



## Research Article

# SCIENTIFIC RATIONALITY OF DOCUMENTED INDIGENOUS TECHNOLOGIES IN PULSE CULTIVATION

POONGUZALI B., VELUSAMY R.\* AND PUSHPA J.

Department of Agricultural Extension & Rural Sociology, Agricultural College & Research Institute, Madurai, 625 104, Tamil Nadu Agricultural University, Coimbatore, 641003, Tamil Nadu, India

\*Corresponding Author: Email - [veluswamy.r@tnau.ac.in](mailto:veluswamy.r@tnau.ac.in)

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**Abstract:** Indigenous technologies are the techniques or method of cultivation practices followed by farmers from generation to generation and also it gets some modification based on the environmental situations. Pulses are cultivated both in irrigated and rainfed conditions in Tamil Nadu. Farmers are adopting number of local indigenous techniques in pulse cultivation. The study was conducted among 300 pulse farmers in major pulse growing districts of Tamil Nadu. Sixty six indigenous technologies were documented in pulse cultivation and the scientific reason for each indigenous technology was collected. This study concluded that among the 66 indigenous technologies identified, 55 technologies are found to be rational and 11 indigenous technologies are found to be irrational.

**Keywords:** *Indigenous technologies, Documentation, Scientific rationality and pulse cultivation*

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## Introduction

India food grain production steady increased as a result of the green revolution since 1970. This was possible mainly because of efficient use of the natural resources, improved genetic engineering technology and better crop management practices. By way of intensive cultivation which compelled the indiscriminate usage of inorganic fertilizers, pesticides and weedicides. Moreover, the intensive farming and Green revolution brings the Hybrids and transgenic plants into the native cultivation which leads the environment has been treated in an unfriendly manner [1]. The intensive production systems cause in depletion of major and minor nutrients from the soil deteriorated the soil health and resultantly the productivity and sustainability in ruin. Continuous use of fertilizers and pesticides have damaged the soil flora and fauna. Earthworm activity in the soil has been reduced greatly. Therefore, lack of sustainability in production in recent years is becoming a major cause of concern. In the emerging global knowledge economy, a country's ability to build and mobilize knowledge capital, is equally essential for sustainable development as the availability of physical and financial capital. "Indigenous Technical Knowledge refers to the knowledge of indigenous people as well as any other defined community. It is dynamic and not static, as the word 'traditional' community implies that it is used synonymously with 'traditional and local knowledge' to differentiate the knowledge developed by a given community from the international knowledge systems [2,3]. Based on the above facts the study was conducted to identify the scientific rationality of indigenous technologies in pulse cultivation.

## Materials and Methods

The study was conducted in Thanjavur, Pudukkottai, Tiruvallur districts with 300 pulse growers. Five blocks in each district were selected based on the maximum number of pulse farmers and area under pulse crop. In each block two villages were selected based on the major area under pulse crop. Ten pulse farmers were selected randomly in each village and totally 300 pulse farmers were selected for this study. Sixty six indigenous technologies were documented in pulse cultivation. Testing the rationality of the selected indigenous knowledge items is essential as it

has been envisaged to test the awareness and adoption of such knowledge by the farmers. For this study -rationality refers to things or practices that are explainable with scientific reasons or established based on long time experience. Similarly, "irrationality" refers to things or practices which cannot be scientifically explained or supported with long time experience. The collected indigenous knowledge items were discussed with thirty scientist comprising crop production, crop protection scientist of Tamil Nadu Agricultural University those who are involved in pulse research. The scientists were requested to indicate the rationality/irrationality of each of the listed indigenous Knowledge items and also to give the basis for their judgments [4-7].

