



Enhancing the welfare of beginner rabbit farmers through integrated farming systems

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Abstract

Low productivity and limited technical knowledge are primary obstacles for beginner rabbit farmers in Kalidadi Village, Central Lampung. This community service program, through the POHON OPIUM initiative, aims to enhance farmer capacity through appropriate technology application and institutional strengthening. The methodology employed a community-based empowerment approach involving technical-managerial training, integrated cage installation, and continuous mentoring. Results indicated significant increases in knowledge (83.5%), skills (87.5%), and active participation (62.8%). The economic impact included an average income growth of 59.1% within three months through livestock sales and waste diversification into liquid organic fertilizer and planting media. The program's success was further evidenced by the institutional strengthening of the Kakabit Farm group through a breeder rotation system and collective savings. The integration of technological innovation and circular economy principles proved effective in enhancing farmers' economic independence while establishing an environmentally friendly cultivation system.

Keywords: Circular economy; Integrated cages; Community empowerment; Rabbit farming

Meningkatkan kesejahteraan peternak kelinci pemula melalui peternakan terintegrasi

Abstrak

Rendahnya produktivitas dan keterbatasan pengetahuan teknis menjadi hambatan utama peternak kelinci pemula di Desa Kalidadi, Lampung Tengah. Program pengabdian masyarakat ini, melalui inisiatif POHON OPIUM, bertujuan meningkatkan kapasitas peternak melalui penerapan teknologi tepat guna dan penguatan kelembagaan. Metode yang digunakan adalah pemberdayaan berbasis komunitas yang meliputi pelatihan teknis-manajerial, instalasi kandang integratif, serta pendampingan berkelanjutan. Hasil program menunjukkan peningkatan signifikan pada pengetahuan (83,5%), keterampilan (87,5%), dan partisipasi aktif (62,8%). Dampak ekonomi yang dihasilkan adalah kenaikan pendapatan rata-rata mitra sebesar 59,1% dalam tiga bulan melalui penjualan ternak dan diversifikasi limbah menjadi pupuk organik cair serta media tanam. Keberhasilan program ini juga ditandai dengan penguatan kelompok Kakabit Farm melalui sistem rotasi indukan dan tabungan kolektif. Integrasi inovasi teknologi dan prinsip ekonomi sirkular terbukti efektif dalam meningkatkan kemandirian ekonomi peternak sekaligus menciptakan sistem budidaya yang ramah lingkungan.

Kata Kunci: Ekonomi sirkular; Kandang terintegrasi; Pemberdayaan masyarakat; Peternakan kelinci

Contributions to
SDGs

8 DECENT WORK AND
ECONOMIC GROWTH



12 RESPONSIBLE
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1. Introduction

Kalidadi Village, located in Kalirejo District, Central Lampung Regency, has considerable potential for developing small-scale livestock production due to its abundant natural feed resources and available backyard land. Within this context, the Kakabit Farm youth community was established in 2022 as a group of fifteen members aged between eighteen and thirty years who manage small rabbit farms around their homes. Rabbits (*Oryctolagus cuniculus*) are considered one of the strategic livestock commodities because of their high nutritional value, rapid reproductive rate, and potential as a sustainable source of animal protein. Rabbit meat has been recognized for its superior nutrient profile compared to chicken, beef, and pork (Nistor et al., 2013). Studies by Abd-Allah & Abd-Elaziz (2018) and Tărnăuceanu et al. (2014) revealed that rabbit meat is high in protein and low in fat, making it suitable as a healthy food alternative. Likewise, Zamaratskaia et al. (2023) emphasized that rabbit meat products can support food diversification and open opportunities for healthy culinary markets.

Furthermore, rabbit waste management that is often overlooked, actually holds considerable economic potential. Rabbit urine has been proven effective as a bio-fertilizer that enhances the growth of various food and horticultural crops (Ekwere et al., 2023; Prajanti et al., 2023). Both liquid organic fertilizers and hydroponic media derived from rabbit manure can promote optimal plant growth. Efficient utilization of nitrogen from rabbit waste also contributes significantly to the sustainability of farming systems while supporting environmentally friendly circular agriculture practices (Calvet et al., 2008).

