



# Empowering the KWT Rejoarum Group through the Implementation of Drip Irrigation as an Innovative Solution for Water Efficiency and Capacity Building

Arsyad Cahya Subrata<sup>1,\*</sup>, Titisari Juwitaningtyas<sup>2</sup>, Retty Ikawati<sup>3</sup>, Azfa Rahmawan<sup>1</sup>, Amiresti Hakimatul Mahira<sup>2</sup>, Ainin Nuzha Izzatin Fauzia<sup>2</sup>, Haidar Usman Hakim<sup>3</sup>, and Fityatul Nurbaiti<sup>3</sup>

Published online: 13 December 2025

## ABSTRACT

The Rejoarum Women Farmers Group (KWT) in Pandowoharjo, Sleman, faces challenges in cultivating California papaya due to its dependence on an inefficient traditional irrigation system. The main problems include water wastage, high operational costs, and dependence on weather conditions, which affect the group's productivity and income. This community service program aims to improve irrigation efficiency and partner capacity through the participatory application of drip irrigation technology. The method used is participatory action, which actively involves group members in all stages of the program, from planning and installation to system evaluation. The results show that the drip irrigation system was successfully installed on 1,000 m<sup>2</sup> of land and is operating optimally. Pre-test and post-test analyses reveal a 14% increase in the group members' understanding and technical skills in operating and maintaining the system. The participatory approach has proven effective in building the group's independence, increasing water use efficiency, and reducing operational costs. This program not only solved technical irrigation problems but also empowered partners through direct learning processes and local capacity building. The sustainability of the program is ensured through the commitment and sense of ownership of the partners towards the technology applied, as well as plans for replication in other farmer groups.

**Keywords:** KWT Rejoarum, Pandowoharjo Village, Drip Irrigation, Papaya, Participatory Action Method

## INTRODUCTION

The Rejoarum Women Farmers Group (KWT) in Pandowoharjo, Sleman, Yogyakarta, is one of the business groups that manages 1,000 m<sup>2</sup> of California papaya land with around 300–350 trees. Despite its considerable agricultural potential, this group still faces various obstacles, particularly in terms of production. One of the main problems is the traditional irrigation system, which relies on water flow through beds, making it inefficient in water use and vulnerable to seasonal fluctuations

(Angelakus et al., 2020; Yang et al., 2023). During the dry season, water availability is limited, while during the rainy season there is excessive water wastage (Chefany et al., 2024; Mishra, 2023). This results in high operational costs and unstable crop yields (Dotaniya et al., 2023; Zebua et al., 2024).

Drip irrigation is one technology that can be a solution to this problem (Baso & Lestari, 2025). This system is capable of delivering water directly to the root zone of plants in controlled volumes,

---

<sup>1</sup> Department of Electrical Engineering, Faculty of Industrial Technology, Universitas Ahmad Dahlan, Indonesia

<sup>2</sup> Department of Food Technology, Faculty of Industrial Technology, Universitas Ahmad Dahlan, Indonesia

<sup>3</sup> Department of Food Service Industry, Faculty of Economics and Business, Universitas Ahmad Dahlan, Indonesia

\*) *corresponding author*

Arsyad Cahya Subrata  
Email: arsyad.subrata@te.uad.ac.id

thereby reducing evaporation and surface runoff. The application of drip irrigation is expected to increase water use efficiency, reduce labor costs, and support the sustainability of papaya farming (Fitria et al., 2024; Mendoza-Grimón et al., 2024; Negara et al., 2023). In addition, this system is also in line with the principles of sustainable agriculture and supports sustainable development goals (SDGs), particularly in terms of responsible consumption and production (Abdelzaher & Awad, 2022; Heiba et al., 2023; Sari et al., 2024; Sumantri et al., 2025).

Based on these conditions, this community service program focuses on the application of drip irrigation technology to increase the production capacity of KWT Rejoarum. Through a participatory approach and technical assistance, it is hoped that the partner group can adopt this technology independently and sustainably.

This community service activity specifically aims to install a drip irrigation system on the KWT Rejoarum papaya farm as a solution to the problem of water inefficiency that has been occurring. In addition, this program is also designed to provide comprehensive training to group members on how to use and maintain the drip irrigation system independently. With the fulfillment of these two objectives, it is hoped that there will be an increase in water use efficiency and a significant reduction in irrigation operational costs, which will ultimately support increased land productivity and partner income.

