

## Farmer-Developed Varieties as Innovations – The Case of *Kunjukunju* Rice Cultivar from Kerala

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Farmers have been continuously contributing to evolving crop varieties that fit specific locations and changing conditions. There are different possibilities for recognizing farm innovations in India. The Biological Diversity Act ensures equitable sharing of benefits to the conservers of biological resources, their by-products, creators or holders of traditional knowledge, innovations and practices associated with such resources. The National Innovation Foundation scouts and supports grassroots innovations that have been developed without any help from a formal sector. The country also has the Protection of Plant Varieties and Farmers' Rights Act, which offers legal protection to its Plant Genetic Resources for Food and Agriculture. This *sui-generis* legislation for plant variety protection has a unique component: Farmer's Rights, which facilitates the recognition of crop varieties conserved and developed by farmers or farming communities, along with other provisions. This article examines the opportunities and challenges of these legislations, taking the case of *Kunjukunju*, a rice cultivar from Kerala that is claimed to have been 'developed' by a farmer innovator 50+ years ago and which lacks evident and documented information. The methodology adopted for this case analysis could be a promising one for inquiring about and resolving such concerns regarding the rights over Plant Genetic Resources.

**Keywords:** Grassroots Innovations, Farmer-developed Varieties, PPV&FR Act, Farmers' Rights, *Kunjukunju* Rice

Farmers have been openly sharing planting materials and collectively conserving through their use since the earliest crop domestications. The open flows of plant germplasm caused the spread of agriculture and farmers have also continuously contributed to evolving new varieties that fit specific locations and changing conditions.<sup>1,2</sup> The biophysical environment and farmers select plants within populations; the former is called natural selection, and the latter is artificial selection. Farmers also choose between populations or varieties. Most of such farmer practices are intended to further production and consumption goals (intentional selection) and affect crop evolution unintentionally. It was also noted that the urgency of understanding farmer selection and conservation will increase in the future with the ongoing loss of genetic resources, the rapid spread of transgenic crop varieties with limited genetic diversity, the development of a global system of intellectual property rights in crop genetic resources, and the movement to make formal plant breeding more relevant to farmers through plant breeding and conservation based on direct farmer and scientist collaboration.<sup>3</sup> The locally adapted farmer varieties

have greater genetic variability, providing yield stability in even the most challenging climatic conditions, while the formally improved high-yielding varieties have a very narrow genetic base.<sup>4,5</sup> There is also an argument that the practice of seed improvement has mostly moved out of the fields to formal labs and has started valuing genetic uniformity.<sup>6</sup>

### Appreciating and Recognizing Farmers' Innovations in Plant Genetic Resources

The varieties being cultivated presently exist due to the selection done by generations of farmers; yet, many do not view the process of cultivating and developing traditional varieties within farmers' fields as innovative.<sup>7</sup> As farmers are considered the creators, maintainers and conservators of genetic diversity of important crops, especially those for food and nutritional security, their rights in this regard are critical.<sup>8</sup> Farmers' Rights are central to the protection and continued use of traditional knowledge related to the conservation and sustainable use of Plant Genetic Resources for Food and Agriculture (PGRFA), as well as to the sharing of benefits derived from the use of those resources. Such rights can help promote farmer participation in decision-making related to

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PGRFA and in saving, using, exchanging and selling farm-saved seed. Realizing Farmers' Rights enables farmers to continue to maintain, develop and manage crop genetic resources, and involves recognizing and rewarding them for their indispensable contribution to the global pool of genetic resources.<sup>9</sup> Exclusive ownership rights over plant varieties came in 1930 in the USA. The Paris Convention on the Protection of New Varieties of Plants (UPOV, 1961) gave Breeders' Rights over plant varieties. The Trade-Related Intellectual Property Rights (TRIPS) came later in 1994, The Convention on Biological Diversity (CBD) in 1992, and The International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA) in 2001. The objectives were multifaceted, including protecting breeders' and farmers' rights over PGRs. One of the crucial questions posed during the lengthy negotiations coordinated by the Food and Agricultural Organization – FAO in the 1960s was, “*If the new varieties obtained are the result of applying technology to raw material or genetic resources, why are the rights of the providers of the technology recognized (plant breeders' rights, patents, and so on) and not the rights of the providers of genetic resources?*”<sup>10</sup> India also negotiated in this regard, and the result was a ‘*sui-generis*’ system that gives both Breeders' Rights and Farmers' Rights over plant varieties. Thus the Protection of Plant Varieties and Farmers' Rights Act of India was enacted in 2001 (PPV&FR Act). This act provides 9 Farmers' Rights, including that of recognizing the Genome Saviours and registering the varieties that they conserve or develop. As of December 2024, 8,385 varieties have already been given registration under the provision.<sup>11</sup> There is an opinion that the idea of exclusive economic rights on seed is far from progressive, and situating farmers' rights within an intellectual property law is a step backwards. However, such a law will not become any better if some farmer communities begin to endorse it or until farmer conservers benefit from the provisions of the said Act.<sup>12</sup> There are lots of challenges in realizing the Farmers' Rights Act and it needs constant citizen vigilance to keep it ‘pro-farmer’ in its implementation because compliance can become a burden on small and marginal farmers, which is becoming increasingly evident.<sup>13,14</sup>

The PPV&FR Act gives provisions to register farmers' varieties, either conserved or developed. However, there are no designated measures for

documenting, indexing and cataloguing potential varieties to be registered as farmers' varieties as guided by section 8(2)(c) of the Act. Moreover, the responsibility of collecting the passport data and other information regarding the candidate varieties lies on the applicant farmers. A farmer may not be able to characterize his/her varieties as technically as a breeder does. Facilitators like institutes under the Indian Council of Agricultural Research (ICAR), Krishi Vigyan Kendras (KVKs) under ICAR, and State Agricultural Universities are designated to support farmers in accessing their rights under the said Act. There could be a structure like the one which is operational under the Biological Diversity Act, 2002 (BDA).<sup>13</sup> As of now, the mechanism for supporting the applications for farmer-developed varieties is limited, especially in the case of the PPV&FR Act. It is also noted here that there is a limited mechanism for fact-checking farmers' claims for varieties to get registered under the PPV&FR Act. It adds to the concern when the claim comes years after a variety is said to have been developed. On the other hand, the National Innovation Foundation (NIF) of India under the Department of Science and Technology has a mechanism for scouting and supporting innovations from the informal sectors. NIF recognizes basic technological innovations developed by individuals and local communities. Innovators and Traditional Knowledge holders who are not supported by the formal sectors can approach to get recognized. They will also help bring such knowledge and innovations up to the value chain and ensure wide dissemination through commercial or non-commercial channels.<sup>15</sup>

Given the options for appreciating farmers' efforts in improving plant varieties, this article examines the opportunities and challenges of such provisions, taking the case of *Kunjukunju*, a rice cultivar from Kerala that is claimed to have been ‘developed’ by a farmer innovator 50+ years ago and which lacks evident and documented information. The methodology adopted for this case analysis could be promising for inquiring about and resolving such concerns regarding the rights over Plant Genetic Resources.