Despite its potential, Kakabit Farm faces several critical challenges typical of beginner rabbit farmers in rural areas. Most of the existing hutches are built from non-durable materials that are easily damaged by weather, leading to low productivity and poor animal welfare. Farmers have limited technical knowledge in feed formulation, disease prevention, and breeding management. Rabbit urine and manure, which are rich in nutrients, are not yet utilized optimally, and marketing systems remain dependent on local intermediaries with low profit margins. Similar challenges have been observed internationally, where small-scale rabbit producers often struggle with technical and institutional limitations (Cullere et al., 2022; Trocino et al., 2019). Lukefahr (1998) and Mensah et al. (2014) found that inadequate technical support, poor access to finance, and weak market networks significantly hinder the growth of rabbit farming as a sustainable livelihood. These findings reflect the situation in Indonesia, where rabbit farming has not been fully integrated from production to processing and marketing.

Addressing these issues requires an integrated and context-sensitive approach that not only introduces appropriate technology but also strengthens local capacity and institutional collaboration. The POHON OPIUM was therefore developed as an alternative community empowerment model. This program combines three interrelated components: the construction of modern, climate-resilient rabbit hutches (one nest), waste management through pond-based recycling systems (one pool), and household-scale production that supports family-based economic sustainability (one house). The concept reflects the principles of circular economy and integrated farming systems, which have proven effective in improving productivity and reducing environmental impact (Bhagat et al., 2024; Bordignon et al., 2025; Mahadevaswamy & Venkataraman, 1988; Ogello et al., 2013). The approach also supports appropriate technology application

and youth participation as drivers of rural innovation. Previous studies have shown that training and digital entrepreneurship among young farmers increase productivity and independence (Ayeeni et al., 2023; Wongnaa et al., 2023), while the utilization of rabbit manure and urine as organic fertilizer has demonstrated both agronomic and economic value (Li et al., 2022; Mmbaga et al., 2024).

The development of the POHON OPIUM is also in line with successful community empowerment initiatives in Indonesia that combine technological innovation and participatory engagement. Examples include the development of family medicinal plant gardens (Santoso et al., 2021), the processing of cow urine into liquid organic fertilizer (Siswati et al., 2021), and the creation of educational-integrated agriculture villages (Wanudya et al., 2019). These programs collectively demonstrate how empowering communities through technology-based participation can improve both welfare and environmental sustainability.

Based on this background, the POHON OPIUM program aims to enhance the welfare and technical capacity of beginner rabbit farmers through the implementation of an integrated and sustainable farming model. This initiative focuses on increasing technical skills in rabbit husbandry, developing waste-based product innovation, and strengthening institutional capacity for sustainable group management. The program also seeks to demonstrate a replicable model of circular and community-based livestock farming that contributes to achieving the Sustainable Development Goals (SDGs), particularly Goal 8 (Decent Work and Economic Growth) and Goal 12 (Responsible Consumption and Production).

2. Method

The POHON OPIUM community service program was implemented from May to October 2025 in Kalidadi Village, Kalirejo District, Central Lampung Regency, Lampung Province, Indonesia. The location was selected based on its strong potential for livestock-based economic development and the active presence of Kakabit Farm, a local youth rabbit farming group. The group consists of 15 young members, mostly beginner farmers aged 18–30 years, who utilize their backyard spaces for small-scale rabbit production.

The community partners faced key constraints, including limited technical capacity, inadequate housing design, inefficient waste management, and weak institutional organization. This program employed a community-based participatory empowerment approach, integrating educational, technological, and managerial dimensions. The approach followed the model of learning by doing and participatory technology development, which have been proven effective in smallholder empowerment programs (Wanudya et al., 2019; Wongnaa et al., 2023). The main stages of the program were designed systematically as follows:

2.1. Planning and socialization

This initial phase focused on building mutual understanding and commitment among stakeholders, including the Kakabit Farm group, community leaders, and local government representatives. A series of focus group discussions (FGDs) were held to identify needs, map problems, and design an integrated rabbit farming model adapted to local conditions. The planning stage emphasized co-creation between the facilitators and community members.

