



## The Effectiveness of the Use of Photosynthesis in Rice Agriculture in Cibiru Hilir Area, Bandung Regency

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**Abstract** For plants, including rice, photosynthesis is an important mechanism for producing biomass and energy. The purpose of this study is to thoroughly examine how well photosynthesis works to increase rice yields in the Cibiru Hilir area, Bandung Regency. This study aims to understand the role of photosynthesis in rice planting techniques by conducting qualitative interviews with resource persons who are farmers in Ibiro Hilir, Bandung Regency. According to the findings of the study, farmers in Lower Cibiru are aware of how important sunlight and water are for the photosynthesis process. They think that improving the quality of rice involves improving the process of photosynthesis through the proper use of sunlight and a good water supply from the mountains.

**Keywords** : Photosynthesis, Rice, Productivity, Agriculture, Cibiru Hilir.

### INTRODUCTION

The plant environment is affected for growth and productivity. Since each plant requires different light intensities during the photosynthesis process, sunlight is one of the factors that affect plant productivity. Plants perform an important reaction known as photosynthesis. Chemical energy stored in organic compounds is obtained through this reaction, according to Yustiningsih (2019).

The process of photosynthesis is part of life on Earth. Photosynthesis is a very important natural process for plants to develop and survive, which is the basis of the food chain (Anisa & Wulansari, 2023). Paddy rice, also known by its scientific name *Oryza sativa*, is a major crop widely cultivated around the world, especially in Asia, in response to excess water caused by global warming (Ramayana, A. S., 2024).

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Light intensity is defined as the intensity of light emitted from a light source. This study investigates the relationship between the intensity of light produced by the sun and the process of photosynthesis (Mayasari et al., 2023). Photosynthesis is a term used to describe the process by which plants use sunlight to obtain glucose and oxygen. The way living things seek and obtain energy intake is similar to this process (Arum, T. S., et al., 2016). Utilizing light to maximize plant photosynthesis reactions (Himawati, A. W. et al., 2018).

Producing or shaping food by plants with the help of sunlight energy, especially plants that contain chlorophyll, is known as photography (Witomo et al., 2018). Once the plant takes water from the soil and is absorbed through its roots, the water is distributed throughout the plant, including the leaves. On the underside of the leaves, stomata extract carbon dioxide from the air (Siregar, M.M., 2022).

When chlorophyll in leaves captures sunlight and converts it into sugar and oxygen, the process of photosynthesis occurs (Handoko, P., & Fajariyanti, Y. 2013).

The light spectrum shows how long photosynthesis takes in aquatic plants *Hydrilla verticillata*. The resulting sugar can be used directly in the plant or stored elsewhere like the fruit we usually eat. Photosynthesis also produces oxygen, which is used to breathe and is released from the body through our stomata. Carbon dioxide (CO<sub>2</sub>) and water (H<sub>2</sub>O) gases are the raw materials for making glucose (C<sub>6</sub>H<sub>12</sub>O<sub>6</sub>) and oxygen (O<sub>2</sub>). Having the ability to give living things oxygen is one of the advantages of photosynthesis. Utilizing light for algae, especially green algae (Soeprapto, H. 2015). Photosynthesis is essential for producing foods such as glucose, tubers, and fruits.

During the growing season, photosynthesis plays a crucial role in capturing light and converting it into biomass, both of which determine the final yield (Wardani, D. K. et al., 2023). The main source of economic activity in rice farming in most developing countries such as Indonesia is rice. Since agriculture is the largest source of economic development in developing countries, the success of development in other fields will also be influenced (Carsono, Nono, 2008). Agriculture contributes to the development of regions in Indonesia. The production

mechanism of high-quality rice agricultural products is found in producing countries with high rice agricultural yields (Muta'ali, L. 2019).