### The Case of *Kunjukunju* Rice Cultivar

It was in 2018, a representation from a farmer innovator, late Mr Athikkal Abraham Varghese (referred to as ‘Innovator’ further in this article),

through his relative, reached the Kerala Agricultural University (KAU), Thrissur, Kerala. The interest was in acquiring the rights to a rice variety that is claimed to have been ‘developed’ by the Innovator. The claim was that the rice variety named *Kunjukunju* was ‘developed’ by the Innovator during the years 1965-68 at his farm in Karimannoor, near Thodupuzha in Idukki district. The ‘Centre for Intellectual Property Rights, Technology Management and Trade’ under the University dwelled into this matter.<sup>16</sup> This division of the KAU has multiple objectives, including providing necessary IPR support for innovations and crop varieties and facilitating farmers or farming communities in the conservation and legal protection of traditional unique products. A committee appointed by the KAU on the matter verified all information available in this regard and requested further information from the Principal Agricultural Officer, Idukki District, under the Department of Agriculture and Farmers’ Welfare, Govt of Kerala and the representative of the Innovator. KAU also raised this to the Protection of Plant Varieties and Farmers’ Rights Authority of Govt of India (PPV&FRA) for legal and technical advice. The matter has long been discussed between the said parties for an amicable solution. The difficulty faced by all parties was the same: the lack of authentic and reliable information about the development of the *Kunjukunju* cultivar, and the matter remains unresolved. A detailed examination of the matter is required to understand the challenges and possibilities of recognizing the efforts of the farmer innovator. The denomination ‘*Kunjukunju*’ has been variously defined as a variety,

a cultivar, a landrace, or a traditional and indigenous variety in the literature. This also requires an inquiry about the terminologies and the possibilities of defining the denomination. However, it has been indicated as a ‘cultivar’ throughout this article, except in the portions where the claimants mentioned it as a ‘variety’.

### Methodology

The methodology included a detailed review of related literature, farm visits, and key person interviews. The review followed has been designed to capture all forms of the literature, viz., peer-reviewed articles, books, compendiums, Peoples’ Biodiversity Registers, grey and regionally published literature, including media reports and related RTI documents. Farm visits and key-person interviews were conducted in the areas where the rice cultivar in focus was claimed to have been developed and spread in its initial years (Table 1). Key questions for the interview were related to the development, history, spread and cultivation of the cultivar, and about its agronomic/morphological characteristics. Efforts have been made to collect the maximum available data, both documented and transmitted through word-of-mouth, about the cultivar in discussion. Though this study is heavily dependent on secondary information, efforts have been made to verify the information and claims with the formal documents or literature available from various sources, wherever possible. Databases of the International Rice Research Institute (IRRI) and the National Bureau of Plant Genetic Resources (NBPGR), as well as the People’s

Table 1 — Details of the farm visits and key-person interviews conducted

S. No.	Location	Category of the location	Number of people interviewed and their category
1	Karimannur, Idukki district (in Ernakulam district before 1992)	Panchayath where the cultivar was claimed to have been developed (1965-1970)	10 Farmers (8 of them were aged farmers, one still has the cultivar – reference to Fig.1), 4 Members of the Panchayath, 3 Government Officers (Department of Agriculture, Panchayath)
2	Chelakkara and Pazhayannur, Thrissur district	Panchayaths where the cultivar was claimed to have been spread in its earlier days (1981–1985)	5 Farmers, including the one who had brought it from Karimannur, as per the claim
3	Thenkurissi, Palakkad district	Panchayath where the Farmer Participatory Plant Breeding trials (FPB) were conducted for the cultivar by the Kerala Agricultural University during 1997-1998	2 farmers who have participated in the FPB
4	Pallassana, Kollengode, Arangottukara, Palakkad and Thrissur districts	Panchayaths where the cultivar was widely in cultivation until 2010	5 farmers
5	Others	-	The innovator and his 4 near relatives, 3 IPR and Biodiversity experts

Biodiversity Registers (PBRs) with different local Grampanchayaths, have also been referred to. A brief popular article in the local language, *Malayalam*, has also been published with a request for more information from the public.<sup>17</sup> A few responses to the article were also recorded. The data were analyzed critically according to the legal requirements to reach conclusions.

### Observations

#### *Kunjukunju Cultivar of Rice: The Enroute – as claimed by the Farmer*

The farmer claims that the *Kunjukunju* variety was ‘developed’ during the period 1965-1968, ‘crossing’ the then-available varieties IR8 (released by the International Rice Research Institute, Manila) and *Thavalakkannan* (A local landrace). The farm was at Karimannur Grampanchayath, Thodupuzha, in the then Ernakulam District, Kerala (Later, in 1992, the part was included in the newly formed Idukki district). As per the Innovator, twenty plants from a group of plants that showed peculiarities other than those of the parents were identified, and the seeds from selected panicles of those plants were sown repeatedly for 5-6 seasons to get pure seeds. All the plants were numbered, and their characteristics were studied and written on charts. Special attention was paid to the length of the panicle and the number of grains per panicle. As it was challenging to observe separately while cultivating it with the ones with the same duration, it was cultivated along with a long-duration variety called Mashuri. It was said that the stems of some plants appeared light violet in colour. Those plants were not distinguished separately at that time, as there were not many differences in plant or panicle size or yield. The ‘New Variety’ possessed more grains per panicle. Other characteristics included a duration of 110 days and being resistant to lodging and pests. The case was reported to the then-superintendent of the Agricultural Farm in Karimannur, under the Special Agricultural Development Unit of Kerala. The farm superintendent only suggested naming it *Kunjukunju*, as the farmer was affectionately called *Kunjukunju* in his family and close circle. In the course of time, the seeds were shared with the neighbouring farms, and it must have travelled to the districts of Thrissur and Palakkad first and then to other parts of the state, where the farmers looked for varieties that resist lodging. A cultivar in the name of *Kunjukunju* has been recently collected

from a farm in Karimannur Panchayath, from where it was learnt that the same is not in wide cultivation (Fig. 1).

