

POTENTIAL OF CATTLE FEED FROM PALM OIL LEAVES AND MIDRIBS USING THE FERMENTATION PROCESS IN WEST KALIMANTAN

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ABSTRACT

Abstract: One of the most crucial phases of cattle farming is the supply of high-quality animal feed, which can enhance productivity and animal health. Animal feed is often a problem in West Kalimantan. However, this area is an oil palm plantation, so it has the potential to produce oil palm waste. This community service activity aims to increase knowledge and practice community skills in oil palm plantations in utilizing palm oil waste in cattle feed. The community service applied a socialization and training methods to make high-quality fermented animal feed using palm oil waste, namely leaves and fronds. Participants in this program included the village chief and the village's livestock owners, a total of 30 people. The farmers benefited from the results of this training and socialization. The villagers can use palm leaves and fronds to make fermented animal feed. This adds insight into how to improve livestock productivity and health. In addition, this activity also has the potential to reduce the amount of palm oil waste generated, in addition to increasing the economic value of the waste. The results of the feed processing technology service activities after socialization and training were carried out, there was an increase in participants' knowledge regarding understanding feed processing, post-test scores from 33% to 80% after the post-test, and post-test scores on feed processing practices from 40% to 80% after the post-test.

Keywords: Animal Feed; Oil Palm; Fermented.



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A. BACKGROUND

Indonesia's palm oil production is number one in the world Saputra et al. (2024); Grinnell et al. (2022); Pranata & Arico (2019). The number of plantations and smallholder oil palm production in 2021 reached 697,182 ha and 1,041,895 tonnes, based on data from the West Kalimantan Provincial Plantation Service (Badan Pusat Statistik, 2022). In addition, oil palm production owned by private and state companies reached 1,453,126 ha and 4,242,266 tons, and 28,021 ha and 48,177 tons respectively. In addition, Governor Regulation (PERGUB) Number 3 of 2022 stipulates a Sustainable Action Plan for Palm Oil Plantations for 2022–2024. The aim of the PERGUB (Governor's Regulation) is to improve the performance of the oil palm plantation sector in West Kalimantan in economic, social and environmental terms. One strategy that can support the goals of this PERGUB is implementing the Palm Oil-Cow Integration System (SISKA). SISKA is a farming system that integrates oil palm crops with cattle (Umar et al., 2023). SISKA is expected to increase the productivity and welfare of farmers while reducing the negative impacts of oil palm plantations (Pranoto et al., 2020); (Setiawan et al., 2022) thereby supporting global goals, namely the UN Sustainable Development Goals (SDGs), especially PERGUB, in 2030 (Azhar et al., 2021); (Wulandari & Villano, 2021).

Pinang Dalam Village, which is in Kubu District, Kuburaya Regency, is one of the villages that may receive SISKA development with human resources of 1,410 people and 439 heads of families. Most of the people in Pinang Dalam village work as farmers, but they also have livestock businesses such as cattle and goats. However, as land is used for oil palm plantations, the grass normally used as forage is increasingly difficult to obtain, which makes it difficult for these farms to meet their feed needs. As a result, many people sell their livestock to reduce their numbers or meet their living needs (Setiawan, 2020).

Pinang Dalam Village has extensive oil palm plantations and abundant production of palm frond waste. Each year, one producing oil palm tree can produce around 40-50 fronds, with a dry weight of each frond of around 4.5 kg. If calculated, one ha of oil palm plantation can produce 6400-7500 fronds in a year (Simanihuruk et al., 2022). However, this waste resource has not been utilized optimally by society. Oil palm leaves and fronds have a rough texture and cannot be directly given as animal feed. This is the main obstacle in utilizing palm oil waste (Susilawati et al., 2022). Palm fronds have almost the same nutritional content as natural grass, such as neutral detergent fiber (74.1%), acid detergent fiber (51.7%), crude protein (4.6%), dry matter digestibility value (50- 51%) and energy content (Putra et al., 2023). However, palm fronds have a high fiber content and low crude protein. Therefore, palm fronds need to be further processed so that they can become good ruminant feed and have the potential to replace natural grass. Unfortunately, village

communities do not yet know how to process palm fronds into animal feed or other economically valuable products (Simanihuruk et al., 2022).