This activity is expected to provide tangible benefits for various parties. For direct partners, namely KWT Rejoarum, the benefits include efficiency in water use, reduced operational costs, and increased sustainable land productivity. For the wider community in the surrounding area, the presence of this program is expected to create a practical and affordable drip irrigation model that can be adopted by other farmer groups. Meanwhile, for universities, this activity not only serves as a forum for the development of appropriate technology relevant to community needs, but also contributes to increasing recognition in the implementation of the three pillars of higher education, particularly in the field of community service.

## MATERIALS AND METHODS

### *Approach and Methods*



Figure 1. Socialization of the program to KWT Rejoarum and the Pandowharjo village government

This study uses a participatory action method that emphasizes active collaboration between the empowerment team and the community in all stages of the activity, from planning and implementation to evaluation. This approach was chosen to ensure that the solutions offered are truly in line with the needs, conditions, and resources of KWT Rejoarum, while empowering group members to become the main actors of change. The initial approach was to hold a socialization event

to explain the programs that would be carried out together. This socialization was important because it also agreed on the division of labor, schedule planning, and to obtain support from the village government. Documentation of the initial socialization is shown in Figure 1.

In implementing the method, the problem identification stage was carried out through group discussions or structured interviews to explore local understanding of California papaya production and processed products. Knowledge transfer was carried out by delivering material through focus group discussions (FGD) and interactive counseling. Capacity building was carried out by honing the group members' understanding of the material that had been provided. Reflection is carried out by reviewing the results of the understanding refinement with an in-depth analysis of the capacity gains obtained by group members. Subsequently, an evaluation is conducted to determine the sustainability of the program to be provided.

## **Procedure**

In implementing community empowerment programs, the implementation procedures are carried out by involving various parties. The parties involved in the community empowerment program in KWT Rejoarum include the Muhammadiyah Yogyakarta Regional Leadership Council for Community Empowerment (MPM PWM DIY), the Muhammadiyah Sleman Regional Leadership Council for Community Empowerment (MPM PDM Sleman), and Pandowoharjo Village.

### *Participatory Planning*

The activity began with a series of participatory meetings between the empowerment team and the management and members of KWT Rejoarum. Through intensive discussions, an in-depth identification of irrigation problems that had been faced, including technical and operational constraints, was carried out. Together, the team and partners formulated a detailed action plan, including determining a land layout that was suitable for the topographical conditions, compiling a list of material requirements, and agreeing on an implementation schedule that would not interfere with the partners' agricultural activities. At this stage, the empowerment team acted more as facilitators who guided the process, while the group members, as the parties who best understood the conditions on the ground, were actively involved in the decision-making process.

### *Collaborative Action*

The drip irrigation system was installed collaboratively by a team of empowerment experts (lecturers and students) together with members of the KWT Rejoarum. The process of installing the system components, from installing the pump and filter units, arranging the main and lateral pipe networks, to installing the emitters, was carried out collaboratively. At this stage, on-the-job training was provided to partners on installation techniques, proper connection methods, and system operation. This approach not only ensured the technical installation of the infrastructure, but also built the capacity of partners through practical learning.

### *Participatory Monitoring and Evaluation*

After the system is installed, periodic participatory monitoring is conducted to assess system performance and impact. Group members are invited to participate in routine observations of emitter function, water distribution, and plant response. Evaluations are conducted through group discussion forums that address successes, obstacles, and feedback from partners. The qualitative and quantitative data collected form the basis for responsive system adjustments and improvements. The post-training impact measurement form is shown in Table 1. The questions in the pre-test and post-test are divided into the following groups: Transformation of Perceptions and Technology Acceptance, Increased System Maintenance Capacity, Building Confidence in Problem Solving, and Understanding Economic Benefits and Productivity.

