

Innovation of a Technology-Based Seeding Tool to Increase The Efficiency of Agricultural Production in Desa Kaserangan

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ABSTRACT

This community service initiative, undertaken by students participating in the Student Work and Study Program (KKM) in Kaserangan Village, Ciruas District, Banten Province, was motivated by the prevailing practice of manual fertilization specifically, broadcasting fertilizer by hand. This method is labor-intensive, time-consuming, and prone to uneven fertilizer distribution. The project aimed to implement appropriate technology in the form of a fertilizer spreader that is simple, user-friendly, and tailored to farmers' needs. A participatory approach utilizing qualitative descriptive methods was employed, involving a single farmer the RT 06 (Neighborhood Association) head of Kaserangan Village as a pilot partner. The activity stages included initial condition assessment and partner interviews, device design and fabrication, outreach and training on device usage, hands-on field practice, and monitoring and evaluation. Data collected through observation, interviews, and documentation were analyzed descriptively to illustrate conditions before and after the device's implementation, the partner's user experience, and the benefits and challenges encountered. The results indicate that the fertilizer spreader facilitated a more practical fertilization process for the partner, reducing the need for manual broadcasting. The partner was able to operate the device effectively following demonstrations and hands-on practice. The device demonstrated potential in alleviating physical strain specifically the need for repetitive bending during fertilization and promoting more targeted fertilizer distribution. This initiative is expected to serve as a preliminary model for the implementation of appropriate technology that can be further developed and adapted for other farmers facing similar land conditions.

Keywords: Fertilizer Spreader, Appropriate Technology, Efficiency, Agricultural Production, Desa Kaserangan

1. INTRODUCTION

The agricultural sector plays a vital role in ensuring food self-sufficiency in Indonesia [1]. Soil and seed quality influence agricultural productivity, as does the accuracy and efficiency of each stage of cultivation, including fertilisation [2]. Applying fertiliser at the correct dosage, at the correct time and using the correct method can support plant growth and crop yield. Therefore, implementing technology tailored to farmers' needs is an effective way to support the efficiency of agricultural activities, particularly in rural areas.

Issues in the fertilisation process were also found in Kaserangan village, Ciruas district, Banten province. Based on initial observations and interviews with farmers, the fertiliser application process is still carried out traditionally, by scattering the fertiliser by hand while walking along the agricultural land. This labour-intensive method takes a long time and makes the process of spreading the fertiliser very dependent on the movement of the farmers. This can potentially result in uneven distribution of the fertiliser [3]. Furthermore, the manual fertilisation process involving repeated bending and reaching for the fertiliser can cause physical discomfort during work.

These conditions demonstrate the need for tools that can simplify the fertilisation process while taking into account the circumstances and capabilities of farmers [4]. Teknologi Tepat Guna

(TTG) is one such alternative, as it prioritises the compatibility between technology and the needs of its users, the availability of materials, environmental conditions and the economic capabilities of the community [5]. In the context of agriculture, appropriate technology does not necessarily involve complex machinery; rather, it can take the form of simple tools that provide direct benefits to farmers.

In response to this situation, the KKM students developed a fertiliser spreader using appropriate technology and simple, easily obtainable materials. The tool was introduced through a participatory approach, involving farmers as partners in its introduction, use and evaluation. For this activity, a farmer from Kaserangan Village (RT 06) was involved to share their experience of using the tool in real agricultural conditions.

The purpose of this activity is threefold: (1) develop a simple, technology-based fertiliser spreader adapted to local soil conditions, (2) provide partners with the knowledge and skills to use the fertiliser spreader, (3) identify partners' experiences of using the fertiliser spreader as an alternative to the fertilisation process, including its benefits, ease of use and challenges (Agustina, 2025).

2. LITERATURE REVIEW

Fertilisation is one of the most important activities in agricultural production, as it provides the nutrients that plants need. The success of fertilisation depends not only on the type and dosage of fertiliser used, but also on the method of application. The fertilisation process must be carried out correctly in order to make effective use of labour and time, so that the cultivation process can run smoothly [2]. Therefore, a method or tool that can support the application of fertiliser in line with the user's needs and capabilities is required.

