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The Effect of Mosses on the Hydraulic Media of Vegetable Plants in Cirebon, West Java, Indonesia

Retno Widyani, Dein Iftitah and Mus Nilamcaya

Abstract

It's time to eat healthy vegetables. One of the ways to get healthy vegetables is to grow them hydroponically to avoid various environmental pollution. However, it turns out that even hydroponic cultivation still has its own downside, namely the growth of moss. This is because the conditions for moss to grow have been met such as the supply of water which is rich in nutrients and oxygen, and enough sunlight for grow. Usually, in hydroponic systems, we often find moss attached to rock wool and gutter planting media. This begins when the rock wool is submerged in water and the gutter is refilled by water that containing nutrients and also exposed to sunlight. Is there an effect of moss on the productivity of hydroponic plants and how to overcome it? This research was conducted to find out how to overcome moss so as not to interfere with the production of vegetable crops in a hydroponic maintenance system. Based on our observations, the growth of moss certainly affected the development of plants. With minimal moss, the growth of kale seemed to be the most optimal, with wider leaves and dense stem condition. On the other hand, the spinach that was invested with moss didn't grow as optimal as our kale, with thinner leaves and sparse.

Keywords: Mosses, hydraulic media, vegetable plants, Cirebon, Indonesia

1. Introduction

Indonesia is one of several countries in the world that has abundant diversity. Geographically, Indonesia is located between two continents, namely Asia and Australia. This strategic geographical location is one of the factors so that Indonesia becomes one of the centers of diversity in the world and is known as a mega biodiversity country [1]. Each region grows moss with different types. Research on mosses in forest areas has been carried out by Putri et al. [2], in Waterfalls by Cut Raihan et al. [1], in watersheds by Jumiati [3], the Leuser ecosystem area by Zahara [4], and in the UGM campus environment by Sujatmiko and Vitara [5].

The moss is very useful for the preservation of nature both in forests, mountains, waterfalls, campus environments, and the environment around us. But, the moss can also be detrimental if it grows in the same place as the plants we are cultivating. For example, moss grows in hydroponics.

In hydroponic planting systems, moss is often seen. If you do not do prevention and care, the growth of moss will be more and more fertile. However, not all the things that moss needs to grow and develop are in a hydroponic system, such as water that is rich in nutrients, oxygen and sufficient sunlight for its growth.

Horticulture is one source of human nutrition to meet the needs of vitamins and minerals as well as fiber. Horticulture consists of various vegetables such as mustard greens, spinach, chaise. Vegetables are used to complement the daily diet. Growing horticulture in the ground requires a large area of land and a larger workforce and the results are often unsatisfactory due to pests and diseases. Therefore, there was an innovation in vegetable production using hydroponics.

Hydroponic technology has many advantages compared to traditional farming, namely environmentally friendly, hygienically produced products, faster plant growth, maintained vegetable quality, increased quantity, and healthier because it is free from soil pollution, both by heavy metals and plastic waste.

2. The hydraulic media of vegetable plants

Increasing vegetable production needs to be supported by various efforts, one of which is extensification with increasing use of non-agricultural land and agricultural intensification [6].

Hydroponics is a way of cultivating plants by utilizing water without using soil as a planting medium, so hydroponics is very important in meeting plant nutrients. In the hydroponic method, the function of the soil replacement medium is to support the plant and the most important thing is water which functions to dissolve nutrients that will be absorbed by plant roots.

Hydroponics requires less water and is more efficient than plants with soil media (conventional), so it is very good if applied to areas that have a limited water supply. This system does not require a large area of land, it is enough to use the yard of the house or narrow places in urban areas.

Rockwool or often also called mineral wool is an inorganic material made by blowing air or steam into melted rock. The result of this method is a type of fiber that has cavities with diameters between 6 and 10 micrometers. Rockwool can hold water and air in good amounts to support the development of plant roots [7].

Another advantage of planting with the hydroponic method is:

1. Eco-friendly.
2. Safe from pesticides.
3. More innovative.
4. Vegetables are fresher.
5. Harvest can be arranged.
6. Plants grow faster.
7. Free from nuisance plants/weeds.
8. Easy to harvest results.

3. Bryophyta on the hydraulic media

Moss (Bryophyta) is a group of lower plants that grow widely on land. Moss is a small plant that grows attached to the substrate (stones, trees, wood, and soil). The life of moss is influenced by environmental factors such as temperature, humidity and light [3].