## Findings and Discussion

### Scientific rationality of the practices in pulses

Thirty scientist and experts were consulted to identify relevant indigenous technologies and also the scientific reason behind in each and every documented indigenous technology were collected. The scientific rationality of documented indigenous technologies is presented in the [Table-1]. The indigenous knowledge items which are having a score of more than 2.5 were considered as rational and these below were considered as irrational. This study reveals that among the 66 indigenous technology identified 55 Technologies were get a mean score of more than 2.5 and finalized that 83.33 percent of the indigenous Technologies followed by the Pulse growers of Thanjavur, Pudukkottai, Tiruvallur Districts are found to be rational. Out of 66 identified indigenous technology 11 technologies a tune of 16.67 percent was get a less than 2.5 mean score and found to be irrational.

## Conclusion

The study concluded that the documented indigenous technologies are having scientific advantages which intern leads to productivity, environmental safety and soils are enriched. Continuous practices of indigenous technologies improves the soil health and reduce the soil problems. Regarding rationality of indigenous technology, out of 66 identified indigenous technology 55 technologies are found to be rational and 11 technologies are found to be irrational.

Table-1 Scientific rationality of documented Indigenous Technologies

S	ITK	Scientific rationality
Land Preparation		
1	Achieving fine tilth is better than applying manures	Soils a natural medium in which crops are grown, fine tilth the form used to express soil condition, tilth is a loose friable, airy powdery, suitable for seed germination and sprouting.
2	It is better to plough intensively than extensively	Pulses grown in variety of soil ranging from light to heavy (Clay loam). Deep ploughing with soil turning will give more germination and yield.
3	It is better to have deep ploughing rather than shallow ploughing for pulse growth	One deep ploughing followed by harrowing will result more yield
4	Plough four times for garden land	In garden land 4 ploughing is necessary, for drainage and it is most important because black and green gram sensitive to water logging.
5	Plough seven times for wet land	On heavy soils one (or) two deep ploughing followed by two to three cross harrowing should be given. In case of light soil, one ploughing and one harrowing is must.
6	Summer ploughing gives good crop in the ensuring season	Summer ploughing improves soil structure, also increases the water holding capacity of soil and reduces runoff, reduces pest and weed infestation.
7	Mixing and applying coir waste with compost to arrest soil hardening	Maintaining optimum moisture is the pre requisite for uniform growth. Composting (or) Waste material application will maintain the soil health. Composting is aerobic process and compost material always keep the wetness for long time. It will prevent the soil hardening.
8	Maturing and Mulches	In rainfed Agriculture / Manuring: Adding Organic manures such as farm yard manure and compost every year as basal application to the soil, improves physical condition of soil.
Seeds & Sowing		
9	Yield of the crops depends on seed quality, before sowing, knowing the quality of seed.	Seed must be genetically pure. Nuclear seed /Breeder seed – 100%, Foundation Seed – 99%, and Certified seed – 98% free from other crop seeds and objectionable weed seeds.
10	Seed should be a dried one because well dried seeds will have higher longevity and keeping quality.	Seeds should be dried without losing viability. Planting physically sound seeds is most important.
11	It is better to change the seed material atleast once in two years	Continuous use of the same seed material will have low germination percentage. Changing the seed material once in year is must.
12	The seeds are generally stored along with the leaves of neem, pungam, notchi and thusasi	Seeds mixed with neem leaves, pungam leaves, notchi leaves and thuli leaves will act as pest repellent to control pulse beetle and lesser grain borer.
