Scientific rationality and perceived effectiveness of indigenous technical knowledge on coconut (*Cocos nucifera* L.) cultivation in Kerala

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Abstract

We documented 129 traditional practices (indigenous technical knowledge, ITK) on coconut cultivation in Kerala. Aspects such as collection and storage of seed nuts (20.15%), cultural operations (14.73%), manuring (13.95%) and nursery management (13.18%) constituted the dominant categories of indigenous knowledge. Of the 129 practices, 30 were analyzed for their scientific rationality and awareness and adoption among farmers and 19 practices studied for their perceived effectiveness. Of the 30 practices, 24 were found to be rational, while the rest six were adjudged as irrational. The scientific rationale/operational principles behind 24 rational ITK were also elucidated in this study. Farmers' knowledge on a majority of selected ITK was good with more than 50% of the sampled farmers (52.50 to 92.50% per practice) having awareness on 20 practices. Twelve practices were adopted by 57.5 to 82.5% farmers. Of the 19 ITK studied for effectiveness, 17 were perceived as effective by the farmers, implying that many indigenous practices were both rational as well as effective. This calls for more scientific intervention to validate the indigenous knowledge, which in turn would enrich our agricultural technology.

Keywords: Adoption, Indigenous practices, Perceived effectiveness, Rationality, Traditional knowledge.

Introduction

In view of the ecological problems (e.g., pesticide residues and agricultural non-point source pollution) associated with modern agricultural technology, besides its unsustainable nature, the planners and policy makers around the world have been thinking of sustainable alternatives. Organic farming is regarded as one of the best alternatives in this context. It mostly involves revival of the traditional agricultural practices, known as indigenous traditional knowledge (ITK), with some modifications. Such practices were evolved by the early agriculturists over centuries of trial and error under adverse environmental conditions and with little or no chemical inputs. Unravelling the indigenous technical knowledge has emerged as a research priority with the hope that it will at least partially offset the chemical input intensive agricultural practices.

Most ITK systems are also eco-centric, objective as well as intuitive, and derived from the practical and innovative life of generations of indigenous people (Rajagopalan, 2003). These are also readily available, socially acceptable, economically affordable, and sustainable, besides involving minimum risk to farmers and consumers, and above all, resource conserving (Grenier, 1998). However, with the passage of time and advent of modern scientific knowledge systems, several of these useful traditional practices are continually being lost. Hence, there is an urgent need to systematically document the indigenous practices in agriculture and validate them, before they become extinct. This is also important in the present context of Intellectual Property Rights (IPR) regime and upscaling ITKs in agriculture along with modern agricultural practices.

Coconut (*Cocos nucifera* L.) is the principal crop of

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Kerala (India) covering 781,000 ha (38% of the net cropped area: Government of Kerala, 2009). It has been a principal source of livelihood for a vast majority of small and marginal farmers in the state for a long time. It is also a traditional crop, with a long history of cultivation and considerable indigenous wisdom (Kumar, 2008). Although some researchers made attempts to document the ITK on farming (e.g., Hunter, 1996, from Maldives, Bandyopadhyay and Saha, 1999, from Andaman and Nicobar islands, Sundaramari, 2001, from Tamil Nadu, and Manju, 1996, Bonny 2001, Swapna, 2003, and Sreekumar et al., 2006, from Kerala), most of these are fragmented studies focussing on relatively a small geographical area. Furthermore, none of these studies have attempted to characterise the scientific rationale of the traditional practices. In view of this, the present study was undertaken with the specific objectives of collecting information on ITK relating to coconut cultivation in Kerala and documenting the same, besides analysing the scientific rationale of selected ITK, and assessing the extent of knowledge, adoption, and perceived effectiveness of selected ITK.

Methodology

The study was conducted in the four major agroclimatic zones of Kerala: Southern , Central, Northern, and High Altitude zones. ITK being local knowledge systems, the sampling strategy was devised to cover all major agroclimatic zones. One district in each agroclimatic zone (Fig. 1) was purposively selected based on the area under coconut; districts with high production, and high percent of total cropped area under coconut (Government of Kerala, 2008) were selected. From each selected district, two National Extension Service Blocks (NES blocks: Fig. 1) were chosen purposively (based on area under coconut), and from each block two *grama panchayats* (lowest level of local self-government) were selected in the same manner (on the basis of records available at the local *krishi bhavans*—agricultural extension offices of the Department of Agriculture, Kerala). A total of 16 *grama panchayats* spread over the state of Kerala were thus selected.

