

## Evaluation of Soil Conditions of Maidhiya Pond of Birganj (Nepal)

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### Abstract

Soil conditions of Maidhiya pond (Birganj, Nepal) in relation to fish were studied during 2006 and 2007. Soil chemistry of this pond was found to be within the range of normal condition for aqua-culture process especially the fish culture. Favorable pH range, comparatively high phosphate content during monsoon and presence of moderate amounts of organic compounds were observed on the soil analysis of this pond. Organic carbon content of this pond remained in the range of moderate productivity being higher during post-monsoon and winter seasons. The potash content of the soil was highest during monsoon season might be due to inflow of this mineral along with the water from the adjoining areas.

**Key words :** Soil conditions, Aquaculture, Seasonal fluctuations.

In aquatic ecosystem, soil is one of the most important ecological factor. It plays a significant role in the productivity of a water body as it is one of the essential pre-requisites to the aquaculture. The productivity of any fish pond depends largely on the quality of bottom soil which is the store house of nutrients. Banerjee (1967) observed that soil conditions serve as more reliable index for productivity than water qualities. Hickling (1975) described soil as the chemistry laboratory of fish ponds on the basis of maintaining productivity of fish ponds. Saha (1985) stressed on the need of comparative ideas of bottom soil and water qualities as a great significant for fish culture program. Mandal and Chattopadhyay (1992) emphasized that an intimate knowledge of nature and properties of soil which is essential for increasing the productivity of fish ponds. In view of the importance of soil, the present study was made to evaluate the soil conditions of Maidhiya pond (Birganj, Nepal) which no such work was done previously.

### Study Area

The Birganj township is old and the gateway to the capital of Nepal. The Birganj city is closely located to the Indian city, Raxual. Maidhiya pond is large, deep, perennial and roughly rectangular in shape. It is generally rain fed and also receives wastes from nearby restaurant and residential area. It has an

area of 2.5 hectares. Its seasonal average depth varies from 3.0 m during the rainy season to 1.80 m during the dry season. The deeper zone is muddy whereas the soil upto a depth of 0.5 m consists of sand with bricks, stones and gravels. The pond is well infested with different types of hydrophytes.

### Methods

The procedures described by Piper (1947) and Wilde et al. (1972) were followed. Electrical conductivity was estimated with the help of conductivity meter in soil water suspension (1 : 2.5 wt/vol). Soil samples were collected from four spots representing approximately entire area of the pond and one from the middle of the pond for 2006 and 2007. All the samples were mixed thoroughly to get an uniform composite sample and dried under shades.

The air dried soil samples were brought to a polythene bag and powdered and sieved through mesh. The air dried samples were analyzed for important chemical components.

### Results and Discussion

Soil samples were taken for chemical analysis (Tables 1 and 2). The pH value of the soil of Maidhiya pond was found of slightly alkaline in nature with less fluctuations in their monthly value. It ranged

**Table 1.** Seasonal fluctuations in various parameters of soil of Maidhiya pond (Birganj, Nepal) during 2006 and 2007.

Parameters	Year	Jan—Mar (Spring)		April—June (Summer)		Jul—Sep (Monsoon)		Oct—Dec (Winter)	
		Range	Mean	Range	Mean	Range	Mean	Range	Mean
1 pH	2006	7.6-7.8	7.7	7.3-7.5	7.4	7.2-7.8	7.5	7.2-7.8	7.6
	2007	7.5-7.6	7.6	7.2-7.4	7.3	7.2-7.3	7.2	7.2-7.9	7.5
2 Organic carbon (%)	2006	1.04-1.12	1.09	0.94-1.00	0.98	1.00-1.08	1.04	1.15-1.17	1.16
	2007	0.92-0.96	0.94	0.79-0.95	0.84	0.82-0.85	0.83	0.85-0.94	0.88
3 Organic matter (%)	2006	1.65-1.95	1.84	1.62-1.67	1.63	1.73-1.81	1.76	1.87-2.02	1.96
	2007	1.41-1.57	1.49	1.36-1.38	1.37	1.41-1.46	1.43	1.63-1.67	1.60
4 Available phosphorus (ppm)	2006	44.0-50.0	47.3	51.0-52.0	51.6	105-115	110.0	83.0-88.0	85.6
	2007	38.0-46.0	42.0	45.0-46.0	45.3	100-112	106.3	78.0-85.0	82.6
5 Available potash (ppm)	2006	70-94	80.6	61.0-75.0	66.3	82-138	104.0	125-155	142.0
	2007	65-71	68.6	55.0-66.0	61.3	92-155	118.6	65-141	49.7
6 Conductivity m/mhos/cm	2006	0.1-0.3	0.2	0.4-0.6	0.4	0.3-0.5	0.4	0.2-0.3	0.2
	2007	0.1-0.2	0.1	0.3-0.4	0.3	0.2-0.4	0.2	0.1-0.3	0.2

between 7.7, 7.4, 7.5 and 7.5 in spring, summer, monsoon and winter season respectively in 2006. In 2007, the pH ranged more or less in similar pattern. The annual average values of pH were 7.5 and 7.4 respectively during both years (Tables 1 and 2). The alkaline range of soil were also reported from different regions of water bodies (Raheja 1968, Kumari et al. 1990, Singh 1980). However, no impact of seasonal change was noticed in this water body. But Saha (1985) related summer decrease of pH value with the increased rate of decomposition in organic matter and conversion of released carbondioxide into carbonic acid. The selected water body might be considered under the favorable range of pH.

