

## Need to Conserve Pokkali for a Sustainable Future

*Surya Babu S*

Assistant Professor  
Biotechnology Department  
SCMS School of Technology and Management  
Kalamassery

*K. Raju Thomas*

Research Guide & Assistant Professor  
Department of Zoology  
Mar Thoma College, Tiruvalla  
suryababu2016@gmail.com

### Abstract

The Pokkali is a distinctive, tall, traditional rice variety, impervious to salinity with a Geographical Indication (GI). It is cultivated organically in the coastal regions of Ernakulam, Alappuzha and Thrissur districts of Kerala, India. This rice variety has been around for 3000 years and is famous for its flavour, protein content and medicinal properties. The Pokkali fields are an archaeological milieu ecosystem near the Vembanad Lake and Arabian Sea with rich biodiversity and the ability to sustain alternatively paddy (during the low saline phase, i.e. June - September/ mid October) and prawns/shrimps/fishes/mollusc (during the high saline phase, i.e. September/ mid October - March) in an organic manner. These tidal regions are water-logged throughout the year and are highly nutritive and biodegradable, providing umpteen services. The cultivation depends on the quality of the field soil, water and decomposition rate of the paddy stubbles and the symbiotic association of rice and prawn. The Pokkali wetlands of Kerala are an Important Bird Area (IBA) and part of the Vembanad Ramsar site. The rotational cultivation of paddy-prawn is a sustainable eco-agriculture approach. The Ernakulam District has the largest area under Pokkali cultivation. The Pokkali wetlands lie under the Central Asian Indian Flyway (CAF) and hence serve as a favourite habitat providing feeding, breeding and stop-over sites for many avian species, including Transcontinental migrants, Threatened and Near Threatened, as well as for many flora and fauna that are attuned to the hospital environment. A detailed study was carried out from 01<sup>st</sup> June 2016 to 31<sup>st</sup> May 2022 in the Pokkali wetlands of Ernakulam District, Kerala to study the issues of Pokkali cultivation and the need to conserve them for a sustainable future. Six different Pokkali fields were selected as sample sites for the study: Kadamakkudy (10.0634°N 76.2494°E), Ezhikkara (10.1053°N 76.2392°E), Kuzhupilly (10.1694°N 76.1711°E), Njarackkal (10.9254°N 79.8380°E), Kumbalanghi (9.8761°N 76.2871°E) and Chellanam (9.8394°N) (76.2740°E). The study employs both survey and direct observation techniques. Fortnightly visits were conducted. The issues related to cultivation were identified and recorded. Data was collected from farmers, agriculture officers, experts, Pokkali Samrakshana Samities and Pokkali Land Development Agency (PLDA). Climatic changes, variations in the physico-chemical parameters and cultivation patterns were recorded. The biodiversity (avifauna, fish and flora) of the study area was also identified and meticulously recorded. Pokkali cultivation is a part of our culture. It is currently threatened by a number of issues, including ecological, socio-economic and anthropogenic and it has been discovered that the fields are dwindling. Hence, it is important to take prompt action to ensure their healthy perpetuation, protection and conservation.

**Keywords:** *GI, Vembanad Ramsar site, Central Asian Indian Flyway, Organic farming, Sustainable Future*

## **Introduction**

Rice is a staple food that provides 20 percent of the world's diet. The nutrient content of rice varies according to its variety and environmental conditions (FAO, 2004). The Pokkali is a distinctive, tall, traditional rice variety, impervious to salinity with a Geographical Indication (GI). It is cultivated organically in the coastal regions of Ernakulam, Alappuzha and Thrissur districts of Kerala, India. This rice variety is over 3000 years old and is famous for its flavour, protein content and medicinal properties (Tomy *et al.*, 1984).

The Pokkali fields are an archaeological milieu ecosystem near the Vembanad Lake and Arabian Sea with rich biodiversity and the ability to sustain alternatively paddy (during the low saline phase, i.e. June - September/ mid October) and prawns/shrimps/fishes/mollusc (during the high saline phase, i.e. September/ mid October - March) in an organic manner. The cultivation depends on the quality of the field soil, water and decomposition rate of the paddy stubbles and the symbiotic association of rice and prawn. The cultivation strictly relies on nature and the climate (Thampy, 2002; Sasidharan, 2006; Jayan and Nithya, 2010).

