



TRADITIONAL RICE-FISH FARMING SYSTEM IN THE SALINITY PRONE COASTAL WETLANDS OF KERALA

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(Photo: K P Vincent)

Presence of and saltwater aquifer and the tide oscillation level leads to the evolution of unique ecosystems in coastal areas where development of soil and vegetation are strongly linked to the time of submergence, oxygen diffusion mechanisms, and high salinity levels (Ding et al., 2010; Zuo et al., 2012). One of the best examples for this phenomenon is the salinity prone coastal wetlands of Kerala. These salinity prone coastal wetlands are located as small patches along the coastal tract of the state in Ernakulam, Alappuzha, Thrissur and Kannur districts (figure 1).

These ecosystems are low lying marshes located near the estuaries of rivers and streams which are naturally connected to the Arabian Sea. The river networks act as the inlet for the entry of saline water in to the coastal wetlands during high tide and keep the land submerged for most part of the year. Soils of these coastal wetlands are categorized as saline hydromorphic (acid saline) and rice is the only crop grown traditionally in these soils. After the harvest of rice crop these coastal wetlands are used for growing fish, prawn and shrimp.

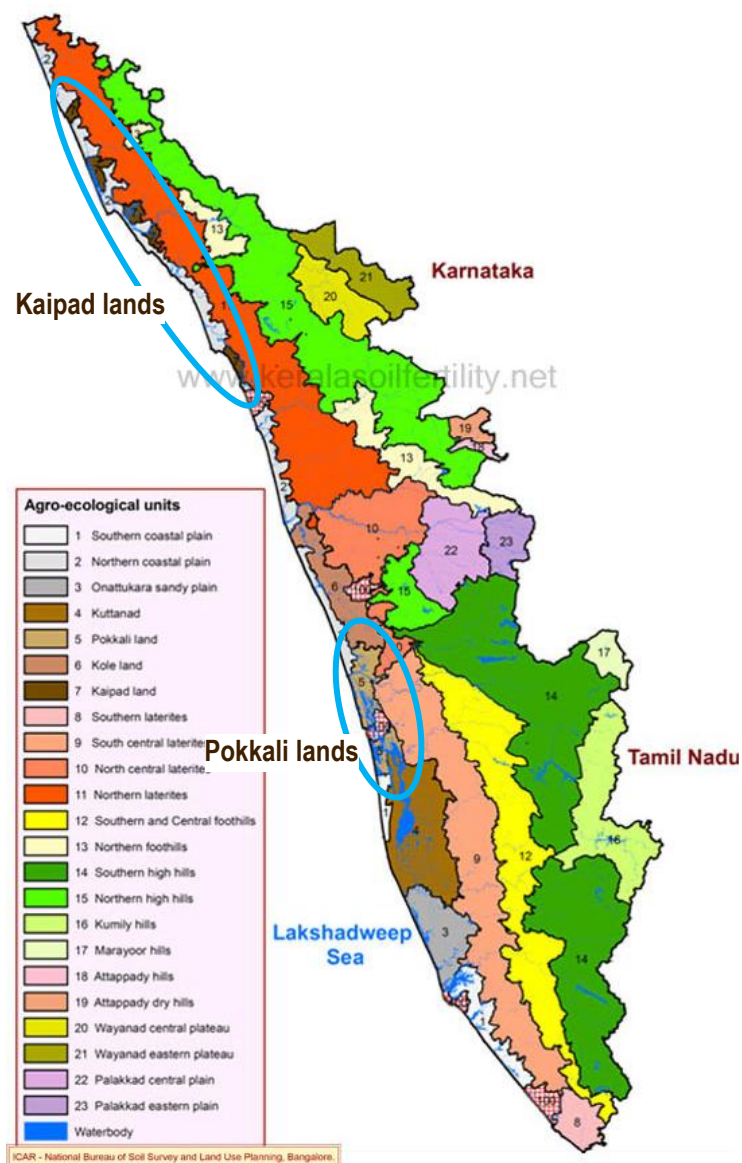


Figure 1: Map showing different agro-ecological zones of Kerala State

(Source: <http://www.keralasoilfertility.net/en/agroecology.jsp>)

