

Integration of Indigenous Agricultural Technologies with Modern Scientific Knowledge for Reinforcement of Natural Resources

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ABSTRACT

Immediately after Green Revolution era, the Agricultural Scientists shifted their approach from laboratory research to farming systems research and operational research involving farmers, farm women and farming conditions. Efforts were made to move towards participatory research which of course could not be achieved up to desired level under Indian conditions due to farm women illiteracy and Scientist's conveniences. Reversal of transfer of technology and farmer participatory research was conceived not only to understand the farmer conditions but also to revitalize the natural resources. Especially farm women have developed their strong knowledge system which is based on numerous informal experiments through generations and rigorous testing of knowledge in their farming system. This indigenous knowledge of farm practices has been embodied and integrated culturally in the farming system and the practices have been taken the shape of social norms to be followed by each and every farmer in the village social system. The alternative to participatory research could be integration of indigenous knowledge system with modern scientific knowledge for conserving the natural resources with maximum sustainability, eco-friendly and profitability. In the present study, ITK in agriculture has been collected, documented and scientifically validated. Most of the ITK's in agriculture are being proved valid efficacious and comparable to the modern technologies which are definitely oriented towards natural resources. The proved ITK's could be used for their specific characteristics and could be blended with the modern technologies for revitalization of natural resources. This study revealed out the utilization of these modified practices and technologies by the farm women up to the medium level of Bikaner district which should be enhanced by further modifying their attitude towards conservation of natural resources.

Key words : Green Revolution; Laboratory research to farming systems research and operational research;

Since last two decades, a growing number of scientists have moved towards analyzing the consequences of modern & scientific development efforts & from 80's the appreciation for traditional wisdom, which are prevalent in the society since time memorial, gained currency globally. Developing countries like ours have a reservoir of indigenous knowledge which may certainly prove to be more valuable to all of us in reorganization of our development efforts towards nation's self sufficiency.

Being an agricultural dependant country, in India, our developmental efforts are concentrated around transforming traditional agriculture technology to a way to modern technology but the potentially of traditional agriculture is increasingly being recognized during last

few years. "Developing countries have a valuable but largely untapped reservoir of indigenous agricultural knowledge." (Warren, 1993).

Traditional agriculture is normally thought to be that collection of practices which were centuries old and is a universal package of practices, a product of way of thinking, way of living, a culture. Its aim was the satisfaction of the basic needs of the surrounding community, not the luxuriant wants of distant region. Such knowledge or experiences have been passed on from one generation to another by word of mouth, which are commonly as "Traditional Agriculture Practices."

The word "Traditional" implies the sense of Tradition and Tradition derived the word "Tradere" means to transmit. In this respect we can say that

tradition is transmission of community value and behavior which is rooted in past. Old traditions are always replaced by new traditions due to some external and internal factors. In this sense, tradition is not static.

The soul of tradition is placed in community value. So, it is quite difficult to differentiate tradition and custom by excluding values. This could be expressed by following equation:

$$\text{Custom} + \text{Value} \rightarrow \text{Tradition}$$

In the Dictionary sense, "Traditional" usually refers to cultural continuity transmitted in the form of social attitudes, beliefs, principle and conventions of behaviour and practices derived from historical experience. Likewise "Indigenous means occurring or living naturally in a specific area, such as native plants and animals. (Reijntes, 1992)

By above discussion, we can conclude that there is no significant difference in traditional and indigenous. Both can be used synonymously or interchangeably because both signify the concept of localization. To understand it, it can be said that all indigenous knowledge may be traditional but all traditional knowledge may not necessarily be indigenous. In spite of this it is quite difficult to draw a line between them and to say when indigenous becomes traditional.

Traditional knowledge has its vast spectrum of knowledge which embodies various aspect of life like – agriculture, health, culture, geography, environment and architect etc. Traditional knowledge like conventional knowledge is always manifold, discontinuous and dispersed. It can not be integrated in term of a logical system of classification because every system of knowledge either it is agriculture or other sector of system has its own epistemology and theory. This knowledge is unique of any society which is fabricated on their sound belief, norms and the culture of the society to which they belong. The wisdom is cherished by rural society is build upon day to day activity.

