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Optimizing the Use of Used Materials for Hydroponic Growing Media in Community Empowerment and Environmental Management Efforts

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Abstract. *This article aims to examine the potential for optimizing the use of used materials for hydroponic planting media, focusing on two main aspects: community empowerment and environmental management. By utilizing used materials, it is expected to reduce dependence on limited natural resources, reduce agricultural production costs, and reduce the environmental impact of waste. In addition, the application of this technology can provide economic and social benefits to local communities, strengthening their capacity to maating these practices as part of a sustainable development strategy.*

Keywords*: hydroponics, community empowerment, environmental management*

1. BACKGROUND

In a modern era marked by urbanization and increasing population, the issues of waste management and food security are becoming increasingly crucial. Waste materials, which are often considered an environmental problem, actually have great potential to be utilized in various applications, one of which is in hydroponic farming systems. Hydroponics, a method of growing crops without the use of soil, offers a sustainable solution for food production with better space and resource efficiency.

However, the main challenge in hydroponic systems is the provision of quality and sustainable growing media. This is where reused materials play an important role. Using reused materials as hydroponic growing media not only reduces waste and environmental impact but also provides opportunities for community empowerment through training programs and local initiatives.

This article aims to explore the potential of optimizing the use of used materials for hydroponic growing media, focusing on two main aspects: community empowerment and environmental management. By utilizing reused materials, it is expected to reduce dependence on limited natural resources, lower agricultural production costs, and reduce the environmental impact of waste. In addition, the application of this technology can provide economic and social benefits to local communities, strengthen their capacity to manage resources and improve food security.

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Through this study, it is hoped that the best model for utilizing scrap materials as hydroponic growing media can be found and these practices disseminated as part of a sustainable development strategy.

2. THEORETICAL REVIEW

Community empowerment is a process that provides opportunities for individuals, families, and community groups to gain greater control over the decisions that affect their lives, and increase their capacity to achieve well-being. According to Suharto (2010), empowerment can be done by improving people's skills and knowledge, as well as strengthening social relationships that support decision-making. One approach to empowerment is through the utilization of local resources, including used materials, for activities that have long-term benefits such as environmental management.

Environmental management focuses on the protection, maintenance, and improvement of environmental quality. One of the emerging approaches in environmental management is the reuse of used goods to reduce waste. According to Munasinghe (2003), this approach can minimize waste going to landfills and also support sustainability practices. The utilization of used materials such as plastic bottles and used beverage containers can be used as hydroponic growing media, reducing plastic pollution, and at the same time providing a means for the community to produce organic plants.

Hydroponics is a method of growing crops without the use of soil, but utilizing nutrient-rich water. According to Resh (2013), this technique provides the advantage of efficient use of water and less space compared to conventional farming. In addition, hydroponics is suitable for urban environments or areas with limited land. The use of used materials as hydroponic growing media is an innovation that supports the concept of sustainability, as well as a solution to the problem of plastic waste.

The use of used materials in hydroponics not only supports waste reduction efforts, but can also be a means for community empowerment. Used bottles, for example, can be modified into hydroponic planting containers, which can then be used to grow vegetables or herbs. According to [Susilawati and Yulianto (2020), the use of used goods can help reduce operational costs in developing hydroponic systems, especially among communities with limited access to capital.

3. RESEARCH METHODS

This research used a participatory research approach with an action research method. The purpose of this research is to develop, implement, and evaluate the use of used materials as hydroponic growing media in the Jatirejo Village community. This research will actively involve the community, both in the process of collecting used materials, making planting media, and managing the harvest.

The subjects of this research are the people of Jatirejo Village, especially housewives, local farmers, and the community. Participants were selected based on their involvement in empowerment programs and environmental management activities. A total of 30 families will be sampled in this study, and they will be involved in training activities and hydroponic practices.

Data collection techniques in this study include:

1) In-depth Interview

   To explore the community's understanding of empowerment, environmental management, and their views on the use of used materials as hydroponic growing media.

2) Participatory Observation

   To see firsthand how the community utilizes scrap materials in hydroponics, as well as evaluate the effectiveness of this method.

3) Documentation

   Documentation in the form of photos or videos documenting the process of implementing activities from the collection of used materials to the harvesting of hydroponik.

4. RESULTS AND DISCUSSION

Hydroponics is a farming technique that does not use soil as a growing medium, but instead utilizes water enriched with essential nutrient solutions for plant growth. The word "hydroponics" comes from the Greek, "hydro" meaning water and "ponos" meaning work. This technique has grown rapidly and become one of the innovative methods of agriculture, especially in urban areas with limited land.