The Village Development Group from the Faculty of Engineering, Tanjungpura University conducted a survey and recommendations to partners to solve this problem. The Pinang Dalam Village Head, who is the representative of the village community, acts as the representative, converting palm oil waste into animal feed as additional food in the form of nutrients. Making fermented feed can be used to develop nutrition with the aim of improving feed quality. This is in accordance with Mauludyani et al. (2020); Rohayeti et al. (2022), stated that processing green feed through fermentation can improve feed quality. The fermentation process involves the use of microorganisms both aerobically and anaerobically to break down organic substances into simpler substances. According to Mardalena et al. (2019), developing feed as an alternative to increase the nutritional content of livestock through special processing, such as fermentation. Apart from that, nutritionally complete fermented feed will help the livestock's digestive process so that it has a positive impact on good livestock growth.

One of the causes of low livestock productivity in Kubu Raya is that the nutritional needs of animal feed are not yet met, both in quality and quantity (Zakiatulyaqin et al., 2017). Many educational programs have been developed in the community to improve the quality of animal feed by utilizing fermented palm oil waste. This method has been implemented by Kusmiah et al, (2021); Setiawan (2020); Lestari et al. (2021) in their community program. It is hoped that the development of this feed can provide a solution for the community in managing palm oil waste into products of high economic value. Based on the potential of palm oil waste, which is abundant in Kubu Raya, this community service activity aims to increase the knowledge and practice of the skills of oil palm plantation communities in utilizing palm oil waste in animal feed.

B. METHOD

The method for Village Development activities is carried out offline through outreach and training. The activity took place at the village office located in Kubu District, Kubu Raya Regency. Partners in this activity are the village head and around 30 community members who work as cattle farmers, traders, and youth. The team that took part in this activity consisted of 6 lecturers and 10 students from the Faculty of Engineering and the Faculty of Agriculture, Tanjungpura University. The following are the steps for implementing Bina Desa activities to make cattle feed from palm oil waste in Pinang Dalam Village:

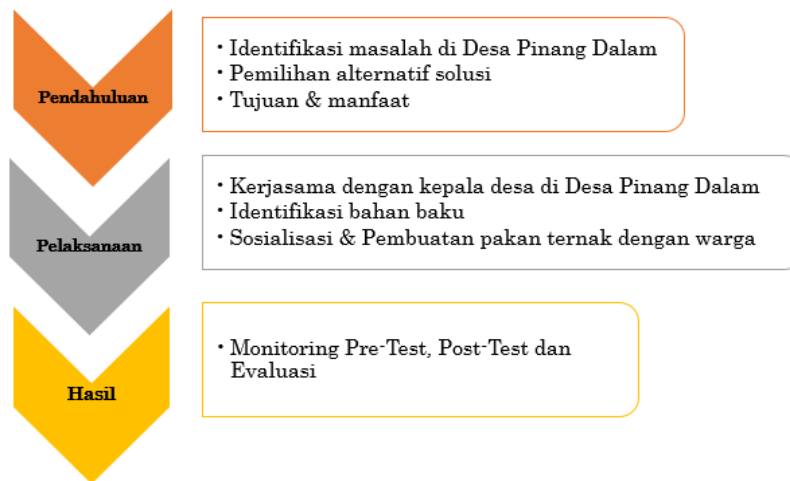


Figure 1. Stages of determining village development activities

1. Initial Stage: Introduction

The initial coordination stage was carried out by collecting information in the field in Pinang Dalam Village to identify partner problems. This information gathering activity is carried out to select alternative solutions to existing problems in the area. Activities carried out included interviewing local residents and discussions with village heads. After that, the Team held a meeting to discuss and plan targeted activities for the residents of Pinang Dalam Village. Apart from that, the team also made a schedule, prepared tools and materials for making feed, and prepared outreach materials.