A Year-wise Chronology of the incidences provided by the Innovator can be summarized as:

- (i) 1965-1970: *Kunjukunju* was ‘developed’ at the Innovator’s farm in Karimannur near Thodupuzha, Ernakulam district.
- (ii) 1970-1980: The cultivar was widely cultivated in Thodupuzha Taluk. Somewhere in between, an unprecedented yield was recorded for the cultivar during the crop-cutting conducted as a part of the Intensive Paddy Development Program of the Kerala Agriculture Department. The higher officials of the Department were convinced about its performance and congratulated the farmer.
- (iii) 1981–1985: The cultivar reached the farms in Thrissur and Palakkad districts from the source through the relatives of the innovator and then spread across the state.
- (iv) 2018: The innovator’s representative initiates discussions and applications for recognition of the variety.

#### *Kunjukunju Cultivar - First Scientific Studies (1992-2002)*

The Kerala Agricultural University (KAU) realized that many of the high-yielding rice varieties developed through centralized breeding programmes were poorly accepted by the farmers, but at the same time, many of the local rice cultivars had attained higher levels of acceptance and spread. Thus, they were motivated to initiate Farmer Participatory Plant



Fig. 1 - *Kunjukunju* collected from Vattakkavu farm in Karimannur (N 11054’24.12”; E075059’23.52”)

Breeding (FPB). The first of its kind project was the GALASA (Group Approach for Locally Adapted and Sustainable Agriculture) project to evolve rice varieties suited to specific agroecological situations of Palakkad district- the rice granary of Kerala. The District Panchayath provided financial support to the project, while the KAU, the State Department of Agriculture and the farming communities collaborated with their technical know-how. One of the objectives of the project was to purify the local popular rice cultivar *Kunjukunju*. KAU and the farmers noted that what they got was not-so-pure and a mix of many seeds in the name of *Kunjukunju*. Pureline selection conducted in *Kunjukunju* led to the evolution of 14 promising rice cultures. Of these, six short-duration cultures with red kernel colour were selected for advanced trials to assess yield potential, pest and disease reaction, grain quality and farmers' acceptance.<sup>18</sup> The FPB conducted in the Panchayaths of Thenkurissi, Nallepilli and Elapulli in Palakkad district during the years 1997-98 had contributed two new seeds to the farmers in 2002, *Kunjukunju Priya* and *Kunjukunju Varna*.<sup>19,20,21</sup> The University must have given the names with the good intention of disclosing the source of the seed. It was also learnt that the university is unsure if the then-collected local cultivar *Kunjukunju* was a farmer-developed cultivar or not.

#### ***Kunjukunju* Cultivar – Other Formal Records**

The cultivar was listed in the Gene Bank collection of the International Rice Gene Bank of IRRI, Manila (Designation: *KUNJUKUNJU*: IRGC 75448-1; Accession: IRGC 127535, Received: 1987; Acquisition Year: 01.05.2011).<sup>22</sup> The National Bureau of Plant Genetic Resources collected the cultivar from different parts of Kerala state (Thalappuncha near Methala, Ernakulam District, in 1997; near Idukki Dam, Idukki District in 2000; and Thottupoyil, Malappuram District in 2005), and evaluated the cultivar with morphological descriptors.<sup>23-25</sup> This 'non-descript' variety was highly preferred for cultivation in many parts of Palakkad district.<sup>26</sup> Such 'non-descript' varieties are characterized by short stature, short to medium duration and unknown pedigree.<sup>27</sup> In 2007, the cultivar was listed as one of the *Palakkadan Matta* Rices, and it became a Geographical Indicator.<sup>28</sup> A community of farmers represented by the *Akampadam Chimpanchala Padasekhara Samithi* from Palakkad district was

honoured with the Plant Genome Savior recognition of PPV&FRA in 2007, followed by the Plant Genome Saviour Award for the year 2011-12. They have been preserving many indigenous rice seeds, including *Kunjukunju*. These farmers have played a major role in the FPB of KAU to purify the *Kunjukunju* cultivar and, thereby, develop the new varieties of *Kunjukunju Priya* and *Kunjukunju Varna*.<sup>29</sup> In the years 2012-2014, the cultivar was listed in the Peoples' Biodiversity Registers of different Gramapanchayaths. The cultivar collected from the Kannur district has been morphologically characterized with detailed descriptors in a compendium of indigenous rice varieties of North Kerala, and the cultivar was spelt differently as *Kunhukunhu*.<sup>30</sup> In 2018, The cultivar was mentioned as 'presently in cultivation' in a compendium of the regional history of Argangottukara in Thrissur, which shares its border with Palakkad district, but it lacks evidence about its reach and spread.<sup>31</sup>

#### **Discussion**

##### ***Kunjukunju* Cultivar – Its Development and Pedigree**

It was claimed that the cultivar was 'developed' during the period 1965-1968, 'crossing' the then-available varieties IR8 (released by International Rice Research Institute, Manila) and *Thavalakkannan* (a local landrace). However, one of the innovator's friends, who had then worked with the Agricultural Office, recalled that the varieties used for developing *Kunjukunju* were IET-1444 and *Thavalakkannan*. It was also said that the Agricultural officers from Alappuzha had visited the fields, knowing about the unprecedented yield recorded for *Kunjukunju*, as part of the routine crop-cutting procedure under the Intensive Paddy Development Program of the Department of Agriculture. Crop cutting is a scientific methodology that analyzes the yield of varieties in cultivation. Though the officers suspected that the huge difference in yield could be due to improper crop-cutting practices, they were later convinced about the new cultivar's performance and congratulated the Innovator, it was recalled. It is to be noted here that IR8 was officially released by the International Rice Research Institute, Manila (IRRI) on 28<sup>th</sup> November 1966. Later, in 1967, Mr. Nekkanti Subba Rao, a progressive farmer in Andhra Pradesh, tested the variety on his farm for the first time in India.<sup>32</sup> Then, it is to be assumed that IR8 could have reached Kerala farms somewhere between 1967-68. If

one of the parents of *Kunjukunju* was IR8, the innovator must have cultivated it and selected *Kunjukunju* after 1968. One of the responses to the recently published popular article<sup>17</sup> also supported this, mentioning that the farmer from Peruvembu of Palakkad district had got the seeds of the variety in 1972, offered by the rice millers of Kaladi. The reference to IET-1444 as one of the parent varieties of *Kunjukunju* could also be possible. The variety IET-1444 (RP2B-849) was the result of a cross between Taichung Native 1 and Co.29 developed at ICAR's AICRIP Centre in Hyderabad. Though it was introduced in the State-coordinated variety trials in Karnataka in 1973, it was officially released in 1977 only.<sup>33</sup> If one of the parents of *Kunjukunju* was IET-1444, the innovator must have cultivated it and selected *Kunjukunju* after 1977, which doesn't match the chronology shared by the innovator. Since there are two versions of the pedigree of the cultivar (IR8 X *Thavalakkannan* or IET-1444 X *Thavalakkannan*), it requires confirmation, probably through genomic analysis.

