Vol. 3, No. 1, 2023
E-ISSN 2807-7679 | P-ISSN 2807-792X

Technology dissemination in training and manufacture of simple fertilizer equipment

Iswanto Suwarno [a,1,*], Raudatul Innayah [b,2], Nabila Turahma Niah Butarbutar [c,4], Robbi Rahim [d,4], Nia Maharani Raharja [e,5], Siewe Pougoue E.B. [f,6], Virro I. [g,7], Claudia Ann Rutland [h,8]

[a] Department of Electrical Engineering, Universitas Muhammadiyah Yogyakarta, Yogyakarta, Indonesia
[b] Universitas Muhammadiyah Yogyakarta, Yogyakarta, Indonesia
[c] Universitas Muhammadiyah Yogyakarta, Yogyakarta, Indonesia
[d] Sekolah Tinggi Ilmu Manajemen Sukma, Medan, Indonesia
[e] Department of Physics, UIN Sunan Kalijaga Yogyakarta, Yogyakarta, Indonesia
[f] Université de Dschang, Faculté d'Agronomie et des Sciences Agricoles, Cameroon
[g] Estonian University of Life Sciences, Institute of Technology, 56 Kreutzwaldi Str, Tartu, EE51006, Estonia
[h] Department of Crop, Soil, and Environmental Sciences, Auburn University, Auburn, AL, United States
[1] iswanto_te@umy.ac.id; [2] raudatul.innayah@umy.ac.id; [3] nabila.turahma.niah.butarbutar@umy.ac.id; [3] usurobbi85@zoho.com; [5] nia.raharja@uin-suka.ac.id; [5] Siewe_blaise@yahoo.fr; [7] indrek.virro@emu.ee; [8] car0053@auburn.edu
* Corresponding Author

ABSTRACT

Padukuhan Gadingan is an area on the slopes of Mount Merapi, precisely in the Argomulyo village, Kapanewon Cangkringan, Sleman. Padukuhan Gadingan has very large and fertile land so that most of the population works as farmers. In our project here, we want to conduct training on making a fertilizer sprinkler that makes it easier for farmers to spread fertilizer, the name of the tool is a simple fertilizer sprinkler. Many farmers are elderly and prone to illness, there are still many farmers who fertilize manually without using tools and there is a need for innovative tools to help farmers make their work more effective in agriculture. The aim is to increase farmers' knowledge and understanding of new innovations, utilizing simple tools that do not require large costs to assist the process of fertilizing plants. The methods used are socialization, training, and face-to-face mentoring and the results foster knowledge and insight to the target audience, namely farmer groups in the Gadingan hamlet, especially elderly farmers.

KEYWORDS
Gading Padukuhan;
Fertilizer Sowing Tool;
Agriculture

1. Introduction

Agriculture is the activity of utilizing biological resources by humans to produce food, industrial raw materials or energy sources, as well as to manage their environment. Indonesia is an agricultural country, where as we know that most of the people's livelihoods are from agricultural products. Padukuhan Gadingan is an area on the slopes of Mount Merapi, so it has fertile soil. Therefore, many people in Padukuhan Gadingan use the fertile land on the slopes of a volcano for agricultural land and plantations. In terms of agriculture, of course there are many factors that we must know so that plant growth can produce good and high-quality results. One of the factors is fertilization. Agricultural tools and machines have a very important and strategic role in supporting the fulfillment of agricultural production which continues to increase in line with population growth. Agricultural technology has been widely studied by previous researchers

Micro-level indicators for environmental impact evaluation of agricultural technology were investigated by Maji [1]. Credit constraints and agricultural technology adoption: evidence from Ethiopia researched by Lemecha [2]. Can Crop Insurance Encourage Farmers to Adopt Green Agricultural Technologies—Evidence from Shandong Province in China was investigated by Wei [3]. Access to credit and the relationship of adoption of agricultural technology in Ethiopia: A systematic review and meta-analysis investigated by Girma [4]. Access to credit and heterogeneous effects on agricultural technology adoption: Evidence from a large rural survey in Ethiopia investigated by Regassa [5]. Farmers' Livelihoods, Technological Constraints, and Low Carbon Agricultural Technology Preferences: An Analysis Framework for Technology Adoption and Farmers' Livelihoods was researched by Zhao [6].

