_1….en = Extent of adoption in terms of score obtained by the respondents for particular use of neem

P_1…Pn = Potentiality of the respondents in terms of score obtained for the particular practices.

W_1…Wn=Weightage of the particular practice for adoption score 1 and non-adoption score 0.

W = Summation of the weightage of all practices included.

N = Number of years for which adoption quotient was calculated.

Table 2
Weightage of Adoption of Different Uses of Neem

Sr. No.	*Name of Practices/Parts used*	*Weightage*
1.	Trees	19
2.	Leaves	16
3.	Twigs/Branches	11
4.	Oil	22
5.	Cake	15
6.	Gum	09
7.	Root	08
	Total	100

Coefficient of Correlation (r): To find out the relationship (association) between dependent and independent variables, the Pearson's product moment method of computing correlation coefficient, which provided generally accepted means for measuring the relationship, was used.

Following formula was used to calculate the correlation coefficient

$$r = \frac{SP(XY)}{\sqrt{SS(X).SS(Y)}}$$

Where,

r = Co-efficient of correlation
X and Y = Two variables under study.
SP (XY) = Sum of product of the deviations on X and Y from their means.
SS(X) = Sum of squares due to 'x' variable.
SS(Y) = Sum of squares due to 'y' variable.

For testing the significance of 'r', 't' value was calculated by using the following formula:

$$t = r\frac{\sqrt{n-2}}{1-r^2}$$

Where, t = 't' value
r = Coefficient of correlation
n = Total member of observations.

RESULTS AND DISCUSSION

Level of Knowledge of the Respondents about Indigenous and Scientific Knowledge of Neem

It is quite clear that 73.00 per cent of the respondents had medium level of knowledge whereas, 13.00 per cent had low and 14.00 per cent had high level of knowledge about indigenous practices (Table 3 and Fig. 1).

Table 3
Distribution of Farmer based on their Knowledge about Indigenous Practices (n=100)

Categories	*Knowledge score*	*Frequency*	*Per cent*
Low	Below 56.25	13	13.00
Medium	Between 56.25 to 85.97	73	73.00
High	Above 85.97	14	14.00

Mean = 71.16 S.D.=14.81

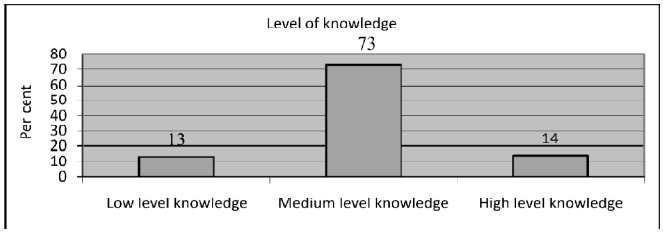

Figure 1: Level of Knowledge

This finding was in conformity with the findings of Kanani (1998), Temkar and Chauhan (2000), Sahoo (2004) and Patel (2005).

Practice Wise Knowledge of Respondents about Indigenous and Scientific Knowledge of Neem

To ascertain the practice wise knowledge of respondents about indigenous and scientific uses of neem. All the different uses of neem were listed and on the basis of different uses scores obtained by the respondents in knowledge particular uses, the frequency were worked out and frequency again converted in to the percentage. The ranks were assigned to each uses and then overall rank assigned. The results are presented in Table 4.

Table 4
Practicewise Knowledge of Farmers about Indigenous and Scientific Knowledge of Neem (n=100)

Sr. No.	*Particulars*	*Frequency*	*Per cent*	*Rank*	*Overall Rank*
I	**Knowledge related to usages of tree**				I
A	**Agricultural usages of tree**				
1	As a wind break	84	84.00	III	
2	To make best use of the fellow land	97	97.00	I	
3	To prevent soil erosion	96	96.00	II	
4	To make farm implements	97	97.00	I	
B	**General usages of tree**				
5	For shade	84	84.00	III	
6	For bringing rain	97	97.00	I	
7	Wood or furniture	96	96.00	II	
8	For rearing of GALO	97	97.00	I	
II	**Knowledge related to usages of neem leaves**				III
A	**Agricultural usages of neem leaves**				
1	For storage of grains	100	100.00	I	
2	As an animal feed	100	100.00	I	
3	As a fertilizer	86	86.00	III	
B	**Health related usages of neem leaves**				
4	To prevent from mosquitoes	73	73.00	VI	
5	Anti venom for bite of scorpion	40	40.00	VII	
6	Anti venom for snakebite	40	40.00	VII	
7	As a medicine for worms	33	33.00	IX	
8	Used in bathing water for prevention of dermal diseases.	90	90.00	II	
9	As a cure of fever	100	100.00	I	
10	As an anti-coughing agent	34	34.00	VIII	
11	As a medicine for piles	3	3.00	XI	
12	To control diabetes	15	15.00	X	