2. Second Stage: Implementation

The next step is to collaborate with the village head to facilitate village development activities. The team will visit the location to prepare the necessary materials, especially coconut leaves and fronds as basic ingredients for making fermented feed. After that, the Team will prepare administrative documents for collaboration with partners at the location. The following are the steps that will be taken in carrying out village development activities in partnership with the local community:

a. Socialization of the Use of Fermented Feed

This socialization activity was carried out by providing an explanation and followed by a question and answer discussion. The methods used in this activity are lectures, discussions and demonstrations (Aisa et al. 2021). The aim is to inform the public about the benefits of feeding and explain each step taken. The transfer of knowledge through the application of innovative science and technology to the feed provided will be very helpful and can be developed further in the future.

b. Training Assistance

After participating in the outreach, the next step for residents is to receive guidance and training in making animal feed. According to Training is an alternative force to improve the quality of skilled and

knowledgeable human resources. Support from science and technology is important for breeders as an effort to optimize their potential so they can develop their business. This practical training is very important to implement, where residents will test their ability to make animal feed using the nutritional composition, processing and manufacturing methods that have been taught. The aim is to increase their knowledge and skills in animal feed production.

3. Third Stage: Results

The monitoring process is conducted to assess how well the participants understand the knowledge provided during the activity. Pre-Test and Post-Test can help evaluate fermented animal feed production activities, so that learning outcomes can be improved. Success is measured by the participants' ability to produce feed using applied scientific and technological principles taught during the activity. Apart from that, success is also determined by their ability to combine local raw materials to increase feed production. It is hoped that the results of the evaluation will increase community knowledge and skills in fermenting palm oil waste, thereby increasing livestock productivity and reducing feed costs.

C. RESULTS AND DISCUSSIONS

On September 30 2023, a team consisting of 6 lecturers and 10 students from the Faculty of Engineering, Tanjungpura University conducted community empowerment activities in Pinang Dalam Village. They coordinate with the village head to obtain permission to implement activities in accordance with the goals and plans. The team visited their partner locations, namely Pak Usman's oil palm plantation and the Pinang Dalam village office, Kubu District, Kubu Raya Regency, West Kalimantan. The village development program with the topic of training on making cattle feed in the Pinang Dalam village community has been successfully implemented. The target participants for this program are community members, most of whom are fathers who own cattle and goats. Training participants are invited through village heads who live in the Pinang Dalam area. They are expected to be able to disseminate information and skills related to making animal feed to other community members. This program was attended by a total of 20 participants. The following is the implementation of the Village Development Program regarding the production of animal feed from palm oil waste:

1. Opening of the event from the Team Leader

The Village Development event was opened by Walidi, Head of Pinang Dalam Village and Ely Nurhidayati as Head of the Tanjungpura University FT Team. The event began with remarks from the head of village, followed by remarks from the team leader. The purpose and benefits of this event were explained, and appreciation was expressed to the participants who attended.

2. Socialization of Animal Feed Production

During the socialization, the instructor provided information, about various types of animal feed, nutritional content, and how to process animal feed. It is important for instructors to convey information effectively to participants to achieve training objectives. It is hoped that participants can understand the material presented by the instructor and apply it in the practice of making animal feed. Understanding theory before applying it in practice is an important guideline that must be followed by all participants. The delivery of the material went smoothly and was supported by the enthusiasm of the participants in listening to the information presented. The team gave participants the opportunity to ask questions during the presentation. The enthusiasm of the participants during the discussion was seen asking many questions regarding the process of making fermented feed from palm fronds and leaves. The activities of farmers and livestock breeders in Pinang Dalam, Kubu District are farming and gardening, such as planting corn and managing oil palm plantations, so sometimes there is not much time to till grass (Muhtarom et al., 2022). The big problem faced by livestock farmers in Pinang Luar is the limited availability of forage for livestock during the dry season, however, there are many plantation wastes in this village that have not been utilized, such as palm leaves and fronds (Setiawan et al., 2022), as shown in Figure 3.



