Analysis of Physico-chemical parameters of sediment in selected paddy fields of Kanyakumari district, Tamilnadu, India

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ABSTRACT

During the last few years there has been an increasing trend to monitoring soil quality analysis of various agricultural lands for cultivation purpose by regular measurement of their physico-chemical characteristics. The sediment samples were collected for the period of 6 months during monsoon season and post monsoon seasons (September 2010 to November 2010) for the determination of physico-chemical parameters in eight paddy fields of four taluks in Kanyakumari District. Physico-chemical parameters like pH, Electrical Conductivity, Nitrogen, Phosphorous and Potassium content were recorded from the sediment samples. The present investigation suggests that the increasing pollution along with chemical fertilizers and pesticides may affect the health of the paddy field environment and sediment dwelling organisms and resulting in decrease survival, reduced growth and species diversity.

Key words: *Physico-chemical parameter, Paddy field, sediment, monsoon season, post monsoon season.*

1. Introduction

Paddy cultivation is one of the most long-term sustainable cropping systems and rice is the only major crop cultivated in monoculture for centuries without severe soil degradation. Rice fields are temporary wetland ecosystem and an important habitat for a multitude of aquatic species[1]. Rice is cultivated in 12 countries covering every continent and is consumed by 2500 million people in the developing countries[2]. India has the largest paddy output and also second largest exporter of rice in the world. The areas estimates of paddy cultivation in India is 40.9 million ha[3,4]. In Tamil Nadu, rice is cultivated 21.1 million hectares with a total production of 8.19 million tones and an average yield of 3.4 t/ha[5]. In addition to the economic benefits, rice fields play numerous ecological roles including maintenance of trophic structures, nutrient recycling, ground water recharge and most importantly harbours diverse floral and faunal communities[6,7].

Soils and sediments are repositories for physical and biological debris and sinks for a wide variety of chemicals[8]. Soil variability in paddy fields is well recognized where its spatial variability and seasonal variability of soil chemical and physical properties within a field are unavoidable. Sediments are complex environments, with varying physicochemical characteristics, such as composition and type of organic matter, particle size, distribution and pH. Monitoring of this sediment quality is an important part of preserving and restoring the biological integrity of water bodies as well as protecting aquatic life and human health. Soil contains diverse living organisms making the aquatic environment more stable. The nature and rate of

sedimentation depends mostly on the nature of water transport and ecological stress [9]. Physico-chemical Parameters is very essential and important to test the sediment before it is used for agricultural purpose to identify the soil quality. The objective of this study was to assess the physico-chemical characteristics of sediment in the selected paddy fields of Kanyakumari district.

2. Materials and methods

2.1. Study area

The eight paddy fields were selected for the present work from Parvathipuram (2 fields) of Agastheeswaram Taluk, Thottiyode (2 fields) of Kalkulam Taluk, Thovalai (2 fields) of Thovalai Taluk and Padanthalumoodu (2 fields) of Vilavancode Taluk in Kanyakumari District.

2.2. Sediment sampling

Sediment samples were collected from 8 paddy fields in polythene bags for physico-chemical analysis. Samples were air dried and impurities such as decayed wood pieces, shells of mollucs etc were removed. The dried sediment was then passed through a 2 mm sieve to remove coarse particles; the sieved soil was then sub-sampled and ground to a fine powder by using a mortar and pestle. Physico-chemical parameters such as pH, Electrical conductivity, Nitrogen, Potassium and Phosphorus were analyzed in soil samples.

3. Results and Discussion

Physico-chemical parameters of sediment samples recorded during monsoon and post monsoon seasons from the selected rice fields (Tables 1 and 2).

Table 1. Physico-chemical parameters of sediment samples recorded from the study fields during monsoon

Sl. No	Parameters	Study area (Paddy field)							
		I	II	III	IV	V	VI	VII	VIII
1	pH	5.8 ± 0.30	6.0 ± 0.30	5.6 ± 0.29	5.9 ± 0.30	6.8 ± 0.32	5.2 ± 0.28	5.9 ± 0.30	6.98 ± 0.33
2	Electrical conductivity (dSm^{-1})	0.10 ± 0.03	0.20 ± 0.05	0.23 ± 0.05	0.26 ± 0.06	0.25 ± 0.06	0.13 ± 0.04	0.22 ± 0.05	0.06 ± 0.03
3	Nitrogen (mg/kg)	147 ± 1.51	154 ± 1.55	135 ± 1.45	128 ± 0.41	153 ± 1.54	79 ± 1.11	154 ± 1.55	154 ± 1.55
4	Phosphorous (mg/kg)	35 ± 0.73	30 ± 0.68	20 ± 0.55	60 ± 0.96	25 ± 0.625	25 ± 0.625	50 ± 0.88	60 ± 0.96
5	Potassium (mg/kg)	50 ± 0.88	75 ± 1.08	46 ± 0.84	68 ± 1.03	54 ± 0.91	43 ± 0.81	64 ± 1.0	86 ± 1.15