contd. table

Sr. No.	Particulars	Frequency	Per cent	Rank	Overall Rank
13	For curing of ill health due to opium	0	0.00	XI	
C	**Industrial usages of neem leaves**				
14	As an ingredient of toothpaste	76	76.00	V	
15	As an ingredient of soap	80	80.00	IV	
III	**Knowledge related to usages of neem twigs/branches**				II
A	**Agricultural usages of neem twigs/branches**				
1	To know the source of underground water	0	0.00	II	
B	**Health related usages of neem twigs/branches**				
2	As a toothbrush (Datun)	100	100.00	I	
C	**Usages of neem twigs/branches for home purpose**				
3	As a fuel	100	100.00	I	
IV	**Knowledge related to usages of neem oil**				VI
A	**Agricultural usages of neem oil**				
I	For control of sucking pests				
1	For control of aphids (mustard)	0	0.00	XIII	
II	For control of sucking pests in cotton				
2	For control of biting pests	66	66.00	III	
3	For control of leaf eating caterpillar	49	49.00	VI	
4	For control of Helicoverpa	33	33.00	X	
5	For control of castor semilooper	31	31.00	XI	
6	For control of diamond back moth (cabbage)	0	0.00		
7	For control of fruit borer (Okra)	39	39.00	VII	
8	For control of whitegrub	0	0.00	XIII	
9	For control of hairy caterpillar	34	34.00	IX	
10	As a fungicide	30	30.00	XII	
B	**Health related usages of neem oil**				
11	For control of dandruff	69	69.00	II	
12	For the cure of gum boil	36	36.00	VIII	
13	As a contraceptive	0	0.00	XIII	
14	To prevent from mosquitoes (apply on body)	65	65.00	IV	
15	As nasal drop for cure of sinus	0	0.00	XIII	
C	**Industrial usages of neem oil**				
16	As an ingredient of soap	84	84.00	I	
17	In preparation of medicines	56	56.00	V	
D	**Usages of neem oil for home purpose**				
18	As a fuel in lamp	33	33.00	X	
V	**Knowledge related to usages of neem cake**				IV
A	**Agricultural usages of neem cake**				
1	For control of nematodes	0	0.00	III	
2	To make the soil fertile	73	73.00	I	
3	For coating of urea	41	41.00	II	
VI	**Knowledge related to usages of neem gum**				VII
A	**Health related usages of neem gum**				
1	As a medicine against itching	6	6.00	II	
2	As a tonic	11	11.00	I	
VII	**Knowledge related to usages of neem root**				V
A	**Agricultural usages of neem root**				
1	To prevent soil erosion	71	71.00	I	
B	Health related usages of neem root				
2	For making of the paste (Ghanvati) from bark	0	0.00	II	
VIII	**Method of preparing a solution of neem seed kernel and neem oil**				VIII
1	How to separate kernel from neem seed	3	3.00	III	
2	Procedure to prepare solution from kernel	3	3.00	III	
3	How to prepare 5 % of solution of extracted kernel	4	4.00	II	
4	Preparation of neem oil solution for spraying	5	5.00	I	

contd. table

1. Agricultural Usages of Tree

The knowledge regarding the uses of neem tree, out of total eight indigenous uses, more than 90.00 respondents have a knowledge of to make best use of the fellow land, to prevent soil erosion, to make farm implements, for bringing rain, Wood or furniture and for rearing of GALO. Less than 90.00 percent respondents have a knowledge regarding as a wind break and for shade.

As an agricultural usages of tree got a first rank in all eight indigenous knowledge of neem tree.

2. Knowledge Related to Usages of Neem Leaves

The data in Table 4 revealed that the cent percent (100.00) respondents having knowledge in practices were : for storage of grains, as an animal feed and as a cure of fever. More than (90.00 per cent) response in usages of neem leaves was used in bathing water for prevention of dermal diseases. The remaining practices responses were: as a fertilizer (86.00 per cent), to prevent from mosquitoes (73.00 per cent), anti venom for bite of scorpion (40.00 per cent), anti venom from snakebite (40.00 per cent), as a anti-coughing agent (34.00 per cent) and as a medicine for worms (33.00 per cent).

Least response in respect to control diabetes, as a medicine for piles and for curing of ill health due to opium. Knowledge related to usages of neem leaves ranked third in all practices of usages of neem.