Vol. 3, No. 1, 2023
E-ISSN 2807-7679 | P-ISSN 2807-792X

Rural schools as effective centers for the dissemination of agricultural technologies: experimental evidence from Tanzania and Uganda researched by Kpaka [7]. Innovation context and technological traits explain heterogeneity across agricultural technology adoption studies: A meta-analysis conducted by Schulz [8]. Adoption of better agricultural technology and its impact on household income: propensity score matching estimation in eastern Ethiopia investigated by Mailena [9]. Study and Comparison of Agricultural Technology Development in Various Modes of Agricultural Land Management: A Case Study of Grain Production, China was researched by Luo [10]. Don't Be Anticlimactic: Farmer Behavior in the Application of Sustainable Green Agricultural Technology—Value Perceptions and Perspective of Government Support was researched by Xiang [11]. The method of measuring the index of agricultural technology utilization was researched by Mailena [12].

Agricultural Technology in Africa was researched by Suri [13]. The Effect of Advances in Agricultural Technology on Agricultural Carbon Emissions and Carbon Sequestration in China was investigated by Li [14]. The molecular biology of grafting was investigated by Hunter [15]. Diffusion of Agricultural Technology Innovations: Research Advances on the Diffusion of Innovations in China's Agricultural Science and Technology Park was researched by Chen [16]. Marginal returns on Chinese agricultural technology transfer in Nigeria: Who benefits more? studied by Olasehinde [17]. Urban Expansion and Its Effect on Adoption of Agricultural Technology by Peri-Urban Smallholders in the Tigray Region, Ethiopia was investigated by Weldearegay [18]. Will Digital Financial Inclusion Increase Chinese Farmers' Willingness to Adopt Agricultural Technologies? investigated by Zhou [19]. Ex-post impact of agricultural technology adoption on poverty: Evidence from the northern Shewa zone of Amhara region, Ethiopia investigated by Belay [20]. Inflows of Remittances and Adoption of Agricultural Technology: Evidence from Ethiopia investigated by Zegeye [21].

Assessing agricultural technology startups using real options was researched by Wilson [22]. Gender and access to complex and gender-biased agricultural technology information and knowledge: Evidence from smart-valleys in West Africa investigated by Kinkingninhoun Medagbe [23]. Time Preferences and green agricultural technology adoption: Field evidence from rice farmers in China was researched by Mao [24]. The application of nano-agricultural technology to biotic stress management: mechanisms, optimization, and future perspectives was investigated by Cao [25]. Study of Sustainable Modern Agricultural Technology with a Transdisciplinary Multistakeholder Approach researched by Liang [26]. Adoption of agricultural technology in developing countries: A meta-analysis of empirical literature researched by Ruzzante [27]. The dynamic relationship between Agricultural Technological Progress, Agricultural Insurance and Farmer's Income was investigated by Tan [28]. How Does Trust Affect Farmers' Adoption of Low Carbon Agricultural Technologies? Evidence from Rural Southwest China was investigated by Zhou [29]. Utilization of Podcasts in Disseminating Agricultural Technology Innovation: SWOT Analysis researched by Tresnawati [30]

To make it easier for farmers, one of them is the fertilization process which covers acres of hectares takes a long time and drains a lot of energy, so we need an effective and efficient tool to make it easier for farmers who still use traditional methods in terms of fertilization. Fertilization in the traditional way is very ineffective because it requires a lot of energy, other effects such as farmers are very tired at work because the body keeps bending during the fertilization process. Therefore it is necessary to look for efforts that need to be made to solve various problems faced by farmers, especially solutions for fertilization that are operated semi-manually which are made of PVC pipes.

2. Method

The implementation of community service activities in the form of introducing a simple fertilizer sowing tool was carried out at the Gadingan Padukuhan, Argomulyo Village, Kapanewon Cangkringan, Sleman Regency. This activity was held 2 times, namely in RW 31 and RW 32 Padukuhan Gadingan, Argomulyo. In this activity, a survey was carried out in advance in the form of a permit application to Dukuh Padukuhan Gadingan, RW heads (RW 31 and 32), RT heads (RT 1, 2, 3, 4), as well as farmer groups and providing explanations regarding the purpose of the activity and the benefits that could be obtained. Activities carried out in the form of outreach, training, and face-to-face mentoring. The following is the design of the stages of implementing activities presented in Table 1.

