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Summary

My focus in research and development has been centered on four key areas: Conservation, Cultivation, Consumption, and Commerce — specifically concerning rice, black pepper, and coconut. Another significant focus of my work is eco-friendly farming and hands-on training in target areas.After my MSc project, which involved evaluation of coconut, and my PhD project on genetic variability studies in rice, my work was primarily focused on variety development research in both black pepper and rice during the first ten years of my career at the Pepper Research Station, Panniyur. Over the next five years, I engaged in teaching and MSc guidance, alongside research and development projects in rice at the College of Agriculture, Padannakkad. Since 2015, I have been actively involved in research and development projects on rice and coconut at RARS, Pilicode. Since 2020, I have also been involved in administrative responsibilities.In black pepper research, my challenging work in interspecific hybridization resulted in the first reported promising interspecific hybrid for Phytophthora foot rot resistance. Additionally, I identified an alternative source for Phytophthora foot rot resistance. I carried out several interspecific and intervarietal hybridizations in black pepper, conducted surveys of undisturbed plantations, forests, sacred groves, and collected wild black pepper germplasm. All hybrids and germplasm collected were planted at PRS, Panniyur. In rice research, my challenging intervarietal hybridization efforts, adopting noval strategies of Organic Plant Breeding (OPB) and Participatory Plant Breeding (PPB), led to the development and commercial release of the first high-yielding organic rice varieties suited for the saline-prone, naturally organic Kaipad tract of North Kerala, christened as 'Ezhome-1', 'Ezhome-2', 'Ezhome-3', 'Ezhome-4', and 'Mithila'. Additionally, I also developed and commercially released the first organic rice variety, JAIVA for non saline wetlands. The naturally organic Kaipad ecosystem of North Kerala, which was once neglected, has been under development since 2000 through my series of research interventions. In 2010, my project established the stakeholders' society for Kaipad tract named 'Malabar Kaipad Farmers' Society', covering three districts, and successfully secured the Geographical Indication (GI) tag for Kaipad

rice. This society was later taken over by the Kerala government and transformed into the Kaipad Agency (KADS) in 2018, where I was appointed as the founder project director. In 2021, this society evolved into a Farmer Producer Company. Since 2010, I have been actively supporting this society through various research and development projects, such as establishing the Food Security Army and providing training in all aspects of agriculture, value addition, and marketing of Kaipad organic products, including export. As a result, the society received the prestigious 'Plant Genome Saviour Community Award' in 2023.Between 2014 and 2020, I was also involved in the collection and conservation of traditional rice varieties from four districts in North Kerala. Out of these varieties a set of 75 were multiplied and handed over to farmers in the Pilicode Panchayat for farmer-participatory conservation and were also deposited at NBPGR. During the same period, I conducted hands-on training and demonstrations of organic rice farming in farmers' fields, covering the entire cropping period from nursery to harvest across six panchayats. In coconut research, in addition to five years of work with AICRP (Palms), I conducted extensive field surveys across 14 districts in Kerala to locate ecotypes of coconut. As a result, I identified 52 ecotypes, which were collected and conserved at RARS, Pilicode. Currently, as the Principal Investigator, I am engaged in developing location-specific, abiotic stress-tolerant organic rice varieties, establishing the Kaipad Research and Development Centre, and setting up an Agri-tourism Centre. Since 2020, as the Head of the Institute at RARS, Pilicode, my notable contributions include: Enhancing the biodiversity of the farm through intercropping and border cropping with around 20 different crops.,Introducing duck and fish rearing alongside existing Integrated Farming System (IFS) facilities., Facilitating the establishment of North Kerala's first Trichogramma production unit and other organic input production units, such as Trichoderma and Pseudomonas., Establishing mother gardens of medicinal crops and tubers., Converting six acres of the institute's wetland into an organic field and starting the sale of organic rice and paddy seeds., Publishing a 'Compendium on Coconut' and compiling 100 years of research work at RARS, Pilicode.