From each of the 16 selected *grama panchayats*, 10

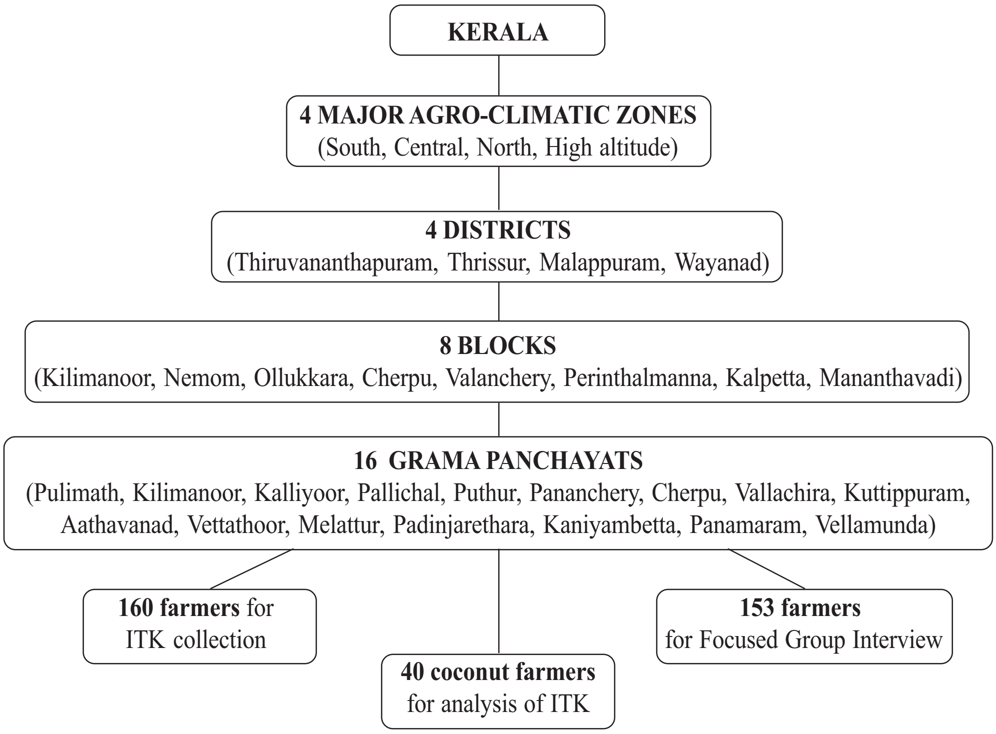

Figure 1. Flowchart showing selection of farmer respondents of the study.

farmers (more than 55 year-old with at least 30 years of farming experience) were identified through judgement sampling, in consultation with the local agricultural extensionists (Agricultural Officers and Agricultural Assistants in the local *krishi bhavans*), making a total of 160 respondents for elucidating ITK on coconut cultivation. Information on ITK was collected through a participatory informal interview method. Eight Focus Group Interview sessions were also conducted (two per agroclimatic zones) during April – July 2008 to crosscheck and refine the information gathered, in which a total of 153 farmers participated. A total of 129 items of ITK on coconut cultivation were documented through this exercise.

In the next phase (January-March 2009), after excluding the zone-specific ITK, a rationality analysis on the remaining 30 ITK was performed. Apart from zone-specific nature of the ITK, aspects such as use of chemicals (ITK involving some chemicals excluded), importance of the ITK as stated by the farmers, and adoption by farmers (items reported from more areas) were considered for selecting the suite of 30 ITK. Rationality refers to the degree to which ITK can be explained or supported with scientific explanations, or have been established based on long term experiences. Conversely, irrationality refers to the degree to which ITK cannot be explained or supported with scientific reasons, or not supported by long term experience. The suite of 30 selected ITK was administered to experts, who were asked to elucidate the rationality or otherwise, using a four point continuum. The response categories were rational based on scientific evidence, rational based on experience, irrational based on experience, and irrational based on scientific evidence with a score of 4, 3, 2, and 1 respectively (Somasundaram, 1995). The respondents were drawn from among the horticultural scientists of Kerala Agricultural University, Thrissur, Gandhigram Rural Institute, Dindigul, and Central Plantation Crops Research Institute, Kasaragod. A total of 54 horticulture experts were approached, and 41 responded by returning the filled out questionnaires. Mean scores were calculated for each ITK, and those having a mean score of 2.5 and above were identified as rational and those below 2.5 were considered as irrational. Items which secured a score of 3.5 and above were considered highly rational.

