UTILIZATION OF PLANT MEDIA IN AQUAPONIC SYSTEMS IN SOME PRODUCTION OF RED CHILI PEPPER VARIETIES

Maimunah Siregar *, Refnizuida, Najla lubis, Devi Andriani Luta, Sulardi, Akhmad Rifai Lubis

Pancabudi University, Medan, North Sumatra
Jalan Jendral gatot Subroto KM 4.5, Medan 20122
* maimunahsiregar17@gmail.com

Abstract - Aquaponics is a cultivation technique carried out by combining plant cultivation and fish farming. This study aims to determine the effectiveness of the use of planting media on aquaponic systems on the production of several red chili varieties. This research was conducted in growth centers from July to October 2018. This study used a factorial randomized block design. The first factor is planting media with 4 media (rockwool, husk charcoal, coco peat and ferlit). The second factor is the variety with the name Kirana, Pasemah and Kopay. The parameters observed were number of branches, number of fruits and weight of fruit. The results showed that planting media and varieties had a very significant effect on production while the interactions of both had no significant effect.

Keywords: Planting media, Red Chili, Varieties, Aquaponics

INTRODUCTION

Aquaponics is a combination of aquaculture and hydroponic systems mutually beneficial. Aquaculture is the farming of fish (Rofiq, *et.al* .2014) while hydroponics is the cultivation of free soil plants with nutritional sources derived from dissolved materials that are tailored to their needs by considering or paying attention to important factors including maintaining a healthy environment for roots, pH of water and dissolved O_2 (Fathulloh and Budiana, 2016). Maintain fish in a container, producing water contaminated with ammonia which if too thick can poison fish, but when combined with hydroponics, ammonia in fisheries wastewater it is converted into nitrite and nitrate by microbes in the media hydroponics, then absorbed by plants as nutrients. Plants will flourish, while the remaining water becomes safer for fish because plants and media function as water filters.

Aquaponics cultivation techniques are similar to those used in conventional hydroponic cultivation (Somerville *et al.*, 2014). Aquaponics is a technique that integrates resirculating aquaculture combined with plants. Aquaponics basically consists of fish farming and plant maintenance. Water which is a medium for fish cultivation is used as a source of nutrition in the maintenance of plants, whereas plants function as biofilter for water. Plants make use of decomposition results organic matter in water as a source nutrition for growth so amount toxic materials in water can be controlled (Wahap et al, 2010). Aquaponics techniques will occur symbiosis of mutualism or a mutually beneficial cycle.

In CMS (2011) it was stated that aquaponics is an interesting combination between aquaculture and hydroponics that can recycle nutrients by using a small portion of recycled water to enable the growth of fish and plants in an integrated manner. This system requires simple and effective technological intervention. Aquaponics systems guarantee the oxygen content of water and suppress the poison of ammonia produced from fish feces will be broken down into nitrates and nitrites through natural processes and utilized by plants as a source of nutrition. Linking hydroponics and aquaculture will approach natural systems in the cultivation of plants and fish. So that the two systems complement each other perfectly.

When compared to conventional land-based cultivation, there are several aquaponic advantages, including not requiring fertilizers and pesticides, very efficient use of water, can be done on non-agricultural land, producing two products at once namely tanamna and fish, products produced in organic and free categories chemical and biological cypress, efficient workforce and can be carried out by everyone at various ages (Somerville *et al* ., 2014). Aquaponics system must also have biofilter and aerator. Biofilter is a place for nitrifying bacteria to change Ammonia produced by fish feces becomes nitrate which can used by plants, while the aerator functions to increase dissolved oxygen levels in the water that are beneficial for fish and plants. Aquaponic systems have the advantage of saving water, *Zero waste* , without chemicals and pests decreasing.

Chili including food commodities to increase production prioritizes improvements in cultivation technology. To produce quality chili can be done from the start of the nursery to cultivation until postharvest handling (Harpenas and Dermawan, 2010). Red chillies planted in plant houses have better quality than planting on open land. The use of house plants aims to create a controlled environment so that optimal plant growth, such as protecting plants from wind and rain, keeps plants from pest and disease attacks and maintains temperature and humidity in the environment (Wijayani and Widodo, 2005).