Research highlights

Development of Varieties / pre-release cultures/ breeding lines / hybrids

Rice

- Developed and commercially released six organic rice varieties christened as 'Ezhome-1','Ezhome-2', 'Ezhome-3', 'Ezhome-4', 'Mithila' and 'Jaiva' as principal breeder and principal investigator. 'Ezhome-1','Ezhome-2', 'Ezhome-3', 'Ezhome-4', 'Mithila' are saline tolerant and also the first high

yielding rice varieties of naturally organic, sea coastal Kaipad rice tracts of Kerala. 'Jaiva' is the first organic rice variety for non-saline wetlands.

- All the developed rice varieties/cultures were tested in various locations in various Indian states under AICRP on rice, and were found to be superior to their local check.
- Developed two flood tolerant pre-release organic rice cultures JK 71 & MK 115 and two organic rice cultures for ordinary wetland , JK14 & JK59 which are under evaluation.
- Developed 17 salinity tolerant organic rice breeding lines namely, JK-58-1-1, MK-61-1, E-1 x FL-478-3, Kuthir x Orkayama-1-2, JO-560-2, MK-146, OK-45, JK-15, JO-91, E-1 x FL-478-1, Orkayama x IRE-28-1, KO-18, JO-395, JK-46, JK-74, OK-38, and Pokkali x Orkayama-1. These are at present CYT evaluation stage. These breeding lines also include pyramided lines for salinity tolerance mechanism.
- Developed 18 organic rice breeding lines suitable for ordinary wetland namely, JK-49-1-1, IRE-50, JK-74-2, JO-474-1-3, JK-1, JO-21-1, JO-424-1-4, IRO-94, MK-162-2, MK-21-2, JK-78, JK-28, JK-27-2-1, JK-12-1-1, JO-463-1, MK-139-1-1, IRE-139, and JK-49-1-3, which are under CYT at present CYT evaluation stage.
- Coauthor of 'Manupriya' rice variety released from ARS Mannuthy.
- Association between physicochemical characteristics and cooking qualities in high – yielding rice varieties of diverse origin was estimated.
- Identified rice genotypes as parents for the development of organic varieties, and also identified among current conventional rice varieties the best suited varieties for organic farming.

Black pepper

- Developed the first promising inter specific hybrid between *Piper nigrum* and *Piper colubrinum*, for *Phytophthora* foot rot tolerance in black pepper.
- Associated with the development of the black pepper varieties, Panniyur-6, Panniyur-7, and Panniyur-8.
- Developed an array of inter-specific as well as inter-varietal hybrids of black pepper for biotic stress tolerance, and planted at Pepper Research Station Panniyur of Kerala Agricultural University.

Geographical Indication Tag: Secured GI tag for Kaipad rice in 2014.

Identification of New Genetic Resources

Rice

- 'Vytilla -3' was identified as cytoplasmic male sterility in tropical climate.
- 'Kuthiru', and 'Orkayama' land races were identified as two new genetic resources for salinity tolerance.

Black pepper

- North eastern fragrant pepper was identified in black pepper as alternative source for tolerance to Phytophthora foot rot disease.

Germplasm collection, Conservation, Evaluation & NBPGR deposit

Rice

- Collected 102 traditional genotypes from North Kerala and characterized 68, and published book.
- Deposited seeds of 77 traditional rice varieties in NBPGR, New Delhi for long term storage.
- Seeds of 75 traditional rice varieties were given to farmers of Pilicode Panchayat & Pilicode Grama Panchayath was declared as the first Paithruka NelVithugramam of Kerala state in 2020.

Black pepper

- Collected 98 wild accessions from forests and undisturbed plantations and conserved at Pepper Research Station, Panniyur.

Coconut

- Surveyed farmer fields of 14 districts of Kerala and formed Coconut Germplasm Conservers Unit for each district, collected 52 ecotypes and conserved at RARS, Pilicode.

DNA Finger Printing and Identification of putative molecular markers:

- In 2003, DNA Finger Printing of all the rice varieties released till that time from Kerala Agricultural University was done for the first time.

- Identified putative molecular markers in rice for salinity tolerance, red and white kernel colours, and for Photoperiod sensitivity and insensitivity.