Wetlands are the 'Kidneys of Earth'. They are vital productive life support systems in the world (Mitsch and Gooselink, 2000). Wetlands alone support 20% of the known range of biodiversity in India (Deepa and Ramachandran, 1999). Among the various states of the country, Kerala stands first in having the largest area under wetlands and Pokkali cultivation (Nayar and Nayar, 1997). The Pokkali cultivation has been done in 33 panchayaths in Kerala. The Pokkali wetlands of Ernakulam District comprise of 4050 hectares whereas in Alappuzha and Thrissur Districts, they extend to 997 and 655 hectares respectively (PLDA, 2019). These areas are Important Bird Areas (IBA), which are part of the Central Asian Flyway and the Vembanad Ramsar site (Wetlands International, 2007). These regions are highly nutritive, biodegradable and biodiverse, providing umpteen services (Suchitra and Venugopal, 2002). The Pokkali fields are tidal wetlands which are invaded by tides twice a day. The tides play a pivotal role in the fertility and productivity of the agro-ecosystem. The fields can hold water logging and flooding (Shylaraj and Sasidharan, 2005; Jayan and Nithya, 2010).

The UN Millennium Ecosystem Assessment determined that environmental degradation is more prominent within wetlands than in any other ecosystem on Earth (Davidson *et al.*, 2003). Sustainable development is possible only without the depletion of natural resources. Wetland conservation is essential for sustainable development and improving human well-being. A sustainable society is one that meets the needs of the present without compromising the demands of future generations. A sustainable society is only possible through sustainable living and development. Natural farming or Eco-farming is one of the successful techniques for sustainable development. The natural cultivation method practised in the Pokkali land is internationally acclaimed as a sustainable approach (Shylaraj and Sasidharan, 2005).

The sustainability of wetlands greatly relies on the dynamics of water supply and loss. The Ramsar Convention defines wise use of wetlands as "maintenance of their ecological character achieved through implementation of ecosystem approaches within the context of sustainable development". Wise use is essential for the benefit of people and nature.

## **Study Objectives and Methodology**

A detailed study was carried out from 01<sup>st</sup> June 2016 to 31<sup>th</sup> May 2022 in the Pokkali wetlands of Ernakulam District, Kerala to study the issues of Pokkali cultivation and the need to conserve them for a sustainable future. Six different Pokkali fields were selected as sample sites for the study: Kadamakkudy (10.0634°N 76.2494°E), Ezhikkara (10.1053°N 76.2392°E), Kuzhupilly (10.1694°N 76.1711°E), Njarackkal (10.9254°N 79.8380°E), Kumbalanghi (9.8761°N 76.2871°E) and Chellanam (9.8394°N) (76.2740°E). Paddy cultivation was practised during the low saline phase, followed by prawns/shrimps/fishes/mollusc cultivation in the high saline phase. The study employs both survey and direct observation techniques (Altman, 1974). Fortnightly visits were conducted. The issues related to cultivation were identified and recorded. Data was collected from farmers, agriculture officers, experts, Pokkali Samrakshana Samities, and Pokkali Land Development Agency (PLDA). Climatic changes, variations in the physico-chemical parameters and cultivation patterns were recorded. The biodiversity (avifauna, fish and flora) of the study area was also identified and meticulously recorded (Talwar and Jhingran, 1991; Ali, 1996). Analysis of the water and soil samples from the Pokkali fields was carried out using standard methods (APHA, 1995). Photographs were taken using a digital camera (Canon EOS 700D). The correlation was analysed using PAST software.

## Results and Discussions

During the study, several ecological, socio-economic and anthropogenic issues associated with farming were examined and recorded.

