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Socialization of Crop-Livestock Integration System to Increase Farmer-Livestock Income in the Framework of Community Empowerment

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ABSTRACT

Food security is a strategic concern for emerging nations. A crop-livestock integration system must generally be put in place if the Indonesian people are to attain food security, independence, and sovereignty. One of the most advanced agricultural systems available today is the integrated crop-livestock system. One of the agricultural systems that promotes the expansion of the farm industry in rural regions is the crop-livestock integration system. One of the communities in Jepara with significant potential for agricultural and animal husbandry is Karangrandu Village, located in the Pecangaan District of the Jepara Regency. The crop-livestock integration system is a particularly useful tool since many farmer groups have not yet improved the transformation of food crop waste into animal feed and livestock manure into organic fertilizer.

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INTRODUCTION

One of the strategic issues for developing countries is food security. In the future, each region must optimize the use of land resources to sustain production and support food security programs (Descheemaeker et al., 2016). To achieve an active and healthy society, food security must be built by incorporating multi-sectoral and multidisciplinary thinking (Komaryatin, Roosdhani, Arifin, & Huda, 2024; YUSRONI, 2024). In general, one of the ways for Indonesians to achieve food security, independence, and sovereignty is to implement crop-livestock integration systems (Minarni, Nurtiati, & Wulansari, 2023; Yuniarsih & Nappu, 2014). According to Wadi, Fajar, Akhsan, Mihrani, and Bando (2021), there are various types of crop-livestock integration in Indonesia, including rice-livestock integration, maize-livestock integration, vegetable-livestock integration, and fruit-livestock integration.

Livestock-integrated farming systems are one of the most widely developed technologies today to ensure the sustainability of the production system and increase the income of farmers and ranchers(Budi et al., 2023). It is also one of the farming systems that promote the growth of the agricultural sector in rural areas. Livestock-integrated farming systems support sustainable agriculture by combining animals and crops in the exact location. According to Handaka and Hendriadi (2009), positive relationship between crops and livestock is a crucial feature of crop-livestock integration. The integrated division of land and the use of waste from each section demonstrate this relationship (Rahimah, Sastramihardja, Dewi, Trusda, & Andriane, 2023).

Livestock businesses depend on a constant source of animal feed, problems with the disposal of animal feces, and environmental problems surrounding the company (Hasan & Setiawati, 2024). Meanwhile, agricultural companies face difficulties in providing nutrients for the land; plants become less healthy due to lack of nutrients; maintenance of plant growth requires money; and the issue of increasing waste, which causes pests and diseases to attack crops that are ready to harvest. By integrating between sub-sectors in an integrated manner, farmers can utilize more than one type of farming enterprise. By doing this, farmers can run two or more types of farming businesses on one piece of land.

The crop-livestock integration system is not a new technology because the habit of farming and raising livestock in one household has long existed in Indonesian agricultural culture. By implementing crop-livestock integration, livestock can be incorporated into the farming business without reducing crop activities or productivity, and its presence can even increase the productivity of crops and livestock simultaneously. However, despite the many economic, social, and nature conservation benefits of crop-livestock integration, farmers and ranchers in Indonesia are still not optimally implementing it (Mulyoutami, Stefanus, Schalenbourg, Rahayu, & Joshi, 2004).

Karangrandu Village, Pecangaan Subdistrict, Jepara Regency, is a village with the most significant agricultural potential in Jepara, so it is nicknamed the Rice Barn of Jepara, but not only rice; the community still cultivates many other food crops; this is evidenced by the village area of 372 Ha, of which d20 Ha is agricultural land/rice fields. Almost 85% of the population depends on the farm sector for livelihood. Not only agriculture but also Karangrandu Village has relatively high populations of livestock. Many people work as farmers as well as breeders. Therefore, farmers have great potential to implement a crop-livestock integration system between rice and cattle.