The underlying principles of the rational ITK were elucidated with the help of experts while collecting the data on rationality, using open ended questions. There were some partial responses on this. The data were collated, and put before a panel of experts for discussion and to arrive at a consensus. For validating the ITK, a Scientists' Forum with a 12 member multidisciplinary expert team comprising 50% horticultural scientists was constituted. The meetings were conducted at the College of Agriculture, Kerala Agricultural University, Trivandrum in April 2009. Decision on underlying operational principles was by consensus and strong dissents, if any, were recorded.

In the third phase (June-September 2009), the extent of knowledge and adoption among farmers, and the perceived effectiveness of the ITK were assessed using a structured interview schedule. Five farmers each were randomly selected from the eight selected NES Blocks giving a total of 40 respondents for the purpose. To elicit the extent of knowledge, the respondent farmers were asked appropriate questions regarding each ITK. A score of 'one' was assigned if they knew about the ITK and 'zero' if they did not know.

$$\textit{Knowledge index of ITK} = \frac{\textit{Number of farmers who knew the ITK}}{\textit{Total number of farmers}} \times 100$$

In this study adoption was operationalized as whether an individual respondent had ever practiced the selected ITK. For this, the suite of selected ITK was systematically explained to the respondents, enquiring whether they had adopted the ITK in question in the past. If the answer was "Yes", a score of one was assigned and if the answer was "No", zero was given. The scores awarded by all respondents for a particular ITK were summed up and an adoption index worked out to identify the level of adoption.

Adoption index of ITK =

$$\frac{\text{Number of farmers adopted}}{\text{Number of farmers having applicability}} \times 100$$

Adoption of a particular ITK by farmers having knowledge of that ITK was computed as:

$$\frac{\text{Number of farmers who adopted the ITK}}{\text{Number of farmers who knew the ITK}} \times 100$$

Perceived effectiveness of the ITK, i.e., the degree of relative usefulness of the ITK as perceived by the farmers in resolving the problems in coconut cultivation, was measured using the Perceived Effectiveness Index (PEI) methodology (Sundaramari, 2001). A mean perceived effectiveness index (MPEI) of 3 was regarded as the most effective and an MPEI of 1 was regarded as the most ineffective. An average effective ITK would get an MPEI score of 2.0. Hence, ITK with MPEIs greater than 2.0 were considered as effective, as per farmers' perceptions and all others as less effective. ITK with MPEI of 2.5 and above were regarded as highly effective. Of the total 30 ITK on coconut, 19 were known to more than 50% of the farmers and adopted by more than 50% farmers having knowledge on the respective ITK and these were selected for assessing their effectiveness.

Results and Discussion

A suite of 129 items of ITK were documented as part of this study and a category-wise summary of the same is presented in Table 1. The technological dimension in which the ITK abounds highlight the cultivation category of collection and storage of seed nuts (20.2%); this was followed by cultural operations (14.7%), manuring (13.9%) and nursery management (13.2%).

Rationality analysis revealed that out of the 30 practices evaluated, 24 were rational and the remaining six irrational. The underlying scientific rationale of the rational practices is presented in Table 2. As can be seen from the data presented, most of the ITK have sound scientific bases. Some of these, however, demonstrate certain constraints and a few practices which were characterised as irrational also possessed certain advantages, as explained below.

- ITK 9 (seed nuts are to be sown at an angle of ~ 60°) is a very good practice with sound scientific basis, but would create problems while transporting the seedlings.
- ITK 16 (transplant in the main field 1 to 2 months after sprouting of seed nuts) is a scientifically rational practice, but it does not provide an opportunity for seedling selection.
- ITK 30 (shake non-bearing palms with the help of an elephant; the palm will start bearing) is also scientifically logical, but the expert view was that that it is hard to standardize this practice.
- ITK 2 (discard 2 to 3 nuts adjacent to spathe while selecting seed nuts) is rational; the experts' view was that nuts adjacent to spathe may not be well developed. However, some experts were also of the view that nut quality was not decided by the position of nuts.
- ITK 4 (dry the nuts for reducing coconut water content but at the same time do not dry the nuts fully, for which the nuts should be put in water/in ponds), although found to be irrational, is an age old practice. Reducing the content of nut water to some extent is desirable and drying the husk is also

Table 1. Classification of the documented indigenous technical knowledge (ITK) on coconut in Kerala.

