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Mentoring and Literacy on the Use of a Chlorophyll Measurement Device for Farmers in Sumbersari Village, Bandung District

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ABSTRACT

Farmers in Sumbersari village, located in Bandung district, were in great need of assistance in effectively managing their paddy fields to ensure the production of high quality and high yield rice. One crucial factor that significantly impacts it is the proper application of urea fertilizer based on the conditions of the paddy plants, which can be determined by measuring the chlorophyll content present in the leaves of paddy plants. Therefore, mentoring and literacy activities were held to educate farmers on the utilization of a chlorophyll content measuring device which is the result of research previously conducted by the Faculty of Engineering, Universitas Kristen Maranatha so that farmers are able to measure the precise amount of fertilizer that must be applied in accordance to the needs of their paddy plants. The mentoring methods covered socialization, demonstration, and hand-on practice with the measuring device. As the result, all farmers became proficient in using the measuring device that had previously been developed. The device's size and weight are appropriately designed making it convenient for farmers to carry the device the fields and measure the chlorophyll content in the leaves of paddy plants.

Keywords: *Mentoring, urea fertilizer, leaf chlorophyll content, paddy plant*

1. INTRODUCTION

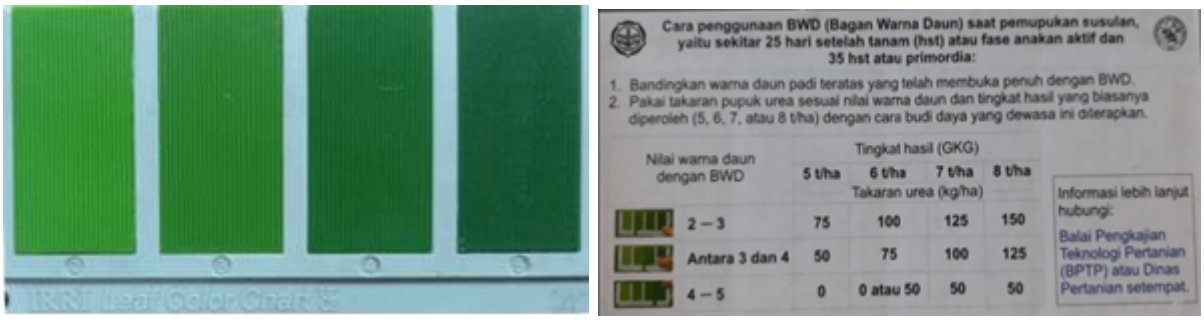
Sumbersari village is one of the villages in Bandung district which has the largest paddy farming area. Nearly 70% of the Sumbersari Village area is paddy farming land which produces good quality rice because of the good contours of the land but requires good tertiary water ditches to make it easier for farmers to irrigate their agricultural land. In an effort to increase agricultural yields and improve the welfare of farmers in Sumbersari village, the Head of Sumbersari village, Mr. Ahmad Munawar, S.Pd. continue to strive for and propose programs related to agriculture in order to increase the agricultural output of farmers.

Currently the Government of the Republic of Indonesia is implementing rice self-sufficiency, this is related to receiving an award from the International Rice Research Institute (IRRI) because Indonesia already has a good food security system and has succeeded in carrying out self-sufficiency in rice in the 2019-2021 periods. The award entitled "Acknowledgment for Achieving Agri-food System Resiliency and Rice Self-Sufficiency during 2019-2021 through the Application of Rice Innovation Technology" was handed over by the Director General of IRRI Jean Balie to the President of the Republic of Indonesia Joko Widodo, Sunday (14/08/2022), at the State Palace, Jakarta. According to IRRI, Indonesia is considered successful in achieving self-sufficiency in rice due to its success in building agricultural and food systems, as well as implementing rice technology and innovation, as explained by Minister of Agriculture Syahrul Yasin Limpo. IRRI, which has a network with other world institutions whose members are great researchers, provides justification that Indonesia's food security is the best in the world.

According to the Minister of Agriculture, the rice self-sufficiency rewarded by IRRI was confirmed by the availability of national rice stocks based on the 2022 National Rice Reserve Survey conducted by the Ministry of Agriculture and BPS. "National rice stocks for the period March 31, 2022 reached 9.11 million tons of rice. On April 30 2022 (ahead of Eid), national rice stocks increased to 10.15 million tons of rice, which is the highest stock compared to other periods," explained the Minister of Agriculture.

The need for the use of urea fertilizer as the main component to increase crop yields plays an important role in increasing the productivity of food crops. The problem is the continuous use of chemical fertilizers in large quantities can negatively affect the environment and reduce the efficiency of their use. Therefore, another effort is needed to improve fertilization efficiency, namely by managing the application of the right amount of fertilizer according to plant needs and land conditions so that the productivity becomes high.

