University of Muhammadiyah Malang, Indonesia
e-ISSN 2622-4836, p-ISSN 2721-1657, Vol. 3 No.2, August 2020. pp. 87–94
IJOTA
Indonesian Journal of Tropical Aquatic
Journal homepage: http://ejournal.umm.ac.id/index.php/ijota

The effect of AB Mix nutrition on growth performance of catfish (*Clarias gariepinus*) and lettuce (*Lactuca sativa*) cultivated in aquaponic system

Rogerio Lainus Tilman Sarmento[1], Riza Rahman Hakim[1]*, David Hermawan[1]
[1]Aquaculture Department, Faculty of Agriculture and Animal Science, University of Muhammadiyah Malang, Indonesia.
*rizarahman@umm.ac.id
*Corresponding author

ARTICLE INFO

Keywords:
African catfish
Fish culture
Vegetables
Watercress

ABSTRACT

Catfish farming is growing rapidly because the cultivation and marketing technology is relatively easy for the community to master, and the required business capital is relatively small. Pond water waste originating from fish metabolism and dissolved food waste is toxic to fish. One of the efforts that can be done is fish farming that is integrated with plants through an aquaponics system. Research to determine the effect of AB Mix addition on the growth of African catfish and lettuce cultivated by the aquaponics system. The research method used was an experimental method with a completely randomized design (CRD) consisting of three treatments and three replications. The addition of AB mixed nutrition did not differ in the growing significance of catfish and lettuce. However, the increase in growth occurred with an increasing dosage of AB mix with the best treatment with AB Mix 3 mL L^{-1}. This treatment resulted in absolute growth in fish of 20.52 g and 4.62 g of watercress. The use of a dosage of AB mix higher than 3 mL L^{-1} may result in better growth.

How to cite:
Sarmento RLT, Hakim RR, Hermawan D. 2020. The effect of AB Mix nutrition on growth performance of catfish (*Clarias gariepinus*) and lettuce (*Lactuca sativa*) cultivated in aquaponic system. *IJOTA,* 3(2): 87–94.
DOI: https://doi.org/10.22219/ijota.v3i2.12923

1. Introduction

Catfish farming is a type of aquaculture business that is growing. Catfish cultivation is growing rapidly due to cultivation and marketing technology that is relatively easy to master by the community, and the required business capital is relatively small. Catfish is a type of freshwater fish that can grow and develop properly because catfish can be cultivated in a limited area. In the maintenance of catfish, of course, produces pond water waste that comes from the metabolism of fish and dissolved food waste, where this waste contains pollutants that are toxic to fish. Usually the

change of water in catfish cultivation causes environmental pollution so that it adversely affects the surrounding environment. However, water from catfish waste can still be used for vegetable cultivation.

One effort that can be done is fish farming integrated with plants through the aquaponic system. Aquaponics is a combination of fish farming and plant cultivation with hydroponic technology that is mutually beneficial. The principle of the aquaponics system in this study is that vegetable plants can reduce and utilize organic material from catfish cultivation wastes for growth so as to reduce pollutants present in aquaculture wastewater.

Vegetables are an important aspect of agriculture in Indonesia. Because vegetables are useful as a source of food for the fulfillment of vitamins, minerals, and sources of body fiber. Vegetables as a main complementary food are needed right now, because more and more people are aware of health that can be supported by tail azoll growth rate of 4.47gram / head / day with a maximum ammonia level of 24.93 mg L^{-1}. In order for organic vegetable plants to grow and develop properly, proper nutrition is needed. Therefore it is necessary to conduct research to determine the effect of the addition of AB Mix on the growth of African catfish and lettuce plants cultivated by the aquaponic system.

2. Material and methods

This research was carried out for 42 d from April 2020 to June 2020. The research method used was an experimental method with a Completely Randomized Design (CRD) consisting of three (3) treatments and three (3) replications. Fish stocking density is 50 fish with an average weight of 2.5 g and stocked in a 60 L capacity tank. The treatments used in this study are:

Treatment 1: Aquaponics without AB Mix nutrition.
Treatment 2: Aquaponics with the addition of the nutrient AB Mix 1.5 mL L^{-1} of water.
Treatment 3: Aquaponics with the provision of nutrition AB Mix 3 mL L^{-1} water.

