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# The effect of stocking density ratio of fish on water plant productivity in aquaponics culture system

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**Abstract.** *Andriani Y, Dhahiyat Y, Zahidah, Zidni I. 2016. The effect of stocking density ratio of fish on water plant productivity in aquaponics culture system. Nusantara Bioscience 8: xxxx.* This study aims to determine the productivity of water plants at various stocking density ratios in the aquaponic culture system. This study is conducted experimentally using the Completely Randomized Design with the differences in the treatment of stocking density ratio, each repeated five times. The treatments of the stocking density ratio of both the catfish fry and the Nile tilapia fry include: A (75:75 fry/$m^2$), B (100:50 fry/$m^2$, and C (125:25 fry/$m^2$). The observed parameters are 1) plant productivity including measuring the growth of water spinach and growth rate, covering weight gain, stem length and number of leaves, and 2) water quality, including dissolved oxygen (DO), nitrate and phosphate. The data of plant productivity is analyzed descriptively while the water quality is analyzed using ANOVA. The result of this study shows that the stocking density ratio significantly affects the productivity of water plants and the water quality of the media. The highest productivity of water spinach productivity occurs at the stocking density ratio of 75 catfish fry/$m^2$: 75 Nile tilapia fry $m^2$, at which the average stem length is 59.14 cm, average number of leaves is 13.67, and the harvest weight is 465 g. Fish stocking density ratio also affects the quality of water, where the synergy between fish farming and water plant growing results in the better water quality compared to fish farming without water plant. The highest quality of water is achieved at the stocking density ratio of 100 catfish fry/$m^2$: 50 Nile tilapia fry/$m^2$.

**Keywords:** Catfish fry, Nile tilapia fry, water plant productivity, water quality

## INTRODUCTION

The availability of land and water for aquaculture processing is getting more limited due to population growth and physical development. This calls for innovation in technology to anticipate the decrease of aquaculture products caused by the loss of land for culturing and deterioration of water quality. A technological innovation already available is the integration of fish breeding and planting through the aquaponics system (Diver 2006). The aquaponics system is capable of growing plants, such as lettuce and water spinach, for both the nutritional needs of the fish and edible vegetables for people, thus providing food efficiently by making use of the limited availability of land.

The productivity of water plants and the quality of water for culturing are influenced, among others, by the stocking density ratio in the culture media, in order to achieve an ideal combination for a useful biological control. The results of fish metabolism in forms of ammonium ($NH^{4+}$), nitrate ($NO^{3-}$) and phosphate can be utilized by the water plants to reduce the percentage of nitrogen in the media (Rakocy 2007), as well as to increase the growth level of the water plants.

In order to determine the level at which the stocking density ratio of fish influences the productivity of the water plants, an experiment is required in which polyculture of catfish fry and Nile tilapia fry of a certain ratio is conducted, in synergy with the growing of water spinach (*Ipomoea aquatica* Forsk.) and lettuce (*Lactuca sativa* L.) in an aquaponics system.

## MATERIALS AND METHODS

### Study area

The materials used in this study are: (i) 2,100 Sangkuriang catfish fry aged 54 days with the average weight of 3.07 g, (ii) 1,050 Nile tilapia fry weighing around 4-5 g obtained from Fish Hatcheries (Balai Benih Ikan) in Ciparay, Bandung District, West Java, Indonesia, (iii) water spinach shoots 7-10 cm in height, seeded at Ciparanje pond and lettuce plants of 5-7 cm in height obtained from PT. Momenta Agrikultura "Amazingfarm" Lembang, West Bandung District, West Java, Indonesia and (iv) fish feed in the form of commercial pellets with crude protein contents of 31-33%.

The research method used in this study is the experimental Completely Randomized Design (CRD) method with the factorial pattern of (3x3): factor I fish stocking density ratio (3 levels) and factor II water plant species (3 levels), each repeated three times. The treatment design is listed in Table 1.

Factor I is the stocking density ratio of fish in polyculture (A) at the following levels: (i) a1: Stocking density ratio 150 fry/$m^2$ (75 catfish fry + 75 Nile tilapia fry), (ii) a2: Stocking density ratio 150 fry/ $m^2$ (100 catfish fry + 50 Nile tilapia fry), (iii) a3: Stocking density ratio 150 fry/ $m^2$ (125 catfish fry + 25 Nile tilapia fry).Factor II is the