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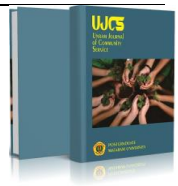

Sustainable Agricultural Transformation through the Rice–Duck–Turi Integrated Farming System in the Karya Makmur Farmer Group in Air Satan Village, Musi Rawas Regency

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Abstract: Rice farming remains a vital sector for rural communities in Indonesia, but dependence on conventional systems has resulted in low productivity and economic instability for farmers. This activity aims to introduce the Rice-Duck-Turi (RDT) system as a sustainable Integrated Farming System (IFS) model applied to the Karya Makmur Farmer Group in Air Satan Village, Musi Rawas Regency. This approach integrates rice cultivation with duck farming in the fields and the planting of turi (Sesbania spp) on the embankments. The research method used a participatory approach through socialization, training, mentoring, and field evaluation activities. The results of this activity show that the Paitri system can reduce the use of chemical fertilizers by up to 25% and provide additional income through duck egg and meat production. The integration of turi plays a role in providing natural organic fertilizer and forage, while also improving soil fertility. This system also strengthens social solidarity and economic independence among farmers through mutual assistance and collective learning. The implementation of the Paitri system has proven to be an efficient, environmentally friendly, and economically valuable sustainable agricultural innovation that can be replicated in other rural areas to strengthen local food security.

Keywords: IFS, Rice–Duck–Turi, Sustainable Agriculture.

Introduction

Agriculture remains the primary source of livelihood for most rural communities in Indonesia. Rice, as a staple food, has a very vital position because it is not only a source of food but also a source of income for millions of farmers. However, despite its essential role, the rice farming sector faces serious challenges that can threaten the productivity and welfare of farmers (Quirinno et al., 2024). One of the primary issues is farmers' reliance on conventional cultivation methods. This system forces farmers to rely solely on rice harvests without diversifying their business. Thus, if crop failure occurs due to pest and disease attacks, unpredictable climate change, or a decline in soil fertility resulting from excessive chemical use, farmers can suffer significant losses. This condition is exacerbated by rising production costs, especially for chemical fertilizers and pesticides, which actually reduce soil fertility in the long term (Sumini, 2024).

Sustainable farming systems were agricultural practices that do not harm, create a balance, and work in harmony with nature, which can be realized through four different systems (Salikin, 2011; Rasyid et al., 2024; Sirajuddin et al., 2025). One of the models that can be used in the implementation of sustainable agriculture is the integrated farming system (Mukhlis et al., 2023).

The integrated farming system, or IFS, is an agricultural approach that merges two or more sectors of agriculture (Channabasavanna et al., 2009; Ugwumba

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et al., 2010; Jaishankar et al., 2014). This system facilitates connections between different products, promoting a cycle of biological recycling (Prajitno, 2009; Changkid, 2013; Thorat et al., 2015). It relies on minimal external inputs (Devendra, 2011; Nurcholis & Supangkat, 2011; Hilimire, 2011) and maximizes resource efficiency (Bosede, 2010; Balemi, 2012; Soputan, 2012). Various methods are implemented to enhance agricultural output, boost productivity, increase farmers' earnings, and promote sustainability (Gupta et al., 2012; Manjunatha et al., 2014; Thorat et al., 2015; Mukhlis et al., 2024). Integrated farming system of rice and cattle with utilization of cattle waste and rice crops is more feasible than monoculture farming system (Mukhlis et al., 2019; Nurhapsa et al., 2024).

These problems are also felt by the Karya Makmur Farmer Group, where crop yields are often unstable and the welfare of group members has not improved significantly. Fluctuations in grain prices in the market make farmers' incomes increasingly uncertain. With limited knowledge of environmentally friendly agricultural technology, farmers in this group continue to struggle with escaping the cycle of economic uncertainty. To overcome these problems, cultivation innovations are needed that not only focus on increasing rice production but also provide added value for farmers. One solution that can be implemented is the rice-duck-turi system based on *the Integrated Farming System* (IFS). This system combines rice cultivation with duck rearing in the fields and turi planting around the land. This integrated approach creates a mutually beneficial agricultural ecosystem and can increase crop productivity (Sumini et al., 2019; Dethan et al., 2024).