2.1. Parameters

Growth of fish and lettuce plants

Weight growth dumbo catfish has a very fast growth when consuming feed that is in accordance with the nutritional needs for growth and will be resistant to environmental conditions around the cultivation sitefish, while the parameters of lettuce include biomass, stem length increase, and number of leaves. Weight gain, both fish and plants are calculated using the following equation (Ogunji et al. 2008):

$$PM = Wt - Wo$$

PM = growth,
Wo = initial weight,
Wt = Measurement final weight

Survival rate

$$SR = \frac{Nt}{N0} \times 100\%$$

SR: Survival Rate
Nt: Number of fish that live at the end of the culture
N0: Number of initial fish stocked

Water quality

Water quality parameters were carried out at the beginning of the study and repeated every seven days. Water quality parameters tested included temperature and pH using their respective equipment.

2.2. Research Procedure

The research began by preparing vegetable seeds, preparing aquaponic installations, preparing catfish seeds, planting plants in hydroponic installations, taking data, analyzing data. Aquaponics media used in this study is to use a 60 liter tank. Media to grow watercress using tubs, 9 hole impraboard, black netpot 5cm + axis flannel. Fish selection and watercress planting tubs are arranged as shown in Figure 1.

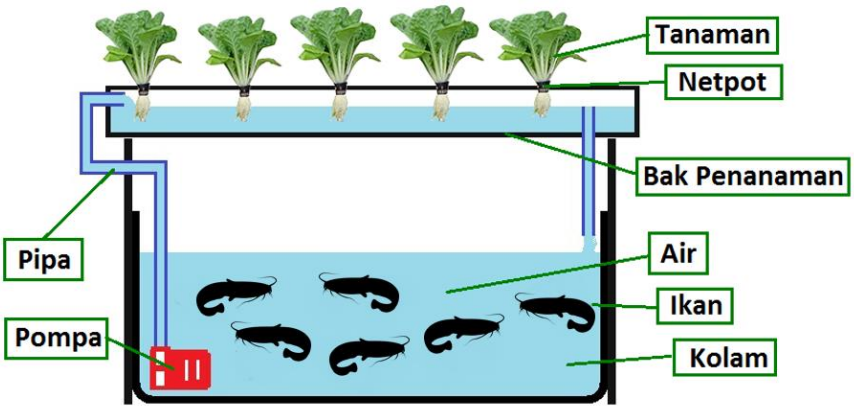

Figure 1. Aquaponic Design

Lettuce seeds are sown using rockwoll media and placed on a tray, doused with water to keep it moist. The seedlings are closed to stay dark for 24 hours. After that, the lid is opened when the seedlings have begun to germinate, placed in a place exposed to sunlight. To maintain moisture, the seeds are watered with water as needed. At this stage, each bucket is filled with 60 liters of water. Catfish are stocked, measuring 5-7cm in 50 heads in each rearing tank. Feeding is carried out three times a day, namely in the morning at 07.00 West Indonesia Time, afternoon at 12.00 West Indonesia Time, and afternoon at 17.00 West Indonesia Time. Feed given as much as 3% of the total body weight of fish in one tub. Planting seeds after 2 weeks of age. Seedlings that have been sown are then put into impraboard. Seedlings that are ready are then transferred into the gutters that have been provided. Rockwoll is required to touch the flow of catfish pond wastewater so that the roots of the seedlings can absorb nutrients.

Plant maintenance is carried out so that the seeds that have been planted in the system can grow optimally. Plant maintenance activities include control of plant pests (OPT). Control of pests is

done manually. If at the time of planting there is a pest attack then the pest is removed from the plant. Crops harvested on crops that are suitable for harvest have leaves that thrive, the base of the leaves looks healthy, and the height of the plant is uniform and evenly distributed. Harvesting is done in the afternoon or morning because the sun is not too hot.