Traditional agricultural practices are the sum total of knowledge and wisdom, based on the accumulated experiences in dealing with problems and situations which are specific for a particular culture. Much of this existing knowledge about traditional practices has not been consolidated and put together as they are unwritten and untapped knowledge, which is concrete and relies strongly on institution, historical experience

and directly perceivable evidence. As *Attee (1989)* opined that "It is untapped unwritten body of knowledge which is held in brains, languages and skills are as many groups, languages, culture and environment."

Although the traditional practices or knowledge are the outcomes of daily experiences of local people, they are still in vague and not have any scientifically supported framework. If this age old practices are integrated with scientifically acceptable practices, then it will definitely result in convincing and credible practices to the rural people specially to farming community. So there is urgent need to safeguard and reaffirm traditional agricultural practices among farm women and encouraging them to adopt scientifically valid and acceptable traditional practices which are need base, better problem solving, locally available and more intelligible and credible to the rural clientele.

Therefore, much work has to be done to locate, document and disseminate traditional knowledge so that it become part of body of development-sustainable development. As there is common proverb in African society that "When a knowledgeable old person dies, a whole library disappears," so unless we make urgent and quicker efforts to track this valuable knowledge, it will be lost soon, not to be regained at any cost.

METHODOLOGY

With this consideration in mind, the present research was carried out to find out the extent of utilization of indigenous agricultural practices by farm women of Bikaner district. The research was conducted in the Bikaner district covering three panchyets namely Bikaner, Nokha and Lunkaransar, which were randomly selected. Ten gram panchyats, involving 15 villages were selected from total number of panchyats in such a way that no of selected villages from each gram panchyat is proportional to the size of the gram panchyat. From all the selected villages, 150 farm women were chosen by simple random sampling, which have at least one bigha cultivable land.

Inter view schedule was developed to get the data authentically from farm women. Utilization index was developed covering various degrees of utilization. Scores were assigned 4,3,2,1 and 0 respectively for each category. Frequency, mean score and S.D. were computed for analysis of data. Aspect wise utilization

of various agricultural technologies was also analyzed.

RESULTS AND DISCUSSION

By using utilization index, different levels of utilization was measured, which has been presented under following sub-heads:

Different levels of utilization of various traditional agricultural practices by farm women: The statistical data regarding the extent of utilization of traditional practices by the farm women respondents has been presented in the Table 1

Table 1. Distribution of farm women respondents into different levels of utilization of various traditional agricultural practices N=150

Levels	Frequency	Percentage
High utilization (scores above 299.53)	34	22.67
Medium utilization (scores from 276.50 to 299.50)	87	58.00
Low utilization (scores up to 276.50)	29	19.33

$X = 288.01$, $\sigma = 11.51$

By using this continuum, utilization score was computed for all the respondents. From the utilization score of farm women, mean score and standard deviation (S.D.) was computed for the purpose of classifying the utilization level into three classes' namely low utilization, medium utilization and high utilization as follows:

1. The respondents who obtained the mean score up to 276.50 were classified as having 'low utilization level' of traditional agricultural practices.
2. The respondents who obtained the mean score from 276.50 to 299.53 were classified as having 'medium utilization level' of traditional agricultural practices.
3. The respondents who obtained the mean score more than 299.53 were classified as having 'high utilization level' of traditional agricultural practices.

It is evident from the Table 1 that about 58 percent of the respondents were having medium utilization level, while 19 per cent and 23 percent of the farm women were having 'low' and 'high' utilization level of traditional agricultural practices respectively. Hence, it may be inferred from the results that more than half of the

Table 2. Practice wise extent of utilization of traditional agricultural practices by the farm women

