



## Improving Biosecurity Knowledge and Injection Techniques in Small-Scale Cattle Farming Through an International Student Summer School

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**Abstract:** This community service program aims to enhance the knowledge and practical skills of international students regarding livestock biosecurity and injection techniques in small-scale beef cattle farming systems. The activities were conducted through workshops, hands-on practical sessions, and group discussions as part of a structured summer school program. A questionnaire was used as an evaluation instrument to assess participants' knowledge, perceptions, and confidence levels. The program involved 11 international students from diverse backgrounds who participated in field-based learning activities at a livestock training facility in East Kalimantan, Indonesia. The results showed that 64% of participants had prior awareness of biosecurity, and all participants (100%) recognized its importance in preventing disease outbreaks. However, only 27% reported confidence in explaining injection techniques, indicating the need for more intensive practical training. In addition, 91% of participants perceived that small-scale farmers lacked adequate knowledge of biosecurity, suggesting a substantial gap in field-level awareness. The main challenges identified were limited knowledge (45%) and financial constraints (36%). Overall, the program contributed to improving participants' understanding and awareness while highlighting the strategic role of international students as agents of education in promoting biosecurity practices within local farming communities.

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## Introduction

Beef cattle farming is a sub-sector of the livestock industry with strong potential for development (Anari et al., 2018). Beef cattle play an important role in supporting food security, particularly as a source of animal protein (Tumewu & Lainawa, 2025). To maintain livestock health and productivity, farmers need to implement proper management practices, including feeding, housing, and disease prevention. One of the key approaches in preventing disease transmission is biosecurity. Biosecurity is a simple, low-cost, and practical measure that can be applied at the farm level to protect animals and the surrounding environment (Kementerian Pertanian Republik Indonesia, 2024). It refers to the management of risks associated with the entry and spread of diseases that may affect animal health, human health, and the environment (Robertson, 2020).

In livestock production systems, biosecurity includes a range of preventive measures such as controlling the movement of animals, people, and equipment, maintaining sanitation, and implementing proper farm management practices (Ferreira et al., 2024). Biosecurity can be divided into three main components: conceptual, structural, and operational biosecurity, all



of which are important in reducing the risk of disease transmission (Sayekti & Sitompul, 2023). However, the implementation of biosecurity at the smallholder level is often inconsistent due to limited knowledge, financial constraints, and lack of access to training.

This community service activity was conducted at the UPTD Balai Penyuluhan dan Pengembangan SDM Pertanian (BPPSDMP/BAPELTAN) of East Kalimantan Province, located at Sekolah Pertanian Pembangunan Negeri (SMK-SPP) Samarinda, Indonesia. The facility functions as a training and education center for agriculture and livestock development. The practical activities were carried out using a small-scale cattle unit managed within the training facility, consisting of Bali and Limousin cattle. This unit reflects a smallholder farming system with basic management practices and limited application of biosecurity measures.

In the field, several practical problems were identified. One of the main issues was parasitic infection (helminthiasis), which is common in tropical environments due to favorable conditions for parasite development. Helminthiasis is recognized as a significant health problem, particularly in developing countries, where it contributes to increased morbidity and can lead to productivity losses due to its often undiagnosed and persistent nature (Al Amin & Wadhwa, 2023). In livestock systems, this condition can reduce animal productivity and overall health performance (Pramu et al., 2020).

The use of anthelmintics for treating parasitic diseases in cattle varies depending on the type of parasite. Commonly used anthelmintic drugs targeting gastrointestinal parasites (GIPs) in cattle include albendazole, ivermectin, levamisole, and fenbendazole (Ninditya et al., 2024). This highlights the importance of appropriate parasite control strategies, including routine deworming, as part of livestock health management in small-scale farming systems. In addition, biosecurity practices were not consistently applied, such as limited control of human and equipment access and insufficient sanitation procedures. These conditions represent common challenges faced by small-scale cattle farming systems and further increase the risk of disease transmission. The program also involved international students from various academic backgrounds, many of whom had limited experience in livestock farming. Some participants had basic knowledge, while others were beginners in practical livestock handling. This situation highlights the gap between theoretical knowledge and field practice, and the need for practical learning experiences.