2.2. Technical and managerial training

The second phase aimed to enhance the partners' technical capacity through hands-on training sessions. The materials covered included:

- a. Construction of two-tier integrated rabbit hutches designed for efficient space use and improved animal welfare;
- b. Health management and disease prevention practices;
- c. Feed formulation using locally available ingredients to reduce production costs;
- d. Waste utilization through the fermentation of rabbit urine into liquid organic fertilizer (LOF) and the conversion of solid manure into organic planting media; and
- e. Digital marketing and entrepreneurial skills development for product diversification.

The learning by doing method ensured that participants acquired practical skills that could be directly applied in their farming activities, consistent with successful empowerment frameworks

2.3. Implementation of appropriate technology

During this stage, participants constructed 12 integrated rabbit hutches at their households, each equipped with a lower pond system (one pool) to collect and process waste materials. This design supported the concept of circular economy and integrated farming. The collected urine was fermented into organic fertilizer, while solid manure was used as a hydroponic substrate. Farmers also practiced product diversification through the production of rabbit-based processed food items such as nuggets and floss (abon).

2.4. Mentoring, monitoring, and evaluation

Regular mentoring and monitoring sessions were conducted at least seven times during program implementation. Evaluation focused on technical performance, group management, and household income improvement. Data were collected using interviews, field observations, and simple questionnaires.

2.5. Sustainability planning

The final stage involved designing strategies for program continuity. The Kakabit Farm group was facilitated to develop a collective savings system, breeding rotation, and internal institutional strengthening to ensure long-term sustainability. Additionally, the team prepared a pocket guide and digital module to serve as educational materials for future farmers. Collaboration with local cooperatives and agricultural agencies was also established to expand market networks and ensure post-program resilience.

3. Results and Discussion

This community service program was implemented in five main stages. Each stage generated tangible outputs and outcomes that contributed to improving the welfare and capacity of the partner group, Kakabit Farm.

3.1. Planning and socialization

The initial phase focused on establishing shared understanding and commitment among stakeholders, including Kakabit Farm members, village leaders, and local government

representatives. A series of focus group discussions (FGDs) were conducted to identify local needs, map existing challenges, and design an integrated rabbit farming system suitable for the rural context.

This participatory planning process emphasized co-creation between facilitators and community members, aligning with the empowerment principles discussed by [Santoso et al. \(2021\)](#), who emphasized that participatory planning enhances community ownership and sustainability. The resulting design incorporated three main components: modern two-tier rabbit hutches (one nest), waste treatment ponds (one pool), and household-scale production systems (one house). These concepts were supported by the integrated farming frameworks proposed by [Bhagat et al. \(2024\)](#) and [Ogello et al. \(2013\)](#), which link resource efficiency to environmental sustainability.

By the end of this stage, 12 partner members agreed upon role assignments, activity schedules, and output targets. The process successfully built collective motivation and a strong foundation for the next stages, consistent with the findings of [Wanudya et al. \(2019\)](#), who reported that early community engagement contributes to higher participation and long-term project ownership. The planning stage successfully aligned the objectives among team members, community leaders, and the Kakabit Farm group. Similar participatory planning has been reported as a key success factor in rural empowerment projects ([Santoso et al., 2021](#)).

3.2. Technical and managerial training

The second stage focused on enhancing the partners' technical, managerial, and entrepreneurial capacities through hands-on training sessions. The learning by doing approach was applied to ensure that participants acquired practical skills that could be immediately implemented in their daily farming routines. This method aligns with the experiential learning principles highlighted by [Siswati et al. \(2021\)](#), who found that participatory learning improves knowledge retention and technology adoption in community empowerment programs.

The evaluation of training outcomes revealed notable improvements: participants' technical knowledge increased by 83.5%, practical skills by 87.5%, and participatory attitudes by 62.8%. Economic value and index both improved by 59.1% and 65%, respectively ([Table 1](#)). These results correspond with the findings of [Ayeni et al. \(2023\)](#) and [Wongnaa et al. \(2023\)](#), which confirmed that skill-based capacity building strengthens productivity and income among smallholder farmers.