S. No.	Practices	Utilization score				Mean score	Practise wise Rank	Overall Rank
		MU(4)	U(3)	LU(2)	NU(1)			
1.	<i>Land preparation practices :</i>							
1	The moisture level for ploughing is known by farm women with their experience based on visual observation of color of soil as yellow soil is considered productive soil.	90 (60%)	20 (13%)	25 (17%)	15 (10%)	3.23	IV	27
2	Deep ploughing is done for moisture conservation.	120 (80%)	18 (12%)	12 (8%)	0 (0%)	3.72	I	13
3	Summer ploughing is done for weed control & also for controlling insects-pests.	110 (73%)	20 (13%)	10 (7%)	10 (7%)	3.53	II	19
4	"Pata" is used for leveling of land, clode crushing & for moisture conservation.	110 (73%)	10 (7%)	20 (13%)	10 (7%)	3.47	III	22
5	Soil is tested by touching as soil particles which bind together is good & fertile.	90 (60%)	10 (7%)	35 (23%)	15 (10%)	3.17	V	30
2.	<i>Seed treatment & sowing practices :</i>							
1	Maize seeds are soaked in water for 24 hours before sowing which results in better germination percentage.	90 (60%)	30 (20%)	20 (13%)	10 (7%)	3.33	II	26
2	Dip the seeds in 20% salt solution to ensure good germination.	60 (40%)	40 (27%)	25 (17%)	25 (17%)	2.90	VIII	40
3	Cotton seeds are coated with cow dung before dibbling which helps in compacting the fuzz in seeds & making dibbling easy.	140 (93%)	10 (7%)	0 (0%)	0 (0%)	3.93	I	5
4	Sorghum seeds are soaked in cow urine to induce drought tolerance of seeds.	30 (20%)	48 (32%)	42 (28%)	30 (20%)	2.52	X	50
5	To test the spoiled seeds, dip the seeds in water then	70	50	20	10	3.20	III	28

6	For easy sowing of some cucurbits, it is done in 1.5-2 ft. deep pit & covers it with by straw which protect the nascent plants from frost & moisture deficiency.	60 (40%)	45 (30%)	42 (28%)	3 (2%)	3.08	IV	33
7	Seeds are stored in earthen pots which are kept for next season sowing purpose.	40 (27%)	80 (53%)	22 (15%)	8 (5%)	3.01	V	35
8	Some cotton growing farmers of arid districts immerse the seeds in kerosene before sowing for better germination.	0 (0%)	40 (27%)	100 (67%)	100 (67%)	1.75	XIII	67
9	Farmers moisten the seeds of bottle gourd & tie it in the "Dhoti" tightly around waist for its better germination.	40 (27%)	70 (47%)	28 (19%)	12 (8%)	2.92	VII	38
10	Soaking & drying alternatively for 4 days makes seeds hardy & salt resistant.	27 (18%)	88 (59%)	35 (23%)	0 (0%)	2.95	VI	37
11	The extract of neem leaves is used for treating the seeds of sorghum for keeping stray animals away.	20 (13%)	23 (15%)	48 (32%)	59 (39%)	2.03	XII	62
12	For better germination of seeds of groundnut are smeared with lime solution before sowing.	22 (15%)	40 (27%)	60 (40%)	28 (19%)	2.37	XI	53
13	The water-soaked cotton seeds are treated by the soil from the termite burrow to increase its germination percentage.	32 (21%)	42 (28%)	70 (47%)	6 (4%)	2.67	IX	45
3.	<i>Weed control practices :</i>							
1	Hand weeding is used for weed control.	140 (93%)	10 (7%)	0 (0%)	0 (0%)	3.93	I	5
2	For destruction of all type weed seeds, before sowing the crop irrigation & ploughing method is used.	110 (73%)	40 (27%)	0 (0%)	0 (0%)	3.73	III	12
3	Burning of weeds is also a common practice of weed control.	70 (47%)	80 (53%)	0 (0%)	0 (0%)	3.47	IV	23
4	Common salt is used for Lucerne seed treatment to control "dodar" (Cuscuta reflexa), also known as "Amar Bel."	40 (27%)	90 (60%)	10 (7%)	10 (7%)	3.07	V	36
5	The ash of cow dung is dusted on the plants at the rate of 50-60 kg/ha to prevent growth of cuscuta.	20 (13%)	60 (40%)	66 (44%)	4 (31%)	2.64	VI	49
5	Compost of aak, dung & common salt are used for better fodder quality & more production of fodder inn Lucerne crop.	40 (27%)	88 (59%)	22 (15%)	0 (0%)	3.12	III	33
6	Pond soil or tank mud (silt) is mixed in crop field for more production.	100 (67%)	50 (33%)	0 (0%)	0 (0%)	3.67	II	14
7	Fruit trees gardeners use castor cake for better growth & bearing in next season at the rate of 250-500g/plant.	80 (53%)	20 (13%)	33 (22%)	17 (11%)	3.09	IV	34
8	Some vegetable growers mix the bat excreta collected from old building at the time of transplanting.	10 (7%)	10 (7%)	80 (53%)	50 (33%)	1.87	VIII	70
6.	<i>Soil reclamation practices :</i>							
1	Farmers incorporate empty shell of cotton in the salt affected soils.	105 (70%)	35 (23%)	10 (7%)	0 (0%)	3.63	I	16
2	Some farmers grow Gram & Okra in salty soils.	70 (47%)	40 (27%)	22 (15%)	18 (12%)	3.08	II	35
3	Empty pods are incorporated into saline soils as part of reclamation.	40 (27%)	38 (25%)	30 (20%)	42 (28%)	2.51	III	54
4	Press mud (byproduct of sugar industry) is also used for reclamation of alkaline soil.	0 (0%)	30 (20%)	100 (67%)	20 (13%)	2.07	IV	65
7.	<i>Soil Fertility management practices :</i>							
1	Earthworms are incorporated in bulk to make soil porous & fertile.	135 (90%)	15 (10%)	0 (0%)	0 (0%)	3.90	I	6
2	Farmers mix clay clods collected from the nearest/tank at the time of land preparation.	122 (81%)	28 (19%)	0 (0%)	0 (0%)	3.81	II	11
3	Plantation of Khejri trees on farm increase the soil fertility.	0 (0%)	40 (27%)	70 (47%)	40 (27%)	2.00	VIII	67
4	Summer ploughing helps increasing aeration & infiltration capacity of soil.	97 (65%)	33 (22%)	20 (13%)	0 (0%)	3.51	V	22
5	Farmers in arid part of Rajasthan dust the ash on the soil at the time of sowing tuber crops.	49 (33%)	50 (33%)	23 (15%)	28 (19%)	2.80	VI	45