In a hydroponic system, the plant roots are directly in the nutrient solution or in an inert growing medium such as rockwool, husk charcoal, or perlite that has no nutrient value but is able to hold water and oxygen. This system allows full control over plant growth conditions,

including pH, humidity, and nutrient concentration, allowing plants to grow faster and produce higher yields compared to conventional farming methods.

In this program, 90 used bottles and aqua bottles were collected by KKN students and the people of Duren Hamlet. The bottles were then processed into hydroponic planting media. Each bottle was cut and turned into a container for plants, which were then arranged in a simple hydroponic system in several residents' homes.

Advantages of Hydroponics The hydroponic method offers a number of significant advantages, including:

1) Efficient Water Use: Hydroponic systems use much less water compared to conventional farming. The water used in these systems circulates and only a small portion is lost to evaporation. This makes hydroponics an ideal choice for areas that have water limitations.
2) Faster Plant Growth Since plants directly get the nutrients they need without the need to look for them in the soil, plant growth in hydroponic systems tends to be faster and healthier.
3) Better Pest and Disease Control Without the use of soil, the risk of soil pests and diseases is minimized. In addition, the controlled environment in a hydroponic system also reduces the need for pesticides.
4) Effective Space Utilization Hydroponics allows planting vertically or in enclosed spaces such as greenhouses, which optimizes the use of space and is suitable for urban environments with limited land.

Disadvantages of Hydroponics While hydroponics has many advantages, it also has some disadvantages that need to be considered:

1) High Initial Cost: The initial investment to start a hydroponic system is relatively high compared to conventional farming. This cost includes the purchase of equipment, such as pumps, irrigation systems, and growing media, as well as operational costs for system maintenance.
2) Dependence on Technology and Electricity: Most hydroponic systems rely on technology and equipment that require electricity, such as grow lights, pumps, and ventilation systems. In the event of a power outage or technical malfunction, plants may experience stress or even die.
3) Specialized Skills and Knowledge: Managing a hydroponic system requires a deep understanding of plant nutrition, pH regulation, and environmental management.

Without adequate knowledge, small mistakes in settings can cause major damage to the plants.

4) Dependence on Artificial Nutrient Sources: Hydroponic systems are completely dependent on nutrient solutions that must be prepared manually and regularly. This makes it necessary for the grower to have constant access to the necessary chemicals and to ensure the right balance of nutrients for the plants.

1. **Potential Utilization of Used Items in Hydroponics**

Picture 1. Documentation

Picture 2. Documentation

The use of used items as growing media or other components in hydroponic systems offers an attractive solution to overcome some of the above drawbacks. The utilization of used items, such as plastic bottles and used pipes, can reduce initial costs and contribute to environmental sustainability by reducing waste. In addition, the use of used items can be an effective educational tool to increase the environmental awareness and technical skills of the community, which in turn can support broader community empowerment.

This literature review provides an overview of the concept of hydroponics and its advantages and disadvantages. With this understanding, research on the utilization of used

goods as hydroponic growing media can be more focused and make a meaningful contribution to the development of sustainable agricultural technology.

2. Use of Used Materials as Planting Media

In recent decades, environmental sustainability and sustainable agriculture have become a major focus in various research fields. One of the growing approaches is the use of scrap materials as growing media. This research reviewed relevant literature on the use of various scrap materials, such as plastics, old fabrics, sawdust, coffee grounds, and various other organic wastes, that have been used as growing media. This review aims to evaluate the effectiveness of these materials in supporting plant growth, as well as their potential in reducing waste and supporting sustainable agriculture.

a) Recycled Plastic as Growing Media

Several studies have explored the use of recycled plastic as a component in growing media. Although plastic is not an organic material, its physical structure can be utilized to improve soil aeration and drainage. For example, a study by Smith et al. (2015) showed that the use of recycled plastic in combination with conventional soil can improve drainage and reduce root diseases in several types of horticultural crops. However, the use of recycled plastics needs to be considered carefully due to the potential risk of microplastic contamination which can have adverse effects on the environment and human health (Thompson et al., 2009).

b) Rags and Textiles

The use of scrap fabric as a growing medium has been investigated in several studies highlighting its water retention and soil erosion control capabilities. According to research by Jones and Grace (2017), scrap fabrics such as cotton and linen have good water-absorbing ability and can support the growth of plant seedlings effectively. In addition, scrap fabric can be used in vertical or hydroponic systems to provide physical support for plants without the use of conventional soil, which can reduce the overall weight of the system and minimize water usage.