Figure 3. Socialization of Animal Feed Production

3. Process of Making Animal Feed

Production of fermented animal feed can improve the nutritional quality of palm leaf and frond waste. The complete nutrition in fermented feed can help the animal's digestive process, thereby increasing its growth. The chopping machine (Figure 4d) is used to cut or chop animal feed ingredients into smaller and finer pieces. This tool is portable, easy to carry, and easy to use. Prepare ingredients for the fermentation process such as palm leaf stems, corn cobs, brown sugar, water, plastic bags, rope and EM4.

Animal feed production involves several processes to produce high-quality animal products. The nutrients in the feed are adjusted to the animals' needs to ensure they grow and develop well. A chopping machine (as shown in Figure 4d) is used to cut or chop animal feed ingredients into smaller, finer

pieces. This tool is portable, easy to carry anywhere and easy to use. Apart from that, prepare materials such as palm fronds and leaves, corn stalks, brown sugar, water, plastic bags, rope and EM4. The steps for making cow feed from palm oil waste can be seen below:

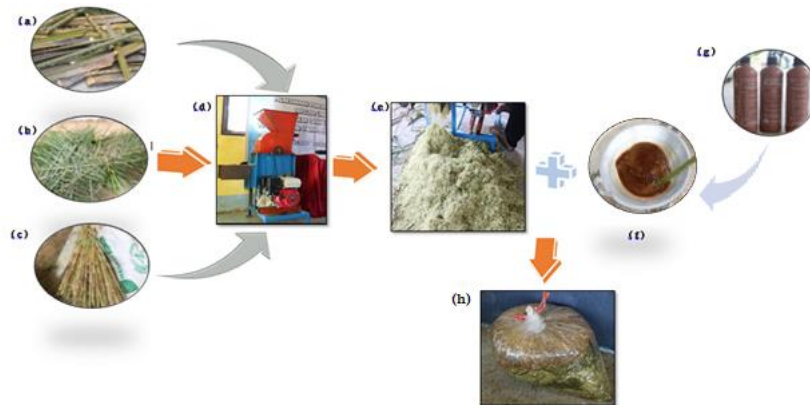


Figure 4. Stages of Making Animal Feed

The first step is the process of making silage from stems, leaves of oil palm and corn stalks (Figure 4) which have been chopped using a chopper machine. After that, the ingredients were mixed evenly as shown in Figure 4. The next stage is to make a mixture of brown sugar (molasses) and EM4 fermenter. All ingredients are mixed and stirred evenly until the brown sugar and EM4 dissolve in water. The next stage is sprinkling or pouring the mixed solution evenly with a mixture of brown sugar solution and EM4. The process of mixing the solution and mixing these materials into the plastic. Then, after all the feed mixture is evenly mixed, the mixture in the plastic is tied or closed tightly then left to rest for 7 - 21 days. After 7 - 21 days of fermentation, silage is produced, where according to (Nur'aini et al., 2022), the silage produced generally has a greenish yellow color, a fragrant aroma like tape, and a soft texture. In addition, the color of good silage is close to the original color when it was made. The aroma of silage is an indicator of physical quality, and the aroma of good silage smells sour or not sharp (Muhtarom et al., 2022). Apart from that, in making silage based on palm waste, it is maintained at a pH of 4-4.5 so that the silage is long-lasting (Setiawan & Purnomosidi, 2020). The denser the texture produced, the better the quality of the silage. Silage is ready to be given as a basic feed to replace fresh grass and can be stored as a reserve for animal feed.



Figure 5. Assistance in Animal Feed Manufacturing Practices

Figure 5 shows where the residents accompanied by the Team carry out direct practice in making animal feed. You can see in Figure 5. that residents are chopping the ingredients that have been prepared using a chopper machine. After all the ingredients had become small and smooth, the residents continued the process of making fermented feed by putting the ingredients in plastic then adding a mixture of brown sugar and EM4 solution by dripping in stages.