3. Knowledge Related to Usages of Neem Twigs/ Branches

The data presented in table 4 concluded that cent percent (100.00 per cent) respondents had a knowledge of As a toothbrush (Datun) and as a fuel and 0.00 per cent respondents had a knowledge of to know the source of underground water. Knowledge related to usages of neem twigs/branches ranked second.

4. Knowledge Related to Usages of Neem Oil

The data revealed from table 4 that knowledge related to usages of neem oil were : as an ingredient soap (84.00 per cent), for control of drandruff (69.00 per cent), for control of sucking pests in cotton (66.00 per cent), to prevent from mosquitoes (apply body) (65.00 per cent), preparation of medicine (56.00 per cent), for control of leaf eating (49.00 per cent), for control of fruit borer in okra (39.00 per cent), for the cure of gum boil (36.00 per cent), for the control of hairy catter piller (34.00 per cent), as a fuel in lam (33.00 per cent), for the control of helicoverpa (33.00 per cent), for the control of castor semi looper (31.00 per cent) and as a fungicide (30.00 per cent).

The practices had zero per cent responded were : for control of aphids in mustard, for control of diamond back moth in cabbage, for control of white grub, as a contraceptive and as a nasal drop for cure of sinus. Out of total eight practices about knowledge of different usages of neem, usages of neem oil ranked sixth.

5. Knowledge Related to Usages of Neem Cake

Knowledge related to usages of neem cake, Table 4 data concluded that the practices to make the soil fertile (73.00 per cent) followed by for coating of urea (41.00 per cent) and no any responses in control of nematodes. Usages of neem cake ranked fourth.

6. Knowledge Related to Usages of Neem Gum

Table 4 data concluded that least percent respondents had a knowledge regarding usages of neem gum were: usages as a tonic (11.00 per cent) and a s a medicine against itching (6.00 per cent). Knowledge related to usages of neem gum ranked seventh.

7. Knowledge Related to Usages of Neem Root

The data presented in Table 4 depicted that use of neem root knowledge in the practices for prevent soil erosion (71.00 per cent) and For making of the paste (Ghanvati) from bark (0.00 per cent). Fifth ranked for usages of neem root in all eight practices.

8. Method of Preparing a Solution of Neem Seed Kernel and Neem Oil

Least respondents had a knowledge regarding method of preparing a solution of neem seed kernel and neem oil. The data presented in Table 4 concluded that the practices were : preparation of neem oil solution for spraying (5.00 per cent) how to prepare 5% of solution of extracted kernel (4.00 per cent), procedure to prepare solution from kernel (3.00 per cent) and how to separate kernel from neem seed (3.00 per cent). Method of preparing a solution of neem seed kernel and neem oil practice was got last ranked in all usages of neem.

EXTENT OF ADOPTION OF USES OF NEEM

The data in Table 5 revealed that 69.00 per cent of the trained farmers had medium level adoption. Remaining 16.00 per cent and 15.00 per cent of them had high and low extent of adoption, respectively (Table 5 and Fig. 2).

Table 5
Extent of Adoption of Uses of Neem by Respondents
(n = 100)

Sr. No.	*Adoption score*	*Frequency*	*Per cent*
1	Low (Below 56.84 score)	15	15
2	Medium (56.84 to 83.22 score)	69	69
3	High (Above 83.22 score)	16	16

Mean = 69.53 S.D.=13.69

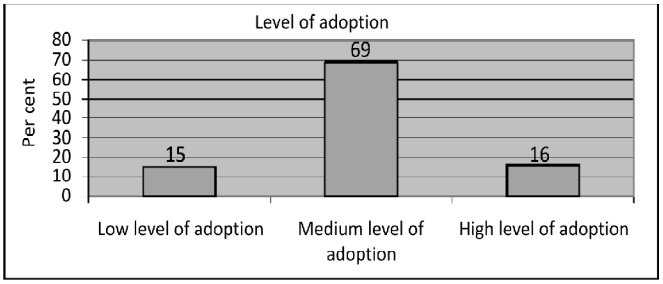

Figure 2: Level of Adoption

Hence, it can be concluded that majority (69.00 per cent) of farmers possess medium extent of adoption of indigenous practices of neem. Such a high adoption has been observed may be in farmers towards indigenous and scientific knowledge. Moreover they all were found educated, having good contact with NGOs, other progressive farmers and were receiver of farm literature too.

Similar findings were reported by those of Kanani (1998), Bhagat (2005) and Kamani (2007).

PRACTICE WISE ADOPTION OF USAGES OF NEEM

To ascertain the practice wise extent o adoption of usages of neem. The different six usages were listed and usages wise scores obtained by the respondents in particular use, the mean scores were worked out for all the individual usages. These mean score were again converted in to percentage, for all the usages. The ranks were assigned to each usages. The results are presented in Table 6 and Fig. 3.