Rice is grown organically in salinity prone coastal wetlands using traditional saline tolerant rice varieties and the farming practices in these agroecosystem is mainly based on the traditional knowledge base of the farmers. These special rice growing tracts are known as *Pokkali lands* in the south and central Kerala districts. These are spread in an area of 25000 ha in Alappuzha, Ernakulam and Thrissur districts. *Pokkali lands* got that name because of the use of salinity tolerant rice cultivar *Pokkali* for cultivation in the wetlands. This cultivar is enormously tall (160-200 cm) and a healthy plant produces around (12-16 tillers per plant). *Pokkali* is the shortened version of two Malayalam words *pokkathil* which means tall and *aali* means abundant growth. In north Kerala, it is named as *Kaipad lands* that are spread in an area of around 4100 ha in Kozhikode, Kannur and Kasaragod districts. *Kaipad lands* got the name from two Malayalam words *kayal* meaning salt water lake and *padam* which means rice field.

These coastal wetlands are subjected to tidal action throughout the year. Saline water enters in to coastal wetlands during high tide that raises water level about 1-1.3 meter more and water flows out of the land during low tide even to an extent that the soil will be visible. During summer months, saline water enters to these coastal wetlands through estuaries of rivers and streams makes the soil highly saline and unfit for cultivation. However, during monsoon season these wetlands experience flood and flood water washes excess salts away from the soils and make it less saline.

SOIL CHARACTERISTICS

Though the *pokkali* and *kaipad* lands have some differences in properties; in general these saline hydromorphic soils of Kerala coastal wetlands are clay textured deep soils with high water holding capacity. These soils used to have a bluish black colour with light grey colour on surface. They develop fissures when dry and sticky when wet.

Studies revealed that during high saline phase pH and EC of *Kaipad* soils used to be in the range 3.40 to 6.48 and 9.72 dSm⁻¹ to 29.00 dSm⁻¹ whereas that of *Pokkali* soils used to be in the range of 3.31 to 6.46 and 0.10 dSm⁻¹ to 9.80 dSm⁻¹. Regarding nutrient status, these soils have high organic carbon content (0.45-2.90% in *pokkali* soils and 0.53-3.34% in *kaipad* soils). These soils are high in available nitrogen, potassium, and sulphur content but low in available phosphorus and magnesium content (Sreelatha & Shylaraj, 2017; Santhi *et al*, 2017).



CULTIVATION PRACTICES

Rice-Fish cultivation in the salinity prawn coastal wetlands is not merely a farming practice to the farmers of the society but it is a culture interwoven strongly with the way of life of the people of the respective societies. Most of the agricultural activities of this agro-ecosystem require collective action of the farmers. For example, in this coastal rice growing tracts flow of saline water in to the field and is controlled using wooden sluice gates fixed on mud bunds which are constructed around the paddy fields. Farmers do strengthening of bunds in each season, opening and closing of sluice gates etc through collective efforts.

Land preparation for the paddy cultivation starts by the mid April by draining the saline water from the field and by closing the sluice gates. Then fields are allowed to dry for nearly about a month. Once the fields are dry; the farmers plough the land and prepare beds (*Pokkali*) or small mounds (*Kaipad*) manually (figure 2a & 2b).

During monsoon when rainwater washes away excess salts from seed beds/mounds farmers spread germinated paddy seeds on beds/mounds and cover it with a thin layer of mud (figure 3a & 3b) to protect seeds from the flocks of weaver birds (*Ploceus philippinus*) which visit these paddy fields during the crop season. Saline tolerant traditional landraces like *Kuthir* and *Orkkayama* are widely grown in Kaipad lands whereas *Pokkali*, *Cheruvirippu* and *Chettivirippu* in Pokkali lands.

Nursery beds/mounds are dismantled when seedlings become ready for transplanting usually in a month or two (figure 4a & 4b). Transplanting practice is different from that of other wetland rice systems. Seedlings are lifted along with soil in bits without disturbing the roots using spade, and thrown to empty spaces around the mound to place them

firmly in the soil. Crowding of seedlings used to be managed through simultaneous spreading by women labourers (figure 5).