Agriculture contributes to the development of regions in Indonesia. The production mechanism of high-quality rice agricultural products is found in producing countries with high rice agricultural yields (Muta'ali, L. 2019). The use of high-quality materials and seeds, productive labor, and the right amount of fertilizer ensure better yields. To carry out energy-intensive processes such as irrigation, milling, drying, and fertilizing, rice farming also requires an efficient energy supply (Umar et al., 2017).

## **LITERATURE REVIEW**

This study explores the basics of photosynthesis theory and how it can be used to increase rice productivity. Photosynthesis is a biochemical process that allows plants, such as rice, to convert light energy into glucose through the use of light, carbon dioxide (CO<sub>2</sub>), and water (H<sub>2</sub>O).

### **The Role of Photosynthesis in Rice Growth**

Photosynthesis plays an important role in providing energy to rice. The resulting glucose supports the formation of starch in rice seeds and determines crop yields. In addition, photosynthesis supports the formation of proteins, fatty acids, and the metabolism of whole plants.

### **Factors Affecting the Efficiency of Photosynthesis in Rice**

The various factors that affect the efficiency of photosynthesis in rice are:

#### 1. Sunlight:

Sufficient light intensity supports the rate of photosynthesis. Lack of light reduces glucose production.

#### 2. Temperature:

The optimum temperature for photosynthesis in rice is around 25-32°C. Extreme temperatures can decrease the efficiency of photosynthesis.

#### 3. Water availability:

Rice requires large amounts of water for photosynthesis. Lack of moisture can interfere with this process.

4. Carbon Dioxide (CO<sub>2</sub>):

Higher CO<sub>2</sub> concentrations can increase the rate of photosynthesis in rice plants.

5. Soil Nutrition:

The availability of nutrients such as nitrogen, phosphorus and potassium greatly affects the ability of plants to carry out optimal photosynthesis.

Technologies to improve the efficiency of photosynthesis in rice plants: superior varieties that are resistant to environmental stress, light management (proper planting), and efficient irrigation systems are used. With proper fertilization and the use of sensor-assisted irrigation, photosynthesis can also be optimally supported.

1. Challenges to Improve Photosynthesis Efficiency: Climate change, which causes changes in temperature and rainfall, as well as soil erosion and pest infestation, reduces the photosynthetic capacity of plants. Proper management and adaptation to these changes is essential.
2. Photosynthesis is an important process that determines rice productivity. The efficiency of photosynthesis can be improved by using proper agricultural techniques and managing environmental factors. However, problems such as climate change and land degradation continue to exist.

## RESEARCH METHODS

A method is a way to solve a problem related to the object being studied. This study was conducted using a qualitative method. Qualitative research is research that emphasizes important qualities or elements. This study was carried out in the Cibiru Hilir area, Bandung Regency. The second meeting began the investigation. Data on how effective photosynthesis is in agriculture was collected in this study through tools to conduct observations and interviews. Since data is the primary goal of research, data collection techniques are the most important step in research.

## RESULTS AND DISCUSSION

The purpose of the research conducted on farmers in the Cibiru Hilir area, Bandung Regency is to gain a better understanding of the role of photosynthesis in rice cultivation, because it greatly affects harvest time and rice yield.

The period from planting rice to harvest is approximately four months if the weather is good. However, in the rainy season, the rice harvest lasts for four months and one week. The sun does have an important role in rice cultivation. "Even if the sun is hotter, the rice yield produced is more satisfactory," said the farmer.

Because there is a photosynthetic reaction in rice, which serves to convert the sun's energy (light) into chemical energy stored in organic compounds. The photosynthesis process experienced by the farmers we interviewed is also similar to the general photosynthesis process, which is when chlorophyll in the leaves captures sunlight and uses it to convert water and carbon dioxide into sugars and oxygen. Farmers also said that "To maximize the yield of rice, the most effective time to get sunlight is between 07.00 am to 10.00 am, and from 15.00 to 17.00 pm, and in the water flow of Mount Tankuban Parahu". Water from the mountains flows alternately once a week. The water disposal site from the rice field is connected by a ditch on the edge of the rice field. Therefore, the importance of converting sunlight in rice plants is the ability of plants to convert the energy received into plant biomass.