The Bagan Warna Daun (BWD) or Leaf Color Chart **(Erythrina, 2016)** as shown in Figure 1 can be used as a reference for determining the amount of urea (Nitrogen) fertilizer applied. From the results of research that has been done, applying fertilizer with reference to BWD can save the use of urea fertilizer by 15 – 20% of the dosage commonly used by farmers without reducing yields. Leaf color chart (BWD) is a measurement device consisting of 4 (four) levels of green color from light green to dark green, which describes the greenness of paddy plant leaves which is useful for determining nitrogen nutrient levels in paddy plants. For example, if the leaves of a plant are light green, it means that the plant is deficient in nitrogen, so it needs to be fertilized. Conversely, if the leaves are dark green or the level of greenness of the leaves is the same as the color in the level 4 box on the BWD, it means that the plant already has sufficient nitrogen levels so that it does not need to be fertilized.



(a) **(b)**

Figure 1. (a) Bagan Warna Daun or Leaf Color Chart. (b) How to Use the BWD

At present, especially in Sumbersari village, determining the amount of fertilizer application is still based on experience and information from extension workers, namely 100 kg/ha of urea fertilizer and 300 kg/ha of NPK fertilizer. The application of this fertilizer has not been based on the needs of the paddy plant according to the conditions, so that the application of fertilizer is not efficient and effective. With this background, a measuring device is needed that can help determine the amount of needed fertilizer according to the conditions of the paddy plant.

Determination of the amount of fertilizer that must be given according to the condition of the paddy plant can be done using the BWD reference, which is based on the value of the color of the paddy plant leaves. However, measuring leaf color values using BWD is still inaccurate, because BWD cannot show differences in leaf green color that are too small. A very small difference in the green color of the leaves can still be detected by measuring the chlorophyll content in the leaves, so that the measurement of the chlorophyll content in the leaves **(Hidayah et al., 2019)** of paddy plants can be used to determine more accurate fertilizer requirements **(Andrianto et al., 2021)**. Therefore a device is needed to measure the chlorophyll content in the leaves and at the same time be able to determine the amount of fertilizer needed according to the chlorophyll content in the leaves **(Ardiansyah et al., 2022)** of the paddy plant being measured. The measuring device designed from the research results will display the Chlorophyll Content Index (CCI) value of the paddy plant leaves being measured.

2. METHOD OF MENTORING

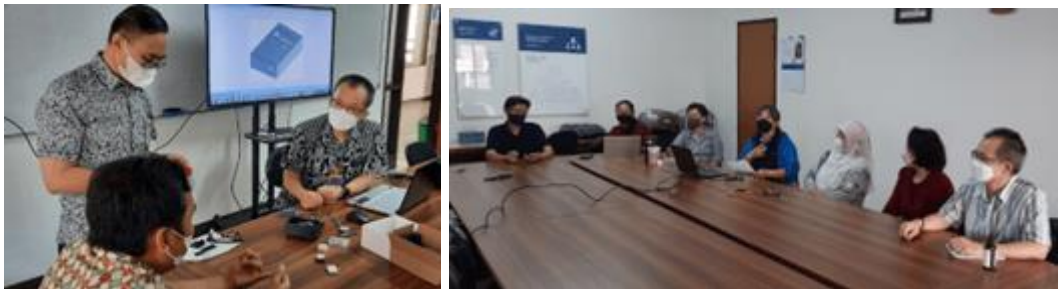
The method used in this mentoring activity begins with conducting interviews as shown in Figure 2 with farmer groups in Sumbersari village regarding what problems farmers face in planting paddy. From the interview results, one of the problems faced by farmers is how to use urea fertilizer efficiently and effectively, so as to reduce the costs required for rice production. Efficient use of urea fertilizer means that the fertilizer given is the right amount not excessive and effective means that the fertilizer given can produce the maximum amount of rice production. To find out how much urea fertilizer should be given can be seen from the chlorophyll content in the leaves of paddy plants. The lower the chlorophyll content in the leaves means that more urea fertilizer must be applied **(Ardiansyah et al., 2022)**. To determine the chlorophyll content in the leaves of paddy plants, a device is needed that can measure the chlorophyll content in the leaves.

(a) **(b)**

Figure 2. (a) Interview with Farmer Group Members. (b) Group Photo after Interview.

To make a measuring device for chlorophyll content, the community service was carried out on how to design and realize the measuring device so that it can function properly, reliable, easy to use by farmers and has an ergonomic shape. This study involved researchers from the

fields of electrical engineering and industrial engineering. Figure 3 shows the community service team's community service activities. The designed measuring device, in addition to measuring the chlorophyll content in the leaves (CCI value) of paddy plants, also provides information on how much urea fertilizer should be given to paddy plants according to the measured chlorophyll content in leaves.