Pokkali cultivation strictly depends on the climate. A lot of changes have been recorded in the patterns of summer rains and monsoons during the past decade (Gopakumar, 2011). On analysing the global mean surface temperature, it was noticed that the temperature is rising. According to NOAA, 2017 was the third-warmest year globally (NASA ranked it as the second warmest year). During the study, it was recorded that the climate has become more erratic. The South-West monsoon and tidal action of the Arabian sea had an influence on the paddy cultivation as well as the growth, survival and harvest of prawns, shrimps, fishes and mollusc. The drizzle is essential for sowing the sprouted seeds. As a result of changes in precipitation patterns, the farmers were unable to sow the seeds in time. It was observed that the changes in the weather patterns also affected the migration of the prawns, shrimps and fishes from the sea to the fields. This led to a decrease in production. As a result, the farmers have been compelled to purchase prawn, shrimp and fish seeds, raising their production costs.

During the low saline phase, pokkali rice is grown in the fields, whereas the high saline phase is used for prawn, shrimp and fish farming. Changes in the water levels have been noticed as a result of climatic and weather changes. The symbiotic relationship between the prawn and rice was disrupted by changes in agricultural methods, which in turn disrupted the ecological balance.

Despite the fact that pokkali has the ability to withstand waterlogging, the 2018 floods severely damaged the crop. Even though increased water levels favour plant growth, the high flow rate destroyed the majority of the crops. The 2019 floods also lowered the yield. It was observed that the farmers were losing their produce completely or partially owing to a break in the monsoon or unseasonal floods. Variations in the physico-chemical parameters of air, soil and water were recorded during the study. These changes also had an impact on the production as well.

The paddy yield was reduced due to attacks by tortoises, rats and birds such as Grey-headed Swampphen *Porphyrio porphyrio*, Garganey *Spatula querquedula*, Little Grebe *Tachybaptus ruficollis capensis* and Greylag Goose *Anser anser*.

Similar issues were recorded by Suchitra and Venugopal (2002), Shylaraj and Sasidharan (2005), Vijesh *et al.* (2006), Jayan and Nithya (2010), Deepa (2015), Tomy (2016) and Shamna and Vasantha (2017).

The invasion of weeds also decreased the yield. Increased weed growth in the bunds and adjoining areas provided a favourable feeding, breeding and nesting environment for Grey-headed Swamphen that damaged the pokkali plants which are ready to harvest.

Weeds compete for scarce resources such as water, nutrients and light along with cultivated food crops (Akobundu, 1987; Oudhia, 2004). Weed infestations also promote disease, serve as an alternate host for harmful insects, hinder harvesting operations and increase production costs (Holm *et al.*, 1977).

Another important threat is river pollution. The health and survival of crustaceans, fishes and mollusc were affected by contaminated water. Various infections such as Yellow Spot and White Spot were also found to have an impact. The yield is also lowered as a result of plastic contamination. It had a negative impact on soil fertility and paddy production.

"Kettukalakkal" is the final prawn harvest celebrated at the end of the prawn cultivation season (usually at the end of March). Nowadays, it is celebrated as a part of tourism as well. During the festival, boating and fishing were permitted in the fields. It polluted the fields and adjoining areas.

During the study, it was noticed that the majority of the pokkali farmers were older people. At present, only a few young farmers are following this traditional cultivation. This shows that the new generation is drifting away from agriculture. Most of the younger generation prefer white-collar jobs. They are either unaware or ignore the value of this traditional cultivation.

Another critical issue is the scarcity of skilled farm hands. Field preparation, sowing, replanting and harvesting all necessitate special skills. For the paddy harvest, the labourers must stand in knee-deep water. As a result, the work is rather strenuous. The labourers are not satisfied with their current pay, and they demand an increase in wages. High labour costs drive up output costs, rendering paddy cultivation non-profitable.

Lack of mechanisation is another threat. Activities such as ploughing and tilling are still done manually since tractors can't be operated on the clayey soils. The farmers are in great need of machinery that will help them to prepare and dismantle the mounds as well as harvesting the crop. During the study, a prototype of the paddy harvesting machine was tested but was found to be ineffective.

The traditional pokkali seed and farming practices are on the verge of extinction. Farmers are unable to save seeds for the following season due to the lower crop. During the survey, it was discovered that most farmers nowadays do not grow the traditional rice variety. Instead, hybrid varieties such as Vytilla 6, Vytilla 11, Ezhome 1 and Ezhome 4 are being grown.