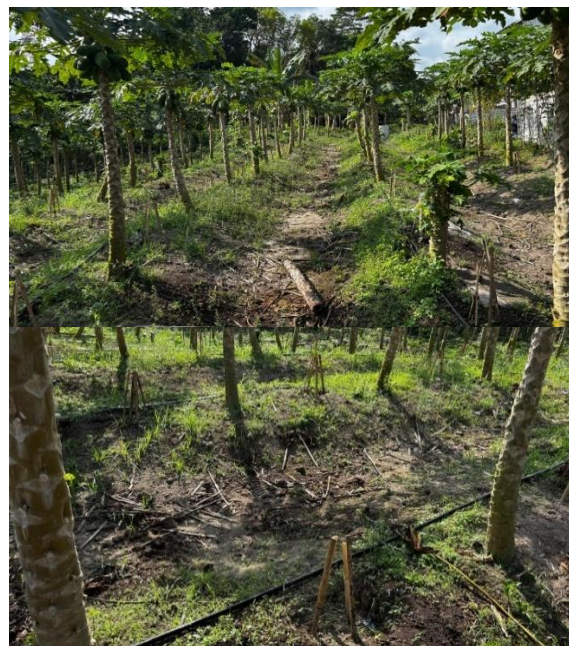
No	Questions	Strongly disagree	Disagree	Agree	Strongly agree
1.	Drip irrigation helps save water and labor.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2.	Maintaining filters and pipes is important for preserving the life of the system.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3.	Drip irrigation can increase crop productivity.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.	Cleaning drip irrigation filters is not a difficult job.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5.	If there is a problem with the system (for example, a clogged emitter), I am able to take corrective action.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6.	Drip irrigation is suitable for various types of crops on our land.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7.	I believe that drip irrigation systems are more cost-effective in the long run than other methods.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8.	In my opinion, regular maintenance of drip irrigation systems will reduce major repair costs in the future.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9.	I am confident that drip irrigation can help improve crop quality.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10.	I believe that our KWT is capable of managing the drip irrigation system independently.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

### *Reflection and Future Planning*

The final stage consists of a joint reflection to evaluate the entire process and the results achieved. Through open discussion, the successes, challenges, and lessons learned during the program are analyzed. Based on the results of the reflection, a follow-up plan is developed to ensure sustainability, including the establishment of a routine maintenance system, the development of problem-solving protocols, and the potential replication of technology to other areas. This plan is developed in a participatory manner to ensure the commitment and ownership of partners to the system that has been built.

## RESULTS AND DISCUSSION

### *Drip Irrigation Installation*



(a) (b)  
Figure 2. Drip irrigation installation in the KWT Rejoarum papaya garden

After identifying the problems, deciding on solutions to overcome them, and formulating methods to implement the program, the empowerment program at KWT Rejoarum was executed. The first stage was to install drip irrigation in the papaya garden. The water source was the main well located next to the land. Water from the well was pumped using a pump and channeled through PVC pipes along the papaya field. Drip hoses with a size of 20 microns were installed in each row of papaya trees through PVC pipes equipped with water tap handles. An illustration of the installation of drip irrigation in the KWT Rejoarum papaya tree field is shown in Figure 2.

### *Operation and Maintenance Training*

The next stage was to conduct training on the operation and maintenance of drip irrigation systems for members of the KWT Rejoarum, which showed significant results in terms of increasing the technical capacity and independence of the group. The training on the operation and maintenance of drip irrigation systems conducted for members of the KWT Rejoarum showed encouraging results in transforming perceptions and increasing the technical capacity of the group. Based on the pre-test and post-test analysis conducted on members, a significant increase in understanding and confidence in drip irrigation systems was identified. The pre-test and post-test results revealed remarkable developments in terms of technology acceptance, understanding of maintenance, and a sharp increase in understanding of economic benefits. Figure 3 shows a graph of the increase in understanding after training in the operation and maintenance of drip irrigation.

