

Dissemination of LED grow light radiation technology to accelerate hydroponic plant growth in the sidomulyo hydroponics business in Perhentian Marpoyan Village, Marpoyan Damai District, Pekanbaru City

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ABSTRACT

This activity is a community service program based on research results. The purpose of this community service program is to make a series of LED grow lights for the "Sidomulyo Hydroponics" business, then increase the growth of hydroponic plants and improve the quality and quantity of hydroponic plants. This program has an output: producing a series of lamps with artificial radiation using UV light that can stimulate the growth of hydroponic plants, so that this technology can help increase the harvest period, quality and quantity of hydroponic plants (mustard) and also with this UV LED grow light radiation technology. there will be many similar efforts that can be helped. The implementation methods used in research-based service include: 1. Preparation of tools and materials, 2. Making circuits and settings for ultraviolet LED grow light radiation, 3. Presentation of materials and training (workshops), 4. Testing the effect of UV grow light radiation. to hydroponic plants. The results of the implementation that have been achieved are as follows: all methods of implementing research-based service have been achieved according to the target. The indicators of success are: 1). series of LED lamps based on UV grow light, 2). The growth of mustard plants using LED grow lights is much faster, with a time span of 1 week faster growth speed than mustard plants without using LED grow lights and includes harvest time.

KEYWORDS

LEDs;
Hydroponics;
Grow Lights;
UV rays;
Harvest Time



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1. Introduction

Agriculture is one sector that plays an important role in meeting food needs in Indonesia, most of the Indonesian population depends on this sector. The process of good plant growth, fertile farmers' lands and the smooth running of this entire process is none other than because it is supported by abundant resources, especially the availability of the most important natural resource for the photosynthesis process of plants, namely sunlight. [1]–[4]. However, this process becomes a problem when unfavorable environmental conditions occur, such as high rainfall, as a result the photosynthesis process in plants does not run well due to lack of sunlight on plants [1], [3]–[5]. This is certainly experienced by every farmer in Indonesia, especially hydroponic farmers [6] in Sidomulyo. Hydroponics lacks sunlight during high rainfall, causing the growth of hydroponic plants (mustard) to be not optimal [7]. This is due to several factors, such as the intensity of sunlight and the duration of sunlight being reduced and not optimal, and this will certainly have a negative impact on the sustainability of this business group. To overcome this problem we need a technology that can be a substitute for even a booster to stimulate the growth of hydroponic plants in conditions of lack of sunlight, the technology that can be used is LED Grow Light [8].

LED grow light is a non-natural light source (artificial) that serves to help and increase plant growth when conditions are lacking in terms of radiation and supplements from natural sunlight [2], [9]. The LED grow light is composed of several rays that can support the photosynthesis process [3], [10], [11]. blue light serves to support the plant growth process during the vegetative process, then red light serves to

increase growth during the generative process in plants. In terms of use and actual application to plants, LED grow lights have advantages and better results than other grow lights such as neon [12]–[14]. based on the results of research conducted by [15]–[19], the LED grow light has a much better efficiency than its predecessor, namely neon, with a maximum PAR efficiency that can be produced, which is 80%-100%, [4], [20]–[23] then only one third of the power used to light fluorescent lamps is used to power LED grow lights [24]. The purpose of this service is to disseminate the introduction of agricultural technology, namely LED grow light [25]–[27]. The workshop was related to training on installing LED grow light lamps and knowing the effect of ultraviolet radiation using LED grow lights on plants in hydroponic Sidomulyo.