ITK categories	Practices under each category	Frequency %
Soil and season	06	4.7
Selection of mother palm	07	5.4
Collection and storage of seed nuts	26	20.2
Nursery	17	13.2
Seedlings	08	6.2
Preparatory cultivation	04	3.1
Planting in main field	07	5.4
Manuring	18	13.9
Cultural operations	19	14.7
Water management	06	4.7
Intercrops	04	3.1
Yield & Harvest	04	3.1
Others	03	2.3
Total	129	100

needed. However, the practice of putting nuts in water may result in decay of the husk; similarly, too much dehydration would destroy the embryo. So the experts recommend preservation of seed nuts in sand for drying the skin.

- ITK 7, 10, 11, 15, and 18 have no scientific rationale (irrational), yet there is some logic behind these practices, for e.g., ITK 15 (seed nuts sown after slicing the top husk results in better germination and robust growth) facilitates easy emergence of the plumule; but more moisture will be retained in the fibre, above the embryo, which may result in fungal infection/ rotting.

Rationality, knowledge, and adoption of ITK on coconut

Overall, the knowledge level of farmers on coconut cultivation based ITK was quite high. For instance, of the 30 ITKs, 20 (66.67%) were known to more than 50% of the respondent farmers. In particular, ITK 27 and 14

Table 2. Scientific rationale of the indigenous technical knowledge (ITK) on coconut cultivation in Kerala.

ITK code	ITK statement	Scientific rationale (as perceived by experts)
ITK-1	Nuts formed during '*Thiruvathira njattuvela'* (June- July) will mature in Feb -March and are good for seed purpose.	June- July being the rainy period favours nut development and good soil moisture availability ensure better nutrient uptake.
ITK-2	Discard 2-3 nuts adjacent to the spathe while selecting seed nuts.	Anthesis and fertilization in a bunch proceed from the distal end conferring the distal nuts a temporal advantage. Better nutrient mobilization due to favourable hormonal balance will also make such nuts more vigorous compared to the later formed ones: adjacent to the spathe (proximal end).
ITK-3	Seed nuts, which are erect with the stalk end upwards when thrown into water in a well or pond, will be better than those float horizontally.	Nuts which are erect in water may have denser kernels compared to those floating horizontally.
ITK-4	Dry the nuts for reducing coconut water. At the same time do not dry the water fully. For that, the nuts can be put in water (in ponds).	No scientific rationale
ITK-5	For better germination, keep the nuts 15 days in sunlight, 15 days in smoke, 15 days in water, a few days in inverted position and finally sow in sand.	Drying and smoking provides hardening effects and post-harvest curing; subsequent wetting ensures moisture availability; keeping the nuts in inverted position induces stress, which when released by placing it upright, enables quick germination and vigorous growth.
ITK-6	Harvested seed nuts are to be kept upside down for around one month.	In the inverted position, there is better moisture and nutrient availability to the embryo; the stress situation however, will prevent germination and the release of stress post-sowing will ensure faster germination.
ITK-7	Smoking of coconut seed nuts will result in sturdy germination.	No scientific rationale
ITK-8	Prepare nursery beds for coconut with a mixture of soil and sand.	Would promote soil aeration and root spread, reduce termite attack (cuticular aberration by sand on termite body), ensure better drainage, enhance germination, and enable easy lifting of the seedlings.
ITK-9	Sowing the seed nuts at about 60^o angle.	Slanting position permits better contact of embryo with nut water, and enables the radicle to touch the nursery bed early.
ITK-10	Drop the seed nuts in water, and plant the nuts in the bed with the upper side on top.	No scientific rationale

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Table 2. Contd......