The implementation of biosecurity in Indonesia is regulated by Government Regulation Number 47 of 2014 concerning the Control and Management of Animal Diseases, specifically Articles 27 and 33–38. Furthermore, Minister of Manpower Decree Number 394 of 2014 concerning the Indonesian National Work Competency Standards (SKKNI) includes biosecurity as part of the competency standards for animal disease prevention and control. However, limited knowledge and resources remain major obstacles to biosecurity implementation, particularly at the smallholder farm level. Therefore, this community service program was conducted through an International Student Summer School to increase awareness and understanding of biosecurity and injection techniques in cattle. This activity aimed to evaluate participants' knowledge and perceptions after the program, identify challenges in biosecurity implementation, and explore the potential role of international students in supporting community-based education.

## Method

This community service activity involved 11 international students participating in a structured summer school program conducted at the UPTD Balai Penyuluhan dan



Pengembangan SDM Pertanian (BPPSDMP/BAPELTAN), East Kalimantan Province, Indonesia. The program utilized a small-scale cattle unit within the training facility, consisting of four cattle (three Bali cattle and one Limousin), as a learning medium.

The implementation of the program consisted of workshops, demonstrations, and group discussions focusing on biosecurity practices and basic livestock injection techniques. The learning process was conducted through direct explanation and visual observation, during which participants observed procedures such as animal handling, preparation of injection equipment, and general injection methods. This indicates that the training followed an observational (passive learning) approach rather than a practice-based (active learning) approach. Therefore, no hands-on practice was conducted during the activity.

Data were collected using a structured questionnaire administered after the activity as an evaluation instrument. The questionnaire consisted of approximately 18 items designed to assess participants' knowledge, perceptions, and experiences related to biosecurity and livestock injection techniques. The instrument included a combination of multiple-choice questions and categorical response options. Multiple-choice questions were used to evaluate participants' technical understanding, while categorical responses (e.g., very familiar, somewhat familiar, not familiar) were used to assess levels of familiarity, perceptions, and confidence. The main parameters measured in this study included:

- 1) awareness of biosecurity concepts,
- 2) level of familiarity with biosecurity practices,
- 3) perceived importance of biosecurity,
- 4) perception of farmers' knowledge,
- 5) perceived challenges in biosecurity implementation,
- 6) prior exposure to livestock farming,
- 7) interest in training, and
- 8) confidence in explaining injection techniques.

The collected data were analysed descriptively using percentage distributions to provide an overview of participants' responses.

## **Result and Discussion**

### **Community Service Report: Enhancing Biosecurity Awareness and Injection Technique Knowledge Among International Students**

The main outcome of this community service activity was the implementation of a series of educational sessions targeted at international students participating in a summer school program. These sessions aimed to increase awareness of biosecurity and provide fundamental knowledge of injection techniques in small-scale beef cattle farming systems. A total of 11 students from various countries and academic backgrounds participated in the program, reflecting diverse levels of prior knowledge and experience.

The activity utilized a small-scale cattle unit consisting of four cattle (three Bali cattle and one Limousin) as a learning medium. Participants were introduced to basic livestock health management practices, including the administration of vitamin B complex through intramuscular injection and anthelmintic (deworming) treatment through subcutaneous injection. Although the activity was primarily observational, it provided participants with a clear understanding of practical procedures and the importance of proper livestock handling.

In tropical environments such as Indonesia, livestock are highly exposed to various health problems, particularly parasitic infections such as gastrointestinal nematodes. The warm and humid climate creates favorable conditions for the development and transmission



of parasites, resulting in relatively high infestation rates in many regions, except in very dry areas (Purwaningsih et al., 2019). Helminthic diseases are widely distributed and strongly influenced by environmental conditions in the field, particularly in tropical climates where parasites thrive and can negatively affect livestock health and productivity (Suweta, 1989). These parasites thrive under warm and humid conditions and can negatively affect animal health and productivity. Although helminthiasis rarely leads to mortality, it can cause significant economic losses due to reduced body weight, decreased feed efficiency, and overall lower performance of livestock (Pramu et al., 2020). This condition highlights the importance of implementing proper health management practices, including routine deworming and biosecurity measures.