The organic matter and carbon are the most important components of the soil. The percentage of organic varied from 0.94 to 1.17% in 2006 while in 2007, it ranged from 0.79 to 0.97% respectively. Its values varied in different seasons. In 2007, the value of organic carbon was found to be less as compared to that of 2006 (Tables 1 and 2). The organic content of this pond remained in the range of moderate productivity being higher during post-monsoon and winter might be result of deposition of new silt on the pond bed coming from different areas of surrounding localities along with rain water. Jaiswal and Singh (1995) reported that the depth of water, decomposition of biota and other abiotic parameters may have influenced the shifting of month for lowest organic carbon. The value of organic matter of this pond varied in different seasons in both years. The organic matter residue serves as a source of nutrients and

energy for bio-activity of the micro-organisms. The organic matter of this pond was maximum in winter and minimum in summer. It is presumed that bacteria may be associated with low value of organic matter during summer. In the present investigation the maximum value of organic matter was noted during winter. The was accompanied with maximum value of pH showing more or less direct relation. This observation substantiates the view of Zafer (1964). According to Pillay and Sreenivasan (1975) soil organic matter contains about 5 ppm of nitrogen and over 54% of carbon. Thus, it is apparent that soil of Maidhiya pond has moderate potential energy.

Phosphorus is most important element for living organisms. Available phosphorus of soil ranged between 47.3 to 110.0 ppm in 2006 and between 42 to 112 ppm in 2007. The deficiency of phosphorus is more likely to limit the productivity. Sreenivasan (1967) suggested phosphate content of 1.0 mg/liter responsible for high productivity, phosphate concentration of this pond was found to be comparatively high from the soil especially during monsoon. This might be due to degeneration of photoplankton and decomposition of shells and bones brought about rain water during rainy months. Singh (1992) found diatoms as one of the main contributors of phosphate in water body and in monsoon months phosphorus phosphate from decomposition of algae (including diatoms) might be the cause of increase of phosphate content in soil. Benerjea (1967) found that the soil with available phosphorus less 30 ppm are poor, 30 to 60 ppm average and above 60 ppm are highly productive. It was ob-

**Table 2.** Chemical properties of the soil of Maidhiya pond (Birganj, Nepal) during 2006 and 2007.

	Months	Year	pH	Organic carbon (%)	Organic matter (%)	Available phosphorus (ppm)	Available potash (ppm)	Conductivity m/mhos/cm
1	Jan	2006	7.8	1.12	1.95	44.0	94.0	0.1
		2007	7.6	0.95	1.57	38.0	65.0	0.1
2	Feb	2006	7.7	1.11	1.93	48.0	78.0	0.2
		2007	7.6	0.92	1.50	42.0	71.0	0.2
3	Mar	2006	7.6	1.04	1.65	50.0	70.0	0.3
		2007	7.5	0.96	1.41	46.0	68.0	0.2
4	Apr	2006	7.5	1.00	1.62	51.0	63.0	0.4
		2007	7.2	0.95	1.38	45.0	63.0	0.3
5	May	2006	7.4	0.94	1.62	52.0	61.0	0.4
		2007	7.4	0.80	1.38	46.0	55.0	0.3
6	Jun	2006	7.3	0.98	1.67	52.0	75.0	0.6
		2007	7.4	0.79	1.36	45.0	66.0	0.4
7	Jul	2006	7.6	1.00	1.73	105.0	82.0	0.5
		2007	7.3	0.82	1.41	100.0	92.0	0.4
8	Aug	2006	7.8	1.04	1.81	110.0	92.0	0.4
		2007	7.2	0.83	1.43	107.0	109.0	0.3
9	Sep	2006	7.2	1.08	1.75	115.0	138.0	0.3
		2007	7.2	0.85	1.46	112.0	155.0	0.2
10	Oct	2006	7.2	1.15	1.87	88.0	146.0	0.2
		2007	7.1	0.87	1.50	85.0	141.0	0.2
11	Nov	2006	7.7	1.16	2.02	86.0	155.0	0.3
		2007	7.8	0.97	1.67	85.0	85.0	0.2
12	Dec	2006	7.8	1.17	2.01	83.0	125.0	0.2
		2007	7.9	0.94	1.63	78.0	65.0	0.3
Average annual value		2006	7.5	1.06	1.88	79.6	98.25	0.32
		2007	7.4	0.88	1.44	69.0	86.25	0.25

served that this pond fall into high category for available phosphorus content.

Available potash content varied from 61 to 155 ppm in 2006 and from 55 to 155 ppm in 2007. The importance of potash in water bodies has been less studied by the investigators. This metallic mineral is normally utilized by the living organisms in the form of phosphate and nitrate. This metal interferes in the sugar metabolism of the organisms. The potash content was highest during monsoon might be due to inflow of this mineral along with the water from the adjoining areas.

The electrical conductivity of soil depends upon the concentration of ions and nutritional status. Sreenivasan (1974) studied the Aliyar reservoir and reported that the conductivity ranging from 38 to 60 m mhos/cm is categorized as low. On this scale, the electrical conductivity of Maidhiya pond (0.1 to 0.6 m mhos/cm in 2006 and 0.1 to 0.4 m mhos/cm in 2007) was low. When the water level was low its value was high, while during monsoon and winter the water

levels were comparatively high, their values were low. Thus the soil of Maidhiya pond is found to be maintaining its productivity and will be useful for pisciculture.

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