Soil and water quality management for shrimp farming

The success of aquaculture can be assured by selecting a suitable site with good quality soil and water. It is essential to understand the pond soil and water characteristics and their optimum requirements to increase the productivity of the ponds.

Soil requirements

The soils with moderately heavy texture (sandy clay, sandy clay loam and clay loam), electrical conductivity value of 4 dS m^{-1} or more, pH ranging between 6.5 and 7.5, organic carbon content of 1.5 to 2% and calcium carbonate content of more than 5% are the best suited for shrimp aquaculture.

Water requirements

Water quality and quantity determine the success or failure of an aquaculture operation. An annual water budget should be calculated for a potential farm site so that the supply is adequate for existing and future needs. Water should be free from pesticides and heavy metals. Maintenance of good water quality is essential for both survival and optimum growth of animals. Water treatment is an important step for the maintenance of good water quality at later stage.

Pond preparation

Pond drying: Following the harvest of a crop, the deposits of organic debris in the pond bottom should be removed, or treated, ploughed, tilled and levelled. All parts of ponds should be thoroughly sun dried for at least three weeks for microbial decomposition of soil organic matter and mineralization of organic nutrients.

Investigations on duration of drying period revealed that farms practicing 3, 5, and 10 days of drying were affected with white spot, running mortality syndrome (RMS) and white gut diseases and had to be prematurely harvested within 60-70 days of stocking whereas the farms that adopted a drying period of 30 to 45 days had successful harvest. Drying pond sediment for at least three to four weeks can help in prevention of WSD.

After emergency harvest due to white spot disease (WSD): Do not discharge water from WSD affected ponds. Remove aeration devices and implements and disinfect by evenly distributing calcium hypochlorite

to provide a minimum final free chlorine concentration of 10 ppm. Allow the system to stand for a minimum of 24 to 48 hours at this minimal chlorine concentration.

CIBA's work on the duration of viability of WSSV in WSD affected pond sediments has revealed that the virus remained viable and infective up to 19 days in the sediment despite sun-drying under experimentally simulated pond drying conditions, and up to 26 days post emergency harvest under actual field conditions.

Lime application has to be done based on pH of the soil and the type of lime material available. The lime requirement depends on the percent effective calcium carbonate (PECC) value, determined by multiplying the neutralisation efficiency (calcium carbonate equivalent value) and fineness of lime material. Based on PECC, the quantity of agricultural lime, dolomite and quick lime required to raise the pH from 6 - 6.5 to 7 varied from 5.5 to 2.8, 5.7 to 2.8 and 4.6 to 2.3 tons/ha, respectively. In soils with chronically low pH it may be beneficial to apply half the total dosage before slight tilling in order to neutralize the underlying soil layers.

Water source: Filter water first through coarse screens to remove larger aquatic animals and debris and then pump into a supply/settling canal for allowing the suspended particles in the water to settle. Then, pass the water through a series of progressively finer screens (150–250 μm mesh size) before introducing into the reservoir.

Chlorinate water in the reservoir with sufficient chlorine (10 ppm) to kill any potential vectors or carriers in the source water. For one ha reservoir pond of one meter depth, 150-160 kg of calcium hypochlorite providing 65% active chlorine would give a final concentration of 10 ppm. However, it is advised to calculate the actual dose based on the chlorine demand of water and actual chlorine content in bleaching powder. Vigorously aerate reservoir at least 48 h for de-chlorination to remove residual chlorine.

Soil and water management

- In order to understand the condition of the pond bottom, soil pH, organic matter and redox-potential (E_h) for oxidized/reduced pond bottom condition have to be monitored regularly. The E_h of pond sediment should not exceed -200 mV.
- The water parameters that should be monitored routinely in ponds during culture period are temperature, pH, salinity, dissolved oxygen and transparency.
- The pH should be in optimum level of 7.5 to 8.5 and should not vary more than 0.5 in a day.
- Variations in salinity not exceeding 5 ppt in a day will help in reducing stress on the shrimp.
- The optimum range of transparency measured using secchi-disc is 25-35 cm.
- Total Ammonia Nitrogen (TAN) and nitrite N concentration should not be more than 1 and 0.5 ppm, respectively.
- Any detectable concentration of hydrogen sulphide is considered undesirable.
- Periodical exchange of chlorine treated water from reservoir as and when required will help in maintaining the water quality in optimal range. The use of aerators results in mixing of water at surface and bottom and breakdowns the DO and thermal stratification.
- Use of inputs without proven efficiency should be strictly avoided.
- The discharge water from the shrimp ponds has to be allowed into a treatment system pond before letting it into the environment so that the suspended solids may settle at the bottom.

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