#### ***Kunjukunju* Cultivar – Other Important Records A Geographical Indicator**

In 2005, the Palakkad Matta Farmers Producer Company, based in Chittoor, Palakkad, proposed that the Matta rice cultivated in the Palakkad district be recognized as Geographical Indications (GIs). *Matta* refers to the rice grains with red kernel. *Thavalakkannan*, *Chengazhama*, *Aryan*, *Thekkancheera*, *Ilapoochampan*, *Chitteni*, *Ravapandi*, *Cheriyaryan*, *Valiyachampan*, *Chuvannamodan*, *Kunjukunju* and *Jyothi* were twelve of the varieties mentioned in the application. Later, in 2007, ten varieties were mentioned in the Geographical Indications Journal. Eight were mentioned as local landraces viz., *Chengazhama*, *Chettadi*, *Aruvakkari*, *Aryan*, *Vatton*, *Ilapoochampan*, *Chitteni*, *Thavalakkannan*; and two newer varieties viz., *Kunjukunju* and *Jyothi*. Of these, *Jyothi* was developed by the Agricultural University and released in 1974 (PTB 39). It is not clear whether the *Kunjukunju* was the cultivar claimed to be developed by the innovator or developed by the KAU. However, since they were not specifically mentioned either as *Kunjukunju Priya* or as *Kunjukunju Varna*, it can be taken that it may be the local cultivar. *Kunjukunju* and *Jyothi* were mentioned as 'newer varieties', and it can be assumed that the *Kunjukunju* was not a local cultivar that had a long cultivation history in the

district.<sup>28</sup> One of the references included in the GI application, a book from 1966, has no specific mention of *Kunjukunju*, which could also mean that it was developed after.<sup>34</sup>

#### ***People's Biodiversity Registers & Other Regional History Documents***

Section 41 of the Biological Diversity Act (BDA, 2002) mandates the development of Peoples' Biodiversity Registers (PBRs) at the local level to document and safeguard bio-resources and associated knowledge.<sup>35</sup> PBRs can play an important role in biodiversity management and IPR disputes in an area. PBRs are prepared at the level of Gramapanchayaths coordinated by the Biodiversity Management Committees (BMCs) at the local self-government. Kerala was the first state in the country to establish BMCs at all levels and to prepare PBRs.<sup>36</sup> The innovator claims that *Kunjukunju* was 'developed' at the Gramapanchayaths of Karimannur (of the then Ernakulam district, which is now of Idukki district) and then spread in the Gramapanchayaths of Chelakkara, Pazhayannur (of Thrissur district), Thenkurissi, Nallepilli, Elapulli (of Palakkad district). The PBRs of these Gramapanchayaths mentioned the cultivar with its characters except for Elapulli Gramapanchayath and did not reveal much conclusive evidence regarding its origin and spread (Table 2). The PBRs of Gramapanchayaths mentioned by the key persons were only referred to.

#### ***Kunjukunju* Cultivar – The Possibility of classifying as a Local Landrace/Traditional Variety**

There is no mention of the *Kunjukunju* cultivar in any of the following most important and prime documents/studies from the state, which could possibly mean that it was not a local cultivar that has a long cultivation history in the state. It was also not included in the list of varieties developed through official breeding programmes of any public research institutes.

- (i) *Krishni Gita* Agricultural verses, a record of agricultural laws, traditional knowledge and Indigenous seeds in the Malayalam land, probably including parts of Tamil Nadu and Karnataka along with the now Kerala state, author and year unknown.<sup>37</sup>
- (ii) A detailed information on rice cultivation in Kerala, Sahadevan (1966).<sup>34</sup>
- (iii) An account of the Ethnobotany of rices of Malabar, Manilal (1981).<sup>38</sup>

Table 2 — Information about Kunjukunju cultivar in the PBRs of Gramapanchayaths, where it was said to have been developed and spread through in its early years

Districts	Gramapanchayaths, with the year of PBR preparation	Information provided for Kunjukunju cultivar
Idukki	Karimannur )2012-13)	Native cultivar; Local status :widespread in the past, limited presently; Source: Local; Community/Knowledge Holder: -
Thrissur	Chelakkara )2013-14)	Hybrid; Local status: Not cultivated in the past, widespread presently; Source: Local; Community/Knowledge Holder: Individual Farmer
	Pazhayannur )2014-15)	Hybrid; Local status: Not cultivated in the past, limited presently; Source: Agricultural Office; Community/Knowledge Holder: General Knowledge
Palakkad	Thenkurissi	Native cultivar; Local status: Plenty in the past, limited presently; Source: Local; Community/Knowledge Holder: General Knowledge
	Nallepilli )2013-14)	Native cultivar; Local status: Cultivated in the past, not cultivated presently; Source: Traditional; Community/Knowledge Holder: Individual farmer

- (iv) The results of the exploratory studies conducted across the state by NBPGR, Joseph & Nizar (1998).<sup>39</sup>
- (v) A comprehensive account of Genetic Diversity of Rice in Kerala, Leena Kumary and Rosemary (2002).<sup>40</sup>
- (vi) An account of heirloom/traditional rice varieties of Kerala, Leneesh *et al.*, (2013)<sup>41</sup>, and Save Our Rice Campaign (2019).<sup>42</sup>
- (vii) A citizen-scientist comprehensive account of rice cultivation in Kerala, Kumar (2014).<sup>43</sup>
- (viii) An account of heirloom/traditional rice varieties of Kerala, Gopi & Manjula (2018).<sup>44</sup>
- (ix) A list of rice varieties developed by research Institutes in India, Directorate of Rice Development.<sup>45</sup>

However, a Compendium of Indigenous rice varieties of North Kerala mentions the cultivar but spelt differently as *Kunhukunhu*.<sup>30</sup> During the collection, it could have been told as an indigenous variety, and it could also be noted that there were/are no accredited procedures for recording farmer-developed varieties.

