



The Production Of Solid and Liquid Organic Fertilizers From Cow And Goat Manure and Their Application To Corn Crops

Ahmad Roziq*¹, Moch. Shulthoni², Bambang Piluharto³, Muhammad Afif Difa Asy Syafiq⁴, Zakiyyah Ilma Ahmad⁵

^{1,2,4} Faculty of Economics and Business, University of Jember

³ Faculty of Mathematics and Natural Sciences University of Jember

⁵ STIES Babussalam Jombang

E-mail: ahmadroziq.feb@unej.ac.id¹, shulthoni@unej.ac.id², bampito.fmipa@unej.ac.id³, bang.apiq@gmail.com⁴, zakiyyahilmaahmad@stiesbabussalam.ac.id⁵

Article History:

Received: Aug 17th 2024

Revised: Oct 15th 2024

Accepted: Nov30th 2024

Abstract: *Bangsri is a village in the Plandaan Sub-district, Jombang Regency, East Java Province, where most residents live as farmers. In Bangsri, several farmers and breeders have over 500 goats and sheep. However, they face challenges in processing goat manure into solid and liquid organic fertilizers that would be more beneficial for plants. Currently, goat farmers lack the innovation to process the manure, often just piling it up or discarding it. Additionally, the sharecropping system in agriculture is becoming increasingly unprofitable, and crop yields are suboptimal, particularly during the dry season, due to high processing costs. As a result, many rice fields are abandoned by their owners. The way to overcome this problem is through a service-learning approach. In service activities, the team provides training and assistance in making organic fertilizer to provide added value for farmers and breeders. As a result, farmers and breeders have started implementing the techniques learned in the training to produce both solid and liquid organic fertilizers. This initiative has been positively received in Bangsri Village, with noticeable improvements in crop yields.*

Keywords: organic fertilizer, farmers, breeders, goat, cow



This work is licensed under a

[Creative Commons Attribution-ShareAlike 4.0 International License](https://creativecommons.org/licenses/by-sa/4.0/).

Introduction

Bangsri is a village in Plandaan District, Jombang Regency, East Java Province, where most of the population works as farmers. Bangsri Village has significant potential in the agricultural sector, particularly in cultivating rice, corn, cantaloupe, cassava, sugar cane, and longan. The village covers an area of 5.6 km² and has a population of 1,077, with 435 of them being farmers. The rest are private-sector employees, civil servants, and self-

employed individuals.¹ As an agricultural area where most of the population depends on farming, Bangsar Village consists of 85 hectares of rice, 35 hectares of dry, 35 hectares of residential yards, and 4.5 hectares of other land. Azmi dan Rusdin

Azmi dan Rusdin explained that each goat produces 1.5 kg of feces and 2.5 liters of urine daily. If livestock waste is not managed correctly, it can negatively impact the environment. One way to utilize the manure produced by sheep and goats is to convert it into organic fertilizer. Sheep and goat feces contain 40-50% dry matter and 1.2-2.1% nitrogen.²

Based on observations, in Bangsri Village, several farmers and breeders have more than 500 goats and sheep. These breeders include young entrepreneurs, one of whom is Zakiyah, an alumnus of the Faculty of Economics and Business, and Aldi, an alumnus of the Faculty of Computer Science, Jember University. Even though goat farming is a side business, they manage 51 goats. Five hundred goats produce around 750 kg of manure and 1,250 liters of urine every day, which can be used to make solid and liquid organic fertilizer. Unfortunately, livestock breeders and farmers have not utilized the potential of organic fertilizer to its full potential.

The problems identified include difficulties in obtaining inorganic fertilizer, as subsidized inorganic fertilizers are limited and do not meet the needs of farmers. Non-subsidized inorganic fertilizers are three times more expensive, making them unaffordable for many farmers. Organic fertilizers are rare due to customary practices, and goat manure is often applied directly to fields, resulting in less successful outcomes. Farmers have not yet developed the capability to process goat manure into more beneficial solid and liquid organic fertilizers. Additionally, there is a lack of innovation among goat farmers in processing manure, with most of it either piled up or discarded. The profit-sharing farming system is becoming increasingly unprofitable, and agricultural yields are suboptimal, particularly during the dry season, due to high processing costs. As a result, many rice fields are abandoned by their owners. The purpose of this initiative is to educate farmers and livestock breeders on the production and processing of organic fertilizers from cow and goat manure, increase their income through organic fertilizer processing, and indirectly contribute to improving the economy of Bangsri Village

¹ Badan Pusat Statistik Kabupaten Jombang, *Kabupaten Jombang Dalam Angka 2023* (Kabupaten Jombang, 2023).