Table 1. Comparison of partner improvement before and after the program

No	Aspect	Before	After	Change (%)
1.	Knowledge (Average Score)	42.25	77.50	+83.5%
2.	Skills (Average Score)	34.75	65.17	+87.5%
3.	Attitude (Average Score)	40.33	65.67	+62.8%
4.	Economic Value (Rp)	969,900	1,543,400	+59.1%
5.	Economic Index (Score)	37.42	61.75	+65.0%

3.3. Implementation of appropriate technology

During this phase ([Figure 1](#)), twelve integrated rabbit hutches were constructed at partner households, each equipped with a lower pond (one pool) for collecting and processing waste materials. This infrastructure supported waste recycling and

environmental sanitation while enhancing animal comfort as emphasized by [Bordignon et al. \(2025\)](#) in sustainable livestock production systems.

Rabbit urine was processed into liquid organic fertilizer following the fermentation protocols adapted from [Li et al. \(2022\)](#) and [Mmbaga et al. \(2024\)](#), while solid manure was utilized as a hydroponic medium for vegetable seedlings ([Wang et al., 2025](#)). These initiatives aligned with the circular economy concept by converting waste into productive inputs, reducing pollution, and creating new income opportunities.



Figure 1. The condition of rabbit hutches before and after the implementation of the POHON OPIUM program

Some farmers began marketing bottled LOF to neighboring communities, similar to the waste valorization model documented by [Siswati et al. \(2021\)](#). Furthermore, the integrated hutches adopted the climate-resilient design principles discussed by [Bhagat et al. \(2024\)](#), ensuring resource efficiency and long-term ecological balance.

Product diversification activities also began during this stage, including the development of value-added rabbit-based products such as nuggets and floss, consistent with the findings of [Zamaratskaia et al. \(2023\)](#) and [Petracci & Cavani \(2013\)](#), who emphasized that processing innovation increases consumer acceptance and market competitiveness. The installation of twelve integrated two-tier hutches represents a practical adaptation of circular farming systems ([Bhagat et al., 2024](#); [Bordignon et al., 2025](#)). Furthermore, the use of rabbit urine as a biofertilizer aligns with findings from [Mmbaga et al. \(2024\)](#) and [Li et al. \(2022\)](#), confirming its potential to enhance plant growth while reducing waste.

3.4. Mentoring, monitoring, and evaluation

Mentoring and monitoring were conducted seven times throughout the six-month implementation period. These activities focused on technical performance, production management, marketing progress, and institutional strengthening. Evaluation tools included structured interviews, field observations, and household income surveys.

The results showed substantial improvements in several aspects, such as (a) rabbit mortality decreased due to better housing and sanitation conditions; (b) waste recycling efficiency reached approximately 90%; and (c) average economic value and index both increased significantly by 59,1% and 65% within six months. These outcomes correspond with the empirical findings of [Ayeni et al. \(2023\)](#), who observed similar income growth among smallholders adopting improved management systems, and [Bordignon et al.](#)

(2025), who confirmed that integrating waste management reduces environmental impact while maintaining profitability.

Mentoring also emphasized the establishment of a collective savings mechanism and breeding rotation plan to strengthen group resilience. This institutional reinforcement aligns with the empowerment model of [Wanudya et al. \(2019\)](#), highlighting the importance of social capital in sustaining community-based agricultural initiatives.

Evaluation results showed an average economic value and index both increased significantly by 59.1% and 65% ([Table 1](#)) within six months among participants. Similar outcomes were observed by [Ayeni et al. \(2023\)](#), who found significant livelihood improvement after adopting integrated rabbit farming in Nigeria.

3.5. Sustainability planning

The final stage focused on ensuring the long-term sustainability of the POHON OPIUM program. The Kakabit Farm group successfully developed a self-managed micro-cooperative system that includes collective savings, breeding exchanges, and product marketing. The program outcomes indicate that partners not only improved their technical competence but also demonstrated leadership and autonomy in managing their enterprises. This finding echoes the perspectives of [Trocino et al. \(2019\)](#) and [Gie-ann et al. \(2025\)](#), who underscored the importance of youth involvement and social networks in sustaining smallholder rabbit farming systems.