2. Method

Community Service Activities (ABDIMAS) based on research results are an internal community service program initiated by the Riau Islamic University, as one of the main tasks of a lecturer, namely community service held in the "Sidomulyo Hydroponics" Business Group. This activity was carried out on Friday, November 12 to December 10, 2021 at the "Sidomulyo Hydroponics" Business Group having its address at the Sidomulyo Housing Complex, Jalan Camar Raya, Perhentian Marpoyan Village, Marpoyan Damai District, Pekanbaru City. The title of this ABDIMAS activity is "Ultraviolet Radiation Using LED Grow Lights to Accelerate Hydroponic Plant Growth in the "Sidomulyo Hydroponics" Business in Perhentian Marpoyan Damai Village, Marpoyan Damai District, Pekanbaru City. This activity is filled with several stages of implementation consisting of:

1. Steps to prepare tools and materials
2. Socialization
3. Intensive workshop
4. Agricultural Technology Testing

This activity focuses on activities related to increasing the quality and quantity of hydroponic plant cultivation based on LED grow light [28]–[34]. The ABDIMAS activities with the "Hydroponic Sidomulyo" business group were carried out with a series of activities, namely:

- The activity was opened by preparing all the tools and materials needed.
- Presentation of material in the form of socialization. The materials presented were: the introduction of lighting technology in agriculture, namely: LED grow light lamps, then making circuits and regulating ultraviolet light radiation (LED grow light).
- The next activity is an intensive workshop (training) with the topic "Installation of LED grow light circuits in closed agricultural ecosystems, namely hydroponic greenhouses as environmentally friendly agricultural technology". In this session, participants will be led to practice installing a series of lights on a hydroponic system.
- Testing the effectiveness of the radiation effect of ultraviolet LED grow light with the primary source of electricity from PLN, in carrying out the workshop activities and testing the agricultural technology, the presenters are assisted by assistants/students.

The community service activity in the "Sidomulyo Hydroponics" business group shows very high enthusiasm in every socialization activity and workshop that is carried out. In the workshop session, training on the installation of LED grow light installations was carried out by several participant representatives. The benchmark for the success of the socialization program, workshops and testing is that the participants who attend provide feedback on each running session, and finally are able to install grow light LED lights that are connected to PLN electricity independently. The documentation of this abdimas activity is as follows:



Fig. 1. The process of community service activities which include socialization, workshops, to testing agricultural technology

3. Results and Discussion

Based on the analysis of the activities that have been carried out, community service activities at "Sidomulyo Hidroponik" went very well, the community was very enthusiastic about the presence of this program, it was shown by their presence in each meeting session from beginning to end. This activity also made the mindset of farmers and community groups increase, especially in terms of awareness of adopting and applying renewable agricultural technology, then from a scientific perspective their understanding of the urgency to migrate from conventional to modern maintenance and cultivation techniques increased rapidly, then from Meanwhile, their understanding related to the installation of LED grow light installations also increased rapidly, during the training session on installing LED grow light technology, participants were able to carry out installations and demonstrate their ability to assemble them. This program is one of the programs that has a very good success measurable index, because from the beginning they did not know anything about renewable agricultural technology, now they already know it and it is hoped that this knowledge can continue to be spread among hydroponic farmers and the people involved in the business. so that the use of agricultural technology will become more massive, sustainable and continuous from one hydroponic farmer to another.

Community service activities in the Sidomulyo Hydroponics business group are carried out through two methods, namely providing education related to the socialization of the use of renewable agricultural technology, then followed by training sessions (workshops) around the installation of LED grow light, lastly testing technology directly on hydroponic plants (plants). mustard). The reason for the presence of this program is that seeing the condition of the people who are members of the Sidomulyo Hydroponics business group under the auspices of the Lucky Women Farmers Group (KWT), it was realized when the mechanical engineering study program team at the Islamic University of Riau visited, there were deficiencies in the production of agricultural products. They, such as inadequate quality and quantity of hydroponic crop yields, are vulnerable to losses when the weather is unfavorable, which only makes hydroponic plant management more difficult and tends to make this business group suffer losses. Therefore, innovations in the context of fixing and mitigating these detrimental things need to be acted upon and resolved.

Introduction of LED Grow Lights As Light Sources To Stimulate Hydroponic Plant Growth Acceleration

The LED grow light is an LED lamp specially made for accelerating plant growth, the LED lights used in this activity are 4 pieces mounted on 4 hydroponic racks with a power usage specification of 12 Watt. LED grow light is the latest innovation in agricultural technology, this innovation aims to accelerate the

process of plant growth so that the owner's productivity in harvesting agricultural crops will increase 2 to 3 times.