(a) **(b)**

Figure 3. (a) Discussion on the Design of a Chlorophyll Measurement Device. (b) Research Team Meeting

The results of the community service on designing a measuring device for the chlorophyll content in the leaves of paddy plants were realized in the form of a prototype for testing and evaluation. The results of trials and evaluations are used to improve the prototype of the measuring device, in order to obtain a better measuring device. After several trials and improvements, we obtained a device for measuring the chlorophyll content in the leaves of paddy plants that can function properly, as expected. Measuring devices that are already functioning properly as shown in Figure 4, are reproduced for use by farmers.

Figure 4. Measuring Device for Final Design Results

In order for farmers to be able to use the device to measure the chlorophyll content in the leaves of paddy plants, mentoring is provided in the form of socialization and demonstrations on the use of the measuring device **(Suharti, 2021; Faisal et al., 2022; Suhendro, 2018)**. The socialization explains the functions and benefits of measuring device, procedures for using measuring device. In the demonstration of the use of the measuring device, the stages of using the measuring device were shown from the beginning until the value of the chlorophyll content in the leaves of the paddy plant and the amount of urea fertilizer needed was produced. After the socialization and demonstration of the use of the measuring device was

carried out, each farmer tried to use the measuring device, so that the farmers really understood and could use the measuring device **(Gany et al., 2020; Desi, 2016; Sompie, 2021)**.

The results of the mentoring in the form of socialization, demonstrations, and trying to use the measuring device for the chlorophyll content in the leaves of paddy plants were obtained by giving questionnaires to the farmers to fill out. The results of the questionnaires that have been filled in by the farmers become data on the results of the mentoring carried out and become material for evaluating the implementation of this mentoring activity and for determining follow-up actions that must be made.

The method of mentoring implementation in general can be shown in Figure 5.

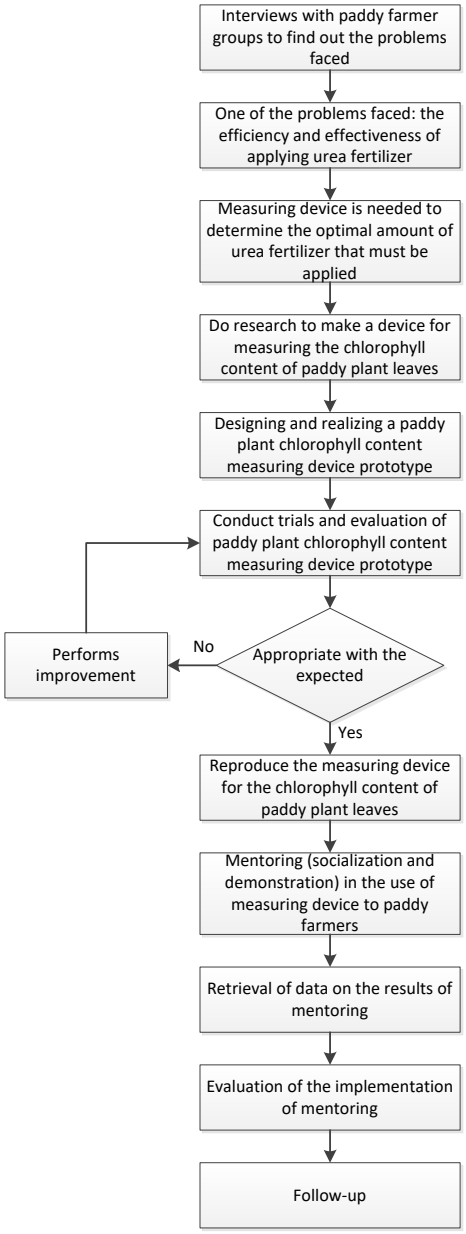


Figure 5. Flow Chart of Implementing the Activity

3. RESULTS AND DISCUSSION

There were 12 farmers representing the Farmer Group Association in Sumbersari village, Bandung district who participated in mentoring and literacy in the use of a paddy plant chlorophyll meter for farmers on May 6 2023. The farmers who attended ranged in age from 30 years to 65 years and have been farmers for between 3 years up to 30 years. In addition, those present were cultivators of the fields, and the rest were cultivators with rent and profit sharing. Participants who attended are shown in Figure 6.

Figure 6. Mentoring and Literacy Participant Farmers

Mentoring is carried out through several stages, beginning with literacy in the use of chlorophyll measuring device in the form of lectures, followed by demonstrations of the use of measuring device that have been made. Demonstrations are shown live, presentations with various photos, and are also equipped with videos. Then all the participants who were present took turns using the measuring device to learn how to use the chlorophyll measuring device as shown in Figure 7.