6	Compost made of animal wastes is used to make soil fertile.	110 (73%)	20 (13%)	20 (13%)	0 (0%)	3.60	IV	17
7	The Dolichos lab-lab (Indian bean) is mixed with sorghum & broadcasted to improve soil fertility through nitrogen fixation.	109 (73%)	29 (19%)	12 (8%)	0 (0%)	3.65	III	15
8	Farmers with irrigation facility applied the suspension of well decomposed cattle dung with irrigation water to Lucerne (Medicago sativa) crop at the time of irrigation.	0 (0%)	58 (39%)	48 (32%)	44 (29%)	2.09	VII	64
8.	<i>Storage Practices :</i>							
1	Gunny bags/ plastic bags are used for storing cereals and pulses.	140 (93%)	10 (7%)	0 (0%)	0 (0%)	3.93	II	5
2	Neem leaves (Azadirachta indica) and tobacco leaves (Nicotiana spp.) are used for grain storage.	150 (100%)	0 (0%)	0 (0%)	0 (0%)	4.00	I	1
3	Earthen pitchers/Kothi or mud kothi is used for grain storage purpose.	139 (93%)	11 (7%)	0 (0%)	0 (0%)	3.93	II	5
4	One part cow dung ash and two part of grain pulses is stored in the earthen pitcher.	134 (89%)	16 (11%)	0 (0%)	0 (0%)	3.89	III	7
5	Onion and garlic heaps are generally scattered on mud floor for short time storage.	87 (58%)	20 (13%)	0 (0%)	43 (29%)	3.01	VIII	37
6	Dry chili powder is mixed with seed for safe preservation.	0 (0%)	20 (13%)	90 (60%)	40 (27%)	1.87	XIII	70
7	Rub/mix slightly mustard oil and salt in all legumes and pulses before storage.	93 (62%)	28 (19%)	29 (19%)	0 (0%)	3.43	V	24
8	Turmeric rhizome is also used for pulses storage.	40 (27%)	45 (30%)	28 (19%)	37 (25%)	2.59	IX	51
9	Common salt is mixed with rice for its storage.	80 (53%)	45 (30%)	25 (17%)	0 (0%)	3.37	VI	25
10	Mixing of sand with gram also helps in long-time storage.	90 (60%)	48 (32%)	12 (8%)	0 (0%)	3.52	IV	21
11	Cowpea soaked for 3-4hours in water and then dried in sun increase its shelf life.	10 (7%)	20 (13%)	98 (65%)	22 (15%)	2.12	XII	63
12	Farmer smears the seeds of wheat and many other crops with castor oil for long preservation.	12 (8%)	22 (15%)	90 (60%)	26 (17%)	2.13	XI	62
13	Farmer mix the empty shells of gram pods with the seeds of any cereal and pulse crop at the time of storage	20 (13%)	22 (15%)	97 (65%)	11 (7%)	2.34	X	58
14	Ash is mixed with water soaked pulse grains by hand followed by two days sun drying on open ground.	78 (52%)	48 (32%)	24 (16%)	0 (0%)	3.36	VII	26
9.	<i>Insects-Pest and Disease Management Practices :</i>							
1	Use of calotropis to control thrips and mealy bugs.	110 (73%)	20 (13%)	15 (10%)	5 (3%)	3.57	IV	19
2	Garlic extract is used for nematode control.	48 (32%)	30 (20%)	68 (45%)	4 (3%)	2.81	IX	44
3	Neem, tobacco and methi extract are used for insect-pest control.	49 (33%)	50 (33%)	35 (23%)	16 (11%)	2.88	VIII	43
4	Pyrethrum obtained from chrysanthemum is used for diseases and pest control inn vegetable crops.	38 (25%)	40 (27%)	42 (28%)	30 (20%)	2.57	X	52
5	Solution of Tulsi extract and neem extract is used for red hair caterpillar.	59 (39%)	60 (40%)	31 (21%)	0 (0%)	3.19	VI	31
6	Five percent tobacco plants are grown in tomato field to check the insect-pest infestation.	40 (27%)	322 (215%)	32 (21%)	46 (31%)	2.81	IX	44
7	castor cake and dry Mahua flower (Madhuka latifolia) are used for termite control in soil.	40 (27%)	30 (20%)	40 (27%)	40 (27%)	2.47	XI	55
8	Solution of tobacco extract and cow urine is used for fruit borer control in brinjal.	38 (25%)	78 (52%)	17 (11%)	17 (11%)	2.91	VII	41
9	Solution of Datura extract with soap water is used for maize stem borer.	0 (0%)	0 (0%)	40 (27%)	110 (73%)	1.27	XV	75
10	mustard oil is used in roots of mango trees for termite	70	80	0	0	3.47	V	23