However, after observation, it turned out that most of the owners of cropland and livestock businesses in Karangrandu Village had not optimized the processing of food crop waste into animal feed and livestock manure into organic fertilizer. The problems faced by farmers can be justified as follows:

- Problems with farm productivity include: rice and other food crop productivity are still very low; farmers still rely heavily on inorganic fertilizers and synthetic chemical pesticides, which increases farming costs; and farmers usually only stockpile livestock manure and use it when needed without

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further processing.

- Livestock productivity problems include: livestock waste has not been utilized, which can cause infectious diseases; livestock manure is scattered in every settlement, making the community vulnerable to diseases caused by livestock waste itself; there has been no community effort to convert livestock manure into a product that is utilized (zero waste)

This problem can be solved by optimizing the use of agricultural and livestock waste resources in production facilities, such as organic fertilizers, vegetable pesticides, and biopesticides (Nasir et al., 2021; Sulandjari et al., 2022). Therefore, efforts need to be made to increase the adoption of crop-livestock integration among farmers who also raise livestock. To start with, they should be given training and counseling on implementing integrated systems (Riwu, Gaina, & Loe, 2023; Rizhan & Desriadi, 2023).

METHOD

For community service implementation activities to answer problem conditions, it is necessary to have a road map that describes the stages of implementing activities (Hendriadi, Sari, & Padilah, 2019). Several steps must be taken to carry out this community service: the first stage is preparation, which includes observation and interview activities; the second stage is implementing counseling and training interspersed with question-and-answer sessions; and the last stage is evaluation.

FIGURE 1. Stages of Activity Implementation

Preparation Stage

Direct observation and interviews with representatives of crop landowner organizations and livestock enterprises in Karangrandu Village, Pecangaan Jepara, constitute the initial part of this community service project. Before moving on to the finalization of the program implementation target, namely the "Socialization of Increasing Farmer-Livestocker Income Welfare Through Community Empowerment with the Crop-Livestock Integration System in Karangrandu Village Pecangaan Jepara" activity, the goal at this stage is to ensure the target time for program implementation as well as inventorying constraints at the farmer-livestocker level.

Implementation Stage

Socialization activities were conducted throughout the community service program's implementation stage. Counseling is a traditional approach that is theoretical or study-based and is implemented using materials connected to the crop-livestock integration system. Subsequently, instruction on converting animal dung waste into fertilizer and plant waste into animal feed was given, and Q&A sessions were interspersed. Farmers are the target audience for this activity, particularly those in Karangrandu Village, Pecangaan Jepara, who are also breeders.

Evaluation Stage

After carrying out several activities including observation, interviews, counseling and training, then in the last stage, evaluation activities were carried out aimed at participants who attended this activity in order to determine the level of success of the delivery of socialisation as well as monitoring and evaluation.

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RESULTS AND DISCUSSION

The socialization activity was held at the house of one of the members of the Karangrandu Village Farmers Group, Pecangaan Jepara, and it was attended by 26 farmers of Karang Randu village, Jepara. Also attending the socialization activities were the head of Karangrandu Village, Mr. H. Syahlan, and the head of the farmer group, Mr. Slamet.

Extension Activities

The activity began by instructing the conversion of crop waste into feed and livestock waste into fertilizer. Rice farming waste can be used as animal feed, such as cows and goats, while livestock waste in cow and goat manure and cow urine can be used as fertilizer.

FIGURE 2. Material Delivery

FIGURE 3. Q&A session

Amid limited access to agricultural inputs, business capital, and knowledge about the world of agriculture and animal husbandry, integrated farming patterns are an option chosen by farmers. In such a limited situation, it is challenging to raise farmers' welfare level; sometimes, farmers are trapped in the intermediaries's trap. Farmers can avoid the intermediaries trap by applying integrated farming patterns that can increase the productivity of their land (Winantris & Jurnaliah, 2023). Ultimately, this will improve the economic welfare of farming families.

The choice of commodities, cultivation methods, income targets, and land design can be customized according to the business design in an integrated farming scheme. Having mutually supportive functional relationships, production process efficiency, and business operation efficiency are all important factors when implementing integrated farming. This integrated farming system allows farming and livestock businesses to support and benefit each other. A complementary business concept will be created through the implementation of integrated farming.