4. Closing

Closing activities include handing over plaques and handing over chopping machines to the head of village. This marks the completion of the village development program with partners. The presentation of this plaque is a form of appreciation to the head of village and residents for their participation in the training. Apart from that, the machine handover aims to provide support to partners in starting a fermented feed production business.

5. Evaluation

The evaluation results showed that the participants responded well to the material, instructor delivery, feed making methods, facilities and the process of organizing the event. The use of the interview method shown in Figure 6 helps to monitor the Pre-Test and Post-Test, which then evaluates the results of the program that has been implemented for the community.



Figure 6. Assistance with test evaluation interviews

During the training, the enthusiasm and activeness of the participants could be seen from their appearance, work results and active participation in discussions. Evaluation is carried out using the Pre-Test and Post-Test methods to measure the absorption capacity of the material presented. This can be seen from the evaluation results which show an increase in the average score from Pre-Test to Post-Test as stated in the Figure 7.

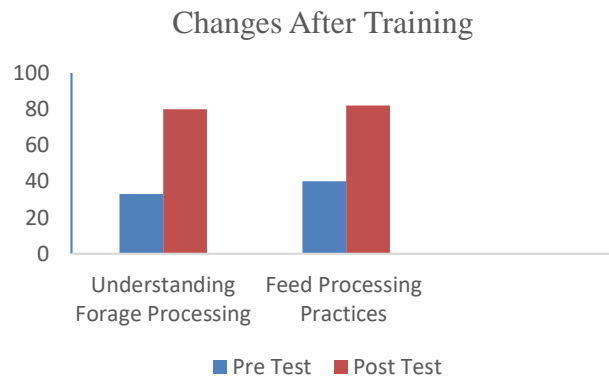


Figure 7. Pre-Test to Post-Test Changes After Training

The results of the feed processing technology service activities after counselling and training were carried out, there was an increase in participants' knowledge regarding understanding feed processing, post-test scores from 33% to 80% after the post-test, and post-test scores on feed processing practices from 40% to 80% after the post-test. Based on the results of monitoring and evaluation of feed products produced by the community, it can be concluded that partners have demonstrated the ability and commitment to produce animal feed. Therefore, according to (Aisa et al., 2021), the transfer of technology and knowledge provided during the village development program has succeeded in achieving its main objective, namely creating independence in producing animal feed. This will have a positive impact on the availability of quality and nutritious feed, thereby increasing cattle productivity. Apart from that, this can also improve the welfare of cattle farmers by giving them the skills to make their own feed, reducing production costs, increasing income, and reducing palm oil waste.

6. Obstacles Faced

Animal feed production in the village development program in Pinang Dalam, a remote village, faces several challenges, mainly due to a lack of facilities and infrastructure. In addition, the village's difficult geographic location makes it difficult to access, meaning that bringing the tools and materials needed for the animal feed production process takes quite a long time. This is largely due to poor road conditions and narrow roads. However, this problem can be overcome by bringing tools and materials before the event starts, to ensure the program runs smoothly.

D. CONCLUSION AND SUGGESTION

This village development program was attended by 30 participants. The evaluation results show an increase in the knowledge, interest and skills of the people of Kubu District, Kubu Raya Regency, West Kalimantan. This can be seen from the evaluation results which show an increase in the average score from 30 (Pre-Test) to 82 (Post-Test). Apart from that, the resulting silage has a yellowish green color, fermented aroma and soft texture. The success of a program is not only measured by the results of the training, but also by its sustainability. Therefore, to ensure the sustainability of silage use in the village, ongoing assistance activities are needed to achieve feed availability throughout the season.