- Through SSR marker analysis, 76 rice genotypes were grouped into 8 clusters and genetically distant rice genotypes were identified.
- Cultivar specific RAPD markers for 10 varieties and STMS markers for 6 varieties were identified.

Other achievements

- Right from the beginning of my carrier sustained research and development efforts have been continuing for the comprehensive development of naturally organic sea coastal Kaipad tract of North Kerala namely., 2000 onwards rice variety development., in 2010 formed the stake holders' society for three Kaipad districts - "Malabar Kaipad Farmers' Society" was formed, which was later taken over by Kerala government and made Kaipad agency, KADS in 2018., in 2021 the society became farmer producer company for which I am working as chief adviser.
- As PI of a Rebuild Kerala Initiative project (4.9crores), standardized five value added products from KAIPAD RICE and being marketed in domestic, international markets and Amazon market through Kaipad FPO.
- At present engaged in establishing R & D centre for organic wetland agriculture in the land of Kaipad agency.
- Established an agri-tourism centre within the institute as PI of a project under Kasaragod development package (2.0 crore) with an objective to attract youth in agriculture.
- Created facilities for rice research at RARS, Pilicode namely, rice breeding cum seed production centre, a rice germplasm conservation unit, a rice hybridization unit, and a plant molecular breeding laboratory.

- Best season for grafting scion of the cultivable variety of *Piper nigrum*, which is susceptible to *Phytophthora* foot rot disease, on the root stock of wild species *Piper colubrinum*, which is immune to this disease, was identified.

- Spray application of water to bush pepper is found to be the best mode of water application compared to basin application.

- Spraying the rooted cuttings of black pepper in the nursery with 5 % cashew leaf extract at fortnight interval will give maximum growth enhancement**.**

- Mulching the black pepper vines with leaves of eupatorium was found to control the slow wilt disease in black pepper.
- 10% Turmeric spray, spray of 50% cow urine + 50% supernatant cow dung solution and 10% leaf extract of the medicinal plant *Swertia chirata* were found to be suitable bio extracts for controlling pollu beetle in black pepper.

Transfer of Technology/ Farmer Outreach programmers

- Founder Director of Kaipad Area Development Society (KADS), a government of Kerala agency for the development of Kaipad rice tracts of North Kerala.
- Since 2014, conducting Farmers' empowerment programmes in organic agriculture through 'Hands on training on mechanized organic rice farming.
- In 2016, NABARD has sanctioned 10.0 crore to KLDC for infrastructural development in traditional Kaipad tract of Kannur district for which I was the technical adviser.
- Conducted two state level workshops of sea coastal rice farmers in 2012 and 2016.
- Conducted Meet of organic rice farmers of North Kerala in 2014
- Conducted meet of rice germplasm conservers in 2018.
- The mission of wild rice eradication conducted in 2018.
- Carried out several training programmes & demonstration trials.

Experience

- Served at Agriculture department as agriculture officer for 2.5 years
- Joined in Kerala Agricultural University as Assistant Professor(Plant Breeding & Genetics) in 1999
- Served at Peeper Research Station Panniyur for 10 years
- Served at College of Agriculture Padannakkad for five years
- At present in Regional Agricultural Research Station, Pilicode as head of institute and Associate Director of Research (North Zone) of KAU.

Education

- Graduation in B.Sc.(Agriculture) from Kerala Agricultural University in 1988
- Post Graduation in Plant Breeding from Kerala Agricultural University in 1993
- PhD in Plant Breeding & Genetics from Kerala Agricultural University in 1999
- Certificate Course (BTECH 652) – One Semester in Molecular Biotechnology from University of Maryland, Baltimore County, USA in 2009

Area of Specialization

Hybridization and variety development in rice and black pepper, Organic rice cultivation, Kaipad natural farming

Awards & Recognitions

National Award

- 2023: Malabar Kaipad Farmers' Society, under my leadership and fecilitation, received the prestigious national award of 'Plant **Genome Saviour community award"** from the President of India.