13	Better to start planting from "Sanimoolai" (North East) of the field to get higher yields.	It is Gods corner and also called as "Ishanya moolai" sun rises in the east and turn to moves north and bio cosmic energy is high in this corner.
14	Severing the broadcasted seeds in dry lands with soil	Seeds mixing with sand and broadcasting reduces the problem of dropping too many seeds in any one spot. Seed mixing with sand will also provide extra cover for the seed and soil does not dry out.
15	Better to perform sowing and planting operations during evening hours	Warm and sunny days evening hours are suitable for seeds sowing. The extended period of coolness in soil in which seeds will not germinate.
16	The best seasons for pulse sowing are "Thai pattam" and Chithraipattam	Thaipattam – December, January, February Chithraipattam – April, May, June – black gram and green gram gives more yield.
17	The pulse crop sown on new moon day escape from pest and disease	By the effect of cosmos (geomagnetic waves) reduce the pest attack by tuning farming to the rhythms of nature on full moon day.
18	Pulse sowing is done on all days except Tuesday and Saturday	Tuesday is owned by "Wars" as a natural 'malefic' because it is a planet of war, this is the strong reason why it is considered inauspicious. Saturday (Shani, Saturn) is papa graham considered to be a day for papa calmas (sinful, cruel) effect/actions agriculture work not started.
19	Yield will be lower in black gram crop if it is sown in snow season/heavy mist season	Temperature, day length and drought are the three major factors affecting flowering in pulses, Temperature is generally more important than day length. Flowering and pod set in pulses requires an average daily temperature of 15° C, cool and wet conditions adversely affect flowering pod and fruit set.
20	Pulse sowing in September second week give better yield.	September – Second week – Purattasi pattam VBN3 black gram is best seed variety yield rainfed 775 Kg./ha, irrigated 900 kg/ha.
21	Micronutrient mixture liquid form	Zn and molybdenum enriched seed can perform better with specific to seed germination, also important for pod and seed formation in reproductive stage of plant.
Manuring		
22	Applying water hyacinth plants either as a compost or as burnt ash to the field for supplying potash	Neerpathumaragam – Water hyacinth (Eichornia) is a source of bio manure. Water hyacinth contains 95.5% moisture, 0.04% N, 1% ash, 0.06% P <sub>2</sub> O <sub>5</sub> and 0.20% K <sub>2</sub> O. Water hyacinth having high content of Potassium.
23	Poultry manure & goat manure gives benefits to pulse crops grown in the same season	Chicken manure contain NPK 1.00 0.80 0.39 Goat manure contain NPK 1.44 0.50 1.21 Pig manure contain NPK 1.01 1.05 0.74 This organic manure improves soil structure and tilth, making more permeable while holding moisture.
24	Higher Blooming of "Tamarind" is. considered as an indication for good pulse production and higher blooming of "Mango" is considered as an indication for poor pulse production	If Tamarind blooming is high during March & April, it indicates occurrence of normal rainfall leads to high agricultural production. If Mango blooming is high during March-April, it indicates occurrence of poor rain fall leads to less Agricultural production.
25	Sheep penning results in more pulse yield	Goat sheep penning is one of the traditional methods of enhancing soil fertility. In this process sheep/Goat are made to stay in the field over night which enables its fecal matter and urine are left in the field later incorporated to a shallow depth. Soil fertility and physical properties of soil also improved. Field is enriched with nutrients and more number of microorganisms. The pulse production is found to be high with good quality seed material. The weight and pod yield is improved.
26	Perennial Vegetation is grown in the irrigation channel converted in to green manure.	Green unrecompensed material occur in irrigation channel used as green manure
27	DAP spraying during full moon season, enhances more flowering	In pulse crop DAP spraying 25 kg/ha in two spray, One at pre flowering and another one at pod formation stage. Spraying at the time of full moon day, wastage of Nitrogen through volatilization, leaching phosphorous (P), wastage through "fixation" will be avoided and the moon will be seen for longer period of time in the sky.