Since many farmers are also cattle breeders in Karangrandu Village, farmers can integrate rice and cattle. Integrating rice and cattle involves utilizing crop and livestock resources to increase productivity. This pattern is usually referred to as an integrated farming pattern, which combines rice cultivation activities with cattle farming. Cattle produce meat and milk. The waste is urine, which can be used as a source of organic fertilizer for rice plants. Meanwhile, the result of the rice crop is rice that can be sold. The waste in the form of straw, bran, merang, and husk can be used as a source of feed for cattle.

Utilizing integration technology for rice and cattle results in variation in the use of production resources, improves soil fertility through the use of organic fertilizer from solid and liquid cow dung waste, reduces production failure, increases rice crop productivity through the use of organic fertilizer, and increases cattle productivity through the use of feed derived from properly processed rice waste. The crop-livestock integration farming model adopts the idea of cleaner production, which results in a zero-waste business. (Eldyani & Wardoyo, 2018).

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FIGURE 4. Photo with Socialisation Participants

Training Activities

After delivery of the materials, farmers in Karangrandu Village were trained in the production of animal feed from rice waste and fertilizer from cow dung, with the aim of changing their practice of burning the trash without further processing. Nonetheless, there are a number of advantages to properly processing animal manure from agriculture (Aldino, Fitriyani, & Rochmat, 2023). It is anticipated that farming and livestock production would rise by turning agricultural and animal waste into goods with a profit. (Hayati et al., 2021; Muttaqijn & PS, 2023).

Processing Livestock Manure Waste into Organic Fertiliser

One cow produces 8-10 kg of manure daily, or 2.6-3.6 tonnes per year, equivalent to 1.5-2 tonnes of organic fertilizer. This will speed up land recovery and reduce the use of inorganic fertilizer (Huda & Wikanta, 2017). Before being used as crop fertilizer, organic matter such as cow dung must be composted for the following reasons: 1) decomposition of organic matter takes place quickly in soil that contains enough air and water, which can interfere with plant growth; 2) decomposition of fresh matter introduces only a small amount of humus and nutrients into the soil; 3) the structure of fresh organic matter is very coarse and not waterproof, so the soil will be very crumbly if it is directly immersed; 4) cow dung is not always available when needed, so the organic matter can be stored in compost before being used as fertilizer (Fitriyah et al., 2021).

Making organic fertilizer is very easy. Cow dung and rice husk or straw are prepared first and then arranged with the rice husk at the top and the cow dung at the bottom. Next, the decomposer is sprinkled evenly. In this PKM activity, the decomposer used is an EM-4 microbe, a culture mixture of various microbes such as photosynthetic bacteria, lactic acid bacteria, actinomycetes yeast, and fermentation fungi (Jalaluddin, Nasrul, & Syafrina, 2017). EM-4 decomposer is widely used in composting as done by (Riga et al., 2022). EM-4 decomposer contributes to multiplying the types of soil microorganisms (Lukhi Mulia Shitophyta & Jamilatun, 2021). Next, molasses was diluted, watered, and stirred with the compost.

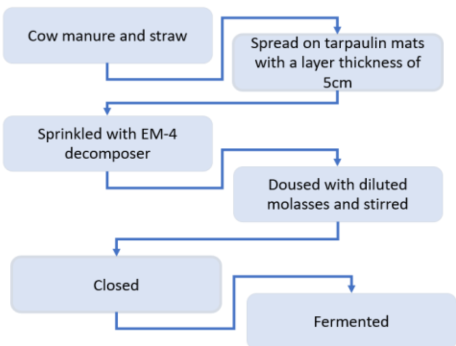

FIGURE 5. Flow of Organic Fertilise Production

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The compost material has a humidity of about 60%, and when grasped, it does not break, and the hands are not wet. If it is not moist enough, add enough water. Then, cover the material with a tarp. Composting lasts for three weeks. Farmers can make and develop compost so that organic fertilizer can be used instead of inorganic fertilizer (Idham, Pagiu, Lasmini, & Nasir, 2021). Although organic fertilisers usually contain low amounts of macro-nutrients (N, P, and K), they also contain high amounts of micro-nutrients that are essential for plant growth (Sulaeman et al., 2023).