Moss has green leaves and contains chlorophyll so that with the help of sunlight it can carry out the process of photosynthesis [4]. Leaf moss (musci) is an expanse of leaf moss consists of one leaf moss plant that grows tightly and densely in groups to strengthen and support each other (**Figure 1**). This moss is not attached to its substrate but has rhizoids attached to its body. The body is generally erect, in the form of a thallus, leaves like scales that are dense, dense, and flattened or piled up. Moss forms a thallus in the form of a pillow or thick, and on the forest, the soil is often a layer resembling a velvet [8]. Leaf moss (moss) is the most famous moss plant. Leaf mosses consist of dense groups of mosses, which support each other. Each plant incorporated in the bed is attached to the substrate by elongated cells or cellular filaments called rhizoids. Unfortunately, in this paper, the identification of mosses has not been carried out.

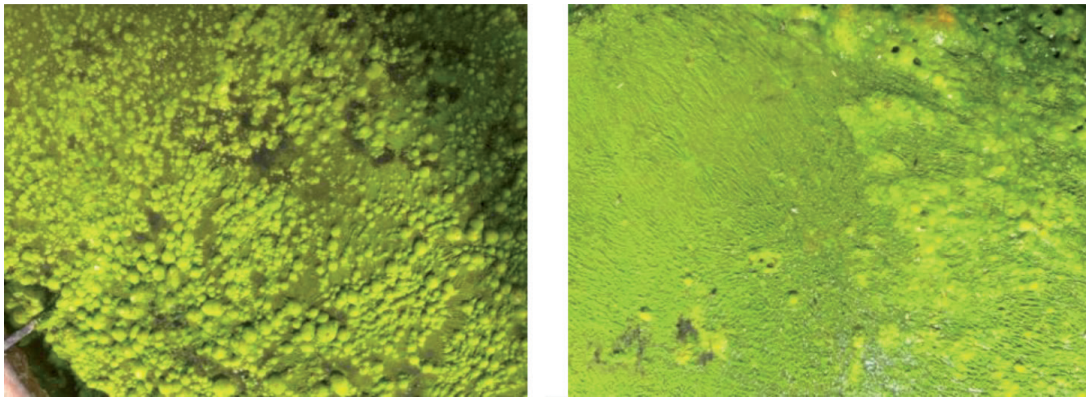


Figure 1.
Moss on Hydroponic Media in Cirebon, West Java, Indonesia.

4. The effect of mosses on the hydraulic media

In conditions with minimal moss, vegetable growth looks very optimal, with indications of wider leaves and dense stem conditions. On the other hand, in conditions where there is quite a lot of moss growth, the growth of kale plants looks not optimal, with indications of thinner leaves and poor stem conditions. Solid (**Figure 2**). The appearance of moss in a hydroponic system will be very difficult to prevent. Farmers cannot avoid the factors that lead to the appearance of moss, even at the beginning of growing seedlings.

The reason moss is not good for hydroponic plants

1. Growing moss needs nutrients, so moss will consume the nutrients available to plants. Thus the plants we plant will compete for nutrients with moss.
2. Moss can reduce the level of acidity in water. Plants absorb nutrients well in a hydroponic system at a water pH level (water acidity) of 5.8 to 6.5. So in the presence of moss, the acidity of the water will be reduced. This will interfere with the plant's ability to absorb nutrients.

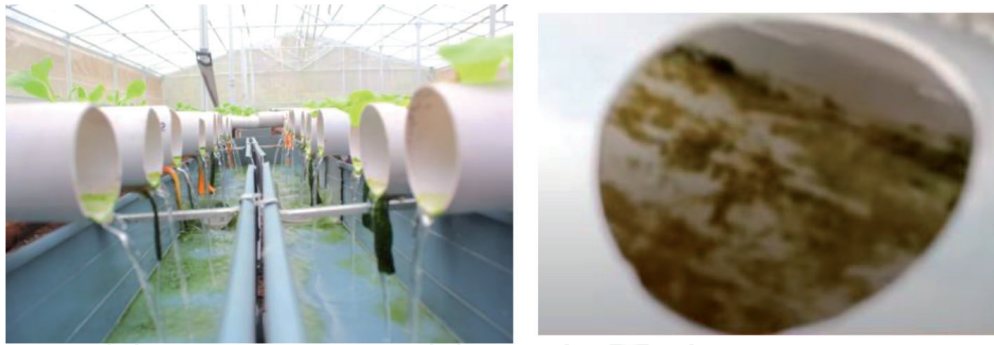


Figure 2.
Moss in the pipe of Hidrophonic instrument.