The use of vitamin B complex injection, as recommended by veterinarians, is considered practical, cost-effective, and easy to apply in small-scale farming systems (Carlito de Araújo Mali Code et al., 2023). Vitamin B complex plays an essential role in metabolic processes, supports enzymatic reactions, and helps improve appetite and immune response in livestock. Meanwhile, anthelmintic treatment using ivermectin is widely applied to control parasitic infections in livestock. Ivermectin has been proven effective against a wide range of parasitic diseases, including intestinal parasites and ectoparasites (Failoc-Rojas et al., 2023). It works by disrupting the nervous system of parasites, leading to paralysis and eventual death (Indah et al., 2023). The drug is commonly administered through subcutaneous injection, which is considered practical and effective for field application (Ajith et al., 2019). Overall, the results indicate that the program was able to improve participants' awareness and interest in biosecurity, although gaps in practical skills and field exposure remain. The following section presents an overview of participant characteristics and key survey responses.

**Table 1. Summary of Survey Results on Biosecurity Knowledge and Practices Among International Students**

Survey Aspect	Response Summary	Percentage (%)
Have you heard of biosecurity?	Yes	64
	No	36
Familiarity with biosecurity	Very familiar / Familiar	55
	Slightly familiar / Not familiar	45
Importance of biosecurity	Very important / Important	100
Small-scale farmers informed about biosecurity	Yes	9
	No / Not sure	91
Biggest challenge in biosecurity implementation	Lack of knowledge	45
	Limited financial resources	36
	Lack of government support	18
Visited or studied small-scale cattle farms	Yes	36
	No	64
Interest in biosecurity and injection training	Interested / Very interested	82
Confidence in explaining injection techniques	Confident / Very confident	27
	Less confident / Not confident	73



Table 1 shows that participants had varying levels of knowledge, experience, and perceptions regarding biosecurity and livestock injection techniques. Although 64% of participants had heard of biosecurity and all participants (100%) considered it important, only 55% reported being familiar or very familiar with biosecurity practices. This indicates that awareness does not necessarily reflect a deep or practical understanding. The findings suggest that the program played an important role in introducing and clarifying biosecurity concepts, especially for participants from non-livestock academic backgrounds.

A particularly notable finding is that only 9% of participants believed that small-scale farmers were adequately informed about biosecurity, while 91% responded “No” or “Not sure.” This result highlights a perceived gap in knowledge at the farmer level. However, this perception should be interpreted carefully. Only 36% of participants had prior experience visiting or studying small-scale cattle farms, while the majority (64%) had no direct exposure. Therefore, participants’ views were likely shaped not only by field observations but also by the learning process during the program, including presentations, visual materials, and discussions. Among those with field exposure, some observed that biosecurity practices were implemented inconsistently, which may have influenced their perception.

The identification of lack of knowledge (45%) as the main challenge, followed by limited financial resources (36%) and lack of government support (18%), further emphasizes that constraints in biosecurity implementation are both technical and structural. In small-scale farming systems, farmers may have basic awareness of disease prevention but face limitations in accessing training, infrastructure, and financial resources needed to implement biosecurity measures consistently. This reflects common challenges in developing livestock systems, where knowledge transfer and practical application are not always aligned.

In addition, the results show that 82% of participants were interested or very interested in receiving further training, indicating a strong motivation to learn more about biosecurity and livestock health management. However, only 27% of participants reported being confident in explaining injection techniques, while the majority (73%) expressed low confidence. This suggests that while the program was effective in raising awareness, it was less effective in building practical confidence, likely due to the absence of hands-on practice during the activity.

These findings highlight the potential role of international students as agents of education. Most participants expressed willingness to contribute through activities such as sharing knowledge in seminars, participating in community outreach, and developing educational media. This indicates that students not only gained knowledge but also recognized their potential role in disseminating information. However, their limited confidence in technical skills suggests that further training, particularly practice-based learning, is needed to strengthen this role.