Table-1 Scientific rationality of documented Indigenous Technologies..

Weeds, pest and disease management		
28	Red gram is also used as a green manure crop which improves the soil fertility	The placing the uprooted Redgram plants in the field will serve as a mulch and soil amendment.
29	Growing cow pea as a green manure to control nut grass	Growing Thattai payaru (cowpea) will act as a competitive crop and its spreading effect are helpful in smoothening nut sedges by cutting light to the weed crop.
30	Growing horse gram to control nut grass.	Kollu beans will act as competitive crop for Cyprus weed
31	To avoid loss it is better not to cultivate pulse crop during severe summer season	Due to heavy sunshine, pollen dry, less pod formation will occur. Hence it is better to avoid growing pulse crop during heavy dry season.
32	Spray neem oil 5 lit./ac to control downey mildew disease in pulses	Neem oil form as outer coats in the leaves, that coat protects and act as "Suffocating" agent for the fungus.
33	Spray purified milk to control yellow mosaic disease in cow pea and black gram.	Purified milk will add an antiseptic effect resulting controlling the yellow mosaic virus through the elimination of the pathogen from site of action. "Purified milk" controls sucking pests and small larvae.
34	Pulse crop mixed with Sorghum to control wilt disease in pulse.	The exudates of maize root having antagonistic effect on wilting
35	Pulse crop mixed with "Marigold" to control pest in pulses.	"Marigold acts as trap crop (or) attractive crop to the pest for the main crop. Trap cropping has indicated benefits in terms of economic returns on an average of 10-30% increase in net profits mainly resulting from reduced insecticide use. Yet another feature is that, the trap crops are attracting natural enemies of pests to the field.
36	Spray Panchakavya in pulse crops to control yellow mosaic disease.	Panchakavya is prepared by mixing five products of cow, the 3 direct constituents are cow dung, urine and milk, two derived products are curd and ghee, Panchakavya possess antifungal properties against phyto pathogenic fungi, that inhibiting the mycelial growth.
37	Spray Navakavya in pulse crops to control many diseases in pulses also get good yield.	Navakavya : Direct constituents of cow are cow dung, urine, and milk two derived products are curd and ghee in addition 5 ingredients of water, banana, tender coconut, jaggery controls diseases in pulse crop.
38	Pulse crops rotation with sorghum and rice to control wilt disease	Wilt pathogen can persist for many years in soil in the absence of their crop host. They persist as dormant chlamydospore on roots of some non-host plants. The pathogen in the soil dies or reduced by cultivation of susceptible crops and it is an effective & relatively inexpensive means for managing some diseases.
39	In pulse crops, sprinkling common salt to control wilt disease.	Common salt spray can cause damage by desiccating the spores of fungus. Salt and coconut oil with detergent soap solution will fight against the growth of fungus.
40	Small lamps are placed on either side of the house act as light trap.	The light lamps in the entrance of house will act as Light trap for insect monitoring, mass trapping of harmful insect pests such as moths, beetles, hoppers, wasp etc. The farmers are able to identify the pest outbreak.
41	Kitchen ash is applied in pulse crops to control aphids.	Wood ash is used to repel insects, slugs, and sucking pests.
42	In pulse crops to control sucking pests, spray tobacco powder, cow urine, and neem oil spray.	Mixture of tobacco powder, neem oil and cow urine is found most effective in reducing the leaf blast, neck blast, and sheath blight.
43	In pulse crops to control nematodes, pungam ( <i>Pungamia pinnata</i> ) or illuppai ( <i>Bassic Latitolia</i> ) cakes are applied.	Kranj- <i>Pongamia pinnata</i> , Mahua-Mahuca indica used as soil amendments against plant parasitic nematodes. These oil cakes applied singly or mixed with wheat straw or sawdust inhibited larval hatching and also improves plant growth.
44	In pulse crops, spray panchakavya solution to add micronutrients.	Panchakavya contain chemical composition of N, P, K, Ca, growth regulators like IAA, GA and microbial loads of lactobacillus, total anaerobes, revealed that they possess almost all the major nutrients, micro nutrients, & growth hormones.
45	Dried fish extract solution spray in pulses to control many pests.	During flowering stage, fish oil spray is given @250ml/tank to prevent flower shedding and also to repel pests. Fish oil is prepared by mixing equal ratios of fish waste and jiggery in plastic barrel and kept for 21 days for fermentation with stirring.
46	Spray tobacco decoction to control warm and sucking pests in pulses.	Tobacco extracts having efficacy against whitefly & jassids. Nicotine alkaloids in tobacco smoke, makes an excellent insecticide. Powder of tobacco leaves & decoctional leaves were used to control sucking pests as a botanical pesticide.
47	Grinding the leaves of " <i>Ipomia cornia</i> " soaking in water 15 days, filtering and spraying to control boll worm in red grams.	Ipomia solution contain ethanolic compound and it act as antifeedent effect to pests.
48	Using pest avoidance technique	To manage Pests & disease effectively, Pulse growers need to understand the biology & growth habits of both pest and crop. The type and concentration of pests are often responses to previous crop history, pest life cycle, soil conditions & local weather patterns.
49	Seed treatment with "Asafotida") to control boll worm in red gram.	Asafotida extract is derived from the resin of ferula, it contain mainly resin 40-64%, gum 25% and volatile oil 10-17 %. The resin portion consists mainly of "Asaresinotannol" asafetida enhances the anticoagulation effects.
50	Spacing between red gram crops to be increased to control boll warms.	In redgram row to row spacing 90 cm and. 22.5 cm from seed to seed or plant to plant .The pigeonpea is planted at wider row spacing and its growth during early period is very low but it will facilitate the farmer to walk in the field to monitor the pest and disease and destruction of larva. The findings is line with findings of previous study.{4}
51	Raising one row of red gram crop with two rows of black gram crop to control pests and disease	The mungbean intercropped with pigeonpea, act as "Trap crop" for bollwarm.
52	October month having conducive climate for boll warms in pulses to avoid this month to escape from boll warm attack.	Cool climatic condition enhances/favours multiplication of spotted bollwarm. Planting date and months suitably to avoid the cool climate will reduce the boll worm attack.
53	Raising Coriander crop to control boll warm in pulses	Coriander having allergic reactions and alternative crop for boll warms. Because it contain major volatile compounds namely "linalool"

