

# ADOPTING BIOSECURITY MEASURES IN CATTLE BREEDING SYSTEMS IN INDONESIA

Veronica SRI LESTARI<sup>1</sup> , Djoni Prawira RAHARDJA<sup>1</sup> , Sitti Nurani SIRAJUDDIN<sup>1</sup> , and Abdel Razzaq ALTAWAHA<sup>2</sup> 

<sup>1</sup>Faculty of Animal Science, Hasanuddin University, Makassar 90245, Jl. Perintis Kemerdekaan Km. 10, Makassar 90245, South Sulawesi Province, Indonesia

<sup>2</sup>Department of Crop Science, Faculty of Agriculture, Universiti Putra Malaysia, 43400 UPM Serdang, Selangor, Malaysia

✉ Email: [veronicasrilestari@unhas.ac.id](mailto:veronicasrilestari@unhas.ac.id)

➤ Supporting Information

**ABSTRACT:** The study aimed to analyze the barriers to implementing biosecurity measures. Biosecurity refers to a collection of procedures designed to keep disease from spreading beyond the farm. Isolation, sanitation, and cage traffic control are all biosecurity strategies. At 2021, this study was carried out in Selli village, Bengo subdistrict, Bone regency, South Sulawesi province. Bone Regency is noted for being the largest livestock supplier in the province of South Sulawesi. A total of 35 people were chosen to be observed and questioned with the help of a questionnaire. The information gathered was analyzed using descriptive statistics. The results revealed that only 2.86 percent and 28.57 percent of respondents used quarantine or provided fences or barriers as isolation or segregation methods. Farm visitors were not provided with sanitary facilities. Everyone entering or exiting the cage was not subject to traffic control. The absence of information was the first roadblock to biosecurity adoption (65.71 percent). Then came a lack of time (31.43 percent) and a hefty price (2.86 percent). Therefore, training and extension should be provided by the Animal Hsubandary Services and Private Sectors.

**Keywords:** Adopting, Beef, Biosecurity measures, Cattle breeding, Smallholder farmers.

## INTRODUCTION

One of the agricultural subsectors, livestock, has been critical to the Indonesian sector's growth (Sirajuddin et al., 2016). Beef cattle are a common animal kept by rural farmers in practically all of Indonesia's provinces (Prasetyo et al., 2020). The Indonesian government, corporate sector, and beef cattle farmers all supported the development of the beef cattle industry, according to Lestari et al. (2017); however, most production in Indonesia was low and did not fulfill domestic demand. This is because the bulk of beef cattle farmers has traditionally been small-scale. Beef cattle ranchers keep cattle purely as an investment that can be sold at any time for academic or religious purposes. According to Agus and Widi (2018), domestic beef supply is not keeping up with increased meat demand, accounting for less than 60% of reasonable consumption. The supply and demand for beef are growing apart. In the short-medium term, importing beef cattle and frozen meat was a quick cure. Indonesia is forced to import beef and meat from nations such as Australia. Indonesia is Australia's largest export market for cattle and beef offal, and the sixth largest market for packed meat, according to Anonymous (2020). In 2020, Australia's total export of lean meat and livestock to Indonesia was a \$1.2 billion, representing 6% of total exports (Anonymous, 2020).

Every animal and public health plan, disease prevention, and control strategy must include biosecurity (Renaults et al., 2021). Biosecurity is a government policy that uses sanitation, isolation, and traffic control methods to prevent disease transmission outside or inside the cage (Anonymous, 2014; Putra et al. 2021). However, some barriers to biosecurity adoption differ significantly depending on the area, farmer socioeconomic level, and local norms. Biosecurity definitions usually include general observations about how biosecurity risks on farms should be addressed and mitigated, according to Maye and Chan (2020). On the other hand, biosecurity strategies used on farms are unevenly distributed across social groups, geographic scales, and agricultural commodity chains (Maye and Chan, 2020).

The reasons for implementing biosecurity software are to ensure that the farm is free of positive illnesses, to ensure customer threats to the products produced, to protect the framework of life and to ensure the sustainability of economic enterprises. That, and the risk of zoonotic diseases, especially for staff (Swacita, 2017). Research on biosecurity practices in cattle breeding has been done by some researchers, such as Gunn et al. (2010), who said that the ability or willingness of clients to invest in biosecurity measures was seen by veterinarians as a significant barrier. Veterinarians also believed that more efficacy and/or better evidence of the potential economic benefits of proposed farm biosecurity techniques were needed. McCarthy et al. (2021) found that protocols for quarantining visitors, colostrum feeding techniques, and calving area hygiene all had room for improvement. According to Victor et al. (2018), farmers who were identified had lax attitudes toward biosecurity under the circumstances, including the necessity to grow the size of the herd, the herd's placement in an area that was purportedly less susceptible to illness, and values associated to maintaining an

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unrestricted farming system. Other potential barriers to adopting proper biosecurity were poor communication between farmers and their workers and visitors, ignorance of infection paths, and financial restraints. Adler et al. (2019) found that the impact of personality and attitude on outcomes was significant. The personality and attitudes of farmers were associated with the health, welfare, productivity, and management of dairy cattle. Damiaans et al. (2020), found that "health management" was especially lacking in the three farm types for internal biosecurity. However, there was little discussion about the constraints of adopting biosecurity measures.