#### *Kunjukunju – Can it be considered as a Variety?*

The denomination '*Kunjukunju*' has been variously defined as a variety, a cultivar, a landrace, or a traditional and indigenous variety during the interviews and also in the available literature. This requires an inquiry about the terminologies and the possibilities of defining the denomination. A Plant Variety represents a more precisely defined group of plants selected from within a species with a common

set of characteristics.<sup>46</sup> Cultivars are plants that have originated and persisted under cultivation or are specifically bred for the purpose of cultivation. Folk Varieties are cultivated plants developed, grown and exchanged informally among farmers. Landraces are primitive cultivars grown by ancient farmers and their successors [Section 41 (2) (a) & (b) of the Biological Diversity Act, 2002&2023]. Traditional/Indigenous varieties are local cultivars that are confined to a region. Hence, it is uncertain if the *Kunjukunju* can be called a Variety/Folk Variety/Landrace. It was observed that the non-descript varieties do not fall under the category of traditional varieties as they only have short stature and duration, but since their pedigree is unknown, they could not be classified as High-Yielding Varieties as well.<sup>26,27</sup> There is also an argument for revisiting such definitions in view of the PPV&FR Act of India<sup>47</sup>. The question here is, can *Kunjukunju* be considered a hybrid variety since it is said to result from a cross of two different pure breeding lines, with the progeny surpassing the parental lines in terms of yield? The innovator's claim of 'developing' the new variety by 'crossing' two varieties also needs to be verified, it could also mean a simple 'selection' process.

#### **Recognizing the efforts of the farmer innovator: Possibilities and Challenges**

##### *Under the Protection of Plant Varieties & Farmers' Rights Act*

The PPV&FR Act of 2001 defines farmers as Cultivators, Conservers and Breeders.<sup>11</sup> Nine (9) Rights were given to the farmers by the Act, including the right to seeds and the right to receive rewards and recognition for their conservation efforts. The

provision of registration of Farmers' Varieties allows the farmers "to register those varieties cultivated and evolved or bred by them, wild relatives, or landraces about which the farmers possess common knowledge." Section 26 of the Act provisions sharing the benefit of the commercial gains of such varieties registered. Four (4) types of plant varieties can be registered under the provision of this Act, which are New Variety, Extant Variety, Farmers' Variety, and Essentially Derived Variety (EDV).

Here, the major concern is defining the type and classification that *the Kunjukunju* cultivar falls in (Table 3).

***Kunjukunju as a Farmers'/ Extant Variety:*** An application has been submitted on behalf of the Innovator through the KAU to register the cultivar as a Farmers' Variety. However, it should be understood that it is difficult to move the application forward as many authentic/reliable documents could not be

produced. Even if required documents are produced, there are more hurdles ahead. The requirements and challenges in this regard are discussed in Table 4.

***How does the scientific characterization differ from that of farmers' documentation of a variety?***

The scientific characterization of a rice variety has to be methodological, using descriptors provided either by the International Rice Research Institute (IRRI) or by the NBPGR/PPV&FRA. The total number of descriptors ranges from 33 to 57, and the characters include that of the plant, flag leaf, leaf, ligule, culm, panicle, grain, kernel etc., which needs to be recorded at different growth stages of the plant. This will also follow a general remark about the plant. The NBPGR collections of *Kunjukunju* in 1997, 2000, and 2005 (Accession Nos. IC85779, IC280810, and IC536604) from different parts of Kerala have been characterized using 33 descriptors.<sup>24,25</sup> Vanaja (2018)

Table 3 — Kunjukunju Cultivar: Defining Type and Classification

S. No.	Type & Classification	Definition in PPV&FR Act 2001	Possibilities of <i>Kunjukunju</i> cultivar for inclusion
	<b>New Variety (Type)</b>	A variety which conforms to the criteria of Novelty, Distinctiveness, Uniformity, and Stability (DUS). [Section 15(1) & 3(a)]	No (DUS test to be conducted, but it has been in the public domain for more than 50 years)
	<b>Extant Variety (Type)</b>	A variety available in India which is notified under the Seeds Act 1966, or farmers' variety, or a variety of common knowledge, or A variety in the public domain. [Section 2(j)]	Yes
	<b>Farmers' Variety (Type)</b>	A variety that is traditionally cultivated and evolved by the farmers in their fields or a wild relative or landrace of common knowledge. [Section 2(l)]	Yes
	<b>Essentially Derived Variety (Type)</b>	A variety which is predominantly derived from an initial variety and retains the expression of the essential characteristics that result from the genotype or combination of genotypes, and is clearly distinguishable from the initial variety. [Section 2(i)] (Sub-Types: Transgenic, Mutant, Tissue Culture Derived, Back Cross Derivative, Any Other – Ploidy change etc.)	No
	<b>Typical Variety (Classification)</b>	A variety that is not a hybrid or an essentially derived variety is normally propagated by using propagules saved from previous crop production cycles. Example: pure lines, including parental lines/composite varieties or vegetatively propagated varieties (as defined in the applications for registration under PPV&FRA).	Could be No
	<b>Hybrid Variety (Classification)</b>	It is the cross (F1) between two different parents, viz., varieties or species with desired traits in a complimentary manner so that the hybrid has a combination of traits from both parents (simple definition, not defined in PPV&FR Act).	Could be Yes?
	<b>Transgenic Variety (Classification)</b>	Genetically modified to possess a new trait that is not naturally present in a plant/variety (simple definition, not defined in PPV&FR Act).	No

Table 4 — Recognition of Kunjukunju Cultivar: The Requirements and Challenges under the PPV&amp;FR Act, 2001