Kerala State Government Awards

- 2020: "**Vanitha Ratnam**" award for outstanding contributions to the field of science & education. Received from the Hon. Chief Minister of Kerala (First woman in Kerala Agricultural University to win "Vanitha Ratnam" award. Also, the first women from North Kerala to win this award).
- 2012: "**Krishi Vigyan**" award for the best Agricultural scientist. Received from the Hon. Speaker of Kerala Assembly in the presence of Hon. Chief Minister of Kerala and other council of ministers.
- 2004: "**Young Scientist**" award instituted by Kerala State Council for Science, Technology and Environment, Government of Kerala for the best research project.

Other Government Awards

- 2012: “Best Poster Presentation” award in the international conference on sustainable agriculture for food and livelihood security held at Punjab Agricultural University, Ludhiana held during November 27-29, 2012.
- 2012: The documentary “Kayalkandam”, based on Kaipad farming, adjudged award in the children’s film festival.
- 2022: ‘Women Achiever’ award from the Central University of Kerala (CUK) on International Women’s Day 2022.

Non-Government Awards

- 2016: “Mother Teresa Sadbhavana” Award instituted by International Business Council, New Delhi. The award is summoned to people and organization for their outstanding contributions to the society as well as the nation.

Honours by Government Organizations

- 2010: Short listed for 2010 **Norman Borlaug Fellowship programme** by the United States Department of Agriculture (USDA), USA.
- 2013: Honour from General Council of Kerala Agricultural University, for securing “Krishi Vigyan” award for the best agricultural scientist.
- 2010: Honour from home institute on international woman’s day for the best research work in rice.
- 2010 : Honour from Ezhome Grama Panchayath and from public organizations for developing and releasing the first high yielding rice varieties – ‘Ezhome-1’ and ‘Ezhome-2’- of saline organic Kaipad ecosystem of Kerala, as Principal breeder.
- 2005 :Appreciation and Honor from Kerala Agricultural University, India for securing external aided projects.
- 2004: Complement from General Council of Kerala Agricultural University, India for bagging young scientist award.
- 2004 :Meritorious award by The Mega National Agricultural Festival and Exhibition on Science and Technology, Kerala for the best organization of exhibition to the public.

Honours by non-Government organizations

- 2010: Recognized as ‘Woman of the Week' by a leading Indian daily - Mathrubhumi – for the innovation in applying science to the development of paddy cultivation in rural saline areas.

- 2012:“Yuva Prathibha” – Honour for best agriculture research by Balagokulam Sarathi Puraskara Samithi, Kanhangad.
- 2014 : Excellency award of Rotary club, Payyanur ,Kannur

Research Projects

Principal Investigator

Ongoing projects

1. Development of Kaipad Organic Tidal wet lands of Northern Kerala through Mechanized farming, Rice Germplasm Conservation, and Biodiversity based farming (EAP- Rebuild Kerala Initiative- Ongoing).

2. Thirumunmp Centre for studies on farming culture at RARS Pilicode (EAP- Kasaragod Development Package- Ongoing).

3. Development of location specific and abiotic stress tolerant organic rice varieties for North Kerala(State plan).

Completed projects

1. Breeding for *Phytophthora* foot rot resistance in black pepper (*Piper nigrum)* (EAP-KSCSTE) (2004-2007)

2. Development of molecular markers in rice associated with genes responsible for salinity tolerance, exploring new genetic variations, and development of rice cultivars with strong tolerance to salinity through molecular breeding (EAP- DBT, Government of India) (2014- 2016)

3. Identification of RAPD molecular marker(s) linked to salinity resistance / tolerance in rice (*Oryza sativa* L.) (EAP- KSCSTE)(2006)

4. Evolution of high yielding rice varieties suited to *Pokkali* rice tracts of North Kerala through farmers participatory breeding approach (State plan) (2002 - 2022_.

5. Evaluation of black pepper varieties for growing as bush pepper (State plan) (2001 -2006).

6. Creation of genetic variability in black pepper for foot rot resistance and drought resistance through mutation breeding (State plan) (2004 -2007).