Furthermore, the integration of circular and community-based approaches demonstrates the model's alignment with the green economy and Sustainable Development Goals (SDGs), particularly SDG 8 (Decent Work and Economic Growth) and SDG 12 (Responsible Consumption and Production). Its scalability for other rural contexts shows high potential for replication, supporting the community resilience framework promoted by [Bhagat et al. \(2024\)](#).

The creation of collective savings systems and product diversification mirrors the empowerment framework suggested by [Wanudya et al. \(2019\)](#), reinforcing the role of institutional strengthening in sustaining community-based agribusiness. A key contribution of the program lies in its role in supporting food security through the provision of an affordable, healthy, and sustainable source of animal protein. Rabbit meat is known for its high protein content, low cholesterol, and rich nutritional profile ([Abd-Allah & Abd-Elaziz, 2018](#); [Nistor et al., 2013](#)). This makes rabbit farming a promising strategy to improve dietary quality, particularly in rural areas that rely heavily on conventional protein sources like poultry and beef. Thus, POHON OPIUM underscores the potential of rabbit farming to advance nutrition-sensitive development and sustainable food systems.

At the global level, rabbit farming innovations have been explored through various technological approaches. [Goswami et al. \(2025\)](#) emphasize the importance of integrating genomics and nutrition to enhance rabbit production efficiency. While POHON OPIUM has not adopted advanced technologies, its simple, home-based integrative model demonstrates strong adaptability to local socio-economic realities. This suggests that local wisdom-based innovations can serve as inclusive and sustainable alternatives to high-tech agricultural systems.

Within the national context, POHON OPIUM aligns with recent efforts to strengthen rural economies through rabbit farming. [Hindersah et al. \(2024\)](#) highlight the potential

of small-scale rabbit farming as a sustainable driver of village economic growth. By engaging rural youth and fostering entrepreneurship through Kakabit Farm, the program has proven that rabbit farming can function as both an economic catalyst and a social empowerment mechanism. Consequently, POHON OPIUM can be regarded as a replicable model of integrated village development rooted in sustainable livestock practices, offering a scalable framework for other regions across Indonesia.

These outcomes affirm that circular and integrated farming models, as highlighted by [Bhagat et al. \(2024\)](#) and [Cullere et al. \(2022\)](#), are feasible pathways toward sustainable rural development. The POHON OPIUM program contributes a replicable model that combines social empowerment, environmental responsibility, and local economic growth.

4. Conclusion

The implementation of the POHON OPIUM in Kalidadi Village, Central Lampung, has successfully demonstrated how community-based empowerment and appropriate technology can enhance the welfare of beginner rabbit farmers. The integration of modern housing systems, waste management through pond-based recycling, and household-scale production has effectively improved productivity, income, and institutional capacity.

Through participatory planning, training, and mentoring, the partners members of the Kakabit Farm youth group acquired technical competence in rabbit rearing, feed formulation, health management, and waste utilization. The construction of twelve two-tier integrated hutches and the production of liquid organic fertilizer from rabbit urine exemplify a practical application of the circular farming concept that minimizes waste while generating additional income.

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Author Contribution

Activity implementation: A, AR, UK; Article preparation: A, AR; Impact analysis: A, UK; Presentation of results: AR; Article revision: UK. All authors contributed to discussions, provided critical feedback, and approved the final version of the manuscript.

Conflict of Interest

The authors declare that there is no conflict of interest regarding the implementation of the program or the publication of this article.

