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EFFECTIVENESS OF ORGANIC VEGETABLE PLANTING PRODUCTIVITY WITH HYDROPONIC AND VERTICULTURE METHODS AT SMA CENDRAWASIH II SOUTH TANGERANG CITY

Abdillah Munawir [1*], Edi Rusdiyanto [2], Siti Umamah Naili Muna [3]
Universitas Terbuka
E-Mail: [1*] abdillahmunawir@ecampus.ut.ac.id, [2] edi@ecampus.ut.ac.id

Abstract

The implementation of service at Cendrawasih II High School focuses on the organic vegetable planting system with hydroponic and verticulture methods. The method used is Participatory Learning through Participatory teachers and school partner students with discussion, practice and demonstration materials. The results of the dedication explain the hydroponic method system, a plant technique that is grown in a nutrient solution consisting of a mixture of water and all the essential nutrients needed by plants for optimal growth. For the verticulture method system, a farming technique in which plants are planted vertically in multilevel containers or multilevel structures. Growing vegetables in verticulture can be a good solution to make efficient use of space, but its success depends on good planning, consistent care, and proper selection of plants. Verticulture farming method, yields are quite good because the multilevel system allows cultivation in limited space, maximizing vertical land use. Hydroponic systems, yields are impressive due to the simple system and excellent control of nutrients provided to plants with higher organic vegetable productivity and grow faster than verticulture systems.
Keywords: Hydroponics, Verticulture, Organic Vegetables, High School, Cendrawasih II

INTRODUCTION

Cultivation for the production of plant materials and other agricultural products with the development of vegetable planting technology is very important to be implemented to maintain crop stability (Roidah, 2013; Rusdiyanto et al., 2023). Vegetable cultivation is the development and application of organic and non-organic vegetables (Alif, 2017; Munawir et al., 2023). Organic vegetable farming is the cultivation of vegetables without the use of chemicals such as fertilizers or pest control (Munawir et al., 2022b; Rusdiyanto and Munawir., 2023). Non-organic vegetable crops are basically vegetable crops that are grown using chemicals such as pesticides and chemical fertilizers (Danfar, 2009; Merpaung et al., 2020). The hydroponic farming system is one alternative to the development of organic agricultural crops without using non-organic materials (Saptorini dan Sutiknjo, 2021). Hydroponic farming systems have various advantages, such as relatively narrow land requirements, low levels of pest and disease attacks due to controlled environmental conditions, increased plant growth and yield due to more controlled nutrition, efficient use of fertilizers and water, and avoiding plants from

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drought, erosion, and flooding. Vegetables grown by hydroponic methods are also generally cleaner and have a better taste than conventionally grown vegetables (Khafidin et al., 2022; Rusdiyanto and Munawir., 2023).

In general, in urban areas, planting the desired crop is sometimes constrained by land area. To overcome narrow land in addition to a hydroponic system can also be done by planting plants verticulturally. Verticulture system is an agricultural cultivation system that is carried out vertically or stratified (Izhar et al., 2016; Diwanti, 2018). This system is suitable for application in narrow lands or in densely populated settlements (Nuraida et al, 2023). The verticulture method is an agricultural cultivation system that is carried out vertically or stratified both indoors and outdoors. Vertical or multilevel farming cultivation systems are very suitable for urban areas and limited land. Verticulture requirements are robust and easy to move (Lukman, 2017). Plants to be planted should be adjusted to the needs and have high economic value, short-lived and short-rooted. There are many types of plants that can be grown verticulturally, usually from vegetables, ornamental plants or medicinal plant commodities known as horticultural plants (Trianto et al., 2021). Vegetable crops that are often cultivated verticulturally include mustard, chives, lettuce, kale, spinach, pakcoy, caisim, katuk, basil, celery, tomatoes, bitter melon, string beans, cucumbers, leeks, and other leaf vegetable crops (Munawir et al., 2023; Lukman, 2017).