3. Results and Discussion

3.1. The growth of catfish

The length of catfish based on the results of research conducted, treatment 1 on observation day 0 has a length of 6.13 cm, and on observation day 14 it has a length of 7.64 cm, and day 28 has a length of 11.05 cm, and observation day to day 42 has a length of 18.14 cm. Whereas in the second treatment the observation day 0 has a length of 5.37 cm, the observation day 14 has a length of 9.27 cm, and the observation day 28 has a length of 12.57 cm, and the observation day 42 has a length of 19.12 cm , and on the 3rd treatment the observation on day 0 has a length of 6.93 cm, and the observation on the 14th day has a length of 7.92 cm, the observation on the 28th day has a length of 11.70 cm, and the last observation is the 42th day has a length of 19.13 cm.

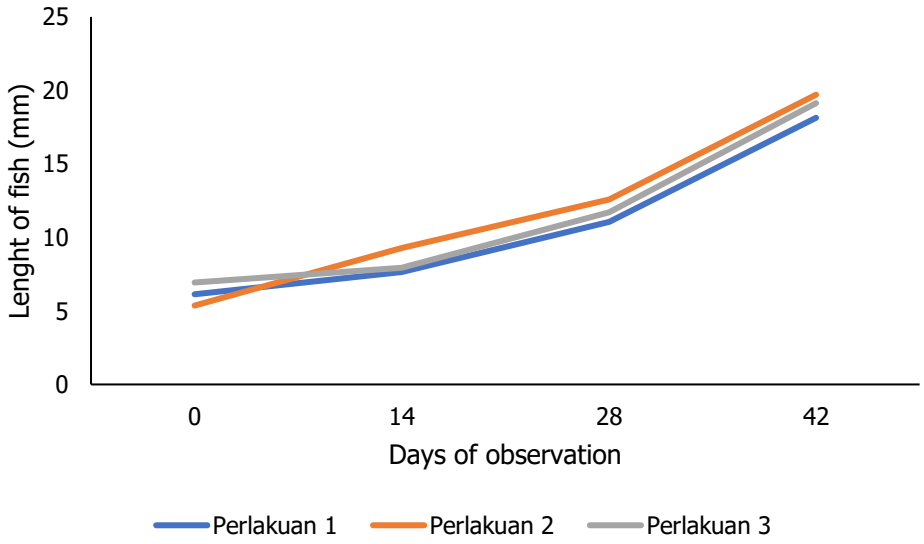

Figure 2. growth performance (length)

Based on figure 2, treatment 2 has the highest yield followed by treatment 3 and treatment 1 the lowest. The growth of fish length is influenced by external and internal factors, namely from genes or derivatives or derivatives of the environment. The use of aquaponic media makes the quality of aquaculture media maintained and more stable. Feeding also greatly affects fish growth. The addition of AB Mix fertilizer can fertilize the waters so that the fish that are reared will develop properly. According Estriyani (2013), states that the growth of fish body length is influenced by the genetics of each individual and also the intake of protein to support the growth obtained from feed. According to Syahid et al (2006), states that food is an external factor that has a role in fish growth. According to Saputra et al (2013), the amount of feed that fish can consume every day and the level of daily food consumption is one of the factors that influence fish to grow optimally.

Based on ANOVA results, the calculated F value of 0.061603 is smaller than F table (0.05) 2.305313. This proves that each treatment does not have a significant effect on the long growth of

African catfish. It is assumed that the three treatments have the same treatment in the process of water recirculation in the media for selecting African catfish, and it is suspected that an optimal filtering process occurs in each treatment so as to produce good water quality in the media for selecting African catfish and feeding in quantities according to the needs fish. According to Hidayat el at. (2013), that growth is influenced by several factors, namely internal and external factors, while internal factors include heredity, disease resistance and ability to use food,

Catfish weight based on the results of research conducted, on treatment 1 observation day 0 has a weight of 3.47 grams, and on the observation day 14 has a weight of 8.80 grams, observation day 28 has a weight of 14.20 grams, observation day to 42 has a weight of 21.00 grams, and on the second treatment the observation on day 0 has a weight of 5.04 grams, the observation on the 14th day has a weight of 11.01 grams, and the 28th day observation has a weight of 15.35 grams, the day observation 42nd weighs 22.87 grams, and the next treatment is the 3rd treatment observation day 0 has a weight of 4.45 grams, the 14th day observation weighs 9.81 grams, the 28th day observation weighs 17.85 grams, and at the last weighting observation day 42 had 24.97 grams.