² Azmi Mangalisu and Rahmawati Arma, "Pengelolaan Terpadu Limbah Cair Ternak Kambing Desa Kompang Kecamatan Sinjai Tengah Kabupaten Sinjai Sulawesi Selatan," *Jurnal Dedikasi Masyarakat* 3, no. 1 (2019): 36–43; Muh Rusdin et al., "Program Bina Desa Pengembangan Peternakan Kambing Di Kelurahan Anggoeya Kecamatan Poasia Kota Kendari," *Indonesian Journal of Community Services* 2, no. 1 (2023): 9–13.

Method

The community service activities related to the production of solid and liquid organic fertilizers from goat manure and urine in Bangsri Jombang are implemented using a service-learning approach. This approach integrates academic learning with direct community service, aiming to empower local communities through the enhancement of knowledge and skills in producing environmentally friendly organic fertilizers, which can be applied in corn cultivation.

The process begins with an initial survey, which is conducted to assess the condition of goat farming and the demand for organic fertilizers in the area. This survey involves local goat breeders and several corn farmers, gathering data about soil types, commonly cultivated crops, and the fertilizer needs of the community. The results of this survey are then analyzed to determine the appropriate composition of fertilizers tailored to the needs of corn cultivation and local soil conditions. Based on this information, the next step is the selection of a strategic location for fertilizer production. The chosen location must consider accessibility, the availability of raw materials (goat manure and urine), and environmental safety. Three goat breeders and seven corn farmers with adjacent land are selected to facilitate the distribution and application of the fertilizers produced.

Once the location is determined, the next step is counseling, which experts in the processing of manure and the production of organic fertilizers deliver. The purpose of this counseling is to provide the community with comprehensive information on the process of making organic fertilizers, their benefits for soil fertility, and how they can be applied to enhance crop yields. The counseling sessions cover the basic principles of manure processing, the impact of organic fertilizers on soil health, and the potential economic benefits for local farmers and breeders. This counseling is not limited to lectures; it also includes interactive discussions, allowing farmers and breeders to share their experiences and ask questions related to the topics presented.

Following the counseling, a discussion and Q&A session is held to provide participants with the opportunity to clarify any uncertainties and deepen their understanding of the fertilizer production process and its application in corn cultivation. This session is crucial for addressing any lingering questions and providing additional explanations about the necessary steps involved in the production of organic fertilizers. Through these direct interactions, the community is able to enhance their knowledge and resolve any misunderstandings related to the procedures they are expected to follow.

The next stage involves the collection of raw materials, including goat manure and urine, which are gathered separately. It is essential to ensure that the manure used comes from healthy, disease-free animals to guarantee the quality of the fertilizer produced. The collection process is coordinated to ensure that each breeder has a sufficient supply of raw materials for fertilizer production. These materials are then processed to create both

solid and liquid organic fertilizers. Throughout this process, the community actively participates under the guidance of experts, learning the correct procedures for mixing and preparing the raw materials to achieve the desired outcomes.

The composition of the raw materials plays a critical role in ensuring optimal results in the production of solid and liquid organic fertilizers. The farmers and breeders are taught the correct proportions of goat manure, urine, and other ingredients, which are adjusted according to the soil conditions and the specific needs of the corn crops in Bangsri. Participants are given the opportunity to practice the steps of fertilizer production, with direct supervision from the experts, ensuring that each phase is conducted correctly and that high-quality products are produced.

After the fertilizer production process is completed, the support does not end. Ongoing assistance and evaluation are provided to monitor the implementation of the fertilizers that are produced in the field. The evaluation focuses on assessing the impact of organic fertilizers on corn plant growth and soil fertility. During this phase, the farmers and breeders are encouraged to provide feedback and discuss the outcomes of the fertilizer application, as well as any challenges they encounter. This evaluation serves as a foundation for refining the fertilizer production process and making necessary adjustments to improve its effectiveness in future applications.

Result

The village research team visited the Jombang Regency Animal Husbandry Service to coordinate and collaborate on conducting training for producing organic fertilizer from goat and cow manure. This training is intended for farmers using a profit-sharing system in Bangsri Village, Plandaan District, Jombang Regency. Mrs. Susi, an expert from the Jombang Regency Animal Husbandry Service, has extensive expertise and experience making solid and liquid organic fertilizers. She has conducted numerous training sessions on organic fertilizer production for livestock breeders and farmers.