Fig. 2. Educational Introduction of LED Grow Lights as a Light Source to Stimulate Hydroponic Plant Growth

Implementation of LED Grow Light Radiation in Hydroponic Greenhouses

LED grow lights have a much higher level of effectiveness in helping plant growth than using non-LED grow lights. LED grow lights have better efficiency than fluorescent grow lights, this is based on the PAR efficiency of LED grow lights of 80%-100% and the spectrum of light produced is much more suitable for plant needs [7]. The LED lights used in this service consist of red and blue colors which end up producing purple light. The combination of red and blue colors produces the final spectrum in the form of purple light which can increase the vegetative and generative processes in plants, and this color is the main energy source in the CO₂ assimilation process in plants, especially during the photosynthesis process [9]. Plant chlorophyll tends to absorb red and blue (purple) light with wavelengths between 400-700 nm [10]. The radiation process using LED grow light lamps carried out on hydroponic plants is as follows:



Fig. 3. Radiation Process Using Solar Cell-based LED Grow Lights at the Sidomulyo Hydroponic Greenhouse

LED grow light is a non-natural light source that can serve as a light source for plants to carry out the photosynthesis process. With this lamp, the photosynthesis process will still be able to run even though natural sunlight is not in maximum condition, or as a supplement when there is not enough sunlight. Below is a picture of a mustard plant seed that grows using an LED grow light and without using (non-LED grow light)