ITK code	ITK statement	Scientific rationale (as perceived by experts)
ITK-11	Seeds are kept upside down in seed bed over which sand is spread. On sprouting, they are re-oriented upwards.	No scientific rationale
ITK-12	Spread coconut fibre on the bed, if nuts are sown during summer.	Coconut fibre acts as mulch and conserves moisture; can retain large quantity of water.
ITK-13	For speedy germination and good healthy seedlings, sow the seed nuts in gunny bags filled with a mixture of top soil, sand, and dried cow dung.	In gunny bags, the seedlings would get better care, can be transported to distant locations without damage, can be retained for several days before transplanting, and enables transplanting without root damage.
ITK-14	For better rooting and reduced termite attack, sow with 50% of the nut size above the nursery bed.	Lower planting depth promotes rooting and germination and positioning the point of attachment of fruit stalk above soil will reduce termite attack.
ITK-15	For better germination and robust growth, sow the seed nuts after slicing the top husk.	No scientific rationale
ITK-16	Transplant the seedlings in the main field 1-2 months after sprouting.	Reduces root damage and transplanting shock, especially useful for sites where water logging is a problem. Also, 1-2 months old seedlings will establish better if planted soon after heavy rains.
ITK-17	Apply a mixture of sand, salt and ash in the pit before transplanting.	Sand improves drainage, salt improves soil conditions and loosens the laterites, and ash enriches soil potassium levels. This mixture also provides protection against termites.
ITK-18	Prepare pits (30 cm diameter and 15 cm deep) for planting coconut seedlings in summer. Also, dig a small hole (of the size of a coconut) in the centre of the pit for planting the sapling.	No scientific rationale
ITK-19	Better to plant coconut seedlings during '*pathamudayam'* (i.e. 10th day of *Medam*, in the Malayalam calendar or 23rd day of April).	The summer showers during this period will help initial seedling establishment and the seedlings will be in a position to better utilize the monsoon showers (June-July) resulting in better seedling growth.
ITK-20	The coconut seedlings planted during summer will show robust growth. However, if irrigation is available, plant during January- February.	Summer planting permits better hardening of the seedlings. With irrigation, they also develop better root systems resulting in robust seedling growth (utilizing the SW and NE monsoons).
ITK-21	Spacing between the coconut palms should be such that a squirrel can jump from the leaf tip of one palm to that of the nearest neighbouring palm.	It means that the palms should be planted at sufficiently wide spacing so that the leaf tips of palms should not touch one another, when full grown. This will ensure unimpeded leaf development, and avoid competitive interactions among the palms.
ITK-22	When the trunk starts to develop, make circular basins around it – first during the ensuing '*Thiruvathira njattuvela*' (June- July) and there-after every year.	This is for conserving rainwater in the basins. In addition, it is useful for manure application and prevents losses owing to runoff.
ITK-23	The coconut basins should have a width equal to the length of leaves so that the leaf drip will be retained within it.	This practice calls for making the basins along the drip circle to collect rainwater and to maximize moisture conservation in the root zone.
ITK-24	Do not disturb the soil in a coconut garden during summer months in order to protect soil moisture.	Absence of tillage during the summer prevents water loss through evaporation and helps in soil moisture conservation.

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Table 2. Contd......

ITK code	ITK statement	Scientific rationale (as perceived by experts)
ITK-25	Make basins before '*kalavarsham'* (southwest monsoon, June to August), and cover them with soil before '*thulavarsham'* (northeast monsoon, October-November). In Malayalam: '*Kalavarsham akathum, thulavarsham purathum*').	This also promotes soil moisture conservation. The basins prepared during the onset of SW monsoons facilitate better infiltration of rainwater into the soil. If the basins are covered after putting green leaves and organic wastes before NE monsoons that will offer protection against excessive rates of evaporation during summer.
ITK-26	Burying coconut husk around coconut palm at a distance equal to the length of a coconut frond from the trunk in trenches (75 cm wide and 60 cm deep), and putting sand over it will hasten nut production.	Husk is a rich source of potassium. Furthermore, it can hold large quantity of water thereby helping in drought mitigation. Thus husk burial conserves moisture, adds K to soil, and ultimately helps in better growth and early bearing of the palms.
ITK-27	Application of salt in coconut basins results in increased growth of the palms. In bearing palms, apply 0.5 kg salt twice a year.	It provides sodium to the plant which is essential for nut production. Further Na in NaCl is a substitute for potassium. The laterite soils also get softened by salt application, promoting palm growth.
ITK-28	Application of coir pith/coconut fibre above the soil at the base of the palm found in certain areas is not good as the roots will come above the soil resulting in yellowing of the leaves. Instead, it may be buried in trenches (60 cm wide and deep) at a distance of 150 to 200 cm from the trunk	Coir pith/coconut fibre stores large quantity of water, which prompts the active feeding roots of the palms to come above the soil surface. Since coir pith/coconut fibre is very rich in lignin with dearth of nutrients, it results in yellowing of the palm. Moreover, leaching out of tannin/ polyphenols from coir pith/ fibre to the soil may affect the root growth also.
ITK-29	Put rice chaff in the coconut basins; no irrigation is needed, and the yield will be doubled.	Rice chaff stores water during rainy period and makes it available to the palms later. Availability of sufficient water to coconut palms increases the yield.
ITK-30	Shake non-bearing coconut palms with the help of an elephant. The palm will start bearing.	It gives a shock treatment (stress) which stimulates the plant to enter into reproductive phase.

were known to more than 90% of the respondents and more than 80% of the farmers were familiar with ITK 26, 25, 17 and 21.