Spreading fertiliser by hand is one of the simplest and easiest methods. However, it requires repetitive movements and depends on the user's ability to control how the fertiliser is spread. Using this method for long periods of time can also cause discomfort due to the repetitive nature of picking up and spreading the fertiliser [7]. The consistency of distribution can also be affected by the user's walking speed and movements. These factors highlight the need for tools that can make the fertiliser spreading process more practical [8].

Several studies have been conducted on the development of fertiliser spreaders in various forms with different mechanisms. [9] for example, developed a simple solid fertiliser spreader and demonstrated that using the tool reduced the time taken for fertilisation compared to manual methods. [10] developed a urea fertiliser spreader, primarily using PVC pipes. Meanwhile, [11] developed a mechanical fertiliser spreader for corn plants. These studies demonstrate that using tools to spread fertiliser can support the fertilisation process and reduce reliance on manual application.

The implementation of agricultural tools must be tailored to the needs and conditions of users to ensure the effective utilisation of developed technology. Teknologi Tepat Guna (TTG) is designed to meet the needs of the community, taking into account environmental conditions and the availability of resources, and is affordable for users [5]. In agriculture, TTG implementation can take the form of simple tools with specific functions to assist farmers. Therefore, the success of a technology should be evaluated based not only on the tool's ability to perform its technical functions, but also on how well it meets the user's needs [12].

In addition to the technical aspects, implementing technology in society requires a process of introduction and learning for users. Users need to understand how each part of the tool functions, how to operate it and how to adjust it when facing certain conditions during use (Musyafa, 2025). Training through explanation, demonstration and hands-on practice can help users gain experience in operating technology. [14] argues that training and support can help users to better understand how to use technology, which in turn will improve their ability to utilise it.

User involvement in the implementation of technology is also an important aspect of a participatory approach [15]. Users do not just play a passive role in receiving technology; they can also provide information on their needs, how easy it is to use, how comfortable it is, and any issues encountered during implementation. [6] highlights the importance of considering user experience and needs when implementing technology. Adopting a participatory approach enables the development and implementation of tools to be adapted to real-world conditions, ensuring that the resulting technology functions technically and is more easily accepted and used by the community.

Based on this study, the development of a simple fertiliser spreader is related to the principle of appropriate technology, particularly in terms of its suitability for users' needs and the availability of resources [16]. While previous research has examined various fertiliser spreader tools, the direct application of these tools to users still requires consideration of their experience and conditions in the field. This community service activity therefore focuses on implementing a simple fertiliser spreader in Kaserangan Village, Ciruas District, Banten, in collaboration with the head of RT 06 as a model partner. Activities included identifying problems, making the tool, demonstrating its use, and conducting observations and interviews to determine its benefits, ease of use and limitations [17]. It is hoped that this activity will provide an initial overview of the implementation of simple TTG that aligns with users' needs in the fertiliser spreading process.

3. METHODS

This community service activity took place in Kaserangan Village, Ciruas District, in the province of Banten. The project involved an RT 06 farmer from Kaserangan village. A participatory approach with a descriptive qualitative method was used. This approach involved the partner's direct participation in identifying issues, recognising suitable technology, practising tool use, and evaluating the fertiliser spreader implementation [18].

The first stage of this activity involves making direct observations and conducting interviews with partners. These were carried out to evaluate current fertilisation practices, including methods used, working positions adopted, processes for applying fertiliser, and any challenges encountered during fertilisation activities. The interviews were conducted to collect information on experience, needs relating to fertiliser equipment and expectations of the equipment to be implemented. These observations and interviews provide the basis for determining the specifications of the most suitable fertiliser spreader for the agricultural land in question.

The next step is to design and produce a fertiliser spreader based on appropriate technology. The tool is made using easily obtainable materials that can be adapted to the user's needs. The design takes into account ease of operation, user comfort, fertiliser flow and the tool's ability to assist in spreading fertiliser. Once completed, a function check is carried out to ensure that each part can be used before implementation in the field [19].

The implementation stage involves socialisation, demonstrations and hands-on practice with the equipment. The KKM team explained how the equipment worked and demonstrated how to use it to the farmers in Kaserangan village. The farmers then practised using the equipment under the direct guidance of the KKM team. During the training session, the KKM team made observations

regarding the farmers' ability to operate the equipment, how easy it was to use, the fertiliser distribution process, and the working conditions during fertilisation.