Senior High School (SMA) students are students who can develop organic farming techniques using hiroponic and verticulture systems. The results of growing organic vegetables in middle school-age children become a determining factor in introducing vegetable foods early to get information about the benefits of organic vegetables for health, and others. If school students' interest in organic vegetable foods is increased, it will have an impact on improving student health not only for current health but also beneficial for future health. If school students only know snacks and industrial drinks without considering other risks that can affect the development of children's intelligence levels. Even though the age of high school is known as the golden age, which is when the human brain experiences its best development. The problem of low level of vegetable consumption and the lack of knowledge of high school students about gardening activities and the types of vegetables and their benefits so that our Community Service Team at the Open University wants to participate and play a direct role in helping the Principal of Cendrawasih II High School (SMA) in empowering students for Hydroponic and verticulture vegetable cultivation activities. As a consideration, the school was chosen as Abdimas' target because based on the observations of the Abdimas team, it showed that CENDRAWASIH II HIGH SCHOOL was included in a group of schools that were not at all familiar with good vegetable cultivation techniques for high school students' nutrition with hydroponic and verticultural models.

The Open University as a Higher Education institution participates in building society by applying its knowledge. According to Law No. 12 of 2012, article 1 paragraph 9, universities have the obligation to organize the Tri Dharma of Higher Education with elements of Education, Research, and Community Service. The element of Community Service is an activity of the academic community that utilizes science and technology to advance community welfare and educate the nation's life.

IMPLEMENTATION METHOD

Participatory Learning (Nursyamsu, 2018) in (Munawir et al, 2022a), this method includes discussion activities with the community and farmer groups about the importance of organic vegetable planting techniques in schools with Hydroponic and Verticulture Method System Techniques.

The object of service activities is Cendrawasih II Senior High School (SMA) Students, Pondok Aren District, South Tangerang City. The target target is as many as 50 students from the Student Council Members of SMA Cendrawasih II.

The stages of this service activity consist of vegetable cultivation with hydroponics and verticulture which are integrated into CENDRAWASIH II HIGH SCHOOL students by carrying out a series of activities, as follows:

Table 4.1. Details of Vegetable Cultivation by Hydroponics and Verticulture methods on CENDRAWASIH II High School Students

No.	Activities	Executive
1.	Giving questionnaires to principals, teachers, and students about the importance of vegetable consumption. As well as understanding about vegetable cultivation with hydroponics and verticulture that can be done in the school yard, so that students can learn to cultivate organic vegetables.	UT Abdimas Team Center
2.	Providing counseling related to organic vegetable consumption on the fulfillment of nutrients for brain development and improving body health for CENDRAWASIH High School Students	UT Abdimas Team Center
3.	Preparing land of 3 x 4 M2 for hydroponics and verticulture areas.	
4.	Making media for hydroponics and verticulture with paralone and mild steel in holes with a diameter of 10 cm and plastic gutters	
5.	Make a green house with a size of 3 x 4 M2	
6.	Demonstrate how to cultivate organic vegetables with hydroponics and verticulture.	UT Abdimas Team Center
7.	Monitoring and evaluating the results of counseling and demonstration	UT Abdimas Team Center

*) *Open University Abdimas Team.*

In addition to the activities of providing knowledge and skills to school students completed, monitoring activities will be carried out three times. This activity is intended to obtain information whether any of these Abdimas students and teachers experience problems in following up on this Abdimas activity. Monitoring is planned to be carried out for 3-6 months after the transfer of green house verticulture and hydroponic seedlings.

RESULTS AND DISCUSSION

Initial Survey of Hydroponic and Verticultural Organic Vegetable Growing Sites

The implementation of organic vegetable planting service with verticulture and hydroponic systems at SMA Cendrawasih II, Pondok Aren District, South Tangerang City, focuses on implementing productivity, health and growth of school students by planting vegetables that are very useful for school students, especially organic vegetable crops Paprika, Pok Coy, Kale, Spinach, Tomatoes and other organic crops.