	control.	(47%)	(53%)	(0%)	(0%)			
11	Smoking and burning around the field act as repellent for insects.	110 (73%)	40 (27%)	0 (0%)	0 (0%)	3.73	III	12
12	Polythene sheets tied to a long pole flutter during windy season and produce sound-off to wards-off crows.	0 (0%)	0 (0%)	90 (60%)	60 (40%)	1.60	XIV	74
13	Use of trap crops to attracts the insects e.g. Okra around the saff flower or intercropping of cow pea with groundnut is also effective measure.	135 (90%)	15 (10%)	0 (0%)	0 (0%)	3.90	II	6
14	Some farmer use castor oil or kerosene oil in root portion of plant for termite control.	0 (0%)	49 (33%)	40 (27%)	61 (41%)	1.92	XII	68
15	Mixture of kerosene oil and ash of wood is sprayed on the crop for minimizing the white fly and aphid's attack.	0 (0%)	0 (0%)	120 (80%)	30 (20%)	1.80	XIII	72
16	Farmers immersed the seeds of wheat in milk before sowing to avoid rust disease in wheat.	145 (97%)	5 (3%)	0 (0%)	0 (0%)	3.97	I	4
10.	<i>Local Agriculture Implements :</i>							
1	"Ridge maker" (Bund former) is used for irrigation channel and bed preparation.	132 (88%)	18 (12%)	0 (0%)	0 (0%)	3.88	V	8
2	"Noise Maker" or "Beating Drum" is used for protection of mature crop from various types of birds.	140 (93%)	10 (7%)	0 (0%)	0 (0%)	3.93	IV	5
3	The earthen pot is used for seed treatment.	149 (99%)	1 (1%)	0 (0%)	0 (0%)	3.99	II	2
4	Hand chaff-cutter is used for chaffing the green fodder.	150 (100%)	0 (0%)	0 (0%)	0 (0%)	4.00	I	1
5	"Weed Collector", made of wood and iron is used for weed collection from the field.	40 (27%)	80 (53%)	18 (12%)	12 (8%)	2.99	VIII	38
6	Traditional "Indigenous/desi plough" is a most common multipurpose implement.	147 (98%)	3 (2%)	0 (0%)	0 (0%)	3.98	III	3
7	"Gulel" i.e. Catapult (Throwing pebbles/stone by leather rope) and "Scare Crow" i.e. Effigy (Vijuka) are also effective protective implements to ward off birds.	150 (100%)	0 (0%)	0 (0%)	0 (0%)	4.00	I	1
8	"Blade Harrows" is a useful implement for weeding and inter-cultivation in the standing crop.	40 (27%)	100 (67%)	10 (7%)	0 (0%)	3.20	VII	30
9	Bullock drawn wooden board is used for leveling of land.	110 (73%)	40 (27%)	0 (0%)	0 (0%)	3.73	VI	12
10	Traditionally prepared "Pata/Patela" is a common implement for clode crushing.	120 (80%)	3 (2%)	0 (0%)	0 (0%)	3.98	III	3
11	Wooden seed tube (Pora) is used for line sowing and fertilizers application purpose.	140 (93%)	10 (7%)	0 (0%)	0 (0%)	3.93	IV	5
12	Weeding is done by "Kudaali/Spade or Khurpi." (Small hoe with wooden handle)	140 (93%)	10 (7%)	0 (0%)	0 (0%)	3.93	IV	5