When comparing the decomposition rates of traditional and hybrid pokkali varieties, it was discovered that hybrid varieties decompose at a faster pace than traditional varieties. This had an impact on the prawn-rice symbiotic relationship. Due to the variations in the decomposition rate of the paddy stubbles left in the field after the harvest, the prawns, shrimps and fishes experience food scarcity. As a result, additional feed has to be provided, which adds up the production cost.

The monoculture of prawn is a new challenge to the conservation of indigenous pokkali rice. During the study, it was recorded that there was a drastic decline in the number of pokkali farmers and fields in the district. The farmers are increasing the depth of their fields in order to boost prawn, shrimp and fish output. In subsequent seasons, the field will be unsuited for paddy cultivation. In comparison to

conventional rotational farming, monoculture is an unsustainable approach in socio-ecological contexts. The best alternative for greater production and soil fertility is rotational agriculture, which can be described as a sustainable technique.

There was a dearth of government encouragement in the form of subsidies or premium prices. There was also a lack of appealing export policies. The government does not pay the Minimum Support Price (M.S.P.) for pokkali rice. As a result, the farmers were compelled to sell their harvest at a loss.

Wetlands are more vulnerable to environmental degradation than any other ecosystem on earth, according to the UN Millennium Ecosystem Assessment (Davidson *et al.*, 2003). Natural resource conservation is the only way to achieve sustainable development. The dynamics of water supply and loss are crucial to the long-term viability of wetlands. For the sake of the people and the environment, wise use is required. A sustainable society is one that satisfies current needs without jeopardising the requirements of future generations. Sustainable development is the only way to achieve a sustainable society. Natural farming is a proven method for achieving long-term development. Pokkali farming is an environmentally friendly practise that has gained international recognition as a long-term solution (Shylaraj and Sasidharan, 2005).

During the study, it was noticed that some pokkali fields are illegally filled for the construction of flats and hospitals. The fields under cultivation were found to be shrinking. Farmers are forced to abandon or sell their lands due to lower profit margins. A decrease in the pokkali lands disrupts the ecological balance.

Pokkali fields covered 25,000 acres of land a few decades ago (Suchitra and Venugopal, 2002). In the Ernakulam district, these wetlands cover 4050 ha, while in the Alappuzha and Thrissur districts, it is 997 and 655 ha, respectively (PLDA, 2019).

It was observed that the mangrove barks or entire trees were being cut down, affecting the biodiversity. It limited the resting, feeding and breeding areas accessible to the birds. The avian population in the study area was affected by tourism and filming activities too. It was observed that numerous birds, particularly fish eaters, were trapped in the nets hung by the farmers in the fields during the prawn cultivation season. The carelessly disposed masks that were used to prevent the Corona disease got attached to the legs and beaks of birds, causing them trouble. The attack of stray dogs was also noticed during the study. The decreased prawn harvest, illegal cutting of mangroves or tree barks and filling up of paddy fields also affected the avian population in the study area.

The mangroves and wetlands of Kerala are deteriorating. Various development projects in Ernakulam have resulted in the huge devastation of mangroves and wetlands during the last few decades. Mangrove loss will have great ecological and economic effects. Conversion of the mangroves and paddy fields leads to the loss of biodiversity. The natural bio-filter functions were lost when these areas were converted to shrimp farms. This can be related to the reduced production of pokkali, crustaceans and fishes (Tomlinson, 1986; Basha, 1991).

The pokkali fields are shrinking. If this situation continues, this precious agricultural practice will be lost from our culture within the next five years, disrupting the ecological balance.

### **Recommendations**

Many more steps are need to be taken for the protection and conservation of pokkali cultivation. Mechanisation should be implemented to reduce the manual work and production costs. Help from young researchers and mechanics can be sought.

Pokkali rice should get a premium through better marketing. The attack of birds should be addressed as a serious issue and immediate solutions should be adopted. The export potential of pokkali rice should be fully explored and exploited. More interventions by scientists and researchers from the Department of Agriculture and Ministry are essential to find solutions to the problems.