Explanation to Training Participants

The community service research team from the village conducted training on producing organic fertilizer from goat and cow manure for agriculture using a profit-sharing system. The training occurred at the home of Z&Z Livestock partner, Ms. Zakiyyah Ilma. The research team provided an overview of the community service initiative organized by LP2M in collaboration with the Jombang Regency Animal Husbandry Service. The University of Jember fully funds this community service activity as a form of dedication and commitment by university lecturers to the village where they were born.

The research team explained the benefits of organic fertilizer for plant growth, nutrition, and pest control. They also highlighted that the production cost of organic

fertilizer is very low, which can reduce the reliance on non-organic fertilizers and help address shortages of non-organic supplies when farmers need them.



Figure 1. Explanation of Organic Fertilizer Production

Liquid Fertilizer Production Practice

After the training, participants successfully produced solid organic fertilizer and then moved on to practicing the production of liquid organic fertilizer using goat and cow urine. Together, the participants made liquid organic fertilizer from goat urine. They started by filling a container, such as a bucket or drum, with a lid and well water. Next, they added goat urine, EM4, molasses, rice washing water, herbs, dry tobacco leaves, and other ingredients into the container, which was then topped off with water. After thoroughly mixing the contents, the container was sealed tightly to prevent air from entering. The mixture was stirred daily, resealed, and allowed to ferment. The exact process was followed for producing liquid organic fertilizer using cow urine. This daily stirring and resealing process continued for up to 8 days, after which the liquid fertilizer was ready to be used by pouring or spraying it on plants.



Figure 2. Liquid Fertilizer Production Process

Solid Fertilizer Production Practice

After receiving instructions from the facilitator on producing solid organic fertilizer, the participants immediately practiced under the guidance of experts from the Jombang Animal Husbandry Service, Mrs. Susi Ermawati, SP., and organic fertilizer producer Mr. Sanadi. The participants mixed cow dung, softened it using a grinder with dolomite, and stirred until thoroughly combined. The exact process was followed for goat dung, which was softened, mixed with dolomite, and stirred until evenly blended. After mixing, the mixture was sprinkled with water, EM4, molasses, and cow urine to produce solid organic fertilizer from cow dung. The same steps were repeated using goat dung, adding a water mixture containing EM4, molasses, and goat urine to produce solid organic fertilizer from goat manure.



Figure 3. Solid Fertilizer Production Process

Results of Using Solid and Liquid Organic Fertilizers

The solid organic fertilizers produced during the training, made from goat and cow manure, were applied by the participants to corn plants. Participants Khilmi and Iwan used solid goat and cow manure as base fertilizers when planting the corn seeds. Based on interviews with Mr. Khilmi and Mr. Iwan and surveys conducted at the planting site, it was observed that the use of solid goat and cow fertilizers resulted in healthy and uniform growth of the corn seeds, as shown in the images of the corn plants below.



Figure 4. Plants Grown Using Solid and Liquid Organic Fertilizers

The organic liquid fertilizers produced during the training, made from goat and cow urine, were applied by the participants to corn plants. Khilmi and Iwan, two of the participants, used the liquid goat and cow fertilizers, mixed with urea, and poured them onto the corn plants. Based on interviews with Mr. Khilmi and Mr. Iwan and surveys conducted at the planting site, it was found that using liquid fertilizers from goat and cow urine resulted in healthy, green corn growth.

Evaluation of Community Service

The community service initiative, funded by the University of Jember and organized in collaboration with LP2M and the Jombang Regency Animal Husbandry Service, successfully trained local farmers in producing solid and liquid organic fertilizers from goat and cow manure. This project aimed to reduce reliance on non-organic fertilizers and improve soil fertility for better crop yields.

First, Training Overview. The training, conducted at the Z&Z Livestock partner's home, provided both theoretical knowledge and practical skills. Participants learned the benefits of organic fertilizers for plant growth, pest control, and reducing fertilizer costs. The training included practical sessions where participants made both solid and liquid organic fertilizers. Experts, such as Mrs. Susi Ermawati from the Animal Husbandry Service and Mr. Sanadi, an organic fertilizer producer guided them.

