

Nutrition Availability and Salt Content In Aquaconic Cultivation System of Kangkung and Lele Fish Plant

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ABSTRACT

Urban vegetable cultivation using the aquaponic system can be considered as a future agricultural consideration because fish manure and fish food residues can become nutrients for plants after being decomposed by microorganisms in pond water. The study aims to determine the availability of nutrients and dissolved salts in catfish ponds for 5 weeks before harvest and the growth of water spinach plants (*Ipomoea aquatica*) in aquaponic cultivation systems. The study was conducted at the Greenhouse UPN Veteran in East Java using 4 catfish ponds as a test given EM4 probiotic solution. Probiotics EM4 given as much as 20 ml per pool as a decomposer. Control is done by planting water spinach on soil media. Observations are carried out every week. The results showed 1). Water spinach plants planted with aquaponic systems have poor growth compared to those planted using soil media. 2). Nutrient concentration and salt content in pool water always increase during the study.

Keywords: Nutrition, dissolved salt, water spinach plants

1. INTRODUCTION

Vegetable cultivation in urban areas is strongly influenced by land availability. Limited food production land (agriculture-fisheries) has encouraged the cultivation of agriculture-fisheries on narrow land / limited containers. In order for synergy to support one another, limited aquaculture will be better if combined with agriculture, this can certainly increase efficiency in production costs so that it can be said of cultivation *low-input*, because cultivated plants do not need to be fertilized to support growth and fertility, due to waste from fish ponds in the form of manure and fish food residues already contain macro and micro elements needed by plants. Likewise, the presence of plants can reduce toxins in pond water as the results of Gumelar et al (2017) research. The increase in total ammonia concentration increases over time, but the increase that occurs can be suppressed by the presence of plants and microbes given in ponds (Ali & Wulan, 2018).

Catfish farming is very different from cultivation ornamental fish in terms of water needs and amount of feed. Catfish raised for consumption needs, it must be given feed in large quantities and rich in protein. Impurities produced by catfish can be decomposed aerobically or anaerobically by microorganisms in water. The results of the decomposition of dissolved nutrients can be used as a source of plant nutrition.

The problem is whether the availability of nutrients from fish dung sources can meet the needs for the growth of vegetable plants grown with aquaponic systems. Does increasing fish

droppings in the pond meet the water quality standards for growth of water spinach plants with an aquaponic system.

Adding probiotics in aquaponic system cultivation can increase the growth rate and survival rate of fish (Primashita et al, 2017) besides that it can be a solution to maintain water quality, because the microbes found in probiotics can increase the change of nitrite into nitrate, ammonium, so that kale plants can be used to obtain nutrients during their growth and not poison fish that are kept.

Probiotics contain most of the microorganisms *Lactobacillus*, *Bacillus*, *Nitrosomonas* and *Nitrobacter* which can increase waste decomposition and can improve water quality (Tambunan et al., 2010). Provision of probiotics in the aquatic environment is expected to increase the immune response to disease, improve the digestive system of fish, improve water quality because it can change toxic compounds into non-toxic, such as ammonia and nitrite compounds through the process of nitrification (Ghouse, 2015), good

quality catfish pond water if the pH is between 6.5 - 9, hardness (degree of coarse grains) a maximum of 100 ppm and optimal 50 ppm, turbidity (turbidity) is not mud between 30-60 cm, the optimal O₂ needs in a wide enough range from 0.3 ppm for adults to saturated to abundant, and CO₂ content of less than 12.8 mg / liter, ammonium bound 147.29-157.56 mg / liter.

Water spinach which has the Latin name *Ipomoea aquatica Forsk* is a type of vegetable that is quite popular in Indonesia. Everyone can get water spinach by buying it in the market or growing their own. Water spinach is quite commonly eaten is land water spinach and water spinach. Both types of spinach have a taste and nutrition that is not much different (Hariyadi, Huda, Ali, & Wandik, 2019). Water spinach is a plant that has the ability to grow quickly and in unison. Only in 4-6 weeks after seed, water spinach can be harvested and enjoyed. There are several requirements for water spinach to grow well in aquaponic planting systems, namely water pH between 5.5 - 6.5, total dissolved solids or total dissolved salts between 900 - 1200 ppm (mitalom.com, 2016), the newest NaCl salt (EC) between 2.0 - 2.1 S / m.