Category of Variety for Registration	Documents/Information Required under the PPV&FR Act	Challenges identified
Extant/Farmers' Variety	<p>authorization certificate from the Biodiversity Management Committee/District Agriculture Officer/Director of Research/Director of Extension of the Agricultural University/District Tribal Development Officer/Zonal Project Director of the Indian Council of Agricultural Research that the variety was bred/developed by the applicant himself and continuously conserved and cultivated only by the applicant farmer who is a permanent resident of the particular village.</p> <p>Details of commercialization or any other exploitation of the candidate variety</p> <p>Passport information of the Variety</p> <p>A declaration that the parental materials acquired for breeding, evolving or developing the candidate variety have been lawfully acquired.</p>	<p>During the time the cultivar was said to have been developed (1965-70), the Karimannur area was part of Ernakulam district. Later, in 1972, the Idukki district was formed. Therefore, no information regarding this is likely to be available in the Idukki District Administration Section or the District Principal Agriculture Office. An examination of the crop-cutting data maintained by the Department of Economics and Statistics may sometimes prove useful. Due to various reasons, many farmers of Karimunnur have abandoned paddy cultivation, and <i>Kunjukunju</i> is not widely cultivated there. Biodiversity Management Committees under the BD Act came into existence only after 2010.</p> <p>A variety that has been in the public domain in India for more than a year is not eligible for registration as a New variety (Section 15(3) (a) (i)). <i>Kunjukunju</i> cultivar has been in the public domain for more than 50 years if the innovator's claim is real.</p> <p>Though DUS characters are not mandatory for applying, the passport information about the candidate variety needs to be provided. However, it becomes the primary responsibility of the farmer-innovator to provide such detailed information. The scientific and technical characterization differs from the farmers' documentation. Compared with breeders, farmers' efforts in precisely documenting their varieties could be very minimal as their intent is to improve the varietal performance but not an official registration or patent.</p> <p>Farmers freely use, share, and creatively improve the varieties that they cultivate and are not concerned about such legal requirements. Moreover, the PPV&amp;FR Act was enacted, and guidelines were framed in 2001 and 2004.</p>

used 57 descriptors, including the cooking quality, to describe *Kunhukunhu*, which was collected from Vellur PO, Payyanur, and Kannur District.<sup>30</sup> In the case of farmers, they may not follow these descriptors for a particular variety, and they will have more general remarks based on their observations and endorsements from other farmers who used the seeds. For example, in the case of *Kunjukunju*, the Innovator neither documented all the characteristics nor recalled them. Only three of the defined descriptors were clearly provided by the innovator (Days to maturity, Seed coat colour-kernel colour, and Biotic Stress Susceptibility). All other information can be considered as general remarks (The variety can be grown anywhere, in all three cropping seasons; stalk with a violet tint; resistant to lodging even in the case of heavy rains; resistant to lodging even in the case of heavy rains; less chaff; resistant to lodging, even in heavy rains; red and tasty grains; grain yield around 800 Kg/Acre, whereas other cultivated varieties had 600 Kg/Acre; milling ratio 72-75 % whereas other

cultivated varieties had 60-65%; there are no issues if it rains, even in the times of pollination etc.).

#### ***Kunjukunju as a Grassroots Innovation under the National Innovation Foundation***

The National Innovation Foundation (NIF) under the Department of Science and Technology recognizes basic technological innovations developed by individuals and local communities.<sup>48</sup> Innovators and Traditional Knowledge holders who are not supported by the formal sectors can approach to get recognized. They will also help bring such knowledge and innovations up to the value chain and ensure wide dissemination through commercial or non-commercial channels. NIF has filed more than 1381 patent applications on behalf of inventors and traditional knowledge holders. Of these, 652 patents have been granted in India, and 5 in the USA. 24 design registrations and 11 trade mark applications have been filed, and 20 and 7 have been granted. NIF has also filed applications for 81 farmer-developed plant

Table 5 — Crop variety innovations identified by NIF from Kerala State<sup>49</sup>

S. No.	Crop Variety*	Innovator	District
1	<i>Kummukal</i> Pepper	K. T. Varghese	Idukki
2	Wonder Cardamom	Sabu Varghese	Idukki
3	White-flowered Cardamom	K. J. Baby	Idukki
4	<i>Njallani</i> Cardamom	Sebastian Joseph	Idukki
5	<i>Kadukkamakkan</i> Nutmeg	Abraham Mathew	Kozhikkode
6	Budded Nutmeg	Tom C. Antony	Kottayam
7	<i>Ashwati</i> and <i>Suvarana</i> Pepper (Quick wilt resistant)	A. Balakrishnan	Wayanad
8	<i>Panikulangara</i> Green Bold No.1 Cardamom	Joy Peter	Idukki
9	White Gourd (Yellow Mosaic Virus resistant)	Joy A. S.	Thrissur

\*1, 2, 3 and 8 are registered Farmers' Varieties under the PPV&FR Act, 2001

varieties with the PPV&FRA. Of these, 29 were successfully registered. It is understood that those varieties from Kerala have not yet been registered (Table 5).

The question here is whether *Kunjukunju* can be considered for registration with NIF. NIF may consider *Kunjukunju* since it was an invention without any help from the formal sector and, therefore, not included in any formal records. An application can be attempted, provided records of the development of the variety and pure seeds are produced, the lack of which may raise a potential concern here.

#### *Kunjukunju as a Rural Innovation under the Kerala State Council for Science, Technology and Environment*

Kerala State Council for Science, Technology and Environment (KSCSTE) conducts Rural Innovators Meet (RIM) every year to encourage unorganized rural and grassroots innovators involved in the development of rural technologies. RIM is a platform for inventors to showcase and exhibit their innovations/products and interact with scientists.<sup>50</sup> The proceeding of the RIM is an official document of the inventions, and it can also be taken to NIF. Here, the problem is the same: the lack of records of the development of the cultivar.

#### Conclusion

Understanding farmers' practices and the knowledge and goals underlying them is critical from the angles of food production and consumption,

conservation of crop genetic resources, crop improvement and long-term global food security. With the ongoing loss of genetic resources, the rapid spread of transgenic crop varieties (with limited genetic diversity), the development of a global system of intellectual property rights in crop genetic resources etc., the urgency of understanding farmer selection and conservation will increase in the future.<sup>51</sup> It is important to count the farmer-led innovations, such as the development of cultivars like *Kunjukunju*. The denomination, *Kunjukunju* has been variously defined as a variety, a non-descript variety, a cultivar, a landrace, or a traditional and indigenous variety in literature. This requires a revisiting of such definitions in view of the PPV&FR Act of India. There are two versions of the pedigree of the *Kunjukunju* cultivar (IR8 X *Thavalakkannan* or IET-1444 X *Thavalakkannan*), which can be confirmed through further genomic analysis. The farmer's claim of 'crossing' the parent varieties also needs to be verified, it could also mean a simple 'selection' process. There is a lack of formal documents available regarding the development of the cultivar. However, the *En Route* of the cultivar and the etymology help here; the name of the cultivar is the innovator's nickname. An examination of the crop-cutting data maintained by the Department of Economics and Statistics/Department of Agriculture & Farmers' Welfare, Govt of Kerala, may sometimes prove useful to validate the farmer's claim. It is noted that the *Kunjukunju* cultivar cannot be registered as a New Variety within the scope of the PPV&FRA. The possibility of an individual registering *Kunjukunju* as a Farmers'/Etxant (VCK) Variety requires much more effort in collecting evidence, including from DUS test/Genomic analysis. The collections from the gene banks of IRRI and NBPGR may also be requested for verification. An application can also be proposed under the said Act to get *Kunjukunju* registered as a variety of farming communities in Kerala. In parallel, the Innovator's representative can try its recognition under NIF. The Peermade Development Society-Idukki, NIF's regional collaborating agency, can be approached for this. They can also participate in the Rural Innovators Meet (RIM), which is organized every year by the Kerala State Council for Science, Technology and Environment. The Council's IPR Cell can also be contacted in this regard. However, for all this, they have to find time and other resources and provide properly prepared applications and other