Table 1. Stages of Activity Implementation.

No	Type of activity	Method	Execution time
1	Initial coordination of program delivery to farmer groups	Delivery	January 22, 2023
2	Initial preparation	Tools and materials for making fertilizer sprinklers	March 01, 2023
3	Preparation of training materials for making fertilizer sowing tools	The training material is how to make and apply the tools	March 02, 2023
4	Training and practice of making fertilizer sowing tools	Socialization/presentation materials, photos of activities	March 03 and March 14, 2023

3. Results and Discussion

This community service activity was carried out on March 3 2023 in RW 31 and March 14 in RW 32 Padukuhan Gadingan, Argomulyo, Cangkringan, Sleman. Activities carried out in the form of outreach, training, and face-to-face mentoring. In a meeting with farmer groups, we introduced a simple fertilizer sprinkler that we designed ourselves. This simple fertilizer sowing tool utilizes existing materials in the surrounding environment as technological innovations that can be used by farmers for time and space efficiency and to reduce the risk of various diseases that arise due to direct contact with chemical fertilizers or disorders of the bones. The fertilizer sowing tool is made with simple tools and materials that are easy to find in everyday life. With tools and materials that are easily available, it is hoped that the people of Padukuhan Gadingan can make this simple fertilizer sowing tool. Here are the tools, materials, and how to make a simple fertilizer sowing tool

Tool: Grinding, Whiteboard marker, Hacksaw, Sandpaper, and Ruler

Material: Paralon pipe measuring ½ inch with a length of 20 cm, Paralon pipe measuring ¾ inch with a length of 15 cm, Paralon pipe measuring 2 inches with a length of 100 cm, Connecting pipes 2 inc to ¾ inc, Close the pipe pipe measuring ½ inc, Wood, Used tire rubber, Bolts,and Paralon pipe glue

In this community service activity, we accompany farmer groups to directly assemble the simple fertilizer sowing tool that we have made as a tool to help farmers in sowing fertilizer. Apart from assisting farmer groups in Padukuhan Gadingan in assembling a simple fertilizer sowing tool, we also practice how the fertilizer sowing tool works. The working system of this tool is to use the force of gravity and spring force generated by the tire rubber. Fertilizer is put into a 2" pipe. Fertilizer that is in the pipe is released through the outlet by pressing the pipe downwards. The workings of a simple fertilizer sprinkler can be seen in Figure 1.

Fig. 1. The workings of a simple fertilizer sprinkler

With the introduction and training activities for making simple fertilizer sowing tools at Padukuhan Gadingan, this. It is hoped that it can help farmers, especially elderly farmers, in carrying out the fertilization process. At the end of this activity we left a simple fertilizer sowing tool in Gadingan Padukuhan, so that it can be used directly by farmers in fertilizing and can be developed further in the future by farmer groups in Gadingan Padukuhan. Delivery of simple fertilizer sowing equipment can be seen in Figure 2.

Fig. 2. Example of a figure caption. *(figure caption)*

4. Conclusion

The conclusion of this activity is to conduct training and manufacture of fertilizer sowing tools for the target audience, namely Farmer Groups RW 31 and RW 32 in Gadingan, Argomulyo Village, Cangkringan, Sleman, especially elderly farmers and to grow knowledge and insight into new innovative tools by utilizing organic materials. Simple at affordable cost.

The results obtained from the training are as follows: functions and benefits of technology products, Accelerating the work of farmers so as to ease the work of farmers, especially in the fertilization process, making time effective and minimizing labor, especially elderly farmers, utilizing simple materials without the need for expensive costs that can help elderly farmers not to just use their bare hands, and minimizing pain in the waist due to frequent bending, economic and social impact

In this day and age many people need a practical tool, to make it easier for humans to carry out various activities, especially in the agricultural sector during the fertilization process. This simple fertilizer sowing tool has a very important role to support this convenience, the efforts that are made no longer need to bother to carry out tiring activities and minimize labor and provide optimal results. Thus it can be understood that this simple technology is very helpful to meet various problems faced to support agriculture in Padukuhan Gadingan.