In the rice-duck-turi system, ducks provide dual benefits, as they help control pests and weeds in rice fields without the need for large amounts of pesticides (Sumini et al., 2020), while also producing eggs and meat that can serve as an additional source of income for farmers (Susila & Rofi'i, 2020). Meanwhile, turi plants can be used as duck feed, solid organic fertilizer, liquid organic fertilizer, and rice field protection (Kurniati, 2020). Thus, rice fields not only produce rice but also other products of economic value. In addition to increasing farmers' income, this system also supports environmental sustainability (Utami & Rangkuti, 2021). Duck manure and turi leaves serve as organic fertilizers that enhance soil quality, reduce dependence on chemical fertilizers, particularly urea, and help maintain ecosystem balance. This aligns with the principles of modern agriculture, which emphasize resource efficiency and sustainability (Rosalina, 2022).

The implementation of the rice-duck-turi system based on *the Integrated Farming System* (IFS) cannot be successful without a good understanding from the farmers. Therefore, socialization and assistance activities are needed so that farmers not only gain theoretical knowledge but also practical skills in the field. Through these activities, farmers will be assisted at every stage, from land preparation and duck management to the optimal utilization of turi. With these socialization and assistance activities, the Karya Makmur Farmer Group will be able to implement the rice-duck-turi system sustainably. In addition to increasing productivity and income, this system also enhances family food security, conserves the environment, and promotes a spirit of cooperation among farmers. Ultimately, this farmer group can serve as a concrete example of the implementation of integrated farming that is environmentally friendly and enhances the community's welfare.

Method

Community service activities have been carried out at the Karya Makmur Farmer Group in Air Satan Village, Muara Beliti District, Musi Rawas Regency. The stages of these community service activities consist of several steps, namely as follows:

Initial Survey and Location Permit

The first step was to conduct a field survey to understand the actual conditions and identify problems faced by the partner, namely the Karya Makmur Farmer Group in Air Satan Village. This activity aimed to gather information about the partner's profile and analyze the situation at the partner. The results of this survey were the first step in designing a program relevant to the community's needs. The information collected is then tailored to the team's competencies, allowing the designed PKM activities to be more targeted and have a positive impact on the Karya Makmur Farmers Group, ultimately contributing to the village's progress in developing sustainable agriculture.

Figure 1. Location Survey for PKM Activities

Socialization of the Community Service Program

At this stage, the team openly communicated the program's aims and objectives to the members of the Karya Makmur Farmer Group. The socialization process was designed to enable the group to understand the direction of the activities, be actively involved, and agree on common goals. With a shared understanding, the

program can run smoothly, and the results will be more beneficial for all members.

Figure 2. Socialization of the Community Service Program to Members of the Farmer Group and PPL Officers

Extension and Assistance

Extension and assistance are carried out continuously in accordance with the schedule outlined in the Community Service Program. Through these routine activities, a spirit of togetherness will be created and a sense of responsibility will grow among the members of the Melati Women Farmers Group in carrying out each stage of the program.

Training

During this training activity, participants gained knowledge about the importance of preserving the environment by implementing sustainable agricultural practices that involve livestock and increasing farmers' incomes. Farmers were trained directly on how to make solid organic fertilizer and liquid organic fertilizer from turi plants, as well as pesticides from organic materials. With this, farmers not only understand the theory but are also able to practice it independently.

Program Monitoring

The monitoring stage is conducted to track the program's progress and evaluate the extent of progress made. At this stage, various obstacles that arise in the field are also identified, allowing for immediate solutions to be found for the Karya Makmur Farmer Group in Air Satan Village.