Regarding adoption, our results show that 18 of the 30 ITK were not adopted by majority of the farmers (Table 3). The remaining 12 (14, 21, 27, 25, 17, 16, 8, 24, 9, 20, 23 and 22- all rational), however, were adopted by more than 50% of farmers. There were only six ITK (7, 28, 15, 11, 5 and 10) adopted by less than 25% of farmers. ITK 28 was adopted by less number of farmers since there was a well-accepted alternate practice of husk burial. Adoption of practices relating to seed nuts and seedlings (7, 15, 11, 5 and 10) was lower, presumably because of two reasons: first, majority of them were irrational and second, quality seedlings are currently produced and distributed by government agencies and other approved nurseries in adequate quantity and at optimal times.

It is pertinent to note that ITK 14, 16, 17, 21, 27, and 25 were adopted by ≥75% of the respondents. Of these, ITK 14 was considered by the farmers as a good technique to reduce termite damage and to stimulate rooting, without additional labour, and was consistent with the high rationality score (3.15). Likewise, ITK 21 is an age-old practice, which is consistent with the present spacing recommendation for coconut. Applying salt to coconut palms (ITK27) is also a traditional practice, now being recommended by experts. ITK 25 which deals with basin preparation for coconut is also a time-tested practice for collecting, preserving, and utilizing water efficiently, and also for the effective utilization of plant nutrients. The Malayalam proverb '*Kalavarsham akathum thulavarsham purathum*' exemplifies that.

Table 3. Rationality score, knowledge level, adoption, and perceived effectiveness of indigenous technical knowledge (ITK) on coconut cultivation by farmers of Kerala.

ITK	Rationality score (n=41)	Farmers with knowledge on ITK (n = 40)	Number of farmers adopted (n =40)	% farmers who adopted an ITK from among those with knowledge	MPEI	Remarks
ITK-1	3.74 (R)	23 (57.5)	19 (47.5)	82.6	2.23	RE
ITK-2	2.55(R)	12 (30.0)	10 (25.0)	83.3	-	-
ITK-3	3.10 (R)	24 (60.0)	16 (40.0)	66.7	2.18	RE
ITK-4	2.20(IR)	21 (52.5)	12 (30.0)	57.1	1.88	IRLE
ITK-5	2.51 (R)	12 (30.0)	5 (12.5)	41.7	-	-
ITK-6	2.74 (R)	14 (35.0)	10 (25.0)	71.4	-	-
ITK-7	1.92(IR)	4 (10.0)	2 (5.0)	50.0	-	-
ITK-8	3.81 (R)	31 (77.5)	28 (70.0)	90.3	2.25	RE
ITK-9	3.35 (R)	31 (77.5)	24 (60.0)	77.4	2.39	RE
ITK-10	2.15(IR)	10 (25.0)	9 (22.5)	90.0	-	-
ITK-11	1.85(IR)	10 (25.0)	5 (12.5)	50.0	-	-
ITK-12	3.25(R)	23 (57.5)	16 (40.0)	69.6	2.08	RE
ITK-13	2.91(R)	23 (57.5)	12 (30.0)	52.2	2.06	RE
ITK-14	3.15(R)	37 (92.5)	33 (82.5)	89.2	2.35	RE
ITK-15	2.04(IR)	7 (17.5)	5 (12.5)	71.4	-	-
ITK-16	2.72(R)	30 (75.0)	30 (75.0)	100.0	2.76	RE
ITK-17	3.45(R)	33 (82.5)	30 (75.0)	90.9	2.11	RE
ITK-18	2.25(IR)	19 (47.5)	12 (30.0)	63.2	-	-
ITK-19	3.05(R)	28 (70.0)	12 (30.0)	42.9	-	-
ITK-20	3.04(R)	31 (77.5)	23 (57.5)	74.2	2.64	RE
ITK-21	2.87(R)	33 (82.5)	31 (77.5)	93.9	2.04	RE
ITK-22	3.36(R)	26 (65.0)	23 (57.5)	88.5	2.33	RE
ITK-23	3.45(R)	28 (70.0)	23 (57.5)	82.1	2.28	RE
ITK-24	2.96(R)	26 (65.0)	26 (65.0)	100.0	1.84	RLE
ITK-25	3.49(R)	33 (82.5)	30 (75.0)	90.9	2.33	RE
ITK-26	3.20(R)	35 (87.5)	19 (47.5)	54.3	2.24	RE
ITK-27	3.49(R)	37 (92.5)	30 (75.0)	81.1	2.28	RE
ITK-28	2.52(R)	5 (12.5)	3 (7.5)	60.0	-	-
ITK-29	3.15(R)	30 (75.0)	19 (47.5)	63.3	2.16	RE
ITK-30	2.57(R)	17 (42.5)	10 (25.0)	58.8	-	-