Acknowledgment

Special thanks to the internal funder for community service from the University of Muhammadiyah Yogyakarta.

Author Contribution

The activity plan in order to implement the solutions offered that there are five series of activities, namely coordination, logo design, socialization of covid, marketing, and marketing education.

Funding

Special thanks to the internal funder for community service from the University of Muhammadiyah Yogyakarta.

Conflict of Interest

The authors declare no conflict of interest.

References

[1] C. C. Maji, "Micro-level indicators for evaluation of environmental impact of agricultural technology," J. Soc. Econ. Dev., vol. 24, no. S1, pp. 32–48, Dec. 2022.

[2] M. E. Lemecha, "Credit constraint and agricultural technology adoptions: evidence from Ethiopia," Agric. Financ. Rev., vol. 83, no. 3, pp. 395–415, Jun. 2023.

[3] T. Wei, Y. Liu, K. Wang, and Q. Zhang, "Can Crop Insurance Encourage Farmers to Adopt Environmentally Friendly Agricultural Technology—The Evidence from Shandong Province in China," Sustainability, vol. 13, no. 24, p. 13843, Dec. 2021.

[4] Y. Girma, "Credit access and agricultural technology adoption nexus in Ethiopia: A systematic review and meta-analysis," J. Agric. Food Res., vol. 10, p. 100362, Dec. 2022.

[5] M. D. Regassa, M. B. Degnet, and M. B. Melesse, "Access to credit and heterogeneous effects on agricultural technology adoption: Evidence from large rural surveys in Ethiopia," Can. J. Agric. Econ. Can. d'agroeconomie, vol. 71, no. 2, pp. 231–253, Jun. 2023.

[6] D. Zhao and H. Zhou, "Livelihoods, Technological Constraints, and Low-Carbon Agricultural Technology Preferences of Farmers: Analytical Frameworks of Technology Adoption and Farmer Livelihoods," Int. J. Environ. Res. Public Health, vol. 18, no. 24, p. 13364, Dec. 2021.

[7] H. M. Kpaka et al., "Rural schools as effective hubs for agricultural technology dissemination: experimental evidence from Tanzania and Uganda," Eur. Rev. Agric. Econ., vol. 49, no. 5, pp. 1179–1215, Nov. 2022.

[8] D. Schulz and J. Börner, "Innovation context and technology traits explain heterogeneity across studies of agricultural technology adoption: A meta-analysis," J. Agric. Econ., vol. 74, no. 2, pp. 570–590, Jun. 2023.

[9] M. G. Wordofa, J. Y. Hassen, G. S. Endris, C. S. Aweke, D. K. Moges, and D. T. Rorisa, "Adoption of improved agricultural technology and its impact on household income: a propensity score matching estimation in eastern Ethiopia," Agric. Food Secur., vol. 10, no. 1, p. 5, Dec. 2021.

[10] H. Luo, Z. Hu, X. Hao, N. Khan, and X. Liu, "Assessment and Comparison of Agricultural Technology Development under Different Farmland Management Modes: A Case Study of Grain Production, China," Land, vol. 11, no. 11, p. 1895, Oct. 2022.

[11] W. Xiang and J. Gao, "Do Not Be Anticlimactic: Farmers' Behavior in the Sustainable Application of Green Agricultural Technology—A Perceived Value and Government Support Perspective," Agriculture, vol. 13, no. 2, p. 247, Jan. 2023.

[12] L. Mailena, Sumedi, A. Muharam, S. Mardianto, and V. W. Hanifah, "The method on measuring utilization index of agricultural technology," IOP Conf. Ser. Earth Environ. Sci., vol. 892, no. 1, p. 012049, Nov. 2021.

[13] T. Suri and C. Udry, "Agricultural Technology in Africa," J. Econ. Perspect., vol. 36, no. 1, pp. 33–56, Feb. 2022.

[14] S. Li and Z. Wang, "The Effects of Agricultural Technology Progress on Agricultural Carbon Emission and Carbon Sink in China," Agriculture, vol. 13, no. 4, p. 793, Mar. 2023.