Evaluation

Evaluation serves as a process of assessing the program's progress to determine whether it is in line with the initial planning and objectives. The evaluation results serve as a reference for assessing the program's obstacles, achievements, and successes from start to finish, taking into account the implementation mechanism, targets achieved, and outputs produced.

Technical Stages of Rice Cultivation Using the rice-duck-turi System:

1. Land Preparation

   The land preparation process begins with clearing the land of weeds, straw residues, and wild plants that can interfere with rice growth. Once the land is clear, the next step is to cultivate the soil by plowing it with a hand tractor. The plowed soil is then harrowed to make it smoother and more even. Soil cultivation is usually accompanied by flooding the fields. At this stage, improvements are also made to the rice field embankments, and basic fertilizer in the form of compost from turi plants is applied. Next, the rice fields are left until they are ready for planting.
2. Turi Seed and Rice Seed Nursery

   Seedling cultivation is an important stage before planting. This process begins with selecting high-quality seeds and soaking them to promote faster growth in the seedling medium. The land for seedling cultivation is leveled, given basic fertilizer such as organic fertilizer, and then watered sufficiently to keep it moist. The soaked seeds are then spread evenly on the beds. After 7 days, the turi seedlings are ready to be planted on the rice field embankments, and after 21 days, the rice seedlings are strong enough to be transferred to the rice fields.
3. Planting Turi Seedlings

   Turi seedlings that have grown in the nursery are transferred to the field and planted on the rice field embankment with a spacing of 30 cm between plants.
4. Planting Rice Seedlings

   Rice seedlings that are 21 days old after sowing are ready to be transplanted and planted in the rice field. Rice seedlings are planted with a spacing of 25 cm x 25 cm using a 4:1 legowo planting system.
5. Application of Ducks

   Ducks are released into the rice fields when they are 2 weeks old and when the plants are 15 days old after planting. Ducks are released at a population of 100 per hectare. Ducks are released in the morning from 6:00 a.m. to 5:00 p.m. Western Indonesian Time, and at night, the ducks are returned to their pens. This duck release is carried out until the plants enter the generative phase.
6. Application of Liquid Organic Fertilizer from Turi Plants

   Liquid Organic Fertilizer (POC) from turi plants is applied by spraying the leaves of the plants in the morning, starting 7 days after planting, and continuing until the plants enter the generative phase, which is done once a week.
7. Maintenance

   Maintenance involves weeding, controlling pests and diseases using organic pesticides, and applying fertilizers as needed.
8. Harvest

   Harvesting is done when the plants are 110 days old after planting, by cutting the panicles using a sickle.

Result and Discussion

The results of the socialization show that the Karya Makmur Farmer Group responded positively to the implementation of the the rice-duck-turi system. This is evident from the high participation of members in each session, from discussions to field practice. The spirit of cooperation was evident when farmers were directly involved in land cultivation, rice planting, and trials of integration with ducks and turkeys. The success of the assistance program depends not only on the method but also on the community's willingness to adapt to innovations. Therefore, the service team from Musi Rawas University will always be available to assist with these activities, ensuring their sustainability and future implementation (Figure 3).

Figure 3. Community Service Team with the Head of the Farmer Group, Agricultural Extension Officer, and Bankomsus.

Farmers are taught to manage their rice fields in accordance with the requirements of the integrated system and the habitat of ducks. Rice field embankments are also constructed and reinforced to retain water and provide a suitable environment for turi plants to grow. This type of integrated land system provides added value for farmers (Figure 4).

Figure 4. Rice Fields in Air Satan Village

The application of this integrated system in rice cultivation will result in optimal rice growth, a suitable environment for ducks, and long-term benefits from turi. This system also supports the principles of the Integrated Farming System (IFS), which emphasizes sustainability and the efficient use of resources.

Releasing ducks into rice fields results in a reduction in the population of weeds and insects in the fields. Ducks actively search for food in the fields, so farmers do not need to rely too much on chemical pesticides. In addition, duck manure serves as a natural fertilizer that improves soil fertility, and the ducks' foraging activities also loosen the soil structure (Figure 5). These findings reinforce the theory that integrating livestock with crops can create a more efficient nutrient cycle. The presence of ducks serves as a biological pest control and a source of organic fertilizer, ultimately reducing production costs.