Monitoring and evaluation were carried out after farmers had used the tool directly. The evaluation was conducted through observation and interviews. Observation was used to evaluate how the tool was used during the fertilisation process, while interviews were used to collect information about the farmers' experiences, such as how easy they found the tool to use, what benefits they perceived, how their working practices had changed and what challenges they had faced when using the tool. Documentation of the production process, socialisation sessions, demonstrations, practical use, and evaluation activities was used as supporting data.

Table 1. Stages of activity implementation

Stage	Time	Activity	Implementation
Pre-activity	Week 1	Observation of fertilisation conditions, interviews, identification of problems, and coordination of activities	Team of KKM students and farmers
Activity	Week 2	Design and construction of tools, TTG socialisation, demonstration, and practical use of tools	Team of KKM students and farmers
Monitoring and evaluation	Week 3	Observation of tool use and interviews about experience, benefits, ease of use, and problems with tool use	Team of KKM students and farmers

Data obtained from observations and interviews was analysed using a qualitative descriptive method. This involved comparing fertilisation practices before and after the tool was implemented, based on observations and farmers' experience. The interview results were categorised according to ease of use, benefits, changes in working practices and challenges associated with using the tool. The success of this activity was evaluated based on farmers' understanding of and ability to operate the tool, how easily the tool could be implemented, and the benefits experienced by farmers during the fertilisation process.

4. RESULTS AND DISCUSSION

4.1 Initial Conditions and Identification of Issues

Based on initial observations and interviews with a farmer and partner of the RT 06 chairman in Kaserangan village, it was found that fertiliser is still applied to agricultural land manually. The fertiliser is spread by hand while walking along the land. This method has become standard practice, but it is time-consuming and labour-intensive.

Observation also showed that manual fertilising requires farmers to repeatedly bend down and reach for the fertiliser. This can cause discomfort while working, especially when fertilising large areas. Furthermore, distributing the fertiliser manually means its distribution depends heavily on the farmer's movements and speed, which can result in uneven distribution.

Based on the results of the interviews, the partners stated that they needed a simple, easy-to-use tool that would not incur significant costs. The KKM student team then developed a technology-based fertiliser spreader that was adapted to the conditions and needs of farmers, based on these requirements.

This shows that implementing appropriate technology at farmer level requires consideration of not only the technical aspects of the tool, but also working habits, user ability, material availability and land conditions. Therefore, the partners were involved directly in the development process to ensure that the resulting tool could be used effectively in the field [20].

4.2 Design and Construction of a Fertiliser Spreader

Based on the issues identified in the initial stage, the KKM student team designed a fertiliser spreader using simple, readily available materials such as PVC pipes, fertiliser storage containers and funnel spreaders. Using these simple materials is an example of the application of appropriate technology, which aims to produce technology that meets users' needs, is easy to operate, and can be replicated and developed further by the community [21].



Figure 1. Process of making a technology-based fertilizer spreader

The process of creating the tool involves several stages: preparing the materials; designing the tool's shape; assembling the components; and testing the tool's functionality. Throughout this process, partners are given the opportunity to observe and understand the different parts of the tool and how each component works. Involving partners in the manufacturing process means their knowledge of the tool extends beyond mere usage. This provides them with the foundation to make simple repairs or reassemble the tool if necessary [22].

The resulting tool has a relatively simple and practical design for use on agricultural land. It enables fertiliser to be placed in a storage container and then spread using a fertiliser spreader. This means that farmers do not need to handle and spread the fertiliser manually during the fertilisation process.

This tool's design aligns with the principles of appropriate technology, emphasising the alignment of technology with social, economic, and community needs [23]. Using easily obtainable materials was also a key consideration to enable farmers to make the tool themselves.

4.3 Training and practical use of equipment

Once the production process is complete, training in the practical use of the equipment begins, carried out alongside the partners. Training begins with an explanation of how each part of the equipment functions and how the fertiliser spreader operates. The KKM student team will then demonstrate how to load fertiliser, operate the equipment, and adjust the spreading process.