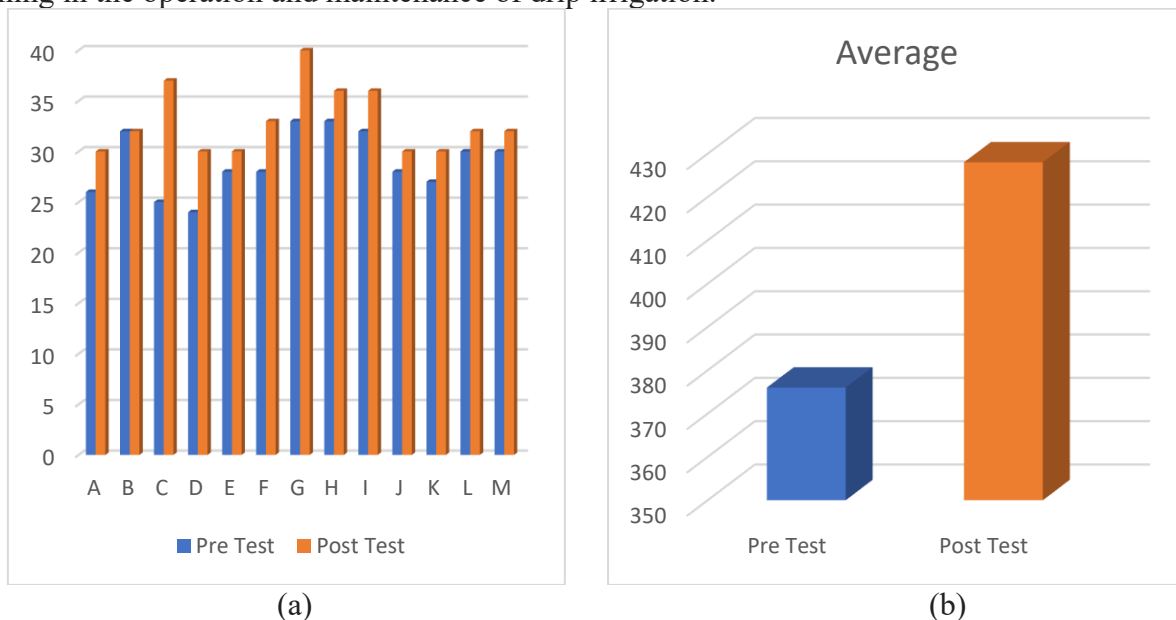


Figure 3. Increase in knowledge of KWT Rejoarum after training in the operation and maintenance of drip irrigation

As shown in Figure 3, the knowledge of KWT Rejoarum members in the operation and maintenance of drip irrigation has increased compared to before the training. Of the 13 KWT Rejoarum members, the majority experienced an increase in knowledge. The average increase in knowledge among KWT Rejoarum members was 14%.

## CONCLUSIONS

Based on the entire series of community service activities that have been carried out, it can be concluded that the KWT Rejoarum empowerment program through the application of drip irrigation has successfully achieved its objectives. The drip irrigation system has been installed and is operating well on 1,000 m<sup>2</sup> of papaya land, replacing the inefficient traditional irrigation system. The participatory action approach that was applied proved to be effective in building the technical capacity and independence of the group, as reflected in the significant increase in the pre-test and post-test

training results. The transformation in the perception of KWT Rejoarum members towards drip irrigation technology is evident from their increased belief in the benefits of water conservation, labor efficiency, and the suitability of the system to their land conditions. Their capabilities in maintenance and technical problem-solving have also improved remarkably, with most members now able to perform routine maintenance and handle basic problems independently.

From a sustainability perspective, this program not only solved technical irrigation problems but also created a strong foundation for sustainable management of the system by the group itself. The commitment and sense of ownership built during the participatory process became important social capital for the program's future sustainability. Going forward, it is possible to replicate a similar empowerment model in other farmer groups in the surrounding area, with adjustments to specific local conditions. Continuous assistance and strengthening of the papaya product marketing network are important agendas to ensure sustainable economic impact for KWT Rejoarum.

### Acknowledgments

This community empowerment activity is funded by DPPM Kemendiktisaintek under contract 015/PkM/LPPM.UAD/VI/2025.

### Conflict of Interests

The authors declared that no potential conflicts of interest with respect to the authorship and publication of this article.