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References

- Abd-Allah, S. M. S., & Abd-Elaziz, D. M. (2018). Nutritional value and quality profile of fresh rabbit meat in Assiut city, Egypt. *International Journal of Research in Agriculture and Food Science*, 4(7), 1–15.
- Ayeni, M. D., Adewumi, M. O., Bello, M. A., AdiAdi, K. F., & Osungade, A. A. (2023). Effects of rabbit production on income and livelihood of rural households in Nigeria. *Heliyon*, 9(8). <https://doi.org/10.1016/j.heliyon.2023.e18568>
- Bhagat, R., Walia, S. S., Sharma, K., Singh, R., Singh, G., & Hossain, A. (2024). The integrated farming system is an environmentally friendly and cost-effective approach to the sustainability of agri-food systems in the modern era of the changing climate: A comprehensive review. *Food and Energy Security*, 13(1), e534. <https://doi.org/10.1002/fes3.534>
- Bordignon, F., Xiccato, G., Trocino, A., Zuffellato, A., Castellini, C., Mattioli, S., & Berton, M. (2025). Environmental impact of rabbit production systems: A farm-based cradle-to-gate analysis. *Animal*, 19(5), 101488. <https://doi.org/10.1016/j.animal.2025.101488>
- Calvet, S., Estellés, F., Hermida, B., Blumetto, O., & Torres, A. (2008). Experimental balance to estimate efficiency in the use of nitrogen in rabbit breeding. *World Rabbit Science*, 16(4), 205–211. <https://doi.org/10.4995/wrs.2008.615>
- Cullere, M., Singh, Y., Gerencsér, Z., Matics, Z., Cappellosza, S., & Dalle Zotte, A. (2022). Silkworm (*Bombyx mori* L.) oil in growing rabbit nutrition: Effects on meat physicochemical traits, sensory profile and shelf-life. *Journal of Insects as Food and Feed*, 8(7), 733–742. <https://doi.org/10.3920/JIFF2021.0084>
- Ekwere, O. J., Udounang, P. I., Efretuei, A. O., & Umoh, F. O. (2023). Evaluation of rabbit urine as bio-fertilizer for the growth and yield of cowpea (*Vigna unguiculata* (L.) Walp). *AKSU Journal of Agriculture and Food Sciences*, 7(3), 37–48. <https://doi.org/10.61090/aksuja.2023.014>
- Gie-ann, A. C., Aranda, C. D., & Narita, R. L. (2025). Constraints and development pathways of rabbit farming in the Southern Philippines: A socioeconomic perspective. *World Rabbit Science*, 33(3), 185–192. <https://doi.org/10.4995/wrs.2025.23899>
- Goswami, N., Solomon Ahamba, I., Kinkpe, L., Mujtaba Shah, A., Xiangyang, Y., Song, B., Dong, X., Wang, S., & Ren, Z. (2025). Enhancing rabbit farming efficiency with integrated genomics and nutritional strategies. *Frontiers in Animal Science*, 5, 1514923. <https://doi.org/10.3389/fanim.2024.1514923>
- Hindersah, H., Dariah, A. R., Nu'man, A. H., Fatmadewi, R., Himayasari, N. D., & Safitri, N. (2024). Pengembangan Ruang Budi Daya Peternakan Kelinci di Desa Margamukti Sumedang Untuk Mendukung Perekonomian Desa Berkelanjutan. *Bandung Conference Series: Economics Studies*, 4(2), 551–560. <https://doi.org/10.29313/bcses.v4i2.12560>