Figure 2(a) Land preparation in Pokkali lands



Figure 3(b) Soil mounds prepared before monsoon in Kaipad lands



Figure 3: (a) Mounds ready for sowing (b) Spreading of germinated seeds on mounds in Kaipad lands



Figure 4: Paddy nurseries (a) Kaipad land (b) Pokkali land

Generally manuring and intercultural operations are not practiced for the paddy crop in these special rice growing tracts.



These agro-ecosystems are famous for their rich biodiversity and sustainable enough to manage pest and diseases through natural enemies. Weaver birds are the prime predator of rice pests along with other life forms of these ecosystems like predatory fishes, frogs and other water birds. The crop will be ready for harvest in 120-160 days and harvesting usually done during September-October months. Generally panicle along with small portion of the stem will be visible outside the water level at the time of harvest especially in the Pokkali lands (figure 6).

Both “Pokkali rice” and “Kaipad rice” have obtained Geographical Indications (GI) tag in the years 2007 and 2013 respectively.



Figure 5: Rice crop after dismantling nursery beds in Pokkali lands



Figure 6: Rice crop ready for harvesting in Pokkali lands

Since rotational paddy-fish or prawn culture is a general practice in these fields; the farmers cut only the panicle along with a small portion of rice stem at the time of harvesting. After paddy harvest saline water flow starts again in to field in tidal action. Crop stubbles left unharvested in the field get decomposed in this water and that in turn activate algal growth. This creates ideal condition

not only for the growth various types of fish and prawn but also provide feed for different migratory birds that visit the field during the season.

The aquaculture in these salinity prone coastal wetlands starts with the strengthening of bunds around the paddy field using wild grasses and mud collected from backwaters. Farmers open the sluice gates to allow low of saline water in to the field. Along with saline water number of fish and prawn fingerlings swim into these wetlands. To trap these fingerlings in the field large conical net or closely packed bamboo baskets are placed in the sluice gate. This structure will prevent escape of fingerlings back to the river/stream. Harvest of prawns and fish starts generally in January and continue up to April till the start of land preparation for the next rice crop.

The research of Quang Tu (2015) in the Mekong Delta of Vietnam conveyed that that there are 30% less risk of any disease outbreak for prawn in the rice-shrimp culture than mono shrimp culture as rice crop acts as natural filtration system to minimize risks of disease outbreak for prawn.

ECOLOGICAL ADVANTAGES

The traditional rice-fish farming systems in Kaipad and Pokkali lands are known for their ecological sustainability. As these wetlands hold more rain water, it will not only control flood but also recharge ground water aquifers. Moreover, it acts as a sink for Carbon and reduces emission of green house gases to the atmosphere. These wetlands are less polluted with chemicals as there is no use of external inputs at any stage of the paddy cultivation as well as aqua culture. The system promotes enrichment of biodiversity by providing food for various birds and aquatic life forms throughout the year.



CONSTRAINTS

Data with Government of Kerala shows that paddy cultivation in these coastal wetlands has declined drastically in the past three decades. There are many reasons behind this trend and some of them are

- Conversion of coastal wetlands for plantation crops like coconut
- Fallowing of wetlands due to labour shortage
- Reclamation of wetlands for tourism and other development activities
- Farmers' disinterest in continuing with paddy cultivation in the system due to less profitability compared to earlier years. Moreover, no agricultural machineries are available for paddy cultivation in these coastal wetlands to replace manual labour.
- Growth of aquatic plants like 'water hyacinth' in the fallow wetlands also acts as a hurdle for this wetland rice cultivation.

CONCLUSION

In recent years agriculture is increasingly getting blamed for not only for economic reasons but also for ecological reasons. In this scenario the importance of traditional agro-ecosystems like *Pokkali* and *Kiapad* that ensure the ecological, economic and social components of agricultural sustainability are increasing. These agro-ecosystems need not only support from the government to continue but the traditional knowledge need to be preserved.

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