Figure 7. Participants are Trying to Use Measuring Device

The results of mentoring through literacy, demonstrations, and trying directly show that the explanations for using the device are easy to understand and the designed device is practical/easy to use. Based on the shape, button location, and indicators installed on the device, it is very helpful for farmers to determine the condition of the chlorophyll content of paddy plant leaves from the chlorophyll meter. Literacy activities are shown in Figure 8.

Figure 8. Lectures and Demonstrations by the Service Team

The results of reflecting on the use of the device through direct demonstrations and experiments as shown in Figure 9 show that farmers must put the correct leaf position on the measuring device. Choose paddy leaves that are wide enough. If the size of the leaf is relatively small, it should be placed sideways so that the sensor from the chlorophyll meter can detect and measure the value of the chlorophyll content in the leaf. As a tip for farmers, for every pinch of paddy taken from paddy fields, farmers are advised to choose the leaves that are the lightest green in color so that the required amount of fertilizer suggested by the measuring device can represent the truth.

Figure 9. Discussion and Reflection when Participants Try to Use the Measuring Device

Through literacy and demonstration, all farmers are able to use the measuring device that have been made. The measurement data can be read clearly, and the variables measured are according to the needs of the farmer, namely being able to find out how much urea fertilizer is needed based on the CCI value of paddy leaves as shown in Figure 10. The size and weight of the device are appropriate enough so that the device is easy to carry to the fields to measure the chlorophyll content in the leaves of paddy plants.

(a) **(b)**

Figure 10. Display on the Measuring Device Display. (a) Taking the 2nd Measurement. (b) Display of 2nd Measurement Result

As an evaluation of the results of literacy and demonstrations and input from farmers, it is necessary to add measurement facilities such as battery indicators so that you can know when to recharge the batteries that have been used. In addition, it is necessary to measure the amount of NPK fertilizer needed, because NPK fertilizer is used in large quantities to improve the quality and quantity of rice produced. To find out more about the use of the given measuring device for the chlorophyll content of paddy plant, it will take some time in the future when farmers start replanting paddy and use the measuring device to determine the amount of urea fertilizer given, and the data stored on the measuring device can be analyzed for follow-up improvements of the measuring device.

Evaluation of the implementation of literacy and demonstration of using paddy plant chlorophyll measuring device, among others farmers who took part in the activity not all members of the Sumbersari Village Farmers Group Association and measuring devices were not directly used on paddy in the paddy fields because at the time of implementation the paddy had already been harvested so there were no paddy fields that paddy plants can be taken directly. An unavoidable obstacle at the time of implementation was that Sumbersari village, Bandung district, was in a flood condition due to rain that fell several hours before literacy was given, so not all members of the Sumbersari village Farmers Group Association could attend. In addition, the survey results still cannot be used optimally, because the educational background of farmers is generally relatively low, so they need to be guided on how to fill out the questionnaire or the questionnaire needs to be made simpler to make it easier for farmers to understand and fill in what the community service team expects.

At the end of the literacy and demonstration activities, community service team handed over 2 sets of chlorophyll measuring devices for paddy plants to the Head of Sumbersari village, Bandung district, represented by the Chairperson of the Farmer Groups Association of Sumbersari village, Bandung district. Figure 11 is a photo of the signing of the document handing over the measuring device and handing over the measuring device for the chlorophyll content of paddy plant leaves from the community service team for Sumbersari village, Bandung district.

(a) **(b)** **(c)**

Figure 11. (a) The Signing of Handover Measuring Device Document. (b) Submission of Measuring Device Handover Documents. (c) Submission of Measuring Device for Leaf Chlorophyll Content.

The activity ended with a group photo with all participants who were present during the mentoring and literacy use of the chlorophyll measuring device on Saturday, May 6 2023 along with a team of community service consisting of lecturers from the Electrical Engineering Study Program, lecturers from the Industrial Engineering Study Program, and students from Universitas Kristen Maranatha as shown in Figure 12. This activity is a form of Community Service activity as a result of research by lecturers and students which is implemented for farmers in Sumbersari village, Bandung district.

Figure 12. Group Photo of Participants and Community Service Team

4. CONCLUSIONS

The implementation of mentoring and literacy using the demonstration method helps farmers more easily understand how to use the paddy plant chlorophyll meter. Direct trials by farmers have made it easier for farmers to use a paddy plant chlorophyll meter and understand the data displayed on the measuring device. Several improvements will be the next step, namely adding a battery indicator and measuring the need for NPK fertilizer so that the NPK fertilizer used becomes more effective and efficient.

The implementation of mentoring needs to be followed by a larger number of farmers so that it can be more beneficial for farmers in Sumbersari village. The questionnaire is made simpler so that it is easily understood by farmers. As a follow-up, the measurement data will be used to analyze the success of using the measuring device and as a reference for improving the chlorophyll measuring device so that it can be used to produce good rice with the use of effective and efficient fertilizers.

ACKNOWLEDGEMENT

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