information along with pure seeds of the cultivar. The Innovator's stance that 'once upon a time many granaries were filled with his variety, and the happiness of it is just enough for him' is welcoming and respectable. It is also significant to value farmers' efforts and inventions beyond the disputes over Intellectual Property Rights. Farmers and their supporting agencies should try to ensure adequate process documentation on such matters. It is also suggested that the local-level Peoples' Biodiversity Registers and other documents need to be prepared and updated in a manner that can be used authentically to resolve such concerns. These documents can make special inquiry into the unique names of the cultivars recorded. The fact that a crop cultivar that is said to have been developed 50 years ago is now being discussed for its recognition must be seen as an opportunity to increase our preparedness in related matters.

## References

- 1 Halewood M, *et al.*, The global Crop Commons and Access and Benefit-sharing Laws, Examining the limits of international policy support for the collective pooling and management of plant genetic resources, In: Halewood M, *et al.* eds., *Crop Genetic Resources as a Global Commons, Challenges in International Law and Governance*, Routledge2 UK; 2013, 1.
- 2 Harlan J R, *Crops and Man*, 2<sup>nd</sup> Ed.; American Society of Agronomy, Inc. and Crop Science Society of America, Inc.: Madison, WI, 1992.
- 3 Soleri D & Cleveland D A, Farmer selection and conservation of crop varieties, In: *Encyclopedia of Plant & Crop Science*; Goodman R M, Ed. (Marcel Dekker: New York), 2004, 433.
- 4 Lehmann C O, Collecting European land-races and development of European gene banks- historical remarks, *Die Kulturpflanze*, 29 (1) (1981) 29.
- 5 Hasan M & Abdullah HM, Plant Genetic Resources and Traditional Knowledge: Emerging Needs for Conservation, In: Salgotra RK & Gupta BB, eds., *Plant genetic resources and traditional knowledge for food security* (Springer, Singapore), 2015, 105.
- 6 Kochupillai M, *Promoting Sustainable Innovations in Plant Varieties*, (Springer, Berlin Heidelberg), 5 (2016) 335.
- 7 Vanloqueren G & Baret P V, How agricultural research systems shape a technological regime that develops genetic engineering but locks out agroecological innovations, *Research Policy*, 38 (6) (2009) 971.
- 8 Singh R P & Agrawal RC, Farmer's Varieties in India-Factors affecting their preferential prevalence and the current status of their legal protection, *Indian Journal of Agricultural Sciences*, 89 (9) (2019) 1371–82. <https://doi.org/10.56093/ijas.v89i9.93450> (accessed on 4 January 2025).
- 9 FAO, <https://openknowledge.fao.org/server/api/core/bitstreams/c6767e7b-331d-421f-b936-f1922a3bc54d/content#:~:text=Realizing%20Farmers%20Rights%20enables%20farmers,global%20pool%20of%20genetic%20resources> (accessed on 4 January 2025).
- 10 Alcázar JE *et al.*, Brief history of the negotiations on the International Treaty on Plant Genetic Resources for Food and Agriculture. In: Halewood *et al.* eds., *Crop Genetic Resources as a Global Commons, Challenges in International Law and Governance* (Routledge2 UK), 2013, 35.
- 11 PPV&FR Authority, <https://plantaauthority.gov.in> (accessed on 4 January 2025).
- 12 Bhutani S, Seed sovereignty, Letters, *Economic & Political Weekly*, 50 (21) (2015) 4.
- 13 Parameswaran P & Kumar AN, Access and Benefit Sharing: Agro Biodiversity and Farmers' Rights on Seeds—The Case of Indigenous Rice Varieties of Wayanad, Kerala, India. In: Oommen OV *et al.* eds., *Biodiversity Conservation Through Access and Benefit Sharing (ABS)* (Springer, Cham), 2022, 187.
- 14 India together, <https://indiatogether.org/plant-variety-protection-law-and-seed-ip-costs-for-farmers-agriculture> (accessed on 4 January 2025)
- 15 National Innovation Foundation, <https://nif.org.in/aboutnif> (accessed on 4 January 2025).
- 16 Kerala Agricultural University, <https://kau.in/institution/centre-intellectual-property-rights-ipr>, (accessed on 4 January 2025)
- 17 Parameswaran P, Chila Kunju Kunju Varthamanangal (In: Malayalam), *Kerala Karshakan* (Farm Information Bureau, Govt of Kerala, Thiruvananthapuram), 2024, 37.
- 18 Elsy CR *et al.*, Farmers and Breeders - Better Partners for Management of Plant Genetic Resources, *Indian Journal of Plant Genetics Resource*, 14 (2) (2001) 106.
- 19 Rosemary F *et al.*, *Keralathil Pracharathilulla Athyulppadanasheshiyulla Nellinangal* (In: Malayalam), (Kerala Agricultural University, Madonna Rani Offset Press Thrissur), 2003, 16.
- 20 Joseph P A, *Nelkkrisshi* (In: Malayalam), (Kerala Agricultural University Press, Thrissur), 2006, 4.
- 21 Subramanian M *et al.*, *Biodiversity of Rice and Its Conservation and Utilization -NBA Scientific Bulletin*, (National Biodiversity Authority, Chennai), 2007, 53.
- 22 International Rice Research Institute, International Rice Gene Bank Dashboard, <https://irgdashboard.irri.org/> (accessed on 4 January 2025).
- 23 Latha M *et al.*, Rice landraces of Kerala state of India: A documentation, *International Journal of Biodiversity and Conservation*, 5 (4) (2013) 250.
- 24 National Bureau of Plant Genetic Resources, Govt of India, PGR Portal Search (ernet.in), [http://pgrportal.nbgr.ernet.in/\(S\(e2hdf4ngzhqbp355dp1i1d55\)\)/EvaluationDataAvailability.aspx](http://pgrportal.nbgr.ernet.in/(S(e2hdf4ngzhqbp355dp1i1d55))/EvaluationDataAvailability.aspx) (accessed on 4 January 2025).
- 25 National Bureau of Plant Genetic Resources, PGR map, <http://pgrinformatics.nbgr.ernet.in/pgrmap/SpeciesDetails.aspx> (accessed on 4 January 2025)
- 26 George JG, Rice Seed Production and Distribution Strategies in Palakkad District, Thesis submitted in partial fulfillment of Master of Science in Agriculture, College of Horticulture, Kerala Agricultural University, (2002) 163. <http://14.139.185.57:8080/jspui/bitstream/123456789/8712/1/171939.pdf> (4 January 2025).
- 27 Ahamed P *et al.*, Farmers' criteria for selecting rice varieties give new insight to rice breeders. *Abstract of the National*

