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Effect of substrate in aquaponic system developed with *Poecilia reticulata* and *Piper betle* on growth performance of fish and plant.

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Abstract

Aquaponics produce both fish and plant in one production system and efficiently utilize the resources. This study was designed to evaluate suitable substrate for betel plant (*Piper betle*) in an aquaponic system with guppy *(Poecilia reticulata*). Coconut peat and sponge were tested in this study as two substrates along with two types of control. Control 1 (CT1) had only fish, and Control 2 (CT2) contained fish, and a floating rafter filled with lids of pet bottles. Two treatments included fish, and plants grown in either sponge (TS) or coconut peat (TC) substrates. Treatment TS and TC contained three plants grown in pots with the relevant substrate, submerged in the floating rafter like CT2.Triplicated treatments were randomly arranged in 60L fiberglass tanks at initial stocking density of 15 fish per tank (0.1859±0.0012g weight). The initial plant height was 16.1±1.2cm. Fish were fed near satiety twice a day for eight weeks. Growth performance of fish and water quality parameters were compared in one-way ANOVA followed by Tukey's test at 5% significance level. At the end of the experiment, significantly highest final mean weight of fish was observed in TC (0.5059±0.0025g) followed by TS (0.4689±0.0028) and it was lowest in CT1 (0.4303±0.0008). Similarly, TC treatment showed the significantly highest percentage Specific Growth Rate (%SGR) of fish (1.79±0.02) followed by TS (1.65±0.02). The significantly lowest %SGR was observed in CT1 (1.51±0.00) and CT2 (1.53±0.01). Although, mean feed intake of fish was significantly higher in TC compared to other treatments, Feed Conversion Ratio was not affected by treatments. Among the tested water quality parameters, temperature was not affected by treatments. Water pH values in this study ranged from 6.1±0.02 (CT1) to 6.5±0.01 (TC) and pH of TC treatment was significantly higher than that of other treatments. The significantly highest NH_3 concentration was reported in CT1 (0.92±0.02mg/L) followed by CT2 (0.61±0.02mg/L) and it was lowest in CT1 (0.20±0.02mg/L). The NO_3^- concentration of both TC and TS was lowest compared to CT1 and CT2. The independent sample t-test showed that plant growth performance in terms of total chlorophyll, stem perimeter and final plant height of betel plant were affected by substrate, and it was highest in TC. These results revealed that an aquaponic system with guppy fish and betel plants enhances growth performance, and survival rate of fish. Further, among tested two substrates, coconut peat is the best substrate for betel plant when used in aquaponic system.

Keywords

Growth performance, stress resistance, chlorophyll content, water quality, aquaponics

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