Processing Food Crop Waste into Animal Feed

As an animal feed ingredient from rice waste, straw is usually dried in the sun to make it dry and not moldy for future animal feed. However, dried straw lacks nutrition (Akbar, Suriyanti, & Nontji, 2022). Thus, the nutritional needs of livestock such as cattle are not fulfilled and will interfere with the growth process. Fermentation is the process of converting dry straw into nutrient-rich cattle feed. Fermentation of rice straw can increase the crude protein content to 9.09% and reduce crude fiber to 18.44% (Basuni, Muladno, Kusmana, & Suryahadi, 2015).

Using agricultural waste for feed is an environmentally integrated enterprise that helps fulfill the needs of cattle (Ardianto, Syam, Hamzah, & Noerfitriyani, 2022; Suwiti, Suastika, Swacita, & Piraksa, 2013). Crop-livestock integration can increase income between 14.9-129.4% (Nazam, Suriadi, Zulhaedar, Hipi, & Tantawizal). A study conducted by Sudjatmiko, Siddik, Anwar, Zaini, and Dipokusumo (2021) Found that 13.2 tonnes of fresh straw were produced from each hectare of rice plant after fermentation to 7.92 tonnes (60% yield), which could be used to feed two cows per year, assuming 10 kg of feed per cow per day.

The ingredients for straw fermentation are straw, EM4 (probiotic), molasses, rice bran (bran), and water. The trick is to divide the straw into one layer and then dissolve the mixture of water, EM4, and molasses. Once mixed, spray the liquid onto the straw layer and cover it with rice bran. Then, repeat for several layers. The next step is to cover the straw layer tightly to prevent oxygen from entering. Wait 14 days for the fermentation process to run well.

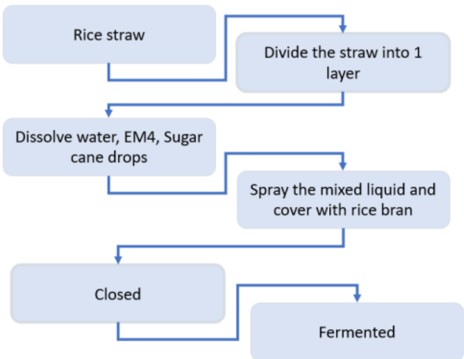

FIGURE 6. Flow of Rice Fermentation

Figure 7. Processing Fertilizer from Cow Waste

Figure 8. Processing of Animal Feed from Rice Waste

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Activity Evaluation

The results of monitoring and evaluation of activities show that farmers and breeders are more aware of how to manage waste from crop harvests and livestock manure. With the hope of increasing production, population, productivity, and competitiveness of livestock products, crop-livestock integration systems can be developed both in areas with limited agricultural land area and areas with extensive agrarian land potential (Yuniarsih & Nappu, 2014). In addition, the ability to process agricultural waste into fermented feed and process livestock manure into improved fertilizer has improved. The authorities must continuously assist this so that farming and livestock activities are clean from waste. These results are by the findings of Lasmi (2024), so that local governments, agricultural industries, research institutions, and local communities collaborate to provide the financial, technical, and educational support needed to develop agriculture and improve farmers' welfare, food security, and the environment.

CONCLUSION

This Community Service Program is helpful as a first step in increasing the economic resilience of farmers in Karangrandu Village, Pecangaan, and Jepara, so it is necessary to develop the application of crop-livestock integration. The activity shows an increase in farmers' awareness of not burning or throwing away food crop waste because it can be used as animal feed. Likewise, livestock manure waste, both solid and liquid, can be used to make food crop fertilizers as a substitute for inorganic fertilizers. For crop-livestock integration systems to be truly successful, continuous assistance from universities and related institutions is required.

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