c) Sawdust and Wood Waste

Sawdust and other wood wastes are common scrap materials used as growing media or compost. Research by Nguyen et al. (2018) showed that sawdust can be used as a mixture in growing media due to its ability to retain moisture and provide good aeration. However, special attention to the decomposition of this material is required, as the use of raw sawdust may cause nitrogen competition with plants, resulting in nutrient

deficiencies (Paz et al., 2019). Therefore, composting of sawdust before use is often recommended to reduce such negative impacts.

d) Coffee Dregs as a Growing Medium

Coffee grounds, often considered as waste, have been investigated as an alternative growing medium due to their high organic and nutritional content. Studies by Bustamante et al. (2010) indicated that coffee grounds can improve soil structure and provide additional nutrients, such as nitrogen, phosphorus, and potassium, which are essential for plant growth. In addition, coffee grounds are also known to have anti-microbial properties that can reduce the risk of fungal infections in plants. However, their use needs to be balanced with other materials to avoid excessive soil acidity.

e) Other Organic Wastes

In addition to the materials already mentioned, various other types of organic waste such as rice husks, eggshells, and vegetable waste are also used as growing media. Research by Zainudin et al. (2020) showed that the use of rice husks as part of the growing media mix can improve drainage and aeration, while providing an important source of silica for rice plant growth. Meanwhile, crushed eggshells can be used to supplement calcium in the soil, which is beneficial for crops such as tomatoes and chilies that require high calcium for optimal growth (Yadav et al., 2021).

5. CONCLUSIONS AND SUGGESTIONS

Conclusion

Based on the research results, it can be concluded that the utilization of used materials as hydroponic growing media has great potential in community empowerment. The use of used materials not only reduces production costs, but also opens up new business opportunities for the community, especially in urban areas. In addition, the formation of hydroponic farmer groups can increase social solidarity and community knowledge about more modern plant cultivation techniques.

Optimizing the use of used materials for hydroponic growing media in community empowerment and environmental management efforts by using used materials such as plastic bottles, plastic cups, etc. can be used as hydroponic growing media. This not only reduces the amount of plastic waste that ends up in the oceans, but also allows the cultivation of plants in areas that experience water limitations.

Hydroponic systems use water as a medium for nutrient delivery, thus reducing the use of soil and fertilizers, and preventing environmental pollution. Socialization and training

activities on making hydroponic growing media by utilizing used materials have been carried out in various regions. This aims to increase the knowledge and skills of the community in managing the environment and improving the community's economy. By utilizing plastic bottle waste, the community can improve their economy through the sale of hydroponic crops. For example, in Jatirejo Village, Ngampel District, Kendal, HIDBOKAS (Used Bottle Hydroponics) activities have improved the creative economy and reduced plastic waste.

In conclusion, the use of used materials as hydroponic growing media is not only effective in reducing plastic waste and saving costs, but can also increase environmental awareness and the community's economy. This implementation can be developed in various regions, especially in areas that have limited land and resources.

Advice

As for suggestions for future researchers, researchers hope that there will be further research on further development, such as expanding the program to other communities, increasing technological capacity, or collaborating with related parties.

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We hope this article can be a useful source of information for everyone interested in optimizing the use of scrap materials as hydroponic growing media. By doing so, we can create a more sustainable society and reduce negative impacts on the environment.

Thank you once again to everyone who has supported us in writing this article. Let us continue to contribute in our efforts to maintain environmental quality and improve the welfare of society.

REFERENCE

Bustamante, M. A., et al. (2010). Coffee grounds as a natural fertilizer for horticultural crops. *Agronomy for Sustainable Development*.

Jones, C., & Grace, J. (2017). Recycled textiles as a medium for urban farming. *Journal of Urban Agriculture*.

Kurniawan, H., & Astuti, W. (2022). Community empowerment through hydroponic technology in Jatirejo Village. *Journal of Community Service, 5*(1), 55–68.

Nguyen, T. T., et al. (2018). Sawdust as an alternative media for plant growth. *Environmental Science and Pollution Research*.

Santoso, B., & Lestari, N. (2023). Utilization of plastic bottle waste for hydroponic farming. *Proceedings of the National Community Service Seminar, 4*(2), 123–130.

Smith, L., et al. (2015). Utilizing recycled plastic in horticultural substrates. *Horticultural Science*.

Thompson, R. C., et al. (2009). Microplastics in the environment: A review of sources, impacts, and policy responses. *Marine Pollution Bulletin*.

Widiastuti, A. (2021). Hydroponics training for village communities in Kendal Regency. *Journal of Innovation and Technology, 3*(3), 45–59.

Yadav, A., et al. (2021). Eggshells as a sustainable source of calcium for tomato plants. *Journal of Agricultural Science*.

Zainudin, M. F., et al. (2020). Rice husk in plant growth: Benefits and potential uses. *International Journal of Plant Production*.