Second, Implementation and Results. Participants, including Mr. Khilmi and Mr. Iwan, applied the fertilizers produced to their corn plants. As confirmed by field surveys, the use of solid fertilizers made from goat and cow manure resulted in healthy and uniform growth. Similarly, liquid fertilizers made from goat and cow urine contributed to vigorous, green plant growth.

Third, Sustainability and Long-Term Impact. The training demonstrated the potential for local farmers to produce cost-effective, sustainable fertilizers. This practice can reduce reliance on chemical fertilizers, lower production costs, and improve crop yields. The participants' involvement in both production and application fosters a sense of ownership, ensuring the continuation of these practices.

Discussion

The results of the community service initiative demonstrate that the training and implementation of organic fertilizer production using goat and cow manure has had a positive impact on local agricultural practices. The hands-on training successfully introduced both solid and liquid organic fertilizers to farmers in Jombang Regency, which directly contributed to the improved health and growth of corn plants. Observations from the participants, Khilmi and Iwan, showed that the application of solid goat and cow manure fertilizers resulted in uniform and healthy growth of corn, while the liquid fertilizers made from goat and cow urine promoted vigorous, green plant growth.

These results align with the primary goals of the community service project: to reduce dependency on chemical fertilizers, lower production costs, and improve soil fertility for sustainable agricultural practices. The positive outcomes from the application of organic fertilizers support the broader objectives of promoting environmental sustainability and economic resilience among local farmers.

The success of organic fertilizer production also suggests that the local community has the potential to engage in sustainable agricultural practices that not only reduce the cost of fertilizers but also enhance the health of the soil over time. This approach contributes to building a more resilient agricultural system in the region, where local resources, such as manure, are recycled to improve farming productivity.

Organic Fertilizers and Sustainable Agriculture

The findings of this community service project are consistent with existing research on the benefits of organic fertilizers. Numerous studies have highlighted the positive effects of organic fertilizers on soil health, nutrient cycling, and plant growth. Organic fertilizers help improve soil structure, increase microbial activity, and enhance the nutrient-holding capacity of the soil, all of which contribute to better crop yields. Furthermore, organic fertilizers reduce the need for synthetic chemical fertilizers, which can degrade soil health over time and contribute to environmental pollution.³

³ Rafi Ziladi Aditya et al., "PENGARUH JENIS PUPUK ORGANIK DAN APLIKASIPUPUK HAYATI TERHADAP PERTUMBUHAN DAN PRODUKSI TANAMAN TOMAT (*Solanum Lycopersicum* Mill) DI DESA SUK ABANJAR KECAMATAN GEDONG TATAAN," *Jurnal Agrotek Tropika* 9, no. 1 (2021): 145–151; Martina Lori et al., "Organic Farming Enhances Soil Microbial Abundance and Activity—A Meta-Analysis and Meta-Regression," *PLOS ONE* 12, no. 7 (2017): e0180442, <http://dx.doi.org/10.1371/journal.pone.0180442>; Yudi Anto, "Buah Mulus Berkat Pupuk Organik," *Revista Brasileira de Geomorfologia* 20, no. 2 (2019), <http://dx.doi.org/10.20502/rbg.v20i2.2190>; A. Bonanomi, G., De Filippis, F., Zotti, M., Idbella, M., Cesarano, G., Al-Rowaily, S., & Abd-ElGawad, "Repeated Applications of Organic Amendments Promote Beneficial Microbiota, Improve Soil Fertility and Increase Crop Yield," *Applied Soil Ecology* 156, no. Desember (2020); Eka Putra Ryandi et al., "PENGARUH KOMBINASI PUPUK ORGANONITROFOS DAN PUPUK ANORGANIK TERHADAP SIFAT KIMIA TANAH DAN PRODUKSI TANAMAN JAGUNG (*Zea Mays* L.) DI TANAH UL TISOLNATAR PADA MUSIM

The use of animal manure, particularly from goats and cows, as organic fertilizers is supported by literature that emphasizes its efficacy in enhancing soil fertility. As highlighted by Assefa et al., manure is rich in essential nutrients, such as nitrogen, phosphorus, and potassium, which are vital for plant growth. The combination of animal manure with other organic materials, such as EM4, molasses, and rice washing water, further promotes the fermentation process, resulting in a nutrient-dense fertilizer that can be applied to crops with minimal environmental impact.⁴

The practice of using organic fertilizers aligns with the concept of sustainable agriculture, which emphasizes long-term environmental health, economic viability, and social equity.⁵ By utilizing locally available resources and reducing dependency on chemical inputs, this approach promotes a more self-sufficient agricultural system that can withstand rising fertilizer costs and supply shortages.