Figure 1. Brainstorming and Location of Community Service Implementation Planning

In the early stages of implementing the Open University Lecturer service, the initial steps were carried out by initial coordination, planning, and brainstorming to SMA Cendrawasih II South Tangerang City. Brainstorming is a very useful process in community service planning, especially in the implementation of verticulture and hydroponic methods. Some of the benefits of brainstorming include:

1. **Idea Gathering**: Brainstorming allows the team to collect diverse ideas from its main team members, Teachers and School Students who have different backgrounds and experiences related to the implementation of Community Service on organic vegetable cultivation.
2. **Creativity**: This process encourages creativity because the main team members of Teachers and Students can think productively and propose innovative solutions related to the cultivation of organic vegetable crops.
3. **Increased Collaboration**: Facilitating collaboration between members of the main team, teachers and school students to broaden perspectives and ideas related to the implementation of community service related to growing organic vegetables, verticulture and hydroponic method systems.

4. **Problem Solving:** Allows identification of problems from verticultural and hydroponic growing of organic vegetables that may arise and plan strategies to overcome these problems.

As for the location of planning the implementation of verticulture and hydroponic vegetable plant service, consider these factors to be very decisive, among others:

1. **Accessibility**: Choose a location that is easily accessible to School Teachers and Students who will be participants or beneficiaries of service from Open University Lecturers.
2. **Available Room or Land:** Make sure there is enough space or land to build a verticulture or hydroponic method system. This can be on vacant lots, rooftops of buildings, or other open spaces.
3. **Environmental Factors:** Consider environmental factors such as solar lighting, water availability, and other environmental conditions that may affect plant growth.
4. **Availability of Resources:** Ensure that the location has access to the necessary resources such as water, electricity, and materials for verticulture or hydroponic method systems.
5. **Participation of Teachers and Students:** The locations involved must have active involvement from Cendrawasih II High School Teachers and Students so that they can learn and be fully involved in the implementation of service.

In identifying the location of the service implementation planning, first ensure some consideration of technical aspects, plant needs, and relevant community involvement. The more holistic the site planning for planting organic vegetables, verticulture and hydroponic systems, the better the implementation of service carried out at SMA Cendrawasih II will be.

Preparation of Training Materials for Growing Hydroponic Vegetables and Verticulture

The preparation of training materials and demonstrations of growing hydroponic vegetables and verticulture in schools has a number of significant benefits including practical education, skills development, increased environmental awareness, introduction to modern technology, school community involvement, interdisciplinary learning, improved nutrition and health, development of independence and confidence and support for sustainability. In line with the opinions of Rusdiyanto and Munawir (2023) who explained that the benefits of implementing organic vegetable planting demonstrations can develop independence and ensure improved nutrition and health. Students gain practical experience as well as become the foundation of the importance of healthy living in growing vegetables with hydroponic and verticulture method technology, which can be valuable knowledge about modern agriculture.

Figure 2. Material Preparation for the Implementation of Hydroponic and Verticultural Methods

The verticulture and hydroponic system of Cendrawasih II High School (SMA) uses various tools and materials to support plant growth without soil. Here are some tools and materials commonly used in both systems:

Verticulture Method:

1. **Vertical Pot:** Can be multi-tiered pots or wall panels with pockets where to plant.
2. **Growing Media:** Such as a mixture of coconut fiber, cocopeat, sand, or other inert materials to support and nourish plants.
3. **Irrigation System:** Drip system or drip irrigation system to provide water and nutrients to plants efficiently.
4. **Fertilizer:** A liquid fertilizer or nutrient solution that is given to plants regularly through an irrigation system.
5. **Plants:** Seeds or seeds of vegetable or ornamental crops suitable for verticulture systems.

Hydroponic Method:

1. **Water Storage Container:** A tub or tank that contains nutrient solution and water to provide nutrients to plants.
2. **Alternative Growing Media:** Rockwool, gravel, sand, or other inert materials used to sustain plants and provide stability.
3. **Nutrients:** A nutrient solution consisting of a mixture of essential minerals needed by plants to grow without soil.
4. **Pump and Irrigation System:** To drain the nutrient solution to the roots of plants in an orderly and controlled manner.
5. **5. pH Meter and EC Meter:** A device to measure the pH level and density of nutrient solutions so that conditions are suitable for plants.
6. **Plants:** Seeds or seeds suitable for hydroponic systems.

