J. Indian Soc. Coastal agric. Res. 31(1): 8-10 (2013)

Sediment Characteristics of Some Brackish Water Shrimp Ponds Near by Panvel in Raigad District of Maharashtra

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Received: 02.07.2013 Accepted: 30.08.2013

Sediment features of some shrimp ponds at Panvel in Raigad district of Maharashtra were studied for a period of one year with two crops. The percentage of sand, silt and clay in the sediment of shrimp ponds was in the range of 50.76 - 67.48, 26.92 - 41.28 and 5.24 - 12.24%, respectively in crop I. The corresponding values in crop II were 45.48 - 61.48, 32.68 - 49.28 and 5.24 - 12.24%, respectively. The pH of the sediment varied from 7.26 to 8.6 and 7.9 to 8.52 in crop I and II, respectively. Specific conductivity was in the range of 8.01 - 17.8ms for crop I and 30.5 - 16.58ms for crop II. Organic carbon content in crop I was 1.1 - 1.95%, while it was 0.3 - 1.41% in crop II. The available nitrogen was in the range of 25.48 - 51.54 and 7.84 - 28.56 mg100g^{-1} in crop I and II, respectively. The available phosphorous in crop I and II was in the range of 24.9 - 60 and 10.5 - 18.0 mg100g^{-1}, respectively in the pond sediment. The organic carbon content, available nitrogen and available phosphorous were significantly differed between crop I and crop II.

(***Key words:*** *Sediment characteristics, Shrimp pond, Organic carbon)*

Pond sediment plays an important role in the productivity. It acts as a store house of nutrients for the overlying water. It helps in mineralisation of organic matter and release of nutrients to water. It also provides shelter and food to the bottom biota, which have significant effect on productivity. It influences natural productivity, water quality and thereby survival, growth and production of shrimp in brackishwater ecosystem. The physico-chemical parameters of pond water are more or less reflected by characteristics of sediment (Boyd, 1990). Among the chemical characteristics of sediment, pH plays the most important role in shrimp farming. Rate of mineralisation of organic matter, inorganic transformation of soluble phosphate and control of adsorption and release of ions for essential nutrients at soil water interface are very much influenced by soil pH (Mohanty, 1999). Soil nitrogen required in protein synthesis is usually available in both complex organic and simple inorganic forms in soil. The bacterial activity in the mineralisation process to put the nutrient back into the production cycle depends largely on carbon content and carbon-nitrogen ratio (Mohanty, 1999).

MATERIALS AND METHODS

The study was conducted for a period of one year in commercial shrimp ponds of Panvel site covering two crops viz., Crop I (December to April) and Crop II (May to September). The sediment samples were collected at monthly intervals from four corners of shrimp ponds and dried under shade. Single composite sample was then formed for each pond and sieved through 2 mm sieve for further analysis. The parameters of sediment such as texture, pH, conductivity, organic carbon, available nitrogen and available phosphorus were estimated by following the standard methods (Jackson, 1967; Jhingran *et al.*, 1969 and Tandon, 1993). The data obtained were subjected to suitable statistical analyses to draw meaningful conclusions.

RESULTS AND DISCUSSION

Sediment texture

The percentage of sand, silt and clay was in the range of 50.76 - 67.48, 26.92 - 41.28 and 5.24 - 12.24, respectively in crop I, while it was 45.48 - 61.48, 32.68 - 49.28 and 5.24 - 12.24, respectively in crop II in the sediment of shrimp ponds. The t-test showed significant difference in mean value of sand, silt and clay percentage between Crop I and Crop II. There were no significant differences in sand, silt and clay contents with months during both crops. The low percentage of clay might be due to removal of top layer of soil during the excavation of ponds. Tape and Boyd (2002) observed accumulation of soft sedimentswith the age of the ponds. In the present study, accumulation of higher silt might be due to the ageing factor. The percentage of sand was comparable with results of Gupta

et al., (1990). The silt percentage was more than that reported by Gupta *et al.*, (1990), but comparable with Das *et al.*, (2001). Clay was less than the values reported by these researchers. Significant negative correlation was observed between sand and silt during Crop II. There was also significant positive correlation ($P < 0.05$) between silt and organic carbon in ponds during Crop I.

pH

The pH of the sediment was in the range of 7.26 - 8.6 and 7.9 - 8.52 in crop I and II, respectively. The sediment pH was found alkaline during both the crops. The slightly alkaline pH was most probably due to submergence of pond sediment under tidal water. Neutral to slightly alkaline pH of pond sediment has been reported suitable for fish production (Ohle, 1938).