**Application of research:** The results will be useful to pulse farmers those who are not practiced the indigenous technologies in pulse cultivation. The results will pave ways for researcher to conduct field level research in identified indigenous technologies to find out the validity of identified indigenous technologies for further spread of technologies to the pulse farmers.

**Research Category:** Expost facto study, field level farmers study

**Abbreviations:** ITK – Indigenous technical Knowledge,

DAP – Diammonium phosphate

NPK – Nitrogen, Phosphorous and Potassium

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# Scientific Rationality of Documented Indigenous Technologies in Pulse Cultivation

Table-1 Scientific rationality of documented Indigenous Technologies..

Seed storage and postharvest storage technologies		
54	Mixing the green gram seeds with sand before storage.	Sand having high silica content, this silica content maintain seed moisture at optimum level and protect the seed from pest in storage.
55	Black gram grains broken in to halves will escape from weevil attack during storage	When reducing intergranular space, the adult pulse beetles become very weak and having a short life. It cannot move in grain mass and are restricted to top 15 cm layer. The infected pulse beetle cannot move in the inter-granular space and could die before mating.
56	Castor seeds are fried, powdered and mixed with red gram seeds to reduce pest attack during storage	Castor seed powder have no toxic effect on human, these plant products can directly be applied in powder form or as bio fumigant in the bags in to which pulses are stored to prevent insect growth and cause mortality of all insects growth stages.
57	Pulse seeds in earthen pots mixed with wood ash to keep away from storage pests	Wood ash having "additive" effect. Use of wood ash cause invisible injuries to the stored pests leading to dehydration. Wood ash also fill the spaces between the grains making difficult for the pest movement and respiration leads to death.
58	Red gram seeds are mixed with red earth slurry, dried and stored to avoid storage pests.	Pulse seeds are coated with red earth for storage: 1 kg of red gram is mixed with 1 kg of red earth @ 1:1 ratio. Seeds are subjected to sun drying for one or two days. The dried grains are stored as such for seed purpose. The small gravels available in the red earth made scratches on the body of the storage pests and makes them to die. On the other side, kaoline act as protectant against pulse beetle, the inert dusts remove the waxy layer of the cuticle of the exoskeleton by absorption resulting in water loss from the insect body that leads to death of pest by desiccation. The findings is line with findings of previous study [6,7]
59	Dry the red gram seeds well and store them in gunny bags after placing dried leaves of "Naithulasi" (Ocimum canum) inside them to prevent pod borer.	Ocimum alcholid in the ocimum canum controls the storage pest in pulse storage.
60	Vegetable oil and castor oil are mixed with pulses before storage	Application of vegetable oil and castor oil to prevent laying of eggs/or larvae hatching on grain surface. The insects would be killed before entry in to the pulse seeds. The findings is line with findings of previous study. {5}
61	Mixing pulse grains with dried chillies to increase the keeping quality and avoid from storage pests like "brooches"	Chillies having punchency odour act as repellent/Astringent smell to prevent pest attack when pulses stored om gunny bags.
62	Spread cooked rice in the field bund to attract birds; these birds collect/eat warms in pulse field.	The cooked rice will attract the birds in to the field and then the birds will eat the larvae of insects.
63	Dusting ash along with pulse seeds to control storage pests.	Wood ash act as an abrasive mineral dusts, natural desiccants, repellent and insecticidal properties will prevent the attack of storage pests like pulse beetle, rice weevil, wheat weevil and lesser grain borer.
64	Neem seed kernel extract is the general organic pesticide used to control many pests in pulses	Neem seed kernel extract having wide range of effects on adults, eggs, and larvae. Neem oil act as a antifeedent leads to egg mortality and deformation of subsequent larvae.
65	Neem seed cake mixed with seed pulses to preserve in container to avoid storage pests.	The antifungal properties of neem seed cake enhanced the storage life of pulses.
66	10 Kgs. pulse seeds mixed with 500 gm. of turmeric power, 500 ml. of groundnut oil for storage even for one year	Turmeric contain phenolic compound known as curcuminoides antifeedent against several pests.