Eco-tourism can be promoted in a balanced mode without disturbing the equilibrium of nature. The seasonal rotation of paddy and prawn should be done for a better yield. New high-yielding hybrid varieties of rice and the high cost of production have contributed to its near-extinct status. It's a part of our culture, and it's our duty to protect the traditional pokkali seeds and wetlands for a sustainable future.

The government should adopt the necessary measures to regain the lost glory of this traditional farming method. Labourers under the MGNRE (Mahatma Gandhi National Rural Employment) scheme should be used for cultivation activities. Implement new packages to reduce the production costs. Also, the necessary machines. Group farming activities can be promoted. Seminars and awareness should be conducted. Special support should be given to young farmers in this field. Support should be given to farmers to make by-products (rice bran, rice husks, broken rice, rice glue and rice-based food products). The activities of Pokkali Samrakshana Samiti (Pokkali conservation agitation committee) and Pokkali Land Development Agency should be promoted.

Regular patrolling can be deployed in the Pokkali lands to monitor and prevent the poaching of birds, especially during the migratory season. Necessary conservation programs should be established to protect birds and their habitats. Restoration of mangroves in the study area should be executed. As the Pokkali wetlands are an Important Bird Area and are rich with biodiversity, the State and Central Government should establish an Integrated Conservation and Development Program for their protection. More research studies should be conducted to study the role of birds and their seasonal fluctuations which can be correlated with habitat and climatic changes. An updated bio-diversity register with special emphasis on endangered and migratory species should be maintained in every panchayath. Various avian and biodiversity conservation days should be strictly celebrated in schools, colleges, local Eco and Farmers clubs to create awareness. Strict laws should be followed, as well as public awareness and participation which are critical.

## **Conclusion**

Pokkali cultivation is a part of our culture. It is currently threatened by a number of issues, including ecological, socio-economic, and anthropogenic and it has been discovered that the fields are dwindling. The traditional Pokkali seed and farming practices are on the verge of extinction. Hence, it is important to take prompt action to ensure their healthy perpetuation, protection and conservation. Conservation of these organic rice cultivation and Pokkali wetlands is essential for a sustainable future.

## **Acknowledgements**

Thanks to the Chairman, Vice Chairman and Group Directors of SCMS School of Technology and Management, Kalamassery for the support. Thanks to Dr. Sethulekshmy Nair, Deputy Director of the SCMS Institute of Bioscience and Biotechnology Research and Development, Cochin for the advice and encouragement. Thanks to Dr. Varughese Mathew, Principal of Mar Thoma College, Tiruvalla; Dr. Sugathan R., Research Director, Salim Ali Bird Sanctuary, Thattekkad and Dr. John George M., Associate Professor (Rtd.), Mar Thoma College, Tiruvalla, for the timely advice. Thanks for the financial support by the M.G. University, Kottayam. We also thank Dr. L. Krishnan, Senior Scientist (Rtd.) of CMFRI, Kochi, Pradeep Kedamangalam and committee members of Pokkali Land Development Agency (PLDA), North

Paravur and farmers for their valuable help and support for data collection. Also thanks to the librarians of KFRI, Peechi and CMFRI, Kochi.