In influencing production one of the factors that must be considered is media planting The use of organic waste as a planting medium is a solution to overcome the problem of nutrient needs in plants (Agustien, 2009). Various composition of planting media each has different nutrient content. Planting media is a growing medium used for plants. The selection of a good planting media is based on the following four criteria: (1) can be a place for storing nutrients for plants, (2) having the ability to store water for plants, (3) not blocking the exchange of air between the roots and the atmosphere and (4) has mechanical carrying capacity for plants. Plants need the right combination of nutrsi to grow, develop and reproduce.

Selection of varieties plays an important role in cultivation, because to achieve a high level of productivity is largely determined by its genetic potential. If the management of the growing environment is not done well, then the potential of high seed yield from these superior varieties cannot be achieved (Wijayani dan Widodo, 2005).

MATERIALS AND METHODS

This research was conducted from July - October 2018 in the K2 home growth center L2DIKTI Medan. Materials used are nila fish (*Oreochromis niloticus*), chili seeds of the varieties of Kirana, Pasemah and Kopay. The planting media used are, rockwall, husk charcoal, cocopeat and ferlit. The tools used are plant racks, pH meters to measure the pH of pond water and TDS (Total Disolved Solution) to measure the density of nutrient solutions in pond water, meters, knives and scissors. The study was conducted using factorial complete randomized design with two factors and two replications. The first factor is planting media (M1 = Rockwall, M2 = husk charcoal, M3 = Cocopeat, and M4 = Ferlit). The second factor is chili plant varieties (V1 = Kirana, V = Pasemah, and V3 = Kopay). The research was carried out by making plant shelves with an aquaponics system made of iron and PVC pipes (figure 1). Plant pots containing each treatment of planting media and varieties were arranged on an aquaponic shelf. Maintenance of plants and fish is done every day. Observation variables observed were number of branches, number of fruit and chili production per plant medium. Data were analyzed using variance analysis. If there is a real effect of the treatment factor, the data analysis is continued with Duncan's multiple distance test (Duncan multiple Range Test).

RESULT AND DISCUSSION

Number of Branches (branches)

The data of observation and test of variance of the average number of branches (branches) of several red chili varieties due to the planting media on aquaponic systems in the average different test using multiple distance test (Duncan) are shown in Table 1. The results of variance analysis showed that media planting has a very significant effect on the number of branches (branches) while varieties and interactions both show no significant influence on the number of branches (branches).

Table 1. Number of Branches Red Chili Varieties due to Planting Media on Aquaponic Systems

M (Planting Media)	V (variety)			Average
	V1	V2	V3	
M1	**63.78** d	**62.89**	**60.78**	**D**
M2	**83.56** b	**80.33**	**79.17**	**B**
M3	**104.78** a	**98.44**	**102.67**	**A**
M4	**76.11** c	**78.44**	**72.78**	**C**

The numbers in unequal columns are followed according to the Multiple Range Test at 5% level.
M_1 : Rockwool; M_2 : Husk charcoal; M_3 : Cocopeat; M_4 ; Ferlit

The highest number of branches was found in M_3 (cocopeat) and the smallest media at M_0 (rockwooll). The highest number of productive branches was found in varieties V_1 (kirana) and the smallest on V_2 (pasemah).

Amount of Fruit

The data of observation and test of variance of the average number of fruits (fruits) of several red chili varieties due to the planting media in the aquaponics system in the average different test using multiple distance test (Duncan) are shown in Table 2. The results of statistical analysis showed that media planting has a very significant effect on the number of fruits (fruits) while varieties and interactions both show no significant effect on the number of fruits (fruits).

Table 2. Number of Fruits of Some Red Chili Varieties due to Planting Media in Aquaponic Systems

M (Planting Media)	V (Varieties)			Average
	V1	V2	V3	
M1	**22.00**	**21.28**	**19.50**	**D**
M2	**32.00**	**28.78**	**27.67**	**B**
M3	**33.06**	**33.17**	**33.44**	**A**
M4	**24.22**	**25.50**	**24.50**	**C**

Explanation: The numbers in unequal columns are followed according to the Multiple Range Test at 5% level.
M_1 : Rockwool; M_2 : Husk charcoal; M_3 : Cocopeat; M_4 ; Ferlit

The highest number of fruits is found in M_3 (cocopeat) and the smallest media at M_0 (rockwooll). The highest number of productive fruit is found in varieties V_1 (kirana) and the smallest on V_2 (pasemah).