2. MATERIALS AND METHODS

Research on the cultivation of water spinach plants with an aquaponic system using Probiotic EM4 as a decomposer of fish droppings in ponds. 4 tarpaulin ponds were used as a test with a size of 1 x 2 m. The EM4 dose added to the 20 ml pool per pond was given 2 weeks before the fish pond was filled. Each pond is filled with 400 catfish with a size of 20 fish / kg. Fish age is 6 weeks. Fish are given Hi-Pro fish pellet feed as much as 3% of the weight of catfish per pond (600 g / pond) per day. As a comparison of the aquaponic planting system of water spinach plants, planting was also carried out using soil media. Observations were carried out, namely: Nutrient of dissolved plants namely

Ammonium (NH₄) mg / l, Phosphorus (PO₄) mg / l. Other indicators observed were total dissolved salts, EC and pH.

The research was carried out by providing four units of catfish ponds of 200 cm x 100 cm x 80 cm in each treatment. Each fish pond is equipped with 3 dm paralon pipes with 200 cm length of 3. Paralon pipes are used to plant water spinach to bring water back to the catfish ponds. . The way the recirculation system works in the following study. Waste water from fish maintenance aquariums is flowed gravity through pipes to gutters that have been planted with water spinach (*Ipomoea aquatica*). The water in the pond is flowed back to the pond using a pump and so on. Catfish (*Clarias sp.*) Used in the study came from farmers in Jombang. Seeding kale is done for one week on the rockwool growing media in the tray. Plants are planted at the netpot in the paralon pipe using rockwool media for planting the aquaponic system while water spinach using soil media as a comparison is directly planted in pots.

Water quality measurements are carried out at the beginning before treatment and are measured once a week during maintenance. The parameters observed were total dissolved salt, pH (pH meter), EC, ammonium, phosphorus, plant length and number of leaves.

3. RESULTS AND DISCUSSION

Observation of dissolved ammonium (NH₄) showed that there was an increase in ammonium concentration in pond water linearly from 56.00 mg / l at week 0 to 607.19 mg / l at week 4 (figure 1.)

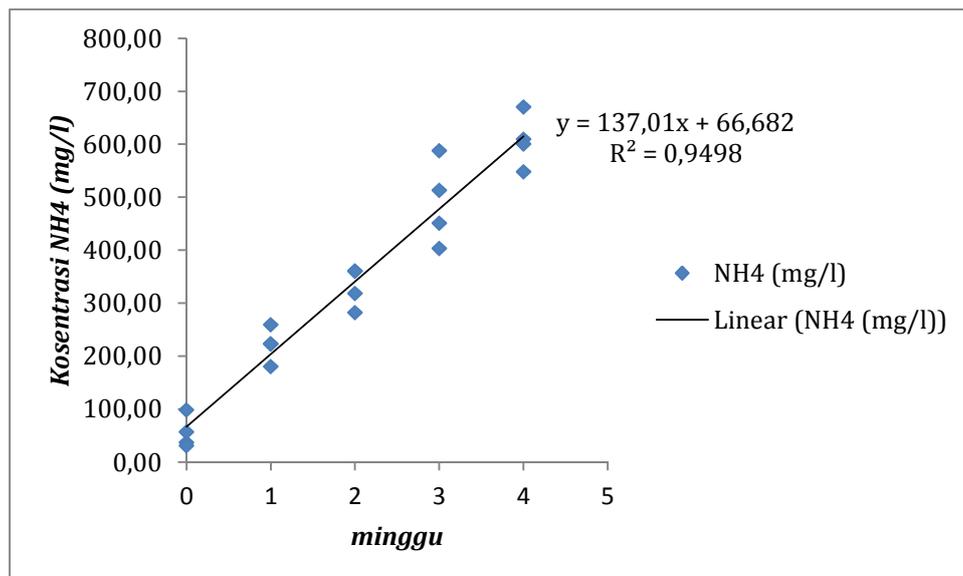


Figure 1. Relationship between time and Ammonium Concentration in pond water

The results of the analysis above show that the ammonium content in the pond is sufficient to meet nitrogen requirements during the growth of water spinach plants. According to the results of the study of Goredva et al (2015), that the administration of nitrogen between 200 to 300 mg / l can increase plant height, root length and fresh weight of lettuce plants linearly in the hydroponic planting system.