## References

- Akobundu, I.O., (1987). *Weed Science in the Tropics: Principles and Practices*. Chichester, Great Britain, John and Wiley. p.59-69.
- Ali, S., (1996). *The Book of Indian Birds*. BNHS & Oxford University Press. 12 th edition. p.66.
- Altman J., (1974). *Observational study of behaviour: sampling methods*. *Behaviour*, 49(3): 227-267.
- APHA, (1995). *Standard Methods for Examination of Water and Wastewater*. 19th edition. American Public Health Association, Washington D.C., US.
- Basha, S.C., (1991). *Distribution of Mangroves in Kerala*. *Indian Forester*, 117(6): 439-448.
- Davidson, O., Halsnaes, K., Huq, S., Kok, M., Metz, B., Sukona, Y., Verhagen, J., (2003). *The Development and Climate Nexus: the Sub-Saharan Africa*. *Climate Policy*, 3S1: S97-S113.
- Deepa, K.M., (2015). *Seasonal Variation in avifauna with Respect to Habitat Changes in the Pokkali fields of Ernakulam District, Kerala*. Ph.D. Thesis, Mahatma Gandhi University, Kottayam.
- Deepa, R.S., Ramachandran, T.V., (1999). *Impact of urbanization in the interconnectivity of wetlands*. Indian Society of Remote Sensing, India.
- Food and Agriculture Organization (FAO), (2004). *Rice is Life*, Italy, FAO. Available at <http://www.fao.org/newsroom/en/200436887/index.html>
- Gopakumar, C.S., (2011). *Impacts of Climate Variability in Agriculture in Kerala*. Ph.D. Thesis, Cochin University of Science and Technology, Cochin, Kerala, India.
- Holm, I.G., Plucknett, D.L., Pancho, J.V., Herberger, J.P., (1997). *The world worst weeds: Distribution and Biology*, Honolulu University Press of Hawaii. p.609.
- Jayan, P.P., Nithya, S., (2010). *Overview of farming practices in the water-logged areas of Kerala, India*. *Biological Engineering*. 3 (4): 28-43.
- Mitsch, M.J., Gosselink, J.G., (2000). *The Value of Wetlands: The Importance of Scale and Landscape Setting*. *Ecological Economics*, 35(1): 25-33.
- Nayar, S., Nayar, N.M., (1997). *Wetlands in the natural resource of Kerala, WWF for nature in India*. p.363-374.
- Oudhia, P., (2004). *Phyto-sociological studies of rainy waste land weeds with special reference to Parthenrium hysterophous*. Available at <http://www.iprng.org/IPRNG15.html>
- Pokkali Land Development Agency (PLDA), (2019). *Pokkali Land Development Agency Report (2019-2020)*. "Pokklai Nelkrishi – Vikasanam Project 2019-2020. Pokkali Land Development Agency (PLDA), North Paravur.
- Sasidharan, N.K., (2006). *Pokkali-The world acclaimed farming system model*. In: Balachandran, P.V., Louis, V., Padmakumar, K.G., (eds.). *Rice-Fish Integration Through Organic Farming*. Agro-Tech Publishing Academy, Udaipur. p.75-86.

- Shamna, N., Vasantha, R., (2017). A Study on Farmers Perception on Problems of Pokkali Rice Farming in the State of Kerala. *Indian Research Journal of Extension Education*, 17(4): 42-47.
- Suchitra, M., Venugopal, P.N., (2002). In troubled waters. *Agriculture*, 36(4): 118-125.
- Shylaraj, K.S., Sasidharan, N.K., (2005). VTL 5: A high yielding salinity tolerant rice variety for the coastal saline ecosystems of Kerala. *Journal of Tropical Agriculture*, 43(1-2): 25-28.
- Talwar, P.K., Jhingran, A.G., (1991). *Inland fishes of India and adjacent countries*. Oxford and IBH Publishing Corporated, Private Limited, New Delhi.
- Thampy, D.M., (2002). Development of fisheries in the wetland ecosystem of Kerala. In: Kokkal, K., Premachandran, P.N., *Wetland Conservation and Management in Kerala*. Bijukumar, A., (eds.). State Committee on Science, Technology and Environment, Thiruvananthapuram, Kerala. p.141-145.
- Tomlinson, P.B., (1986). *The Botany of Mangroves*. Cambridge University Press, Cambridge, London, New York.
- Tomy, F., (2016). Seasonal Variation in avifauna with Respect to Habitat Changes in the Kole Wetlands of Thrissur District, Kerala. Ph.D. Thesis, Mahatma Gandhi University, Kottayam.
- Tomy, P.J., George, T.U., Suseela J., (1984). Pokkali cultivation in Kerala, Kerala Agricultural University, Thrissur, Kerala. p.1-2020.
- Vijesh, V.K., Suryaprakashand, S., Sethulekshmi, K.R., (2006). On conserving the indigenous-organic rice farming system of coastal Kerala, India. In: *Proceedings of Prosperity and Poverty in a Globalized World: Challenges for Agricultural Research*, conducted at University of Bonn, Germany, October 11-13. p.1123-1242.
- Wetlands International, (2007). *Central Asian Flyway interim co-ordination. Wetlands for water and life*. Wetlands International. 9th edition. Horapark, The Netherlands.