Figure 5. Release of ducks on rice fields

The turi plants grown on the embankments showed good growth. The turi leaves can be used as a raw material for solid organic fertilizer, and the liquid organic fertilizer can also serve as an additional feed for ducks when they are kept in pens. In addition, the presence of turi plants on the rice field embankments can also strengthen the embankments' structure. Thus, turi plants not only serve as raw material for organic fertilizer but also enrich the ecosystem around the rice fields. The integration of rice plants with ducks and turi plants shows how diversity in a single system can provide multiple benefits for farmers. Farmers not only harvest rice, but also obtain by-products in the form of duck eggs and meat, reduce their purchase of inorganic fertilizers such as urea, and have a sustainable source of forage (Figure 6).

Figure 6. Duck feed supplemented with turi leaves

The results of this community service activity also show cost efficiency in the purchase of chemical fertilizers and pesticides. The use of chemical fertilizers and pesticides can be reduced because some of the functions of pesticides can be replaced by ducks as natural enemies (predators) in biological control. The use of chemical fertilizers, in this case urea fertilizer, can be minimized by applying solid organic fertilizer and liquid organic fertilizer made from turi plants (Sesbania grandiflora). This system has been proven to increase the

efficiency of agricultural input utilization and strengthen the economic viability of farmers (Tyasmoro, 2023). Although rice productivity is still being observed, farmers have already felt the tangible benefits of reduced external input expenditures and increased food self-sufficiency. This aligns with the concept of sustainable agriculture, which emphasizes not only increased crop yields but also cost efficiency and ecosystem sustainability (Zuhroh et al., 2025). With the the rice-duck-turi system, farmers have the opportunity to increase their net profits from crop yields. This is supported by the results of community service activities (Mukhlis, et al., 2024), which show that the production of bokashi organic fertilizer is very beneficial for farmers as a substitute for inorganic fertilizers and for environmentally friendly rice fields.

One important outcome of the socialization and mentoring program was an increase in farmers' understanding of integrated farming systems. Farming group members not only learned theory, but also gained hands-on experience in land preparation, planting, duck release, and the production of solid and liquid organic fertilizers from turi plants (Figure 7). This training activity is a participatory learning process that can help farmers develop greater confidence. This is because farmers are not only recipients of information, but also active participants who can develop new skills and knowledge.

Figure 7. Extension on the rice-duck-turi rice system cultivation and training on making organic fertilizer from turi plants

The implementation of the the rice-duck-turi system integrates three main components: rice as the primary crop, ducks as biological agents for pest control, and turi (*Sesbania* spp.) as a source of natural nitrogen and forage. This activity has a tangible impact on production cost efficiency, increased rice productivity, and improved soil quality, as well as the balance of the rice field ecosystem. The results of the comparison before and after the activity are shown in Table 1 below.

Table 1. Comparison of External Input Use and Production Outcomes Before and After the Implementation of the IFS-Based Rice-Duck-Turi Integrated System

No	Component	Condition Before the rice-duck-turi System	Condition After rice-duck-turi System Implementation	Changes / Impact
1	Use of urea fertilizer	Complete dependence on chemical fertilizer (urea) at a dose of 200 kg/ha/season	Use of urea fertilizer decreased by 25% with the addition of organic fertilizer from turi leaves as a natural source of nitrogen	25% reduction in external inputs and increased soil fertility
2	Product Diversification	Only rice (no ducks or turi yet)	There are three products: rice, duck eggs, and organic fertilizer from turi plants	Income diversification and resource efficiency
3	Animal Feed	No duck farming activities (no integration system yet)	Use of turi leaves as supplementary forage	Feed cost efficiency and an additional 20% increase in duck egg production

Although there are many benefits to be gained from implementing this innovation in rice cultivation, various obstacles are likely to arise, as some farmers still harbor doubts due to the system's departure from their traditional practices. These challenges are natural because every innovation always takes time to be entirely accepted. With continuous assistance, these obstacles or barriers can be overcome gradually. The assistance and training activities concluded with a group photo taken with the head of the farmer group, some community members, and farmers in Air Satan Village (Figure 8).