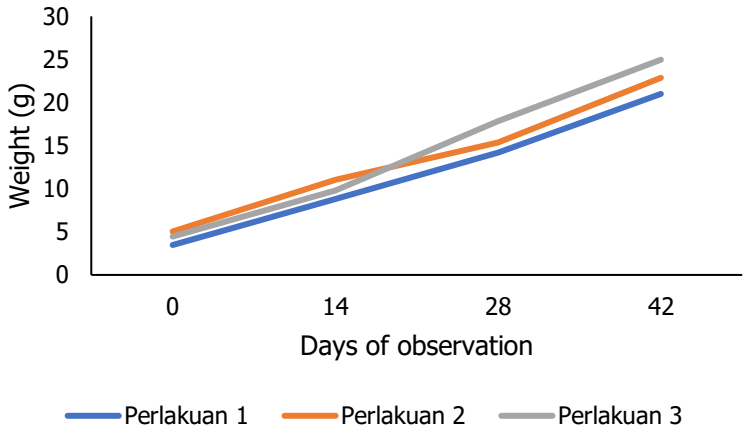

Figure 3. Growth performance (weight)

Based on figure 3 obtained the highest catfish weight results of treatment 3 then followed by treatment 2 and the lowest in treatment 1 which has an absolute length of 20.52 grams, 17.83 grams, and 17.53 grams. The acquisition of treatment 3 which produced the highest fish weight was assumed because the addition of AB Mix made the fish's appetite and fertilized the waters. In addition, the use of an aquaponic system keeps the quality of cultivation water media maintained. Maniagasi et al. (2013) states, water quality parameters are a limiting factor to the type of aquatic biota that is cultivated in a waters. Agus (2011), states that water quality parameters can affect management and survival, breeding, and growth. A good temperature range for cultivation is 24-28oC. If the maintenance temperature is less than the range (low temperature), resulting in low catfish activity and decreased appetite, which will result in slow catfish growth (Supriyanto, 2010). Meanwhile, the pH range during the study was 7.5-8. Suboptimal acidity (pH) can cause fish to be stressed, susceptible to disease, low productivity, and growth (Amalia et al., 2013).

Besides that, ammonia also influences water quality. Things that can cause ammonia concentrations to increase include fish metabolic waste (feces) and fish food that is not consumed so that it is suspended at the bottom of the pond. The increase in ammonia concentration is also

caused by increasing temperature and pH of pond maintenance (Kordi, 2007). Resulting in low catfish activity and decreased appetite, so that it will result in slow catfish growth (Supriyanto, 2010). Meanwhile, the pH range during the study was 7.5-8. Suboptimal acidity (pH) can cause fish to be stressed, susceptible to disease, low productivity, and growth (Amalia et al., 2013). Based on the ANOVA test results obtained Fcount of 0.082841 and Ftable 2.305313 (fcount smaller than ftabel), meaning that the application of AB Mix fertilizer did not affect the growth of catfish weight.

3.2 Survival Rate (SR)

The highest survival rate (SR) was obtained at treatment 3 which was 79 %, then the second treatment was 75 % and the lowest was treatment 1 which was 69 %.