The observation of PO₄ concentration in pond water shows an increase in concentration every week for 4 weeks linearly. (Figure 2.)

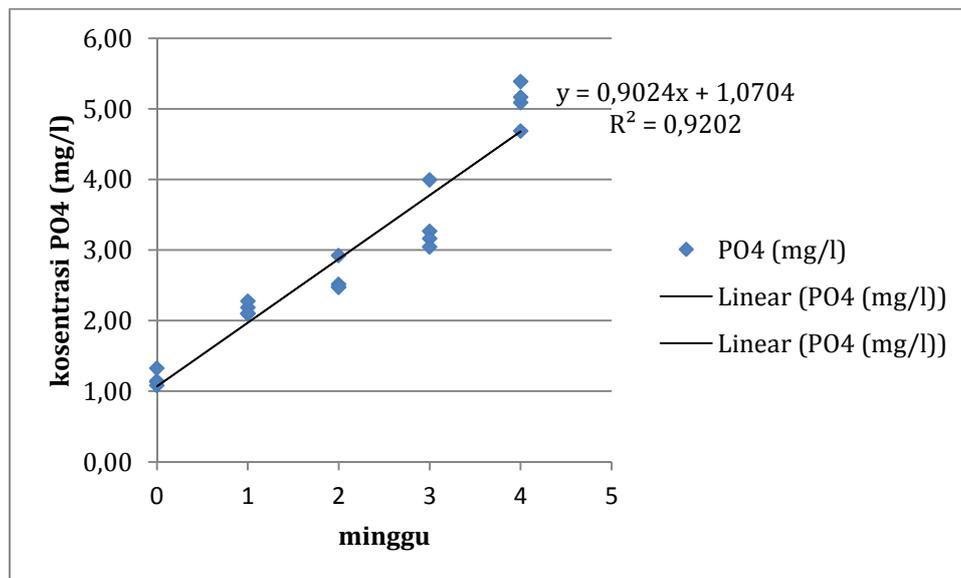


Figure 2. Relationship between time and Concentration of PO₄ in pond water.

If viewed from the needs of phosphate for water spinach plants, then the concentration of phosphate in the pond is enough to meet the needs of water spinach plants during growth. According to Hadjowigeno (1995) that the P₂O₅ content in soil solutions above 35 ppm is already very high.

The results of the observation of total dissolved salt (TDS) showed that concentrations were always increasing from week to week, until the 4th week obtained an average total salt concentration of 1697 ppm (Figure. 3)

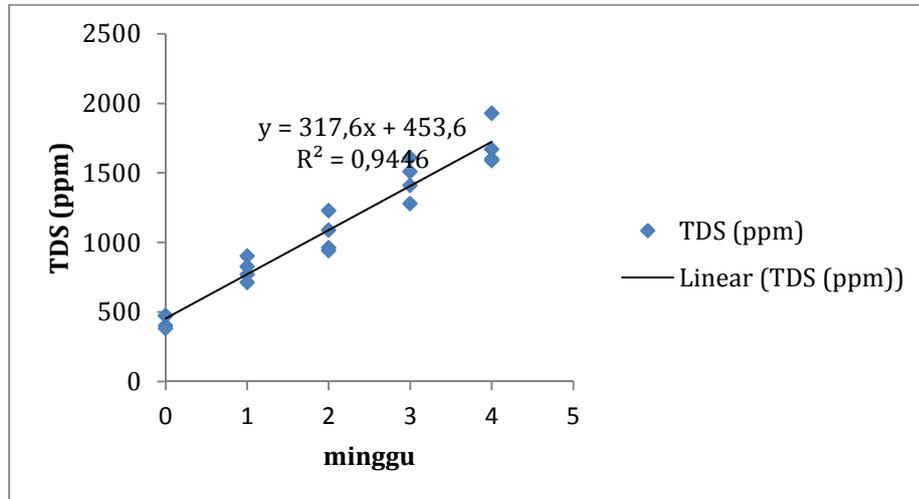


Figure 3. Relationship between time and total concentration of dissolved salts in pond water