Figure 8. Group photo with participants and the head of the Karya Makmur Farmer Group

This socialization and assistance program not only had an impact on the technical aspects of agriculture but also strengthened solidarity within the group. Farmers gathered more frequently, discussed

issues, and supported one another in implementing this new system. This social aspect is essential because sustainable agriculture is not only about cultivation techniques but also about how communities build cooperation to achieve common goals. The the rice-duck-turi system offers new hope for farmer groups to realize environmentally friendly, efficient, and profitable agriculture.

Conclusion

Community service activities, implemented through the rice-duck-turi system in the Karya Makmur Farmer Group in Air Satan Village, Musi Rawas Regency, have had a significant impact on increasing farmers' capacity to manage their farming businesses in an integrated, efficient, and sustainable manner. This program has successfully fostered a new understanding among farmers about the concept of the Integrated Farming System (IFS), which integrates rice, duck, and turi crops as a single productive ecosystem. The application of this system has reduced the use of chemical fertilizers by up to 25%, improved soil structure, and increased farmers' income through the sale of side products, such as duck eggs and meat. In addition to providing economic and ecological benefits, the the rice-duck-turi system also fosters social solidarity among farmer group members through cooperation, active participation, and a spirit of mutual assistance in adopting environmentally friendly agricultural practices. Thus, this activity not only contributes to improving the welfare of farmers but can also serve as an innovative model that can be replicated in other regions as a form of sustainable agricultural transformation at the rural level.

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References

Balemi, T. (2012). Effect of integrated use of cattle manure and inorganic fertilizers on tuber yield of potato in Ethiopia. *Journal of Soil Science and Plant Nutrition*, *12*(2), 253–261. https://doi.org/10.4067/S0718-95162012000200005

Bosede, A. J. (2010). Economic assessment of fertilizer use and integrated practices for environmental sustainability and agricultural productivity in Sudan savannah zone, Nigeria. *African Journal of Agricultural Research*, *5*(5), 338–343. https://doi.org/https://doi.org/10.5897/AJAR.9000186

Changkid, N. (2013). The Factors Production Use Efficiency in the Integrated Farming in Suratthani Province, Southern Thailand. *Procedia - Social and Behavioral Sciences*, *91*, 376–384. https://doi.org/10.1016/j.sbspro.2013.08.434

Channabasavanna, A. S., Biradar, D. P., Prabhudev, K. N., & Hegde, M. (2009). Development of profitable integrated farming system model for small and medium farmers of Tungabhadra project area of Karnataka. *Karnataka J. Agric. Sci*, *22*(1), 25–27. http://ndpublisher.in/admin/issues/IJAEBV6I4p.pdf

Dethan, J. J. S., Lapinangga, N. J., Nainiti, N. P. P. E., & Makaborang, M. (2024). *Sistem Pertanian Terpadu*. Tahta Media Group.

Devendra, C. (2011). Integrated tree crops-ruminants systems in South East Asia: Advances in productivity enhancement and environmental sustainability. *Asian-Australasian Journal of Animal Sciences*, *24*(5), 587–602. https://doi.org/10.5713/ajas.2011.r.07

Gupta, V., Rai, P. K., & Risam, K. S. (2012). Integrated Crop-Livestock Farming Systems : A Strategy for Resource Conservation and Environmental Sustainability. *Indian Research Journal of Extension Education*, *II*(Volume II), 49–54. https://www.ijiras.com/2017/Vol_4-Issue_6/paper_21.pdf

Hilimire, K. (2011). Integrated crop/livestock agriculture in the United States: A review. Journal of Sustainable Agriculture, 35(4), 376–393. https://doi.org/10.1080/10440046.2011.562042