[15] P. Hunter, "The molecular biology of grafting," EMBO Rep., vol. 22, no. 11, Nov. 2021.

Vol. 3, No. 1, 2023
E-ISSN 2807-7679 | P-ISSN 2807-792X

[16] X. Chen and T. Li, "Diffusion of Agricultural Technology Innovation: Research Progress of Innovation Diffusion in Chinese Agricultural Science and Technology Parks," Sustainability, vol. 14, no. 22, p. 15008, Nov. 2022.

[17] T. S. Olasehinde, Y. Jin, F. Qiao, and S. Mao, "Marginal returns on Chinese agricultural technology transfer in Nigeria: Who benefits more?," China Econ. Rev., vol. 78, p. 101935, Apr. 2023.

[18] S. K. Weldearegay, M. M. Tefera, and S. T. Feleke, "Urban Expansion and Its Effect on Agricultural Technology Adoption of Smallholder Peri-Urban Farmers in Tigray Region, Ethiopia," Caraka Tani J. Sustain. Agric., vol. 36, no. 2, p. 365, Sep. 2021.

[19] Z. Zhou, Y. Zhang, and Z. Yan, "Will Digital Financial Inclusion Increase Chinese Farmers' Willingness to Adopt Agricultural Technology?," Agriculture, vol. 12, no. 10, p. 1514, Sep. 2022.

[20] M. Belay and M. Mengiste, "The ex-post impact of agricultural technology adoption on poverty: Evidence from north Shewa zone of Amhara region, Ethiopia," Int. J. Financ. Econ., vol. 28, no. 2, pp. 1327–1337, Apr. 2023.

[21] M. B. Zegeye, "Remittance Inflows and Adoption of Agricultural Technology: Evidence from Ethiopia," Remit. Rev., vol. 6, no. 2, pp. 77–90, Oct. 2021.

[22] W. W. Wilson, L. Vetsch, and D. W. Bullock, "Valuing an agricultural technology startup using real options," Agribusiness, vol. 38, no. 4, pp. 771–785, Oct. 2022.

[23] F. M. Kinkingninhoun Medagbe, A. Floquet, R. L. Mongbo, K. N. A. Aoudji, G. Mujawamariya, and N. R. Ahoyo Adjovi, "Gender and access to complex and gender-biased agricultural technology information and knowledge: Evidence from smart-valleys in West Africa," Outlook Agric., vol. 52, no. 1, pp. 22–33, Mar. 2023.

[24] H. Mao, L. Zhou, R. Ying, and D. Pan, "Time Preferences and green agricultural technology adoption: Field evidence from rice farmers in China," Land use policy, vol. 109, p. 105627, Oct. 2021.

[25] X. Cao and Z. Wang, "Application of nano-agricultural technology for biotic stress management: mechanisms, optimization, and future perspectives," Environ. Sci. Nano, vol. 9, no. 12, pp. 4336–4353, 2022.

[26] D. Liang, W. Tang, and Y. Fu, "Sustainable Modern Agricultural Technology Assessment by a Multistakeholder Transdisciplinary Approach," IEEE Trans. Eng. Manag., vol. 70, no. 3, pp. 1061–1075, Mar. 2023.

[27] S. Ruzzante, R. Labarta, and A. Bilton, "Adoption of agricultural technology in the developing world: A meta-analysis of the empirical literature," World Dev., vol. 146, p. 105599, Oct. 2021.

[28] C. Tan, J. Tao, L. Yi, J. He, and Q. Huang, "Dynamic Relationship between Agricultural Technology Progress, Agricultural Insurance and Farmers' Income," Agriculture, vol. 12, no. 9, p. 1331, Aug. 2022.

[29] W. Zhou, J. He, S. Liu, and D. Xu, "How Does Trust Influence Farmers' Low-Carbon Agricultural Technology Adoption? Evidence from Rural Southwest, China," Land, vol. 12, no. 2, p. 466, Feb. 2023.

[30] T. Tresnawati, D. Medionovianto, and H. N. Pradhipta, "The use of podcast in disseminating agricultural technology innovation: A SWOT analysis," E3S Web Conf., vol. 306, p. 03006, Sep. 2021.