The Service Process and Social Change

The process of implementing this community service, from initial training to the application of organic fertilizers, reflects the key principles of the service-learning model. Service learning, as described by Eyler and Giles (1999), integrates community service with academic learning, allowing participants to engage in meaningful, real-world applications of theoretical knowledge.⁶ The training sessions provided the farmers with practical skills that they could immediately apply to their agricultural practices, reinforcing the connection between theory and practice.⁷

As the community learned to produce organic fertilizers, they also experienced a shift in their perspectives on farming practices. Initially, farmers may have relied heavily on chemical fertilizers, either due to a lack of knowledge about organic alternatives or because of the perceived convenience and immediacy of chemical products. However, after participating in the training, many farmers began to see the long-term benefits of organic fertilizers, not only for improving soil health but also for reducing the economic

TANAM KE DUA," *Jurnal Agrotek Tropika* 8, no. 1 (2020): 111-121.; Shepherd M., Harrison R., and Webb J., "Managing Soil Organic Matter – Implications for Soil Structure on Organic Farms," *Soil use and Management* 18, no. 1 (2002): 284–292.

⁴ Krishan Chandra, "Organic Manures," *Regional Centre of Organic Farming* 34 (2005): 6–46; E Schnug, P Oswald, and S Haneklaus, "Organic Manure Management and Efficiency: Role of Organic Fertilizers and Their Management Practices," in *Fertilizers and Environment: Proceedings of the International Symposium "Fertilizers and Environment", Held in Salamanca, Spain, 26–29, September, 1994* (Springer, 1996), 259–265; Sisay Assefa and Sisay Tadesse, "The Principal Role of Organic Fertilizer on Soil Properties and Agricultural Productivity-a Review," *Agri Res and Tech: Open Access J* 22, no. 2 (2019): 556192.

⁵ Jules Pretty, "Agricultural Sustainability: Concepts, Principles and Evidence," *Philosophical Transactions of the Royal Society B: Biological Sciences* 363, no. 1491 (2008): 447–465.

⁶ Janet Eyler and Dwight E Giles Jr, *Where's the Learning in Service-Learning? Jossey-Bass Higher and Adult Education Series*. (ERIC, 1999).

⁷ Susan R Jones, "Where's the Learning in Service-Learning?" (Taylor & Francis, 2001).

burden of purchasing chemical fertilizers.

This social change can be understood through the lens of the Diffusion of Innovations Theory (Rogers, 2003), which explains how new ideas and practices spread through communities. In this case, the introduction of organic fertilizer production served as an innovation that gradually gained acceptance among local farmers.⁸ Participants like Khilmi and Iwan successfully applied the organic fertilizers to their crops and witnessed the positive results. Their experiences likely encouraged other farmers to adopt similar practices. This process of diffusion is critical for fostering community-wide adoption of sustainable agricultural methods.

Moreover, the community service project also contributed to broader social changes by fostering collaboration between local farmers, breeders, and experts from the Jombang Animal Husbandry Service. This collaboration helped to build trust and knowledge-sharing networks, which are crucial for sustaining the impact of community-based agricultural initiatives.

Conclusion

This community service activity is expected to benefit the participating partners and livestock farmers by teaching them how to convert goat and cow manure into solid and liquid organic fertilizers, which can be used as alternatives to inorganic fertilizers. Farmers can reduce their fertilizer costs and increase their income by replacing inorganic fertilizers with organic ones.

The successful application of solid and liquid organic fertilizers to corn plants will be an example for other farmers and livestock producers to convert goat and cow manure into organic fertilizers. Using these organic alternatives can reduce the cost of inorganic fertilizers. In the long term, the availability of solid and liquid organic fertilizers will help alleviate the scarcity of inorganic fertilizers.

Acknowledgments

The Author Team would like to express their gratitude to the Institute for Research and Community Service (LP2M) of Jember University for providing financial support through a grant for community service in the village. We hope that the results of this community service will benefit the people of Bangsri Village in particular and the people of Indonesia in general.

⁸ Everett M Rogers, Arvind Singhal, and Margaret M Quinlan, "Diffusion of Innovations," in *An Integrated Approach to Communication Theory and Research* (Routledge, 2014), 432–448.