Jaishankar, N., Janagoudar, B. S., Kalmath, B., Naik, V. P., & Siddayya, S. (2014). Integrated Farming for Sustainable Agriculture and Livelihood Security to Rural Poor. 22–24. https://doi.org/10.17758/iaast.a0514013

Kurniati, F. (2020). Potensi Pupuk Hijau Turi Mini (Sesbania rostrata Brem) dalam Bidang Pertanian. *Media Pertanian*, *5*(1), 10–19.

https://doi.org/10.37058/mp.v5i1.2125

Manjunatha, S. ., Shivmurthy, D., Satyareddi, S. A., Nagaraj, M., & Basavesha, K. (2014). Research and Reviews : Journal of Agriculture and Allied Sciences Integrated Farming System - An Holistic Approach : A Review. *Journal of Agriculture and Allied Sciences*, *3*(4), 30–38. https://www.rroij.com/open-access/integrated-farming-system--an-holistic-approach-a-review.pdf

Mukhlis, Fitrianti, S., Wisra, R. F., Hendriani, R., & Sari, N. (2024). *Utilisation of Cow Faeces as a Base Material to Making Bokashi Fertiliser to Increase Farmers Income in Balai Hamlet , Taram Village , Harau District*. *5*(3), 144–148. https://doi.org/10.29303/ujcs.v5i3.669

Mukhlis, Hendriani, R., Sari, N., Firsta Wisra, R., Fitrianti, S., & Lutfi, U. M. (2023). Analisis Pendapatan Petani Model Usahatani Terpadu Jagung-Sapi Di Kecamatan Payakumbuh. *Jurnal Penelitian Pertanian Terapan*, *23*(2), 254–261. https://doi.org/http://dx.doi.org/10.25181/jppt.v23i2.2953

Mukhlis, M., Ismawati, I., Sillia, N., Fitrianti, S., Ukrita, I., Wisra, R. F., Raflis, H., Hendriani, R., Hanum, L., Ibrahim, H., Nofianti, S., Marta, A., & Sari, N. (2024). Characteristics of Production Factors and Production of Zero Tillage System Rice Farming. *Jurnal Penelitian Pendidikan IPA*, *10*(8), 6013–6019. https://doi.org/10.29303/jppipa.v10i8.8542

Mukhlis, Noer, M., Nofialdi, & Mahdi. (2019). Analysis of income and feasibility of rice-cattle integration system farming based on enterprises scale. Journal of Advanced Research in Dynamical and Control Systems, 11(7), 544–553. https://www.jardcs.org/abstract.php?id=2678

Nurcholis, M., & Supangkat, G. (2011). Pengembangan Integrated Farming System Untuk Pengendalian Alih Fungsi Lahan Pertanian. Budidaya Pertanian Urgensi Dan Strategi Pengendalian Alih Fungsi Lahan Pertanian, 71–84. http://repository.unib.ac.id/id/eprint/121

Nurhapsa, N., Rahmawati, R., Semaun, R., Nurhaedah, N., & Mukhlis, M. (2024). Utilization of Livestock Waste for Organic Production: An Environmentally Friendly and Sustainable Solution. Unram Journal of Community Service, 5(4), 318–323. https://doi.org/10.29303/ujcs.v5i4.718

Prajitno, D. (2009). Sistem Usahatani Terpadu Sebagai Model Pembangunan Pertanian Berkelanjutan di Tingkat Petani.