- Li, R., Hao, H., Yang, C., Wang, L., & Wang, H. (2022). Rabbit manure compost as a peat substitute for compound growing media: Proportioning optimization according to physiochemical characteristics and seedling effects. *Frontiers in Plant Science*, 13, 1008089. <https://doi.org/10.3389/fpls.2022.1008089>
- Lukefahr, S. (1998). Rabbit production in Uganda: Potential versus opportunity. *World Rabbit Science*, 6(3-4). <https://doi.org/10.4995/wrs.1998.365>
- Mahadevaswamy, M., & Venkataraman, L. (1988). Integrated utilization of rabbit droppings for biogas and fish production. *Biological Wastes*, 25(4), 249-256. [https://doi.org/10.1016/0269-7483\(88\)90086-9](https://doi.org/10.1016/0269-7483(88)90086-9)
- Mensah, J. O., Aidoo, R., Amponsah, D., Buah, A., Aboagye, G., & Acquah-Harrison, N. (2014). Assessing the feasibility of commercial meat rabbit production in the Kumasi Metropolis of Ghana. *Journal of Experimental Agriculture International*, 4(2), 183-192. <https://doi.org/10.9734/AJEA/2014/5739>
- Mmbaga, N., Ngongolo, K., & Materu, S. T. (2024). Potential of rabbit urine as fertilizer on growth and production of Brassica carinata L. *Discover Agriculture*, 2(1), 99. <https://doi.org/10.1007/s44279-024-00106-2>
- Nistor, E., Bampidis, V., Păcală, N., Pentea, M., Tozer, J., & Prundeanu, H. (2013). Nutrient content of rabbit meat as compared to chicken, beef and pork meat. *Journal of Animal Production Advances*, 3(4), 172-176. <https://doi.org/10.5455/japa.20130411110313>
- Ogello, E. O., Mlingi, F., Nyonje, B., Charo-Karisa, H., & Munguti, J. (2013). Can integrated livestock-fish culture be a solution to East African's food insecurity? A Review. *African Journal of Food, Agriculture, Nutrition and Development*, 13(4), 8058-8078. <https://doi.org/10.18697/ajfand.59.12920>
- Petracci, M., & Cavani, C. (2013). Rabbit meat processing: Historical perspective to future directions. *World Rabbit Science*, 21(4), 217-226. <https://doi.org/10.4995/wrs.2013.1329>
- Prajanti, S. D. W., Litaay, C., Widiatningrum, T., Amelia, D. R., & Daud, D. (2023). Application of Rabbit Urine and Manure Based Fertilizer on the Growth of Arabica and Robusta Coffee Seedlings. *Biosaintifika: Journal of Biology & Biology Education*, 15(3), 441-449. <https://doi.org/10.15294/biosaintifika.v15i3.48027>
- Santoso, S. B., Lutfiyati, H., & Kusuma, T. M. (2021). Pemberdayaan Potensi Masyarakat Melalui Pengelolaan Kebun Tanaman Obat Keluarga. *Community Empowerment*, 6(3), 391-397. <https://doi.org/10.31603/ce.4044>
- Siswati, L., Ariyanto, A., Lestari, S. U., Setiawan, D., & Yandra, A. (2021). Manfaatkan Urin Sapi Menjadi Pupuk Organik Cair di Desa Teluk Jering Kecamatan Tambang. *Community Empowerment*, 6(2), 291-296. <https://doi.org/10.31603/ce.4484>
- Tărnauceanu, G., Lazăr, R., & Boișteanu, P. (2014). Research regarding nutritional quality of rabbit meat (Belgian Giant breeds). *Lucrări Științifice - Seria Zootehnie*, 62, 45-48.
- Trocino, A., Cotozzolo, E., Zomeño, C., Petracci, M., Xiccato, G., & Castellini, C. (2019). Rabbit production and science: The world and Italian scenarios from 1998 to 2018. *Italian Journal of Animal Science*, 18(1), 1361-1371. <https://doi.org/10.1080/1828051X.2019.1662739>
- Wang, O., Deaker, R., & Van Ogtrop, F. (2025). A systematic review of food-waste based hydroponic fertilisers. *Agricultural Systems*, 223, 104179. <https://doi.org/10.1016/j.agsy.2024.104179>

- Wanudya, A., Isnaeni, R., Erlangga, W. C., Zulfa, N. K., Lestari, D. W., Pratiwi, E., Antoro, S. B., Niagasi, A. F., Agustina, L. P., & Putri, E. L. S. (2019). Artikel Ilmiah Penciptaan Pertanian Terpadu dalam Rangka Memperkenalkan Dusun Dukusari, Desa Pengarengan, Kecamatan Kaliangkrik Sebagai Desa Edukasi Wisata. *Community Empowerment*, 4(1), 1-3.
- Wongnaa, C. A., Afful-Kwadam, K., Asempah, M. K., Hagan, M. A. S., & Awunyo-Vitor, D. (2023). Is it profitable and viable to invest in commercialization of rabbit production? Implication on rural enterprise development. *Sustainable Technology and Entrepreneurship*, 2(3), 100048. <https://doi.org/10.1016/j.stae.2023.100048>
- Zamaratskaia, G., Havrysh, O., Korzeniowska, M., & Getya, A. (2023). Potential and limitations of rabbit meat. *Meat Science*, 204, 109293. <https://doi.org/10.1016/j.meatsci.2023.109293>



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