Table 6
Practice Wise Adoption of Usages of Neem (n=100)

Sr. No.	*Name of the practices*	*Total*	*Per cent*	*Rank*
1	Tree	15	15.00	III
2	Leaves	22	22.00	II
3	Twing/Branches	12	12.00	V
4	Oil	27	27.00	I
5	Gum	11	11.00	VI
6	Root	13	13.00	IV

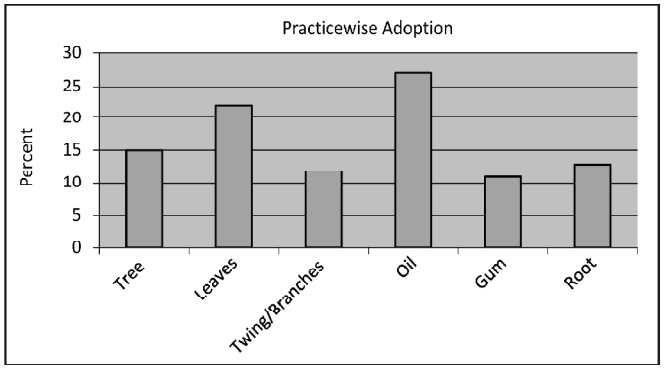

Figure 3: Practicewise Adoption

The data presented in Table 6 clearly indicated that 27.00 per cent respondents adopted practices of neem oil (ranked first) followed by 22.00 per cent respondents adopted practices of neem leaves (ranked second), 15.00 per cent respondents adopted the practices of neem tree (ranked third), 13.00 per cent respondents adopted the practices of neem root (ranked fourth), 12.00 per cent respondents adopted pratices of twings/branches (ranked fifth) and only 11.00 per cent respondents adopted practices of neem gum (ranked sixth)

Association between level of knowledge about organic farming practices and selected independent variable of the respondents

In order to ascertain the association between the level of knowledge (dependent variable) of the farmers and each of their selected characteristics (independent variables), the correlation co-efficient ('r') was calculated on the basis of operational measures developed for the variables, empirical hypotheses was stated for testing the association and its significance on zero order correlation are given in Table 7.

Table 7
Correlation Co-efficient between Indigenous Knowledge of Different Usages of Neem and their Selected Characteristics. (n = 100)

Sr. No.	*Name of the independent variables*	*r- Value*
1	Age	0.5675**
2	Education	0.2809**
3	Type of Family	0.0805^{NS}
4	Size of land holding	0.0357^{NS}
5	Occupation	0.1890*
6	Herd Size	0.0168^{NS}
7	Annual Income	0.0189^{NS}
8	Extension participation	0.2099**
9	Social participation	0.2868**
10	Extension Contact	0.2001*
11	Localite-cosmopolite Value orientation	-0.2060**
12	Innovativeness	0.1996*
13	Scientific Orientation	0.1687*

* 5 Per cent level of Significant r = 0.1509
** 1 Per cent level of Significant at r = 0.1793
NS = Non significant

CONCLUSION

Majority of the respondents were found with 73.00 per cent of the respondents had medium level of knowledge followed by 14.00 per cent had high level of whereas, 13.00 per cent had low and knowledge about indigenous practices.

Practice wise knowledge of the farmers like usages of neem tree (ranked first), neem twings / branches (ranked second), neem leaves (ranked third). Neem cake (ranked fourth), neem root (ranked fifth), neem oil (ranked sixth), neem gum (ranked seventh) and method of preparing a solution of neem seed kernel and neem oil (ranked eighth).

Adoption level of majority of the respondents were found with 69.00 per cent of the respondents had medium level of adoption followed by 16.00 per cent had high level of adoption whereas, 15.00 per cent had low level of adoption about indigenous practices.

There was positive and highly significant results found in age, education, extension participation and social participation with their knowledge, while localite cosmopolite value orientation was found negative and significant with their level of knowledge

Occupation, extension contact, innovativeness and scientific orientation of the respondents were

found positive and significant with their level of knowledge.

There was non-significant association of knowledge of farmers about different indigenous and scientific usages of neem with their type of family, size of land holding, herd size and annual income. The present study will be of great use to planners, administrators and research workers to understand existing status of the farmer in terms of their indigenous and scientific knowledge and use of neem tree. It will benefit the farmers to improve both indigenous and scientific knowledge and thereby to make the optimum use of the evergreen tree neem available around them. The research workers can use the existing knowledge available with farmer for improvement of the technologies regarding the uses of neem. The findings of the study will be benefited to the administrators to create awareness among the rural farmer that how they can exploit the best resource that the nature has given to them at almost free of cost.

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