Figure 2. Use of a fertiliser spreader by farmers

Following the demonstration, the partners practised using the equipment in the field. Based on their observations during this practical session, the partners were able to follow the steps for using the equipment, having received instructions and demonstrations from the KKM student team.

The practical session also gave the partners the opportunity to identify the advantages and disadvantages of using the equipment in real-life conditions.

There was two-way communication between the student team and the partners during the practical session. The partners provided feedback on the tool's ease of use and design, as well as how to carry or operate it and the process of dispensing fertiliser from the storage container. This feedback will be used to evaluate which parts of the equipment still need improvement or adjustment.

The participatory approach to this initiative not only makes the partners recipients of technology, but also enables them to be involved in the implementation and evaluation processes [24]. This is crucial for the successful implementation of technology because the success of an innovation is determined not only by the technical functionality of the tool, but also by users' ability and willingness to adopt it.

4.4 Observations and Interviews on The Use of The Tool

Observations after the field trial showed a change in the way the partners applied the fertiliser. With the manual method, the fertiliser was spread directly by hand, whereas after the tool was introduced, the fertiliser was first placed in a storage container and then released through the fertiliser spreader.

This change makes the fertilisation process more structured, as the fertiliser does not need to be taken and spread directly by hand at every stage of application. The use of containers and the spreading mechanism also helps to reduce some of the repetitive manual movements that were previously necessary.

The results of the post-implementation interviews showed that the partners responded positively to the use of the tool. They felt that it was more practical than manual distribution methods and helped reduce repetitive bending movements. These findings demonstrate that the advantages of the tool extend beyond the fertiliser spreading process itself, encompassing changes in users' work patterns.

These results are consistent with Waslah (2022) study, which found that using a simple fertiliser spreader reduced fertilisation time compared to manual methods. Prihatiningtyas (2023) research also showed that using a fertiliser spreader made from PVC pipes can increase work efficiency and improve the quality of fertiliser distribution. Meanwhile, Rasit (2026) reported increased time efficiency through the use of a mechanical fertiliser spreader on maize plants.

However, this study was not designed to demonstrate quantitative efficiency improvements, as it only involved one partner and used a qualitative descriptive approach. The findings demonstrate the potential of these tools to simplify the fertilisation process and reduce the need for certain manual movements.

4.5 Problems and Solutions

Several challenges emerged during the execution of the project, both in the production stage and when using the equipment. One of the challenges faced was the limited availability of PVC pipes of a specific size required for the project, meaning the production process had to be adapted to the available materials. Selama tahap praktik, para petani juga perlu menyesuaikan kecepatan penggunaan peralatan untuk memastikan distribusi pupuk yang optimal [25].

To address these challenges, the KKM student team made adjustments to the equipment components and provided guidance during the practical training. The farmers were also given the opportunity to try out the equipment repeatedly so that they could understand how to operate it most effectively in their own fields.

Overall, the implementation of this fertiliser spreader shows that simple technology can be an alternative to help farmers with fertilisation tasks. The direct involvement of partners from the problem identification stage to the evaluation of the use of the tool was a key factor in ensuring that the technology applied was in line with the needs of the users.

CONCLUSION

A community service initiative involving the implementation of a technology-based fertiliser spreader in Kaserangan Village, Ciruas District, in the province of Banten, was carried out using a participatory approach. The head of RT 06 was the model partner in this initiative. The initiative included identifying fertilisation issues through observation and interviews, designing and manufacturing the tool, providing training and carrying out practical demonstrations on agricultural land in Kaserangan Village.

Observations revealed that using the fertiliser spreader is a more practical method of working than manual fertilisation. Following a demonstration and guidance, the partners understood the principles of operation and could use the tool. Interviews showed positive responses to the tool, particularly because it eliminates the need for manual application and reduces repetitive bending movements usually required during fertilisation [26]. The tool also shows potential to make fertiliser distribution more targeted.

Adjustments to the implementation of this tool are still required, particularly with regard to the speed of distribution and the fertiliser distribution mechanism, to ensure its suitability for field conditions. The proper implementation of this technology in this initiative demonstrates that a simple fertiliser spreader can be a viable alternative to assist farmers with fertilisation, while also providing our partners with hands-on experience of adopting technology that meets their practical needs.

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