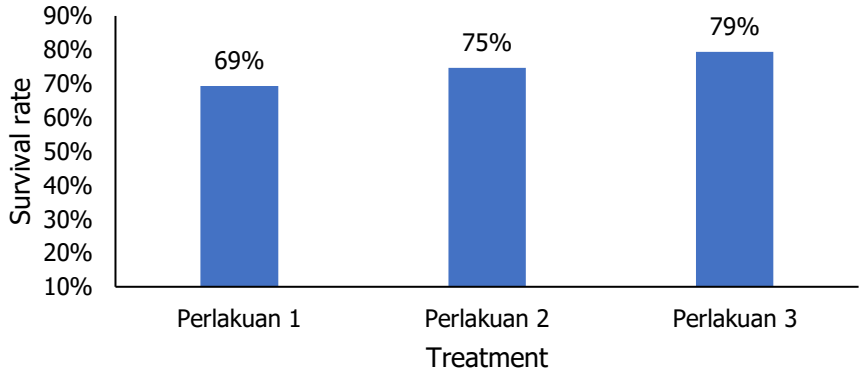

Figure 4. Survival rate

Based on figure 4 proves that giving AB Mix with an aquaponic system in catfish selection makes the survival rate higher. The survival rate of fish is influenced by internal and external factors, the condition of healthy catfish makes the value of sr high. The factors that can affect the low survival of fish are internal and external factors (Effendi, 2003). Internal factors come from the fish itself. Fish experience stress due to inadvertent behavior so that mortality is high. External factors that influence include environmental conditions.

3.3 Watercress growth

Lettuce growth is seen in the length of the stem, leaf width and weight. The 0 treatment weighs 0.15 grams, the length is 2.8 cm, and the leaves fall in 2 strands. On day 42 it has a weight of 4.56 grams, a length of 29 cm, and 12 strands. The second treatment weighs 0.12 grams, the length is 2.5 cm, and the number of leaves is 3 strands, and on day 42 it has a weight of 4.69 grams, the length is 23.5 cm, and the leaves have 12 strands. In the last treatment, the third treatment had a weight of 0.9 grams, a length of 3 cm, and had 3 strands of leaves, on day 42 it weighed 5.53 grams, a length of 25 cm, and the leaves grew 15 strands.

Table 1. Lettuce growth

Treatment	Absolute Growth (PM) (g)	Lettuce Length (cm)		Number of Leaves (strands)	
		Day 0	42th day	Day 0	42th day
P1	4.41	2.8	25	2	12
P2	4.57	2.5	23.5	3	12
P3	4.62	3	29	3	15

Seen from the table 1 , giving AB Mix in treatment 3 is the treatment with the best effect on lettuce growth. The acquisition of weight, length, and number of leaves of watercress produced by the addition of AB Mix in treatment 3 is higher than that of treatments 1 and 2. Growth of watercress is influenced by the environment and the nutrients it absorbs. The addition of AB Mix is able to meet the nutritional needs of watercress to encourage its growth. This is in accordance with the statement of Lawalata (2011), which revealed that the provision of nutrients can increase plant growth in an amount appropriate to plant needs. If too much will cause growth to be stunted. All nutrients contained in hydroponic nutrients are essential elements that plants need in their growth and development. If macro and micro nutrients are incomplete, they can inhibit plant growth and development (Nugroho et al. 2012).

Based on the ANOVA test results, the addition of the AB Mix nutrient did not have a significant effect on the growth of watercress seen by weight, display and number of leaves. No significant effect is suspected because the dose range used is not much different. This is because the two factors influence each other, the use of organic media compositions that contain complete nutrients even though in small amounts and the addition of other fertilizers in accordance with the recommendations can make the nutrients present in the media more and can be absorbed by plants with increased growth of lettuce plants. According to Dobermenn et al. (2000),

3.4. Water quality

Water quality parameters observed in this study include temperature and degree of acidity (pH). The first treatment had temperatures ranging from 26-28° C, the second treatment had temperatures ranging from 27-29 °C, and the third treatment had temperatures ranging from 26 to 29°C.