Specific conductivity

In the present study, the specific conductivity was in the range of 8.01 - 17.8ms for crop I and 3.05 - 16.58ms for crop II. There was a significantly negative relationship between specific conductivity and culture period from May to September at both sites during crop II.This may be attributed to freshwater influx during monsoon period.

Organic carbon

Organic carbon content of the sediment during crop I varied from 1.1 to 1.95%, while it varied from 0.3 - 1.41% during crop II (Fig. 1). Significant positive relationship between the mean value of organic carbon with crop period was found during crop II, but no such relationship was noticed during crop I. There was a significant difference in organic carbon content of sediments between Crop I and Crop II. It might be due to variation in residual feed materials, metabolites and organic matter between the two crops. A similar variation in the organic carbon content of the ponds has already been reported by several workers. The organic carbon content of the ponds of Kakdwip farm varied from 0.5 to 1.05% during monsoon season (Bhowmik *et al.*, 1987). Rajyalakshmi *et al.*, (1988) observed variation between 0.02 and 0.4% in the soils of Chilka lake fringe area. Venkatesan *et al.*, (2001) reported high value of organic carbon (1.05 – 5.13%) in sediment of shrimp ponds during pre-monsoon months at Cochin.

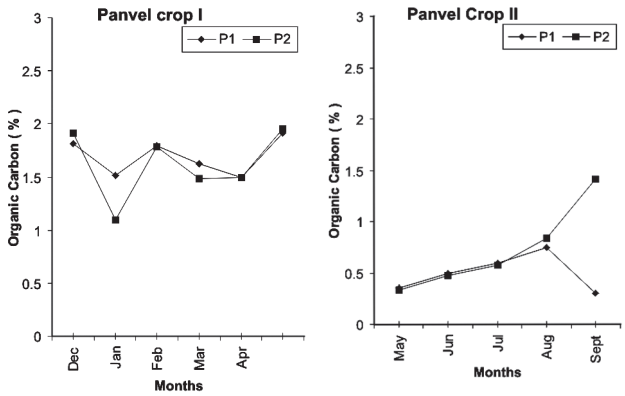

Fig. 1. Organic carbon content of the sediments in two different ponds located at Panvelin Raigad district of Maharashtra

Available nitrogen

The available nitrogen in the pond varied from 25.48 – 51.54 and 7.84 – 28.56 mg100g-1 for crop I and II, respectively. There wasa significantly positive correlation between available nitrogen and the progression in cropping period during both crops. This might be due to increase in supplementary feed with culture period. In the present investigation, the minimum available nitrogen was recorded during the initial phase of culture period and maximum during the final phase of culture period. It might be due to increase in input in the form of residual feed and increase in metabolite waste of shrimp. Blackburn *et al.*, (1988) reported that organic waste in the form of unconsumed feed pellets, faeces etc. accumulated in the sediment are degraded in to ammonia, nitrite and nitrate.

Available phosphorus

The available phosphrous varied from 24.9 to 60 and 10.5 to 18.0 $mg100g^{-1}$ for crop I and II, respectively. A significant difference ($t = 2.7733$, $P < 0.05$) was observed between the ponds. The t-test showed significant difference ($t = 6.3038$, $P < 0.05$) between Crop I and Crop II.The significant difference between the crops at Panvel might be due to variation in water flushing and exchange of water. Ansari and Rajagopal (1974) found much wider range i.e. sediment phosphorus 25.8 – 132 mg $100g^{-1}$ in mud from the Cochin backwaters.

ACKNOWLEDGEMENT

The authors are grateful to Dr. Vijay Mehta, Vice chancellor, Dr. B. S Konkan Krishi Vidyapeeth, Dapoli, Maharashtra for extending necessary facilities required for this study.

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