Figure 3.
The death of the vegetable that grows together with the moss.

3. Lichens will consume oxygen in nutrient solutions at night and produce toxic products. This will interfere with plant growth.
4. Moss can produce an unpleasant odor. The vegetables we grow will smell less fresh (**Figure 3**)

5. Overcoming moss in hydroponic plants

What must be done is to minimize or suppress the growth of moss. Things that can be done include cleaning gutters after each harvest. Cleaning the nursery gutters every time the seedlings move to the gutters (if the seedlings are growing using gutters). Drain and provide shade or cover on the reservoir. Using reservoirs and hoses that do not penetrate the sun. Minimize the gaps where sunlight enters the gutter.

Here we share tips that we do in our garden:

1. Make sure to clean the gully/bucket that we use until it's completely clean at EVERY HARVEST. Because even if there is only a small amount of algae left in the installation, it will spur the growth of more moss in the next planting and so on.
2. Make sure to periodically clean the installation pipelines (inlet and outlet installation networks) to avoid moss interference from inside. Usually, we do it every 6 months to 1 year (depending on the form of each system).

3. At the time of seeding, make sure that the sides of the rock wool are exposed to the sun as little as possible (but for plants you MUST get full sun).
4. We do this by making the Rockwool arrangement neatly lined up in our seedling installation. In this way, there are at least some sides of the Rockwool that are not disturbed by moss.
5. Make sure the root growth is faster than the growth of algae so that the roots are not covered by moss and disturbed the absorption process.
6. If it is already covered with moss, you can spray the roots with water with low pressure and be very careful. The moss will fall off by itself.
7. Close the reservoir. The nutrient liquid in the reservoir, which is full of nutrients, will be the right stimulus for the growth of moss on the walls of the reservoir.
8. Use a black hose. Just like the reservoir, the nutrient liquid flowing down the hose will stimulate the growth of moss on the hose wall. By using a black hose, the sun's rays cannot penetrate.

Another part that likes to be overgrown with moss is in the paragon pipes around the plant roots. The sun's rays penetrate the gaps between the net pot and the PVC pipe, stimulating the growth of moss. For this one, the growth of moss can be overcome by doing regular cleaning.

To overcome the problem of moss growth in Cirebon, West Java, we use H_2O_2 . The benefit of this H_2O_2 is an anti-microbial that is safe from the recommendations of the FDA (United States Food and Drug Administration).

Some of the benefits of H_2O_2 for hydroponic plants:

1. prevent root rot.
2. Plant pest control.
3. Care for seeds before planting.
4. Sprayed on the stems and leaves to eradicate the fungus.
5. Treating wounds or damaged parts of plants.

H_2O_2 can supply extra oxygen to plant roots, so the absorption of nutrients to the roots will be maximized, when plants get enough nutrients, growth will be faster, healthier, and also stronger against pests. In water for hydroponics, you can use the dose of 2 ml H_2O_2 /liter water, first while looking at the condition of the plants because if there are too many hydroponic plants, they can wither.

The second way to deal with moss we use an ultraviolet lamp (**Figure 4**).

The benefit of UV light, the nutrients needed by hydroponic plants are maintained and get enough light for a full 24 hours so that plants grow more optimally. The rapid growth of 24-hour plants will beat the growth of moss so that moss disturbances can be overcome using an ultraviolet lamp. With a stable irrigation system and lighting with UV lamps, organic vegetables can be harvested in just 30–35 days, faster than the normal 45 days. In terms of weight, it can reach 200–250 grams for each plant stem. Certainly heavier than ordinary hydroponics which



Figure 4.
Ultraviolet light.



Figure 5.
Vegetable grows healthy without moss.

usually only reaches 150 grams per plant stem. In terms of quality, plants that use a hydroponic system with a UV light have brighter leaves, bright white roots. This is an indicator that the plant is growing healthily. (**Figure 5**)

6. Conclusion

The Conclusion of this research is the growth of moss certainly affected the development of plants. With minimal moss, the growth of kale seemed to be the most optimal, with wider leaves and dense stem condition. On the other hand, the spinach that was invested with moss did not grow as optimal as our kale, with thinner leaves and sparse.

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