Both verticulture and hydroponic methods have a similar basic principle, which is to provide support and nutrients to plants without using soil as a growth medium. The use of the right tools and materials as well as a good understanding of the needs of plants will help in the success of the farming system run in the School.

Seeding and Seeding Hydroponic and Verticulture Methods

Seeding and seeding organic vegetable crops is an important step in the agricultural process to prepare seeds to grow into strong and healthy plants (Munawir et al., 2023).

Figure 3. Seeding and Seeding of Organic Vegetable Plant Material Verticulture and Hydroponic Methods

Seeding and seeding are important early stages in the hydroponic and verticulture farming process. Here are the general steps that need to be done:

Seeding:

1. **Choose Quality Seeds:** Make sure you use good quality seeds, according to the type of plant you will grow, especially organic vegetable plants.
2. **Seeding Media:** Use suitable seeding media such as rockwool, cocopeat, or special hydroponic media that can support and support the growth of seedlings.

3. **Seed Sowing:** Plant seeds of appropriate depth on seeding medium. Be sure to water it gently so that the seeds are well watered without submerging.
4. **Storage and Care:** Place the seeding medium in a warm, bright place but not exposed to direct sunlight. Make sure humidity is maintained and regular maintenance is carried out.

Nursery:

1. **Transfer to a Hydroponic or Verticulture Method System:** Once the seedlings have grown large enough, prepare a pre-prepared hydroponic or verticulture system.
2. **Preparation of Growing Media:** Prepare planting media that has been prepared in a hydroponic or verticulture method system. Make sure this media is suitable to support plant growth.
3. **Transplant:** Care is required by transplanting seedlings into hydroponic or verticulture methods by ensuring the roots are not damaged. Also make sure the seedlings are planted at an appropriate distance according to the organic vegetable plant growth guidelines.
4. **Maintenance:** Provide the necessary nutrition and care according to the system used. Monitor plants regularly to ensure their growth.

It is important to understand the needs of different plants and pay attention to the environmental conditions of the school where they are grown. Good monitoring of seedling growth and consistent care will help in producing healthy and productive plants. In the implementation of Open University service, systematic stages are carried out from the stages of brainstorming, seeding, seeding, training related to material and planting with hydroponic and verticulture method systems, the last is the stage to determine the development of organic vegetable plant growth carried out regular monitoring.

Demonstration of Vegetable Growing Hydroponic and Verticulture Methods and Understanding the Benefits of the Importance of Organic Vegetables

The importance of organic vegetables for health and intelligence requires a skill in students as an experience learning how to care for plants, monitor growth, manage hydroponic and verticultural method systems, and understand the basic elements of agriculture. Understanding ecosystems with demonstrations of growing vegetables with this method of service helps students understand the role of the environment, plant life cycles, as well as the impact of agricultural systems on the environment. Technological knowledge can introduce hydroponic and verticulture technologies giving students insight into innovations in agriculture that can help solve sustainability and land shortage issues.

Figure 4. Demonstration and Provision of Organic Vegetable Planting Material Verticulture and Hydroponic Methods Open University Service 2023

In figure 4, it shows the increase in teacher and student participation so that it becomes a supporting capacity to be able to encourage student and teacher involvement in school activities, creating positive relationships between schools and communities. With the implementation of this service, integration can be carried out in subjects in the use of hydroponic and verticultural methods so that they are easily integrated into the existing curriculum, connecting fields such as science, mathematics, technology, biology, and the environment related to natural sciences. In addition, it can also be an access to healthy food for students to understand the importance of producing their own food and have greater access to healthy and organic food.