Table-2 Rationality Mean Score

Rationality Mean Score					
Technology	Mean Score	Category	Technology	Mean Score	Category
Technology 1	306	Rational	Technology 34	284	Rational
Technology 2	3.27	Rational	Technology 35	2.84	Rational
Technology 3	306	Rational	Technology 36	29	Rational
Technology 4	2.16	Irrational	Technology 37	3.24	Rational
Technology 5	304	Rational	Technology 38	292	Rational
Technology 6	3.22	Rational	Technology 39	2.98	Rational
Technology 7	224	Irrational	Technology 40	282	Rational
Technology 8	3.24	Rational	Technology 41	2.96	Rational
Technology 9	284	Rational	Technology 42	312	Rational
Technology 10	2.88	Rational	Technology 43	3.74	Rational
Technology 11	3	Rational	Technology 44	228	Irrational
Technology 12	2.92	Rational	Technology 45	2.26	Irrational
Technology 13	304	Rational	Technology 46	208	Irrational
Technology 14	3.1	Rational	Technology 47	2.48	Irrational
Technology 15	288	Rational	Technology 48	294	Rational
Technology 16	2.98	Rational	Technology 49	3.06	Rational
Technology 17	314	Rational	Technology 50	304	Rational
Technology 18	3.12	Rational	Technology 51	2.7	Rational
Technology 19	286	Rational	Technology 52	284	Rational
Technology 20	3.06	Rational	Technology 53	2.96	Rational
Technology 21	222	Irrational	Technology 54	304	Rational
Technology 22	2.96	Rational	Technology 55	2.9	Rational
Technology 23	294	Rational	Technology 56	304	Rational
Technology 24	2.88	Rational	Technology 57	2.96	Rational
Technology 25	314	Rational	Technology 58	304	Rational
Technology 26	3.08	Rational	Technology 59	2.88	Rational
Technology 27	29	Rational	Technology 60	294	Rational
Technology 28	2.98	Rational	Technology 61	2.88	Rational
Technology 29	304	Rational	Technology 62	23	Irrational
Technology 30	2.94	Rational	Technology 63	2.76	Rational
Technology 31	3	Rational	Technology 64	236	Irrational
Technology 32	2.84	Rational	Technology 65	2.3	Irrational
Technology 33	322	Rational	Technology 66	222	Irrational

## Research Guide or Chairperson of research: Dr R. Velusamy

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**Cultivar / Variety / Breed name:** Pulse

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