Overall, the results demonstrate that the program was effective in increasing awareness and interest in biosecurity, but also revealed important gaps in practical competence and field exposure. Therefore, future community service programs should incorporate more hands-on training, structured field visits, and accessible educational materials, as well as stronger collaboration with local farmers. Such improvements would help bridge the gap between theoretical understanding and practical application, and enhance the contribution of international students to biosecurity promotion in small-scale cattle farming systems.



**Figure 1. Sharing knowledge about biosecurity and cattle injection techniques**

The documentation of activities presented illustrates the learning process and interaction between participants and the learning environment. Through visual observation of livestock handling, injection preparation, and administration procedures, participants were exposed to real practices in small-scale cattle farming systems. Although the activity did not involve hands-on practice, the use of visual demonstration combined with guided explanation played an important role in facilitating understanding, particularly for participants with limited prior experience.

From a learning perspective, this approach aligns with the concept of experiential learning, where knowledge is constructed through observation, reflection, and interaction with real-world situations. According to experiential learning theory, even indirect exposure to practical activities can enhance cognitive understanding when supported by discussion and contextual explanation. In this program, the combination of visual materials, demonstrations, and group discussions allowed participants to connect theoretical knowledge with practical applications in the field.

However, the results also indicate certain limitations. As shown in the survey findings, participants' confidence in explaining injection techniques remained relatively low (27%), suggesting that observational learning alone may not be sufficient to develop practical competence. This highlights the importance of incorporating hands-on training in future programs to strengthen both technical skills and confidence.

In terms of implications, the activity demonstrates that community service programs involving international students can contribute not only to knowledge transfer but also to the development of cross-cultural learning and global awareness in livestock health management. The participants' strong interest in further training (82%) and their willingness to engage in knowledge-sharing activities indicate their potential role as agents of education in promoting biosecurity practices.

For follow-up actions, it is recommended that future programs integrate practice-based learning sessions, such as supervised hands-on injection training and direct engagement with farmer groups. In addition, the development of simple and multilingual educational materials (e.g., posters, videos, and guidelines) can support knowledge dissemination at the community level. Strengthening collaboration with local institutions and farmer groups is also important to ensure the sustainability and practical impact of biosecurity education initiatives.



## Conclusion

This community service initiative successfully bridged the knowledge gap among international students regarding tropical livestock biosecurity and injection protocols. The program transformed participants' perceptions, shifting from a general understanding of biosecurity (64%) to a specific technical awareness of intramuscular and subcutaneous injection methods. Although a significant portion of participants (73%) initially expressed low confidence in performing these techniques independently, the observational learning and pharmacological workshops effectively demonstrated the synergy between biosecurity and livestock productivity. These findings underscore the strategic role of international students as global biosecurity ambassadors who can disseminate evidence-based farming practices. For future programs, it is highly recommended to transition from observational learning to supervised hands-on practice and to develop multilingual educational media to ensure the sustainability of biosecurity awareness in local farming communities.

## Recommendation

Based on the findings of this study, several concrete recommendations can be proposed for institutions such as BAPELTAN and universities.

First, institutions are encouraged to integrate hands-on practical training into field-based learning activities, particularly in livestock injection techniques and basic biosecurity procedures. The inclusion of supervised practice sessions would help improve participants' technical skills and confidence, which were found to be relatively low in this study.

Second, the development of multilingual training modules (e.g., Bahasa Indonesia and English) is important to accommodate international students with diverse academic and cultural backgrounds. These modules may include visual guides, instructional videos, and simple manuals to support both learning and knowledge dissemination to local farmers.

Third, the integration of field trip curricula with real farm exposure should be strengthened to allow students to directly observe and interact with small-scale farmers. This approach can enhance contextual understanding of biosecurity challenges and bridge the gap between theory and practice.

Fourth, institutions should establish collaborative partnerships with local farmer groups, government agencies, and extension services to ensure the sustainability of biosecurity education programs. Such collaboration can also help address structural constraints, including limited financial resources and access to training.

Finally, a more structured monitoring and evaluation system should be implemented, including baseline and follow-up assessments, to better measure program effectiveness and support continuous improvement.

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