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REFERENCES

- Aisa, A., Ali, M. M., & Burhanuddin, B. (2021). Strategi Guru Dalam Meningkatkan Hasil Belajar Siswa Pada Mata Pelajaran Pendidikan Agama Islam. *JEC (Jurnal Edukasi Cendekia)*, 5(2), 72–82. <https://doi.org/10.35326/jec.v5i2.3209>
- Azhar, B., Tohiran, K. A., Nobilly, F., Zulkifli, R., Syakir, M. I., Ishak, Z., Razi, N., Oon, A., Shahdan, A., & Maxwell, T. M. R. (2021). Time to Revisit Oil Palm-Livestock Integration in the Wake of United Nations Sustainable Development Goals (SDGs). *Frontiers in Sustainable Food Systems*, 5(September), 1–7. <https://doi.org/10.3389/fsufs.2021.640285>
- Badan Pusat Statistik. (2022). *Statistik Kelapa Sawit Indonesia*. Badan Pusat Statistik. <https://www.bps.go.id/id/publication/2023/11/30/160f211bfc4f91e1b77974e1/statistik-kelapa-sawit-indonesia-2022.html>
- Grinnell, N. A., van der Linden, A., Azhar, B., Nobilly, F., & Slingerland, M. (2022). Cattle-oil palm integration – a viable strategy to increase Malaysian beef self-sufficiency and palm oil sustainability. *Livestock Science*, 259(May 2021), 104902. <https://doi.org/10.1016/j.livsci.2022.104902>
- Kusmiah, N., Mahmud ATBA., Darmawan, A. (2021). Pakan Fermentasi Sebagai Solusi Penyediaan Pakan Ternak Dimusim Kemarau. *Sipissangngi*, 1(11), 3123–3132. <https://doi.org/10.35329/sipissangngi.v1i2.2030>
- Lestari, R., Setiawan, D., & Permadi, E. (2021). Pemberdayaan Masyarakat Melalui Pembuatan Pakan Ternak Itik dari Limbah Ikan di Desa Parit Keladi Kecamatan Sungai Kakap Kabupaten Kubu Raya. *Dharma Raflesia : Jurnal Ilmiah Pengembangan Dan Penerapan IPTEKS*, 19(2), 283–291. <https://doi.org/10.33369/dr.v19i2.15904>
- Mardalena, M., Syarif, S., & Zubaidah, Z. (2019). The Effect Oil Palm Fronds Fermented With Prolinas to Milk Production of Dairy Cattle. *IOP Conference Series: Earth and Environmental Science*, 391(1). <https://doi.org/10.1088/1755-1315/391/1/012016>