If viewed from the needs of the total concentration of dissolved salts, then after 2 weeks old plants in aquaponic pots, plant growth starts to be disrupted, because the total dissolved salt has exceeded the living needs of kale. Likewise, the condition of NaCl salt content in pond water, shows that the concentration is always increasing linearly with the line equation $y = 0.68x + 1.0077$ (Figure 4.)

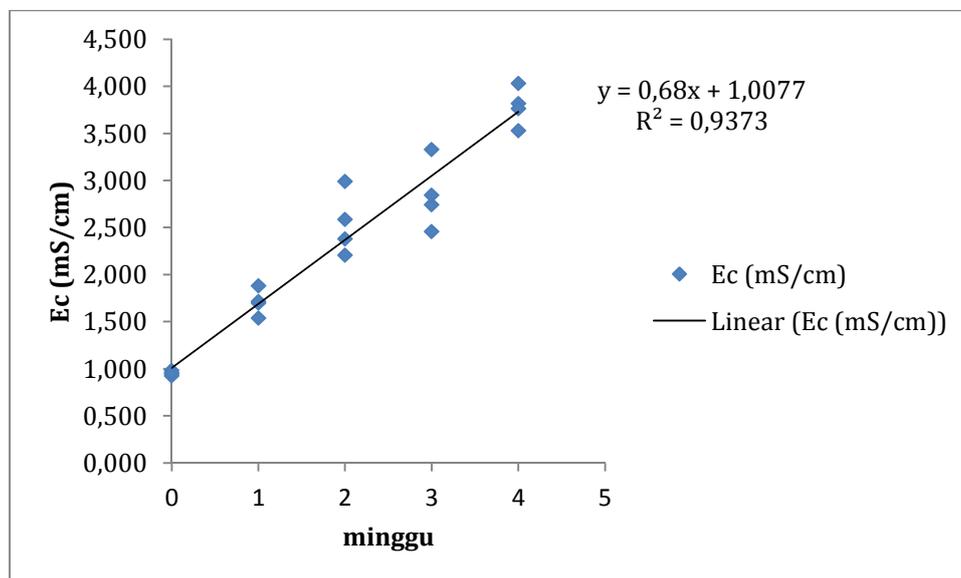
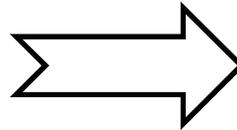


Figure 4. Relationship between time and (EC) mS / cm in pond water

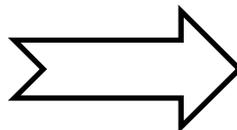
The growth conditions of spinach plants began to be disrupted after 2 weeks in aquaponic pots due to high EC with EC values above 2.5 mS / cm. Whereas water spinach only has an EC tolerance of less than 2.1 mS / cm.

The results of observations of the development of water spinach plants planted using aquaponic cultivation systems the results are still less satisfactory compared to planting water spinach

using the planting method using soil media. This is because it is disturbed by the total dissolved salt concentration and NaCl salt content that exceeds the tolerance threshold for kale plants to live normally (Figure 5.)



The Kangkung root is normal



Water Kangkung roots are not normal

4. CONCLUSION

Aquaponic plant systems carried out in the study can be concluded as follows:

1. Water spinach grown with aquaponic systems growth and yields are less good when compared to planted using soil media.
2. Pellet feeding during catfish maintenance can increase the availability of NH₄ and PO₄ in a linear fashion.
3. Feeding catfish continuously without any particular effort to overcome the total dissolved salt and NaCl salt causes no success in growing water spinach with an integrated aquaponic system.

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