### **Sunlight Intensity**

Sunlight is the main source of energy for photosynthesis. Adequate light intensity can increase the rate of photosynthesis, while less or excessive intensity can inhibit the process. Information from local farmers shows that hotter sunlight has a positive impact on rice yields, signaling that plants get the maximum benefit from optimal light exposure. Conversely, a lack of light, especially in the rainy season, can slow down photosynthesis and potentially lower crop yields.

### **Temperatures**

Air temperature greatly affects the photosynthesis of rice plants. The best temperature for this process is between 25 and 32 degrees Celsius. The rate of photosynthesis tends to slow down at lower temperatures, but temperatures that are too high (more than 35 degrees Celsius) can damage chlorophyll and reduce the efficiency of photosynthesis. As a result, the stability of the temperature in accordance with the needs of the plant greatly affects the yield obtained.

### **Water Availability**

Water plays an important role in photosynthesis because it transports nutrients from the soil

and supports the process of photosynthesis. Farmers in Cibiru Hilir use the water of Mount Tangkuban Parahu to irrigate their rice fields. The smooth flow of photosynthesis is greatly influenced by the availability of sufficient water and effective irrigation management, especially during periods where soil moisture must remain high.

### **Carbon Dioxide (CO<sub>2</sub>)**

One of the main raw materials for photosynthesis, carbon dioxide is absorbed by stomata on the leaves of rice plants. Adequate CO<sub>2</sub> concentrations can accelerate photosynthesis. However, climate change and air pollution can affect the concentration of CO<sub>2</sub> in the atmosphere, which has an impact on the rate of photosynthesis. Rice plants tend to be able to produce more biomass in environments with higher CO<sub>2</sub> content.

### **Soil Nutrients**

Nutrients such as nitrogen (N), phosphorus (P), and potassium (K) are essential to support the photosynthesis process in rice plants. They are also responsible for protein synthesis, chlorophyll formation, and overall metabolism. To increase the availability of nutrients that support photosynthesis, proper fertilization and good soil management are essential because nutrient deficiencies can hinder the efficiency of photosynthesis and decrease the growth and yield of rice plants.

### **Plant genetics**

Variety variations or genetic factors also affect the plant's ability to photosynthesize. Some rice varieties have a higher photosynthetic ability, which allows them to produce more energy for

### **Plant Management and Cultivation Techniques**

The effectiveness of photosynthesis is influenced by plant management and proper cultivation techniques. Good cultivation methods can help plants make optimal use of all the above elements, which results in better yields. Setting the planting distance and the ideal plant density, among other things, affect how well the rice plant receives sunlight. If planting is done too closely, the intensity of light received by each plant can be reduced. On the contrary, adequate planting spacing allows sunlight to be evenly distributed, favoring better photosynthesis.

### **Pest and Disease Control**

Pests and diseases can damage the leaves and other parts of the plant, which are essential for the photosynthesis process. As a result, damage to the leaves reduces the surface area exposed to sunlight, which in turn reduces chlorophyll levels and inhibits the process of photosynthesis. Therefore, it is very important to carry out effective pest and disease control to keep the photosynthesis process running smoothly and get optimal crop yields. The effectiveness of photosynthesis in rice plants is influenced by many factors, including light intensity, temperature, water availability, CO<sub>2</sub> levels, soil nutrients, and genetic factors. By managing these factors well, you can achieve better yields. Therefore, farmers in Cibiru Hilir pay close attention to these elements in practice.

## CONCLUSIONS AND SUGGESTIONS

In agriculture, photosynthesis is very important because it can affect the rice growth process, harvest time, and rice yield. Farmers in Cibiru Hilir carry out photosynthesis like the usual photosynthesis process, which is when leaf chlorophyll captures sunlight and converts water and carbon dioxide into sugar and oxygen. In addition, the importance of converting sunlight into carbon dioxide and water.