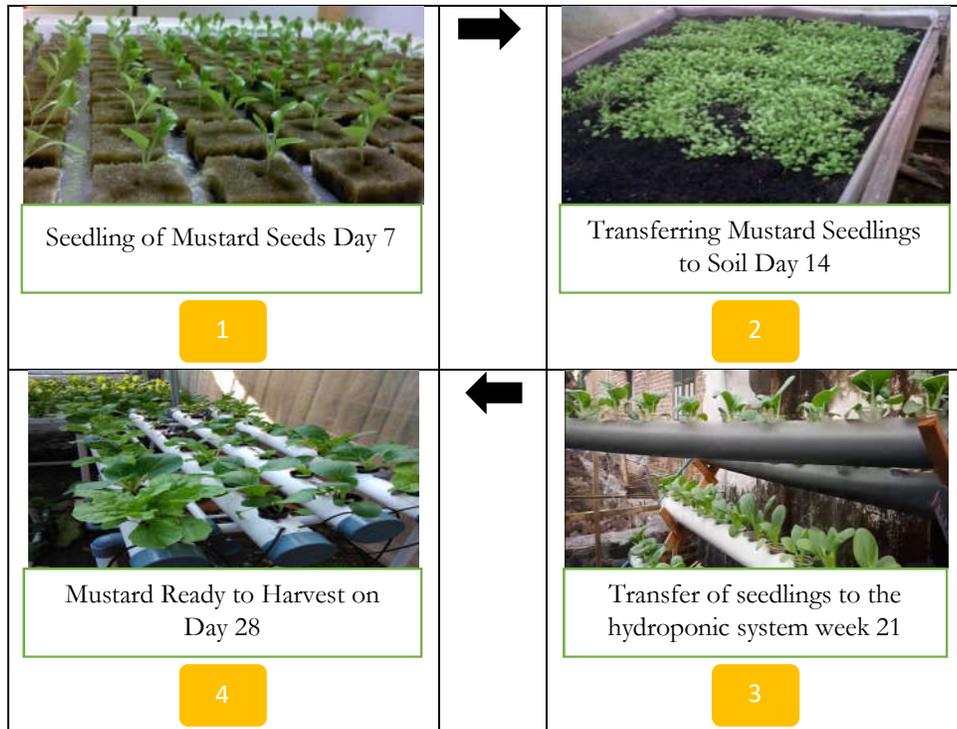


Fig. 4. Mustard plant growth without using LED grow lights

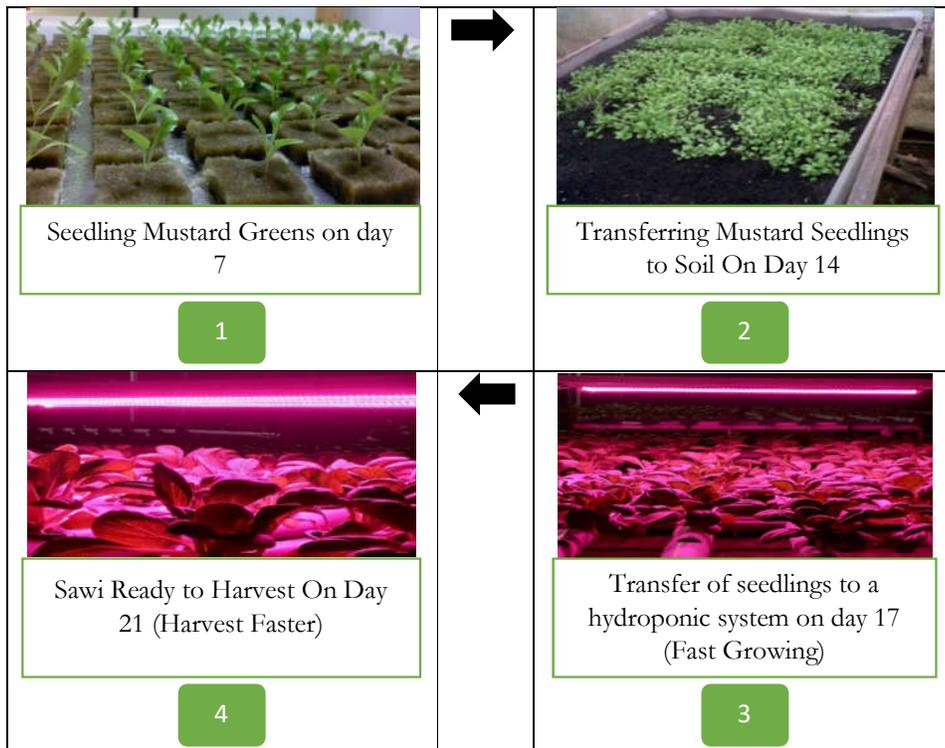


Fig. 5. Growth of Mustard Plants Using LED Grow Lights

Figures 4 and 5 are the growth process of mustard plants from nursery to harvest stage, in Figure 4 it can be seen that the plant growth process from the nursery stage to the harvest process takes 4 weeks, i.e. 28 days, the cultivation process takes place without using LED grow lights. In Figure 5 it can be seen that

the growth process of the mustard plant from the seedling stage to the harvest process takes 3 weeks, namely 21 days.

From the 2 experiments of mustard cultivation above, it can be seen that there is a very significant effect on the growth of each plant, the longest growth is in Figure 4, namely the growth of mustard plants without using LED grow lights, while the fastest growth is in Figure 5, namely plant growth. mustard greens using an LED grow light. The growth of mustard plants using LED grow lights is much faster, with a faster growth speed span of 1 week and includes harvest time.

4. Conclusion

The following is a provisional conclusion from the results of community service activities at the Sidomulyo Hydroponics Business Group. This activity has been carried out according to the Covid-19 protocol by always washing hands, wearing masks, plastic gloves, face shields and of course maintaining a safe distance of virus transmission between business group members. Education on the introduction and benefits of LED grow light has been given to the Sidomulyo Hydroponic business group, so that this lamp will be the main light at night for hydroponic plants, so that at night hydroponic plants can still carry out the natural photosynthesis process, and the end result of the photosynthesis process. The thing is that the growth of hydroponic plants increases to 2-3 times than without using LED lights which only rely on natural sunlight in general. There was a very significant effect on the growth of each plant, the longest growth was in the growth of the mustard plant without using LED grow lights with a duration of time from seedling to harvesting which was 28 days, while the fastest growth was in the growth of mustard plants using LED grow light. The growth of mustard plants using LED grow lights is much faster, with a time span of 1 week faster growth speed, namely the duration of time from seedling to harvest time, which is 21 days than mustard plants without using LED grow lights.

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