Table 2. Water quality

Treatment	Temperature	pH
P1	26–28	6–8
P2	27–29	6–8
P3	26–29	6–8

Water quality (table 2) obtained from measurements in this study can be tolerated by fish or lettuce. Temperature and pH have an important role in the survival and growth of fish and lettuce. The optimum temperature and pH according to the needs of fish and lettuce will encourage the growth and development of a commodity. According to Djoko (2006), good temperatures for catfish farming ranged from 24 - 30℃. Whereas Himawan (2008) states that the optimum water temperature in intensive catfish maintenance is 25 - 30 0C. Whereas the observation on the acidity (pH) level at treatments 1.2 and 3 had a pH ranging from 6-8. Temperature and pH greatly affect the growth of fish and watercress. Optimum water quality will encourage fish growth to be faster. This is also supported by research conducted by Adams et al., (2008) which states that the pH range for lettuce plants in hydroponic systems ranges from 5.6-6.0. Temperature and pH are influenced by environmental conditions

4. Conclusion.

Ab mix tidsk nutrition has a significant influence on growth and survival rate of catfish. Nutrition does not significantly affect the growth of watercress from the weight, length and number of leaves.

References

Adams CR, Bamford KM, & Early MP. 2008. Priciples of horticulture (5th ed). pp. 57.

Agus. 2011. Assessment of Water Quality and Potential Situ Situ Study As Water Tourism University of Indonesia, Depok. FMIPA. UI

Amalia CD, Hasan Z, & Mulyani Y. 2012. Plankton Community Spatial Distribution as Aquatic Quality Indicator in Situ Bagendit, Banyuresmi District, Garut Regency, West Java Province. *Journal of Fisheries and Maritime Affairs*. 3(4): 301–311.

Djoko. 2006. Sangkuriang Catfish Alternative Quality in the Land of Priangan. Trobos Jakarta. August: 80 - 81.

Dobermenn A & Fairhurst T. 2000. Rice: Nutrient Disorber And Nutrient Management. International Rice Research Institude-Potash and Phospate Institude (PPI) - potash

Effendi H. 2003. Analysis of Water Quality for Water Resources and Environmental Management. Kanisius. Jakarta.

Estriyani A. 2013. Effect of Addition of Turmeric Solution (*Curcuma longa*) on Feed Against Growth of Dumbo Catfish (*Clarias gariepinus*). thesis. Now: IKIP PGRI Semarang.

Hidayat D, Ade DS, & Yulisma. 2013. Survival, growth and fish feed efficiency cork *(Channa striata)* which is given food made from bakutepung golden snail *(Pomacea sp). Indonesian swamp aquaculture journal*. 1(2): 161–172

Himawan. 2008. Cultivation of Sangku-merry Catfish. http://IndonesiaIndonesia.com/f/18253-budidaya-lele-sangkuriang-clarias-sp/. 11:30 p.m. June 23, 2012 in Agriculture, New Yourk: CAB International, 1997. (accessed 15 April 2018) 1: 1 column.

Kordi MG & Tanjung AB. 2007. Management of Water Quality in Aquaculture. Rineka Cipta. Jakarta

Lawalata IJ. 2011. Provision of Several ZPT for Regeneration of Gloxinia (*Sinningia speciosa*) Plants from Stem and Leaf Explants in Vitro. *J. Exp. Life*. 4(2): 83–94.

Maniagasi R, Tumembouw SS, & Mundeng Y. 2013. Analysis of the quality of water physics chemistry in the Lake Tondano fish farming area of North Sulawesi Province. *Aquaculture*, 1 (2): 29-37.

Nugroho RA, Pambudi LT, & Haditomo AHC. 2012. Aquaponics technology application in freshwater fish farming to optimize production capacity. Science and Technology Journal of Fisheries.

Ogunji JO, Kloas W, Wirth M, Schulz C, & Renert B. 2008. Housefly maggot meal (protein) as a protein source for *Oreochromis niloticus* (Linn.). Asian Fisheries Science.

Supriyanto. 2010. The effect of giving probiotics in pellets on the growth of Sangkuriang catfish. Semarang State University.

Saputra HM. 2013. Histological Structure of Gills and Hemoglobin Levels of Asang Fish (*Osteochilus hasseltii* CV) at Singkarak and Maninjau Lake, West Sumatra. Padang: Andalas University Biology Journal

Syahid M, Subhan A, & Armando R. 2006. Polyculture of Organic Milkfish Cultivation. Self-help Spreaders. Jakarta. pp. 64.