### REFERENCES

- Abdelzaher, M. A., & Awad, M. M. (2022). Sustainable development goals for the circular economy and the water-food nexus: full implementation of new drip irrigation technologies in upper Egypt. *Sustainability*, 14(21), 13883.
- Angelakis, A. N., Zaccaria, D., Krasilnikoff, J., Salgot, M., Bazza, M., Roccaro, P., Jimenez, B., Kumar, A., Yinghua, W., Baba, A., Harrison, J. A., Garduno-Jimenez, A., & Fereres, E. (2020). Irrigation of World Agricultural Lands: Evolution through the Millennia. In *Water* (Vol. 12, Issue 5). <https://doi.org/10.3390/w12051285>
- Baso, B., & Lestari, A. K. D. (2025). Pemberdayaan Kelompok Taruna Tani Jabalfarm Milenial melalui Teknologi Irigasi Tetes Otomatis Berbasis IoT pada Pertanian Lahan Kering. *Jurnal Atma Inovasia*, 5(4), 293–297.
- Chefany, H. F., Nugroho, M. R., Jannah, R. R., & Annisa, U. (2024). KETERSEDIAAN AIR BERSIH DAN KONDISI IKLIM: Studi Krisis Air Di Nusa Tenggara Timur. *Jurnal Pendidikan Sosial Dan Humaniora*, 3(4), 5185–5201.
- Dotaniya, M. L., Meena, V. D., Saha, J. K., Dotaniya, C. K., Mahmoud, A. E. D., Meena, B. L., Meena, M. D., Sanwal, R. C., Meena, R. S., & Doutaniya, R. K. (2023). Reuse of poor-quality water for sustainable crop production in the changing scenario of climate. *Environment, Development and Sustainability*, 25(8), 7345–7376.
- Fitria, E. A., Utama, A. D., Suhendra, D., Harahap, E. J., Karina, I., Aisyah, S., Mustamu, N. E., & Rahman, A. (2024). *Pertanian Berkelanjutan*. Yayasan Tri Edukasi Ilmiah.
- Heiba, Y., Ibrahim, M. G., Mohamed, A. E., Fujii, M., & Nasr, M. (2023). Developing smart sustainable irrigation matrix (SIM)-based model for selection of best irrigation techniques: A framework to achieve SDGs. *Journal of Cleaner Production*, 420, 138404.

- Mendoza-Grimón, V., Amorós, R., Fernández-Vera, J. R., Lopes da Veiga, E., & Palacios-Díaz, M. del P. (2024). Utilising Reclaimed Water for Papaya (*Carica papaya* L.) Cultivation in Cape Verde: A Detailed Case Study. *Agronomy*, 14(11), 2726.
- Mishra, R. K. (2023). Fresh water availability and its global challenge. *British Journal of Multidisciplinary and Advanced Studies*, 4(3), 1–78.
- Negara, I. D. G. J., Karyawan, I. D. M. A., Yasa, I. W., Saidah, H., Saadi, Y., Supriyadi, A., Suroso, A., & Wiratama, K. (2023). Pelatihan Persiapan Lahan Pepaya Untuk Aplikasi Sistem Irigasi Tetes di Lahan Kering Desa Selengen Kabupaten Lombok Utara. *Jurnal Pengabdian Magister Pendidikan IPA*, 6(3), 743–748.
- Sari, F. P., Munajat, M., Lastinawati, E., Meilin, A., Judijanto, L., Sutiharni, S., Setyowati, E. D. P., Ahmad, A., & Rusliyadi, M. (2024). *Pembangunan pertanian berkelanjutan*. PT. Sonpedia Publishing Indonesia.
- Sumantri, S. P., Karina Rahmah, S. P., Ir Nurliani, M. S., Mustaqim, S., Waliah Nur Rahayu, S. P., Christian Yosua Salomo Aritonang, S. S. T., Ir Rustam Abdul Rauf, S. P., Mukhlis, A. M., SP, M. S., & Candra Sigalingging, S. (2025). *PEMBANGUNAN PERTANIAN*. Azzia Karya Bersama.
- Yang, P., Wu, L., Cheng, M., Fan, J., Li, S., Wang, H., & Qian, L. (2023). Review on drip irrigation: impact on crop yield, quality, and water productivity in China. *Water*, 15(9), 1733.
- Zebua, S. N., Dohona, N. H., & Waruwu, I. P. (2024). Evaluasi Irigasi Berbasis Teknologi Di Sektor Pertanian. *Jurnal Ilmu Pertanian Dan Perikanan*, 1(2), 226–232.

*This page has been intentionally left blank*