References

- Aditya, Rafi Ziladi, Hendaro Kus, C Ginting Y., and Karyanto A. "PENGARUH JENIS PUPUK ORGANIK DAN APLIKASIPUPUK HAYATI TERHADAP PERTUMBUHAN DAN PRODUKSI TANAMAN TOMAT (*Solanum Lycopersicum* Mill) DI DESA SUK ABANJAR KECAMATAN GEDONG TATAAN." *Jurnal Agrotek Tropika* 9, no. 1 (2021): 145–151.
- Anto, Yudi. "Buah Mulus Berkat Pupuk Organik." *Revista Brasileira de Geomorfologia* 20, no. 2 (2019). <http://dx.doi.org/10.20502/rbg.v20i2.2190>.
- Assefa, Sisay, and Sisay Tadesse. "The Principal Role of Organic Fertilizer on Soil Properties and Agricultural Productivity-a Review." *Agri Res and Tech: Open Access J* 22, no. 2 (2019): 556192.
- Badan Pusat Statistik Kabupaten Jombang. *Kabupaten Jombang Dalam Angka 2023*. Kabupaten Jombang, 2023.
- Bonanomi, G., De Filippis, F., Zotti, M., Idbella, M., Cesarano, G., Al-Rowaily, S., & AbdelGawad, A. "Repeated Applications of Organic Amendments Promote Beneficial Microbiota, Improve Soil Fertility and Increase Crop Yield." *Applied Soil Ecology* 156, no. Desember (2020).
- Chandra, Krishan. "Organic Manures." *Regional Centre of Organic Farming* 34 (2005): 6–46.
- Eyler, Janet, and Dwight E Giles Jr. *Where's the Learning in Service-Learning? Jossey-Bass Higher and Adult Education Series*. ERIC, 1999.
- Jones, Susan R. "Where's the Learning in Service-Learning?" Taylor & Francis, 2001.
- Lori, Martina, Sarah Symnaczik, Paul Mäder, Gerlinde De Deyn, and Andreas Gattinger. "Organic Farming Enhances Soil Microbial Abundance and Activity—A Meta-Analysis and Meta-Regression." *PLOS ONE* 12, no. 7 (2017): e0180442. <http://dx.doi.org/10.1371/journal.pone.0180442>.
- M., Shepherd, Harrison R., and Webb J. "Managing Soil Organic Matter – Implications for Soil Structure on Organic Farms." *Soil use and Management* 18, no. 1 (2002): 284–292.
- Mangalisu, Azmi, and Rahmawati Arma. "Pengelolaan Terpadu Limbah Cair Ternak Kambing Desa Kompang Kecamatan Sinjai Tengah Kabupaten Sinjai Sulawesi Selatan." *Jurnal Dedikasi Masyarakat* 3, no. 1 (2019): 36–43.
- Pretty, Jules. "Agricultural Sustainability: Concepts, Principles and Evidence." *Philosophical Transactions of the Royal Society B: Biological Sciences* 363, no. 1491 (2008): 447–465.
- Rogers, Everett M, Arvind Singhal, and Margaret M Quinlan. "Diffusion of Innovations." In *An Integrated Approach to Communication Theory and Research*, 432–448. Routledge, 2014.
- Rusdin, Muh, La Malesi, Deki Zulkarnain, Achmad Selamat Aku, Amiluddin Indi, Muh Amrullah Pagala, Harapin Hafid, Asma Bio Kimistri, Putu Nara Kusuma Prasanjaya, and Nur Santy Asminaya. "Program Bina Desa Pengembangan Peternakan Kambing Di Kelurahan Anggoeya Kecamatan Poasia Kota Kendari." *Indonesian Journal of*

Community Services 2, no. 1 (2023): 9–13.

Ryandi, Eka Putra, Dermiyati Dermiyati, Afrianti Nurul, and Buchari Henrie. "PENGARUH KOMBINASI PUPUK ORGANONITROFOS DAN PUPUK ANORGANIK TERHADAP SIFAT KIMIA TANAH DAN PRODUKSI TANAMAN JAGUNG (*Zea Mays* L.) DI TANAH UL TISOLNATAR PADA MUSIM TANAM KE DUA." *Jurnal Agrotek Tropika* 8, no. 1 (2020): 111-121.

Schnug, E, P Oswald, and S Haneklaus. "Organic Manure Management and Efficiency: Role of Organic Fertilizers and Their Management Practices." In *Fertilizers and Environment: Proceedings of the International Symposium "Fertilizers and Environment", Held in Salamanca, Spain, 26–29, September, 1994*, 259–265. Springer, 1996.