Fruit Weight

The data of observation and test of variance of the average fruit weight (g) of several red chili varieties due to the planting media on the aquaponics system in the mean different test using multiple distance test (Duncan) are shown in Table 3. The results of statistical analysis showed that media planting has a very significant effect on fruit weight (g) while varieties and interactions both show no significant effect on fruit weight (g).

Table 3. Fruit Weight of Some Red Chili Varieties Due to Planting Media in Aquaponic Systems

M (Planting Media)	V (variety)			Average
	V1	V2	V3	
M1	**110.28**	**107.50**	**97.50**	**D**
M2	**147.72**	**148.61**	**130.00**	**B**
M3	**163.06**	**160.00**	**159.72**	**A**
M4	**120.00**	**120.56**	**120.56**	**C**

Explanation: The numbers in unequal columns are followed according to the Multiple Range Test at 5% level.

M_1 : Rockwool; M_2 : Husk charcoal; M_3 : Cocopeat; M_4 ; Ferlit

The highest fruit weight is found in M_3 (cocopeat) and the smallest media on M_1 (rockwooll). The highest number of productive fruit is found in varieties V_1 (kirana) and the smallest on V_2 (pasemah).

DISCUSSION

Some growing media are suitable for use in aquaponic systems, but the media must be routinely controlled whether or not there is a blockage because the blockage of the planting media can cause minimal filtration and death of plant roots because they do not get enough oxygen. In this study cocopeat is the best planting medium compared to other treatments for observing the number of branches, number of fruits and weight of fruit. According to Irawan and Kafiar,(2015) states that cocopeat is one of the growing media produced from the process of destruction of coconut fiber, the process of destruction of coir produced by fiber or fiber, as well as fine powder or cocopeat. Cocopeat has advantages as a planting medium due to its characteristics which contain essential nutrients such as nitrogen (N), phosphorus (P), potassium (K), calcium (Ca) and magnesium (Mg) (Muliawan, 2009). Growing media play a role for plants because plants need nutrients and a wider place to grow to meet the needs of plants. Cocopeat has the advantage of storing water, high water absorption, benefits because it will store nutrients and in cocopeat also contains nutrients that are needed by plants and support the growth of roots quickly so it is good for plants (Artha, 2014). The media used play a role in supporting plant root systems as well as mechanical and biological filters. The aquaponics system is a balanced system between fish sub-systems as nutrient producers, plant sub-systems as users and in the middle are microbial sub-systems as decomposers of organic (substances and ammonia (Samerville *et al* ., 2014). Input of plant properties in aquaponics only comes from the given fish feed. In quality, fish feed contains all the nutrients needed for growth. However, these needs are different from the needs of plants.

Aquaponic water management techniques for fish and plant cultivation will produce nitrogen and phosphorus impurities which will become fertilizer for plants through the use of wastewater from aquaponic tanks so that fertilizer and water needs are no longer a problem. It can be seen that cocopeat is able to withstand nutrients so that plant roots can absorb nutrients derived from this process by utilizing nutrients derived from fish feces. Decomposing bacteria (probiotics) will convert fish feces into nitrogen, then these elements will be used as a source of nutrition in plants (Ghouse, 2015). Through an aquaponics system, plants do not need to be watered or fertilized every day manually. The water in the pool will be pushed upwards (*resirculating*) using the help of a pump so that it can drain nutrient-containing water from fish feces that have been decomposed through the administration of probiotics in pond water so that ammonia (NH_3) decomposes into nitrite (NO_2) and subsequently becoming nitrate (NO_3) and decomposition of ammoniac will lead to the advantage of fish in ponds thereby reducing fish mortality (Tambunan et al, 2010). The quality of water in the pond will be high because the cleanliness of the pool water is maintained, water does not contain substances that are harmful to fish because in the aquaponic system there is a filtration process. Through the recirculation system, the water in the pond is used by plants, and the remaining water from the plants will re-enter the pond again (Saparianto and Susiana, 2014).

CONCLUSION

The results showed that the cocopeat planting media was the best growing media for the use of planting media on aquaponic systems and although the varieties showed no significant effect on parameters but the best varieties were the Kirana varieties on the red chili aquapoinic system.

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