Valuable experience in growing vegetables directly can help students feel a sense of accomplishment as well as build confidence and responsibility. Environmental awareness by practicing environmentally friendly farming methods, students will be more aware of the importance of acting to protect the earth. Training and demonstrations of hydroponic vegetable growing and verticulture in schools are not just about agriculture, but also about introducing sustainability principles, practical skills, and understanding of the environment to future generations.

The implementation of verticultural and hydroponic cultivation of organic vegetable

plants needs to be improved, so that the implementation of mentoring between teachers and students in service activities always runs smoothly.

Figure 5. Conditions of Organic Vegetable Plants at SMA Cendrawasih II Implementation of Open University Lecturer Service.

Yields in organic vegetable growing verticulture and hydroponic systems can vary depending on several factors such as the type of crop grown, care provided, the environment in which the plant is grown, and overall management. In verticulture, yields are quite good as the stratified system allows cultivation in limited space, maximizing vertical land use. With proper care, appropriate irrigation, and selection of suitable plant varieties provide very satisfactory results for students of Cendrawasih II High School. However, verticulture productivity is slightly more limited compared to hydroponic systems due to factors such as the volume of soil available.

While the productivity results of organic vegetable cultivation on a hydroponic system, the yield is impressive due to its simple system and excellent control of the nutrients provided to the plants. With a controlled environment and proper nutrition, plants can grow faster and produce more. The yield of the hydroponic system of organic vegetable plants weighs more vegetables than verticulture, on the other hand growing hydroponic vegetables can reduce the risk related to soil diseases and pest disorders because plants do not grow in the soil.

Both of these methods have great potential to produce a high-quality harvest of organic vegetables. However, success in crop yields depends on good management, knowledge of crop needs, use of appropriate techniques, and consistent care.

CONCLUSION

Growing vegetables using hydroponic methods is an innovative and efficient way to produce quality crops without using soil. In hydroponics, plants are grown in a nutrient solution consisting of a mixture of water and all the essential nutrients that plants need for their optimal growth. The verticulture method is a farming technique in which plants are planted vertically in multilevel containers or multi-storey structures. BGrowing vegetables in verticulture can be a good solution to make efficient use of space, but its success depends on good planning,

consistent care, and proper plant selection. Verticulture farming method, yields are quite good because the multilevel system allows cultivation in limited space, maximizing vertical land use. Hydroponic systems, yields are impressive because with simple systems and excellent control of nutrients provided to plants with higher organic vegetable productivity and grow faster than verticulture systems.

REFERENCES

Alif, S. M. (2017). Kiat sukses budidaya cabai rawit. Bio Genesis.

Danfar, 2009. Defenisi Efesiensi. Diakses pada tanggal 28 Juli 2017.

Roidah, I.S. 2013. Manfaat penggunaan pupuk organik untuk kesuburan tanah. Jurnal Universitas Tulungagung Bonorowo,Vol. 1(1): 30-42.

Diwanti, D. P. (2018). Pemanfaatan pertanian rumah tangga (pekarangan rumah) dengan teknik budidaya tanaman sayuran secara vertikultur. Martabe: Jurnal Pengabdian Kepada Masyarakat, 1(3), 101-107.

Izhar, A., Sitawati., Heddy, S. 2016. Pengaruh Media Tanam dan Bahan Vertikultur Terhadap Pertumbuhan dan Hasil Tanaman Pakcoy (Brassica juncea L). Jurnal Produksi Tanaman, Volume. 4, No. 7, Hal 562-569.

Khafidin, K., Sumartik, S., Jannah, R., & Darmawan, D. P. (2022). Edukasi Menanam Sejak Dini Dengan Sistem Hidroponik Melalui Pemanfaatan Lahan Sempit Pada TK Aisyiyah 5. Jurnal Pengabdian kepada Masyarakat Nusantara, 3(1), 323-327.

Lukman, L. 2017. Teknologi Budidaya Tanaman Sayuran Secara Vertikultur. Bandung: Balai Penelitian Tanaman Sayuran.