## BIBLIOGRAPHY

- Arum, T. S. (2016). *Development of an integrative thematic learning module with the subtheme of the relationship between living things in the ecosystem of scientific approaches for grade 5 elementary school* (Doctoral dissertation, FKIP-UKSW Elementary School Teacher Education Study Program).
- Carsono, N. (2008). The role of plant breeding in increasing agricultural production in Indonesia. In *Paper presented in the Seminar on Agricultural Sciences Observing the Journey of Agriculture, Fisheries and Forestry Revitalization in a Limited Study in the Field of Food Crop Production, on January*.
- Fathoni, A. (2006). *Research methodology*. Jakarta: rineka c
- Handoko, P., & Fajariyanti, Y. (2013). Effect of visible light spectrum on the rate of photosynthesis of aquatic plants *Hydrilla verticillata*. In *Proceedings Biology Education Conference: Biology, Science, Enviromental, and Learning* (Vol. 10, No. 2, pp. 300-308).
- Himawati, Arina Wahyu, Fauzan Ibnu Prihadiyono, and Rahis Rahmata. "Optimizing Photosynthetic Reactions in Plants by Utilizing Light (Optimizing
- Mayasari, S., Sudarti, S., & Yushardi, Y. (2023). Analysis of the Relationship between Solar
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- Energy Heat Intensity and Photosynthesis Process in Rice Plants. *Mekanova Journal: Mechanical, Innovation and Technology*, 9(1), 70-76. <https://doi.org/10.35308/jmkn.v9i1.6681>
- Muta'ali, L. (2019). *Dynamics of the role of the agricultural sector in regional development in Indonesia*. UGM PRESS.
- Photosynthesis Reactions in Plants by Utilizing the Light)." *Welcome Speech from Committee and Head of Chemistry* (2018): 18.
- Ramayana, A. Syamad. *Reference Book for Rice Specific Fields in the Wet Tropical Region*. NEM Publishers, 2024.
- Santhiawan, P., & Suwardike, P. (2019). Adaptation of paddy rice (*Oryza sativa* L.) to the increase in excess water as a result of global warming. *Agro Bali: Agricultural Journal*, 2(2), 130-144. <https://doi.org/10.37637/ab.v2i2.397>
- Siregar, M. M. (2022). *Growth and production of kale plants (brassica oleracea l. var. acephala) in a hydroponic system deep flow technique with the application of liquid organic fertilizer* (Bachelor's thesis, Faculty of Science and Technology UIN Syarif Hidayatullah Jakarta).
- Soeprapto, H. (2009). Light benefits for algae, especially chlorophyta. *Pena Aquatic: Scientific Journal of Fisheries and Marine Affairs*, 1(1). <https://doi.org/10.31941/penaakuatika.v1i1.237>
- Umar, S., Alihamsyah, T., Suprpto, A., North, J. K. K. L., & Banjarbaru, K. (2017). The impact of the use of alsintan on land management and the socio-economic of farmers in tidal land. *PT RajaGrafindo Persada*, 371.
- Wardani, D. K., Panunggul, V. B., Ibrahim, E., Laeshita, P., Rachmawati, Y. S., Tuhuteru, S., & Nugrahani, R. A. G. (2023). *Agronomy Basics*. Tohar Media.
- Witomo, A. T., Lisnawati, E., Prawidya, F. A., Maula, I. H., Chandra, P., Apriliani, W. F., & Maryuningsih, Y. (2018). Pengaruh Oksigen Terhadap Pertumbuhan Biji Kacang Hijau (*vigna radiata*) Effect Of Oxygen On Green Bean Seed Growth.
- Yustiningsih, M. (2019). Light intensity and photosynthesis efficiency in shade plants and plants exposed to direct light. *Bio-Edu: Journal of Biology Education*, 4(2), 44-49. <https://doi.org/10.32938/jbe.v4i2.385>