R = Rational; IR= Irrational; Figures in parenthesis in column 3 and 4 denote percentage values; RE = Rational and effective; RLE = Rational but less effective; IRLE = Irrational and less effective; - indicates ITK not evaluated; Rationality score: <2.5= irrational, >2.5= rational and >3.5= highly rational; MPEI= mean perceived effectiveness index: 3 = most effective, 1 = ineffective, <2.0= less effective, >2.0= effective, > 2.5 = highly effective.

Knowledge being the prerequisite for adoption, adoption of ITK by farmers having knowledge on these was assessed. Twenty eight out of the total of 30 ITK (i.e. except 5 and 19) on coconut were adopted by 50% or more of the farmers who knew about the particular ITK. Thirteen ITK were adopted by more than 80% respondents and ITK 16 and 24 were adopted by 100% of the respondents.

A comparison of the rationality and knowledge level regarding crop production ITK of coconut farmers (Table 3), makes it obvious that majority of the ITK with very low knowledge scores were irrational. Furthermore, except one, all ITK with more than 50% of knowledge among the farmers were rational. Generally, the farmers were better informed about the ITK with higher rationality scores. Likewise, all the crop production ITK on coconut having more than 30% adoption rate were rational. Overall, the farmers are well aware of the rational ITK and they are also being adopted extensively.

Effectiveness of ITK on coconut

Out of the 19 ITK selected for assessing the perceived effectiveness, ITK 4 was irrational and less effective, ITK 24 was rational and less effective, while the rest 17 practices (89.47%) were rational and effective (Table 3). Of these, high mean PEI values were obtained by ITK 16 and 20. ITK 16 that recommends transplanting coconut seedlings to the main field, after 1 to 2 months of sprouting of seed nuts was perceived by farmers as a highly effective practice through which better initial establishment can be ensured; this practice, however, is not generally recommended by modern science. Farmers also perceive that ITK 16 is superior to the present recommendation of selecting and transplanting 9 to 12 months old seedlings. ITK 20, which suggests to plant coconut seedlings in summer, if irrigation is possible, was again perceived as highly effective so that the plant can utilize the ensuing monsoon for better establishment.

In addition, ITK 1, 8, 9, 14, 22, 23, 25, 26 and 27 had relatively high rationality scores and mean PEI scores, implying that these practices are very good and effective. Although ITK 24 was a rational practice but was found to be less effective as per farmers' perceptions. The prevailing notion among the farmers is not to disturb the soil in coconut garden during summer months in order to protect soil moisture. Some farmers, however, were of the view that light digging during this period would help conservation of water from summer showers. Overall, it could be inferred that majority of the ITK (89.47%) on coconut were rational and effective.

Conclusions

The present study documented 129 Indigenous Technical Knowledge on coconut cultivation. Majority of the ITK analysed for their rationality were adjudged as rational by experts. Similarly, majority of the ITK were effective, as perceived by the farmers. Such rational and effective ITK may directly be recommended by the extension system for adoption. Unlike modern technologies, indigenous practices do not involve hazardous chemicals as they generally utilize locally available resources. Thus, indigenous practices may be promoted not only for the benefit of the people but also for maintaining agricultural sustainability and eco-system integrity. Hence the time-tested, rational and effective indigenous practices suited to the local situations and local culture may either be suggested as alternatives or blended with modern crop production technologies, which in turn would promote sustainable crop production.

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