7. Compatibility studies of grafting *Piper nigrum* on *Piper colubrinum* for *Phytophthora* foot rot resistance (State plan) (2004 -2007).
8. Identification of dwarf ecotypes in coconut with high copra (State plan) (2018 -2020).
9. Advanced Rice breeding cum seed production centre (State plan) (2016).
10. Truthfully labeled seed production of newly developed rice varieties of North Kerala through farmer participatory approach (State plan) (2015).
11. Comprehensive development of saline Kaipad rice tract of Kerala (State plan, RKVY, Paddy Mission) (2010).
12. Training on bio-fertilizers and bio input preparation and nursery operations (State plan) (2021).

AICRP (Palms), ICAR (2015- 2021)

- Collection, conservation and evaluation of local germplasm of Coconut
- Performance of Dwarf x Dwarf hybrids of coconut in different agro- climatic regions

Observational trials

1. Testing the suitability of newly developed *Kaipad* rice cultures and wetland rice cultures under different cropping patterns in farmers' field (2010)
2. Testing the suitability of newly developed *Kaipad* rice cultures and wetland rice cultures in open and shaded conditions of upland in Comparative Yield Trials(2010)
3. Nutritive quality analysis of *Kaipad* local rice cultivars and developed cultures (2009)
4. Trial with different mulch materials for control of slow wilt disease in black pepper (2003 -2005).
5. Use of botanicals as growth enhancer in pepper nursery (2003 -2005).
6. Use of botanicals for the control of pollu beetle (2003 -2006).
7. Compatibility studies and influence of season on recovery of graft between *p. nigrum* using *p.colubrinum* as root stock (2001)
8. Interspecific hybridization in black pepper (2000 -2002).

Co-Principal Investigator

All India Co-ordinated Research Projects on spices from 1999- 2007 at Pepper Research Station, Panniyur

1. Germplasm collection, conservation and evaluation of black pepper
2. Inter-varietal hybridization in black pepper
3. Co-ordinated variety trial in black pepper
4. Trial on drip irrigation in black pepper
5. Efficacy of biofertilizer using *Azospirillum* on black pepper
6. Efficacy of biofertilizerusing P-solubilizers on black pepper
7. Organic farming in black pepper