- Symposium on Technological Advancement in Rice Production, 17-19 June*, (Director of Extension, Kerala Agricultural University Thrissur), 1996, 187.
- 28 Geographical Indications Registry, Chennai, Government of India, *Geographical Indications Journal*, 17 (2007) 43 (<https://search.ipindia.gov.in/GIRPublic/Application/ViewDocument> (accessed on 4 January 2025)).
  - 29 Elsy C R *et al.*, *Plant genome saviours of Kerala* (IPR Cell, KAU, Kerala Agricultural University Press, Thrissur), 2021, 10.
  - 30 Vanaja T, *Compendium on a collection of indigenous rice varieties of North Kerala* (Regional Agricultural Research Station, Pilicode, Kerala Agricultural University, Thrissur), 2018, 65.
  - 31 Arangottukara Charithra Padana Koottayma, *Arangottukarayude Charithram* (In: Malayalam), Gireesh V, ed. (Padasala Arangottukara, Thirssur), 2018, 183.
  - 32 International Rice Research Institute, *Rice Today, Special supplement focusing IR8* (2016 November) 2 [http://books.irri.org/RT\\_Supplement-IR8.pdf](http://books.irri.org/RT_Supplement-IR8.pdf) (4 January 2025).
  - 33 Naidu B S *et al.*, IET 1444 (RP2B-849): a short duration high yielding rice variety for drill sowing, *Current Research, University of Agricultural Sciences, Bangalore*, 6 (12) (1977) 202.
  - 34 Sahadevan PC, *Rice In Kerala* (Agricultural Information Service, Dept. of Agriculture, Kerala State Thiruvananthapuram), (1966) 172, 177.
  - 35 National Biodiversity Authority, Govt of India, <http://nbaindia.org/content/25/19/1/act.html> (accessed on 4 January 2025).
  - 36 National Biodiversity Authority, Govt of India. <http://nbaindia.org/blog/513/1/Keralabecomes.html> (accessed on 4 January 2025).
  - 37 Kumar MB (Tr.) Krishi Gita (Agricultural verses), *Agri-History Bulletin 7* (Asian Agri-History Foundation, Secunderabad), 2008, 111.
  - 38 Manilal K S, Ethnobotany of the rices of Malabar, In: *Glimpses of Indian Ethnobotany*, Jain S K eds. (Oxford & IBH Publishing Company), 1981, 297.
  - 39 Joseph K J & Nizar A, Collection of rice germplasm from Malabar, Kerala, *Indian Journal of Plant Genetics Resource*, 11 (2) (1998) 173.
  - 40 Leena Kumary S & Rosemary F, Collection, management, conservation and utilization of genetic diversity of rice in Kerala, In: *Seventy Five Years of Research* (Nair RR *et al.*, eds., (Kerala Agricultural University, RARS, Pattambi), 2002, 1.
  - 41 Leneesh K *et al.*, *Keralathile Nadan Nellinangal* (In: Malayalam), (Save Our Rice Campaign, CREATE Trust, Tamil Nadu), 2013, 1.
  - 42 Save Our Rice Campaign, *Keralathile Nadan Nellinangal* (In: Malayalam), CREATE Trust, Tamil Nadu), 2019, 1.
  - 43 Kumar SCK, *Karshikaparambaryam Keralathil* (In: Malayalam), (The State Institute of Languages, Thiruvananthapuram), 2014, 1.
  - 44 Gopi G & Manjula M, Speciality rice biodiversity of Kerala: Need for incentivising conservation in the era of changing climate, *Current Science*, 114 (5) (2018) 997.
  - 45 Directorate of Rice Development, Dept. of Agriculture, Co-operation & Farmer Welfare, Ministry of Agriculture & Farmer's Welfare, Govt of India, Patna, *Details of Rice Varieties*, <https://drdp.at.bih.nic.in/Rice%20Varieties%20-%20001.htm> (accessed on 4 January 2025).
  - 46 UPOV, The international union for the protection of new varieties of plants, <https://www.upov.int/overview/en/variety.html> (accessed on 4 January 2025).
  - 47 Saxena S & Singh A K, Revisit to definitions and need for inventorization or registration of landrace, folk, farmers' and traditional varieties, *Current Science*, 91 (11) (2006) 1451, <https://www.jstor.org/stable/24093836> (accessed on 4 January 2025).
  - 48 National Innovation Foundation, Department of Science and Technology, Govt of India, <https://nif.org.in/aboutnif> (accessed on 4 January 2025).
  - 49 National Innovation Foundation, Department of Science and Technology, Govt of India, *Kerala Innovates, State Innovation Books*, [https://nif.org.in/upload/dwn\\_files/state-books/NIF\\_Kerala\\_Innovates.pdf](https://nif.org.in/upload/dwn_files/state-books/NIF_Kerala_Innovates.pdf) (accessed on 4 January 2025).
  - 50 Kerala State Council for Science Technology and Environment, Rural Innovators' Meet, <https://kscste.kerala.gov.in/rural-innovators-meet> (accessed on 4 January 2025).
  - 51 Soleri D & Cleveland D A, Genetic resources: Farmer conservation and crop management, In: *Encyclopedia of Natural Resources*, (Taylor & Francis), 2014, 256.