The province of South Sulawesi is one of the beef producers. After East Java and Central Java, Bone Regency is the top cattle producer in the province of South Sulawesi and third in Indonesia. The cattle population in the Bone regency is 415,073 heads, according to statistics from the Statistical Center Bureau (2020). The Indonesian government has released animal health regulations such as biosecurity applications to protect cattle from some diseases. However, not all cattle farmers adopt this regulation. Therefore it was important to conduct this research.

## MATERIALS AND METHODS

This research was conducted in Selli village, Bengo subdistrict, Bone regency, South Sulawesi Province, 2021. The population is all beef cattle breeders. The sample was determined by purposive sampling with a total of 35 farmers. The data consists of primary data and secondary data. Primary data is in the form of breeder characteristics, namely gender, age, education level, number of dependents in the family, number of livestock, farming experience, land area, and distance from house to cage. Another data is the livestock business. In addition, biosecurity measures were obtained from questionnaires submitted to farmers, consisting of sanitation, isolation and traffic control. Questions on biosecurity practices are based on simple techniques that smallholder farmers can carry out. The isolation variable is quarantine (separation) for newly purchased cattle and the use of separator boundaries. The sanitation variable includes checking visitors to the cage using a foot bath, and the third variable is traffic control which consists of the management of humans, vehicles and other animals entering and leaving the cowshed area. Meanwhile, secondary data were obtained from Bone District Livestock Services and other reports. The data obtained were processed by software SPSS version 23 and analyzed descriptively using mean and percentage.

## RESULTS AND DISCUSSION

### Farmers' and the farm's characteristics

Table 1 shows that most respondents are male (94.29%). It is undeniable that caring for cows requires much energy, such as bathing, grazing, cleaning cages, feeding and drinking. This work is physically stronger than women, so it suits men. Looking at the respondents' ages, 94.29% belonged to the working-age category. At this age, human energy and mind are excellent. This means they are still physically strong in doing activities at home. This is so that they can raise cattle as much as possible. According to BKKBN (National Family Planning, Welfare and Population Agency), the working age category is between 15 and 64 years old.

According to the level of education, most respondents graduated from Senior High School (45.71%). This means that they have a good education. Highly educated people can better understand the new technology provided than those with low education. It can be said that they are more open-minded. The results of this study are better than that of Lambertz et al. (2012), who argued that cattle farmers' education level in Thailand was mainly graduated from primary school. Most respondents have more than 10 years of agricultural experience (51.43%), meaning they can raise cattle. Her livestock breeding experience comes from her parents. The majority of respondents were farmers (82.83%). Rice cultivation is the main source of income, and livestock breeding is a side business. Looking at the number of families, respondents, like most families, belong to the small family category 4 or more (77.14%). Therefore, the results of this study differ from Thai breeders, who have an average family size of 4.4 (Lambertz et al. 2012).

Herd size was dominated by a herd of 5-10 for each respondent (57.14%). They raise cattle semi-intensively. That is, after returning home, the cows are released into the yard in the morning and surrounded in the afternoon. The cage is made of wood or bamboo. The location of the cage is usually next to or under the house, and the distance is less than 250m. The reason for keeping cows near the house is the factor of safety from thieves.

### Biosecurity practices

The Food and Agriculture Organization (FAO, 2010), claims the three main components of biosecurity are as follows: a). The process of establishing and maintaining barriers to keep infectious animals and hazardous materials out of an uninfected area is known as segregation. If done correctly, this process will prevent the bulk of contamination and infection. This includes measures such as requiring all people crossing the barrier to remove their shoes and clothing before proceeding and restricting vehicle entry; b) Cleaning: All materials entering (or leaving) a site must be thoroughly cleaned to eliminate visible filth. The majority of microorganisms that contaminate the items will also be eliminated. This indicates that there should be no visible dirt on the materials' surface. Soap, water, and a brush can be used to clean small items; c). Disinfection: Properly performed disinfection nullifies pathogens present in materials that have already been completely cleaned. Therefore, despite its importance, disinfection is the least effective biosecurity measure. Biosecurity practices are essential to be applied to the farm to prevent disease transmission. Biosecurity practices consist

of isolation, hygiene and traffic control. Table 2 shows a simple application for biosecurity. Based on the table, it can be seen that the isolation or segregation measures, such as quarantine and the provision of fences or barriers, are carried out by 2.86% and 28.57% of respondents, respectively. The sanitation measures for farm visitors are not being put in place (100%). There is no foot bath and boot available at the entrance to the cage. The cowshed can be a source of harmful germs, either outside the building or the cows themselves. Germs from the cows can also be spread out into the surrounding area. If good sanitation facilities are not available, this can happen.

According to Dairymple and Innes (2021), all visitors must understand the risks they face when entering a farm, what farmers expect of them and what precautions are taken between the farms they visit. This applies not only to the property of goods of the same type or type but also to those who enter and leave the site and visit the property of other animals. As shown in Table 2. No traffic control exists for anyone entering or leaving the cage (100%). Everyone or other animals, such as chickens and birds, can walk in and out of the cowshed.