Publications

Journal Articles

1. Vanaja, T. and Sreekumari Amma, J. 1997. Evaluation of WCT coconut and Komadan Coconut. *Indian Cocon. J*. XXVIII (8): 5-7.
2. Vanaja, T. and Radhakrishnan, V.V. 1998. Identification of an alternate cytoplasmic male sterile source in rice. *International Rice research Notes*.23(3): 8-9.
3. Vanaja, T.,Sreekumari Amma, J.and Saraswathy,P.1998.Correlation studies on seed nut characters of West Coast Tall and Komadan coconut types harvested during different months of the year. *Madras Agric.J*. 85(3&4):170-174.
4. Vanaja, T. and Sreekumari Amma, J. 2001. Influence of harvesting time on seed nut characters in coconut. *Madras Agric.J*. 88(1-3): 150-151.
5. Sivakumar, G.; Neema, V.P. and Vanaja, T.2002. Effect of Metalaxyl Granules on foot rot disease of Blackpepper. Journal of Mycology and Plant Pathology. v. 32(3) p. 413.
6. Sivakumar, G. Vanaja, T., Neema, V.P. and Unnikrishnan Nair. 2002. Efficacy of certain fungicides in the control of foot rot disease in black pepper nursery. *Pestology*. XXVI (5): 21-22.
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8. Unnikrishnan Nair, P.K., Vanaja, T., Neema, V.P., Arya, K. and Sivakumar, G. 2002. Panniyur-6, a newly released high yielding variety of black pepper. Indian J. Arecanut, Spices & Medicinal Plants 4 (2): 81.
9. Vanaja, T., Babu, L.C., Radhakrishnan, V.V. and Unnithan, V.K.G. 2003. Genetic divergence in high yielding rice genotypes. *Oryza*. 40(1&2): 40-42.
10. Vanaja, T. and Babu, L.C. 2003. Association between physicochemical characters and cooking qualities in high – yielding rice varieties of diverse origin. *International Rice research Notes*.28(1): 28-29.
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12. Vanaja, T., Luckins C. Babu and V.V. Radhakrishnan and Pushkaran, K. 2003. Combining ability analysis for yield and yield components in rice varieties of diverse origin. *J. of Tropical Agriculture*. 41(1 &2): 7-15.
13. Vanaja, T., Luckins C. Babu and V.V. Radhakrishnan. 2003. 'Vytilla 3' – A new cytoplasmic male sterile source of tropical rice (Oryza sativa L.). *Indian J. Genet. and plant breeding* 63(1): 30-32.
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15. Vanaja, T. and Luckins C. Babu. 2006. Development of a new rice ideotype. *J. of Plant Genetic resources.* 19(2).
16. .Vanaja, T. and Luckins C. Babu. 2006 Variability in grain quality attributes of high yielding rice varieties (Oryza *sativa* L.) of diverse origin. *J. of Tropical Agriculture*. 44 (1& 2):61-63.
17. Vanaja, T., Randhawa, G.J. and Mammootty, K.P.2006.Pedigree evaluation and molecular diversity of some true breeding rice (Oryza *sativa* L.) genotypes of Kerala. *J. of Tropical Agriculture*. 44 (1& 2): 42-47
18. Vanaja, T. and Luckins C. Babu. 2006. Variation for grain and quality characteristics in rice (*Oryza sativa* L.). *Indian J. Genet. and plant breeding*, 66 (1). 13-15.
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24. Vanaja, T., Neema, V.P., Mammootty, K.P., Rajeshkumar, R., Balakrishnan, P.C., Jayaprakash Naik and Raji, P.2009. Development of first non-lodging and high yielding rice cultures for saline *Kaipad* paddy tracts of Kerala, India. *Current Science.* 96(8): 1024-1028.
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32. Manjunatha, G. A. Vanaja, T., Vasudevan, N.R. and Rao, G.V.S. 2015. Organic varietal traits in rice (*Oryza sativa* L.) for high yield revealed through farmer participatory evaluation strategy. Ann. Plant Physiol. 29(2): 1-5.
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3. 2019: Album on research and development interventions carried out from northern research institutes of Kerala Agricultural University for development of organic rice tracts of North Kerala, and also for biodiversity conservation of rice
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7. Vanaja, T. , Nikhil, P.G., and Anubhagya, M. 2019. LOKATHILE ADHYATHE JAIVA NELLINANGAL(Leaflet in Malayalam).

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9. Vanaja, T. and Jyothi Krishna.2021. Leaflet in Malayalam entitled' Kaipadu centerile prakrudhidhatha vibhavangalum karshaka sevanangalum'.

10. Vanaja, T. and Jyothi Krishna.2021. Leaflet in Malayalam entitled' Kaipad bhoopradesam, Krishi reethikal, Inangal'.

11. Vanaja, T. and Jyothi Krishna.2021. Brochure in English on Rebuild Kerala Initiative project on Kaipad development.

12. Anupama, S. and Vanaja, T.2022. RARS Pilicode Research Chronicles – At a Glance. Brochure p.24

13. Anagha, G. and Vanaja, T. 2024. 'Thengile Rogangalum niyanthrana margangalum'. Leaflet in malayalam

Allied Publications

1. 2016: Book entitled 'THALIYOLA' (in Malayalam) in connection with centenary celebration of RARS, Pilicode. Functioned as Chairman and Chief editor.

2. 2016: Documentary entitled, 'KOTHUMPU' telling 100 years development of coconut research through retired hands. Functioned as Chairman, Director and script writer.

3. 2023: SAPHALAM RARS Farm Carnival Smaranika. Functioned as chief advisor.

Student Guidance (Major Advisor)

M. Sc. (Ag) - 3 (completed)

External University (short term project) -

Other Responsibilities

1. Associate Director of Research (North Zone), Kerala Agricultural University
2. Head of Regional Agricultural Research Station, Pilicode
3. Project Director, Kaipad Agency KADS, Govt. of Kerala

Membership in Professional Associations

1. Life member of Indian Society of Genetics and Plant Breeding
2. Life member of Association of Rice Research Workers
3. Life member of Indian Society for Plant Physiology