Table 2. Physico-chemical Parameters of sediment samples recorded from the study fields during post-monsoon

Sl. No	Parameters	Study area (Paddy field)							
		I	II	III	IV	V	VI	VII	VIII
1	pH	5.9 ± 0.30	5.4 ± 0.29	6.0 ± 0.30	4.9 ± 0.27	5.3 ± 0.28	5.0 ± 0.27	4.2 ± 0.25	4.4 ± 0.26
2	Electrical conductivity (dSm^{-1})	0.09 ± 0.037	0.86 ± 0.11	0.28 ± 0.066	0.41 ± 0.08	0.28 ± 0.06	0.15 ± 0.04	0.14 ±0.04	0.12 ± 0.04
3	Nitrogen (mg/kg)	95 ± 1.21	80 ± 1.11	87 ± 1.16	108 ± 1.29	92 ± 1.19	95 ± 1.21	98 ± 1.23	99 ± 1.24
4	Phosphorous (mg/kg)	6.0 ± 0.30	8.0 ± 0.35	10.0 ± 0.39	23 ± 0.66	8.0 ± 0.35	16.0 ± 0.5	26 ± 0.63	29 ± 0.67
5	Potassium (mg/kg)	37 ± 0.76	108 ± 1.29	58 ± 0.95	81 ± 1.125	34 ± 1.14	30 ± 0.68	54 ± 0.91	61 ± 0.97

The pH of the soil remains acidic throughout the study period. The soil pH varied from 4.22 – 6.68 and maximum mean pH was recorded during monsoon season (6.68 ± 0.34) in field VIII (Table 1 and 2). Many soil algal species are ubiquitous in distribution and in general blue green algae do not occur in soils at pH less than 4. The relative abundance of Cyanobacteria may be due to the rise in soil pH. The study revealed that the rice field soils of the region were very rich in blue green algal flora even at the pH 4.2 and wide variation in the abundance of the blue green algal species was observed and also reported by many workers from India[10-15]. However in soils of higher pH 6 and less than pH 4 many green algae can grow[16] In the present study pH occurs below 7 and several forms like Diatoms, Blue greens, Green algae, Euglenophyta and Xanthophyta were noticed which is similar to the earlier reports [17-18]

Electrical conductivity is a good measure of dissolved solids. In monsoon season, the electrical conductivity value ranged from 0.06 - 0.26 (Table 1) and 0.09 - 0.41 in post monsoon (Table 2). The relationship of electrical conductivity to variation in crop production caused by soil differences have been reported by several authors[19-22].

Sediment nutrients are considered as one of the most important parameters influencing growth, reproduction and metabolic activities of biotic components. Distribution of nutrients mainly based on season and water flow from the land. The nutrient levels of N, P and K reached their maximum in the month of october with respect to the highest percentage of blue green algae in the soil. The blue greens have a high affinity for phosphorous and compete other algae when the nutrients remained low. Marathe (1972) showed that the rate of algal growth increased by the addition of phosphate[23].

Nitrogen is an important nutrient element in the sediment and nitrogen sources are mainly the oxidation of nitrogenous organic matter. Nitrogen content in the sediment is depending upon local conditions like rainfall, quantities of fresh water inflows, turbulence and biological activities. Fertilizer nitrogen is applied to rice field in the form of ammonium. When a rice field is flooded, the fertilizer largely remains as ammonium and is taken up as ammonium by the rice plant[24]. The nitrogen concentration was recorded maximum during monsoon season 154 ± 1.55 in field II, VII and VIII.

Phosphorous content was recorded maximum during monsoon season 60 ± 0.96 in field IV and VIII. High Levels of both phosphate and nitrate can lead to eutrophication, which increases algae growth and ultimately reduces dissolved oxygen levels in the water[25]. It is widely assumed that nitrite concentrations in freshwaters are negligible and the worldwide average concentration has been estimated to be 1 mg of nitrite/liter[26].

Potassium content of rice field was significantly influenced by both irrigation water sources and fertilizer treatments. In the present study the potash content was recorded maximum during post monsoon season 161 ± 1.58 in field II. Potassium content was found higher when plants were fertilized with NPK and effluent wastes [27].

Conclusion

The present study provides baseline information of the physico-chemical characteristics of sediment quality in the fields of Parvathipuram, Padanthalumoodu, Thovalai and Thottiyode village. From this study, indicates that the physico-chemical characteristics of sediment quality are varied according to season. Physico-chemical properties of sediment significantly increased during the monsoon season, except for electrical conductivity and potassium content. From these results we can say all the parameters are more or less suitable for paddy cultivation except potash content. So, further studies are needed to verify the potash content of sediment in the rice field and also removal of excess potash from the soil.

5. References

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