**Table 1 - Farmers' and the farms characteristics**

Variables		Mean	Frequency (person)	Percentage (%)
<b>Sex</b>	Male		33	94.29
	Female		2	5.71
<b>Age</b>	Unproductive	47.60 ± 10.83	2	5.71
	Productive		33	94.29
<b>Education level</b>	Primary school		6	17.14
	Intermediate school		11	31.43
	Senior high school		16	45.71
	Bachelor		2	5.71
<b>Farm experience (years)</b>	< 5	11.94 ± 7.98	4	11.43
	5-10		13	37.14
	>10		18	51.43
<b>Job</b>	Housewife		1	2.86
	Government employee		1	2.86
	Farmer		29	82.83
	Businessman		4	11.43
<b>Family size</b>	≤ 4	3.34 ± 1.77	27	77.14
	> 4		8	22.86
<b>Land size (ha)</b>	0.25	0.22 ± 0.08	22	62.86
	> 0.25		13	37.14
<b>Herd size (head)</b>	< 5	5.83 ± 2.54	13	37.14
	5 - 10		20	57.14
	> 10		2	5.71

**Table 2 - Biosecurity practices in cattle breeding systems**

Variables	Frequency		Percentage	
	Yes	No	Yes	No
<b>Isolation</b>				
• Quarantine	1	34	2.86	97.14
• Biosecurity land boundary	10	25	28.57	71.43
<b>Sanitation</b>				
• Cleaning visitors	0	35	0	100
<b>Traffic control</b>				
• Control visitors	0	35	0	100

### Adopting biosecurity measures in cattle breeding systems

According to Ritter et al. (2017), social-psychological factors are important in the adoption of farmers recommended management strategies, and disease prevention and management measures should be based on the theoretical framework that takes into account these factors. The specific situations of farmers affect the decision to adopt management strategies. The recognition of their problems and the recognized effectiveness and implementation of the recommended strategies play an essential role in determining farmers switch. The extent of the impact of internal factors on farmers (e.g. A sense of responsibility, pride or perceived social pressure) and their perceived behavioral control is evidence of their importance. Farmers are not an isolated group. They are context-sensitive and can make changes in agriculture more difficult or easier. Various advisory tools should provide consistent, accessible, relevant and feasible information to inform farmers about recommended controls. In particular, more personal means of communication can go beyond simple education to account for the farmer's individual beliefs, objectives and constraints.

Based on Table 3, it can be seen that the biggest barriers to biosecurity adoption were lack of information (65.71%), less time (31.43%) and high cost (2.86%). The study's findings were supported by Lestari et al. (2018). The top factors

preventing beef cattle farmers from implementing biosecurity in Luwu regency, South Sulawesi province, were the shortage of extension personnel, veterinarian shortages, lack of technical knowledge of animal husbandry, and lack of finance. Lack of information lead to a lack of knowledge about animal health, which can be attributed to several factors, including lack of socialization and counseling, shortage of extension staff, remote locations and lack of financing for farming. In addition, farmers are often passive in their search for information, and they do not seek out information on their own. According to Brennan and Christley (2013), most producers thought some of the nominated biosecurity practices were valuable, but there was not always agreement between the utility of practice and its implementation. This research was found by Channanppagouda et al. (2016), a researcher argued that dairy farmers' lack of knowledge about cattle diseases and their control was a major barrier to implementing scientific animal breeding and health care procedures.

The farmers are very busy because they have to go to the fields early in the morning and come back home after the afternoon. Therefore, they have no time to bathe the cow every day; even cow dung may accumulate in the stables without cleaning. Furthermore, the high price reflects the high costs of biosecurity, such as the need to spray cages, boots, foot baths, cage clothes, and cages with a fence. This research was found by Ahmed et al. (2016), who found that one of the constraints of cattle fattening practices in urban and peri-urban kebeles of Dessie Town, Ethiopia, was the capital problem.

**Table 3 - Adopting biosecurity measures in cattle breeding systems**

Obstacles	Frequency (person)	Percentage (%)	Rank
Lack of information	23	65.71	I
No time	11	31.43	II
High cost	1	2.86	III

## CONCLUSION

Based on the results of the study, it can be concluded that the barriers to the adoption of biosecurity measures in cattle breeding were lack of information (65.71%), no time (31.43%) and high costs (2.86 %). It is suggested that biosecurity measures can be provided to beef cattle farmers through guidance and counseling from the government and the private sector, as well as participation in biosecurity measures.

## DECLARATIONS

### Ethics

I declared that this research was funded under contract number: 752/UN4.22/PT.01.03.2021, 26 March 2021.

### Corresponding author

Email: veronicasrilestari@unhas.ac.id

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### Authors' contribution

V Sri Lestari led and fully managed the research project and was responsible for data collection and script writing; DP Rahardja contributed to data processing and interpreting field data; SN Sirajuddin contributed to the data processing and provision of library resources; and AR Altawaha contributed to the article writing process, publication process and translation process.

### Conflict of interests

None.

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