respondents were utilizing the traditional agricultural practices up to medium level of utilization.

Extent of utilization of different traditional agricultural practices : Table 2 depicts the details about the extent of utilization of different traditional agricultural practices by farm women. For this purpose, practices were assigned ranks on the basis of mean score, obtained by these practices

An examination of the data revealed that out of 88 traditional agricultural practices, practices of using traditional agricultural implements got highest rank, jointly with indigenous grain storage practices. On the contrast, traditional pest control practice by applying solution of

Datura extract with soap water for controlling maize stem borer was categorized as least utilized practice by the farm women respondents.

Extent of utilization of different aspects of traditional agricultural practices: The extent of utilization about different aspects of traditional agricultural practices was analyzed separately. The relative utilization of all the ten aspects was highlighted by ranking them in descending order on the basis of aspect wise mean score of utilization. The data were recorded and presented in Table 3.

Perusal of the table reveals that out of ten aspects, aspect of local agricultural implements was the most

Table 3. Aspect wise extent of utilization of traditional agricultural practices by the farm women

S. No.	Practices	Aspect wise mean score	Rank of Utilization
1	Land preparation practices	3.42	III
2	Seed treatment & sowing practices	2.82	VI
3	Weed control practices	3.45	II
4	Threshing practices	2.68	IX
5	Manuring practices	2.79	VIII
6	Soil reclamation practices	2.82	VI
7	Soil Fertility management practices	3.17	IV
8	Storage Practices	3.11	V
9	Insects-Pest and Disease Management Practices	2.80	VII
10	Local Agriculture Implements	3.80	I

utilized aspect by the farm women (3.80 MS) and placed at first rank, whereas aspects of manuring and threshing were reported at last two ranks of utilization comprising

eighth (2.79MS) and ninth (2.68) respectively, which predict their least importance in opinion of farm women.

CONCLUSION

Thus it is apparent from the findings that the farm women had medium to high level of utilization regarding traditional agricultural technologies which are highly contributive for promoting sustainable agriculture. This can not be solely attributed to reverence to the past but it is based on their traditional awareness about eco-friendly agriculture. Further, aspect wise analysis shows that farm women were still relying on traditional implements emphasizing the economic value of these technologies. If these technologies were refined through researches, it will definitely result into scientifically acceptable traditional technologies, which assist all the development planners and policy makers working for rural development to understand and plan for diffusion of such technologies, for solution of problems of farming community.

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