- Mauludyani, A. R. V., Pratinda, W. N. S. A., Ramdan, A. M., Yusuf, A. M., Ipangka, I., Sulaeman, M. S., Maulana, R., Azhar, S. S., Lestari, S., Supiandi, U., & Palisu, V. H. (2020). Pelatihan Pembuatan Pakan Fermentasi di Desa Muaradua Kabupaten Sukabumi. *Jurnal Pusat Inovasi Masyarakat*, 2(November), 11–19.
- Muhtarom, N., Setiawan, D., Nugraha, A., & Rumania, D. (2022). Edukasi Pembuatan Pakan Silase Rumpuk Gajah Di Desa Sungai Besar Kabupaten Ketapang. *Berdaya*, 2(2), 40–46.
- Nur'aini, N., Saputri, K. W., Suningsih, N., Hakim, M., & Sari, K. N. (2022). Teknologi Pengawetan Hijauan Dan Tebon Jagung Melalui Pembuatan Silase Sebagai Pakan Ternak Di Rejang Lebong. *Media Kontak Tani Ternak*, 3(4), 109. <https://doi.org/10.24198/mktt.v3i4.36548>
- Pranata, R. H., & Arico, Z. (2019). Pemanfaatan Limah Kebun Pelelah Kelapa Sawit sebagai Alternatif Pakan Ternak Bernilai Gizi Tinggi. *Biologica Samudra*, 1(1), 17–24.
- Pranoto, Y. S., Agustina, F., & Astuti, R. P. (2020). Pemanfaatan Teknologi Probio_Fm dalam Penerapan Sistem Integrasi Sapi Kelapa Sawit di Bangka Tengah. *Agrokreatif: Jurnal Ilmiah Pengabdian Kepada Masyarakat*, 6(3), 213–221. <https://doi.org/10.29244/agrokreatif.6.3.213-221>
- Putra, R. P., Indrayani, Nur Rahmah, Mukhlis, A. M. A., & Rivai, A. A. (2023). Pelatihan Pembuatan Pakan Ternak Fermentasi Di Dusun Layonga Galung Desa Batulaya Kabupaten Tinambung Sulawesi Barat. *Vokatek: Jurnal Pengabdian Masyarakat*, 1(3), 286–292. <https://doi.org/10.61255/vokatekjpgm.v1i3.255>
- Rohayeti, Y., Heraini, D., Setiawan, D., & Patmawati, S. (2022). Pertumbuhan Dan Produktivitas Rumpuk Gajah Odot (Pennisetum Purpureum Cv. Mott) Yang Diberi Pupuk Kotoran Puyuh. *Agrinimal Jurnal Ilmu Ternak Dan Tanaman*, 10(164), 59–64. <https://doi.org/doi.org/10.30598/ajitt.2022.10.1.59-64>
- Saputra, S., Inawati, Aryani, R., Dewi, N., Manurung, H., Nugroho, R., Setiawan, D., Hasan, M., Amrulloh, N., Tsuraya, F., & IT, L. (2024). *Biologi Dasar* (1st ed.). Penamuda Media.
- Setiawan, D. (2020). Pengabdian Kelompok Ternak Sapi Melalui Perbaikan Pakan di Kabupaten Sambas. *Dharma Rafflesia: Jurnal Ilmiah Pengembangan Dan Penerapan IPTEKS*, 18(2), 218–227. <https://doi.org/10.33369/dr.v18i2.13600>
- Setiawan, D., Jayanegara, A., Nahrowi, & Kumalasari, N. R. (2022). Performance and nutrient digestibility of kacang goats fed with fermented sago waste. *IOP Conference Series: Earth and Environmental Science*, 977(1). <https://doi.org/10.1088/1755-1315/977/1/012136>
- Setiawan, D., & Purnomosidi, M. (2020). Quality of water hyacinth (*Eichhornia crassipes*) silage with different level of rice bran. *IOP Conference Series: Earth and Environmental Science*, 454(1). <https://doi.org/10.1088/1755-1315/454/1/012073>
- Simanihuruk, K., Sirait, J., & Ginting, S. P. (2022). Penggunaan Pelelah Kelapa Sawit yang Difermentasi dengan *Trichoderma viride* sebagai Pakan Basal Kambing Boerka Sedang Tumbuh. *Jurnal Agripet*, 22(2), 213–222. <https://doi.org/10.17969/agripet.v22i2.22316>
- Susilawati, Rahayu, S. U., Marponghatun, & Suharman. (2022). Processing of Palm Midrib Waste into Animal Feed with a Fermentation Process that is integrated with a chopper in Sialang Village, Deli Serdang Regency. *Abdimas Talenta: Jurnal Pengabdian Kepada Masyarakat*, 7(1), 211–221. <https://doi.org/10.32734/abdimastralenta.v7i1.6509>
- Umar, Y., Syakir, M. I., Yusuff, S., Azhar, B., & Tohiran, K. A. (2023). The integration of cattle grazing activities as potential best sustainable practices for weeding operations in oil palm plantations. *IOP Conference Series: Earth and Environmental Science*, 1167(1). <https://doi.org/10.1088/1755-1315/1167/1/012014>

- Wulandari, S., & Villano, R. (2021). Strategies to optimize women's participation in palm cattle integration. *IOP Conference Series: Earth and Environmental Science*, 694(1). <https://doi.org/10.1088/1755-1315/694/1/012014>
- Zakiatulyaqin, Suswanto, I., Lestari, R., Setiawan, D., & Munir, A. (2017). Income Over Feed Cost Dan R-C Ratio Usaha Ternak Sapi Melalui Pemanfaatan Limbah Kelapa Sawit Income Over Feed Cost And R-C Ratio Of Fattening Cattle Through The By Product Of Palm Oil Feed Utilization. *Jurnal Ilmiah Peternakan Terpadu*, 5(1), 18–22.