Munawir A, June T, Kusmana C, Setiawan Y. 2021. Environmental Institution Improvement Using Interpretative Structural Modeling (ISM) Techniques In Lore Lindu National Park (Llnp), Central Of Sulawesi Province-Indonesia. Plant Archives 21(supplement 1). DOI: 10.51470/PLANTARCHIVES.2021.v21.S1.395

Munawir A, Panggabean D, Bachtiar, Muna SUN, Rusdiyanto E, Nirmala SD. 2022a. Traditional Cultivation Techniques Of Cocoa Plants And The Utilization Turmeric Extract Become Vegetable Pesticides For Managing Vascular Streak Dieback (Vsd). ABDI DOSEN, Jurnal Pengabdian Pada Masyarakat. LPPM UIKA Bogor DOI : https://doi.org/10.32832/abdidos.v6i4.1516

Munawir, A., Nurhasanah., Rusdiyanto, E., & Muna, S.U.N. (2022b). Kebijakan Pemanfaatan Hutan Mangrove Berkelanjutan dengan Teknik Interpretative Structural Modeling di Taman Nasional Rawa Aopa, Sulawesi Tenggara. Buletin Ilmiah Marina Sosial Ekonomi Kelautan dan Perikanan. DOI: http://dx.doi.org/10.15578/marina.v8i2.11693

Munawir, A., Rusdiyanto, E., Sumartono, S., Putri, E., & Muna, S. U. N (2023). Membangun Kesadaran Siswa dengan Menanam dan Memasak Sayuran dari Rempah-Rempah Alami di SMP Paramarta Tangerang Selatan. Amalee: Indonesian Journal of Community Research and Engagement, 4(2), 457-467. https://doi.org/10.37680/amalee.v4i2.3059

Nuraida, D., Wulandari, T. S. H., & Nurtjahyani, S. D. (2023). Pelatihan Bertanam Sayuran dengan Teknik Vertikultur pada Paguyuban Wali Murid Raudhotul Athfal Thoriqul

Falah. JPM (Jurnal Pemberdayaan Masyarakat), 8(1), 10-17.

Rusdiyanto E, Muna SUN, Sumartono, Munawir A. 2023. Preparation of Population Data Base for Community Unit 11 East Pamulang Village, Pamulang District South Tangerang City. PKM-P, [S.l.], v. 7, n. 1, p. 154-160, may 2023. ISSN 2615-8019. Available at: <https://pkm.uika-bogor.ac.id/index.php/pkm-p/article/view/1771>. Date accessed: 02 jan. 2024. doi: https://doi.org/10.32832/jurma.v7i1.1771.

Rusdiyanto E and Munawir. 2023. Cultivating Vegetable Planting Beneficial For The Health Of Sdn Students West Cilandak 07 South Jakarta By Verticulture Way. Abdi Dosen : Jurnal Pengabdian Pada Masyarakat, [S.l.], v. 7, n. 2, p. 492-501, june 2023. ISSN 2620-5165. Available at: <https://pkm.uika-bogor.ac.id/index.php/ABDIDOS/article/view/1779>. Date accessed: 02 jan. 2024. doi: https://doi.org/10.32832/abdidos.v7i2.1779.

Saptorini, S., & Sutiknjo, T. D. (2021). Budidaya tanaman sayur dengan metode hidroponik sederhana dalam memanfaatkan botol bekas untuk memenuhi kebutuhan pangan keluarga dalam masa pandemi covid-19. JATIMAS: Jurnal Pertanian dan Pengabdian Masyarakat, 1(1), 82-88.

Trianto, K. A., Setiawan, W., Rindhianto, A. F., Anggrieni, D., Yuptriani, S. P., Fahlifi, R., & Rahayuningsih, S. E. A. (2021). Pengelolaan Sumberdaya Rawa Gambut Dengan Pertanian Sistem Vertikultur Di Desa Tanjung Taruna Kabupaten Pulang Pisau. Pengabdian Kampus: Jurnal Informasi Kegiatan Pengabdian Pada Masyarakat, 8(1), 1-5.