Quirinno, R. S., Murtiana, S., & Asmoro, N. (2024). Peran sektor pertanian dalam meningkatkan ketahanan pangan dan ekonomi nasional. NUSANTARA: Jurnal Ilmu Pengetahuan Sosial, 11(7), 2811–2822. https://doi.org/https://doi.org/10.31604/jips.v11i7.2024.2811-2822

Rasyid, I., Wirawan, I., Sirajuddin, S. N., & Mukhlis. (2024). *Accessibility of Sustainable Beef Cattle Business Development in Mattiro Bulu District , Pinrang Regency*. *10*(6), 7688–7695. https://doi.org/10.29303/jppipa.v10i10.9083

Rosalina, D. I. (2022). Penerapan dalam Pembangunan Pertanian Modern di Indonesia Yang Sehat, Ramah Lingkungan dan Berkelanjutan. SEMAGRI, 3(1), 9–20. https://semagri.upnjatim.ac.id/index.php/semagri/article/view/15/12

Salikin, K. (2011). *Sistem Pertanian Berkelanjutan* (6th ed.). Penerbit Kanisius.

Sirajuddin, S. N., Ali, N., Syah, S. P., Hikmawaty, H., Susanti S, I., & Mukhlis, M. (2025). Teknologi Pengawetan Hijauan Pakan dan Pengolahan Kotoran Kambing Pada KT Mesa Ate Desa Bala, Kecamatan Balanipa, Kabupaten Polewali Mandar. Jurnal SOLMA, 14(1), 10–23. https://doi.org/10.22236/solma.v14i1.16857

Soputan. (2012). *Pola integrasi ternak babi dengan tanaman ubi jalar yang berwawasan lingkungan di minahasa*. Institut Pertanian Bogor.

Sumini. (2024). " Mengenal Pestisida dan Penggunaanya ." In Buku Ajar (Vol. 5).

Sumini, Holidi, & Widianto. (2019). Peningkatan Produktivitas Tanaman Padi Sawah Irigasi Terintegrasi Populasi Itik. J. Agrotek Tropika, 7(1), 203–209. https://doi.org/https://doi.org/10.23960/jat.v7i1.2972

Sumini, S., Safriyani, E., Holidi, H., Sutejo, S., Bahri, S., & Riyanto, R. (2020). Penerapan Padi-Itik Pada Berbagai Sistem Tanam dalam Mengendalikan Serangga Hama di Tanaman Padi (Oryza sativa L). Jurnal Pertanian Terpadu, 8(1), 130–138. https://doi.org/10.36084/jpt..v8i1.204

Susila, A. A., & Rofi'i, M. (2020). Potensi Usaha Ternak Itik Pedaging Dalam Meningkatkan Pendapatam Masyarakat Desa Selokgondang (Studi Kasus Desa Selokgondang Kecamatan Sukodono Lumajang). Jurnal Ekonomi Dan Bisnis Islam, 6(2), 109–133. https://doi.org/https://doi.org/10.36835/iqtishodiyah.v5i2.358

Thorat, B. N., Thombre, B. M., & Dadge, A. V. (2015). *B. N. Thorat*, B. M. Thombre and A. V. Dadge*. *33*(2), 653–657. https://www.serialsjournals.com/abstract/77590_91-bn.pdf

Tyasmoro, S. Y. (2023). *Pertanian organik: Penerapan pupuk organik menuju pertanian berkelanjutan*.

Universitas Brawijaya Press.

Ugwumba, C. O. A., Okoh, R. N., Ike, P. C., Nnabuife, E. L. C., & Orji, E. C. (2010). Integrated Farming System and its Effect on Farm Cash Income in Awka South Agricultural Zone of Anambra State, Nigeria. *J. Agric. & Environ. Sci*, *8*(1), 1–06. https://www.idosi.org/aejaes/jaes8(1)/1.pdf

Utami, S., & Rangkuti, K. (2021). Integrated agriculture systems for land productivity improvement: A Review. *AGRILAND Jurnal Ilmu Pertanian*, *9*(1), 1–6. https://doi.org/https://doi.org/10.30743/agr.v9i1.3855

Zuhroh, M. U., Samudin, S., Yuristia, R., Yustisia, D., Purba, J. H., Afriani, S. R., & Monde, A. (2025). *Sistem Pertanian Terpadu*. Azzia Karya Bersama. https://books.google.co.id/books/about/Sistem_Pertanian_Terpadu.html?id=2ahDEQAAQBAJ&redir_esc=y