Raise Pattern and Biosecurity Application by Broiler Breeders on Different Topography in North Sulawesi Province

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Abstract: The purpose of this study was to obtain information about the raising pattern and level of biosecurity application conducted by broiler breeders in different types of topography in North Sulawesi Province. The research location was the District of Minahasa representing the highlands and District of MinahasaUtara representing the lowland region. The scale of broilers husbandry in the two study areas consisted of small scale (<5000 broilers), medium scale (> 5000 - 10000 broilers) and large scale (> 10000 broilers) for each of production periods. At each scale, 5 breeders were taken as respondents, so that the total of respondent samples was 30 breeders. Data obtained then was analyzed descriptively and quantitatively. The result shows that broilers in the lowlands generally raised for 4-5 weeks with an average weight of 1.2 - 1.3 kg/broiler, while broilers were raised by breeders in the highlands had gained weight of 1.4 - 1.7 kg/broiler. Raising broilers in small-scale business used all in-all out system withfamily workers, while breeders in medium and large-scale husbandry in both topographic areas usedraising pattern and marketing gradually using special labor. As many as 100% of breeders in the lowland areas within a large-scale husbandry had already health programs under the supervision of veterinarians and 80% of large-scale breeders in the highlands did the same. In both research areas, it showed that broiler breeders on the three scales made effort to prevent the risk by burning and burying dead chickens with a percentage of 60-100%.

1 INTRODUCTION

One of husbandry commodities becoming source of living and protein for society is broiler. Broiler is relatively well-liked by breeders since it can gain weight until 1,2 -1,3 kg within relatively short period of raising, during 4-5 weeks. It may happen if it is supported with a better management of production conducted by breeders (Pakage et al.,2018; Amid et al.,2015).

Recently, the condition of broiler has sometimes dealt with less profitable situation, where there is unstable price of production infrastructure in the market. Such condition, then, is occurring annually, so that small-scale breeders suffer from loss. Technically speaking, there is a difference between raising pattern and profitability in broiler cultivated in low and high land. In any high temperature, broiler's performance drastically decreases, so there is a different profitability with broiler cultivated in fresher and more mild temperature.All those factors will determine breeders' productivity in raising broiler, mainly on business's pattern and scale.Both business's pattern and scale will result on business's productivity and efficiency (Rana et al.,2012) Improvement of economic efficiency can be performed by using a better technology, using total of input and optimal raising scale (Tamdogan and Cicek, 2016). The husbandry, theoretically, is divided into four business's pattern, namely side-job business, branch of business, main business, and industry.Those business's patterns are necessarily required in a better management of raising in order to obtain broiler always in good performance and condition, so that breeders can avoid any loss occurred. Therefore, a step to be taken by breeders is applying biosecurity technique. Biosecurity is breeders' effort to avoid disease's penetrated infection from one husbandry to other husbandries (Martindah et al., 2014; Conan et al., 2012)

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North Sulawesi is one of regions producing broiler by total of boiler's population in 2018 of 7,7million broilers. Two districts having the largest population of broiler in North Sulawesi are District of Minahasa Utara, with total of population of 4.5 million broilers (58.4%) and production of broiler of 4,118 ton; and District of Minahasa, having total of broiler's population of 1.9 million broilers (25.3%) with production of broiler of 1,516 ton [BPS Sulut, 2018) District of North Minahasa is located in the lowland, while, contrarily, District of Minahasais in the highland. This topographic different is presumably assumed resulting on difference of raising pattern and husbandry's productivity due to different physical environment. Non-conducive environment will cause broiler vulnerably infected by any disease, meaning that both breeders in these districts should apply biosecurity principles. Applying principle of biosecurity is by reducing any risk resulted by human's mobility in the cages, animals, organic or inorganic materials (Jubb and Dharma, 2009). Particularly, principles of biosecurity comprise of establishing, improving, reducing, detecting, dimension, and selecting.Such risk mentioned above should be avoided since it will potentially become entrance of diseases' seeds. Research on biosecurity application has been done by previous researchers (Ajewole et al., 2014; Lestari et al.,2011; Umam et al., 2014). However, information on biosecurity application by broiler's breeders in different topography, such as in the low and highland along with its raising pattern, is relatively limited.Hence, this research will analyze different raising pattern of broiler, profitability, and biosecurity application by breeders in both District of Minahasaand District of North Minahasa.

2 RESEARCH METHODOLOGY

2.1 Sampling Method and Data Collecting Technique

The research was conducted in District of North Minahasa representing the lowland and District of Minahasa representing the highland. It was done on January to February 2019. In each of districts, it then was selected 2 (two) sub-districts purposively by consideration that it had breeders having ever obtained training and applied regional biosecurity management with the largest population of broiler in respectively every district (BPS Sulut, 2018). Sub-district turned as research's site was Sub-district of Dimembe and Kalawat (District of North Minahasa), Sub-district of Sonder and Tondano Utara (District of Minahasa). There were three scales of broiler husbandry in the District of North Minahasa, such as <5000 broilers (32 breeders), >5000-10000 broilers (16 breeders) and>10000 broilers (10 breeders). Meanwhile, breeders in the District of Minahasa had business scale of <5000 broilers (25 breeders), >5000-10000 broilers (14 breeders) and >10000 broilers (10 breeders). In each of business scales, 5 breeders, thus, were purposively selected in each district respectively (Knottnerus.,2003) by consideration that those breeders had followed training of biosecurity management in broiler's husbandry, so the total of samplings was 30 breeders.Further, data was collected by survey technique using questionnaire. Data gathered then was primary data comprising of technical data, such as mortality, broiler's weight, feeds consumption, business scale, business model, raising pattern, procurement model of production equipment, income, and aspects of biosecurity application used by breeders.

2.2 Data Analysis

Data collected was, hence, analyzed descriptively and quantitatively. Descriptive analysis comprised on characteristic of broiler husbandry, such weight, raising pattern, marketing, business model, procurement model of production equipment, labor, raising period. Whereas, quantitative analysis consisted on calculation of broiler's index and income using following formulation, [Tandogan et al., 2016)

$$\text{Broiler's index} = \frac{(100-\%\, mortality) x\ mean\ of\ weight/broiler)}{feeds\ conversion X\ raising\ period} \quad (1)$$

$$\text{Income} = TR - TC \quad (2)$$

Where:
TR = Total of income in broiler husbandry (Rp/production period)
TC = Total of production cost in broiler husbandry (Rp/production period)

Next, the calculation of biosecurity variable used score obtained from data collected. Data management utilized descriptive method and statistical analysis. Each response of respondents was classified into fivecategories and given score. The score was stated in numerical of 1,2,3,4, and 5 for each answer, which the highest score was 5 and the lowest was 1 (Haedari et al., 2011).Such score,

later, was categorized into 2 parts, namely Pre-EntryandPoint of Entry. In addition, such score in respective groups was calculated in total and a mean was gained from it. Further, this score was analyzed using Independent Sample *t*Testassisted by SPSS.22 program, by following formulation as follows, (Gujarati., 2003)

$$t = \frac{Xa - Xb}{Sp\sqrt{\frac{1}{na} + \frac{1}{nb}}} \quad (3)$$

Where:

Xa = mean of group a, Xb = mean of group b, Sp = combined deviation standard, na = total of samples in group a, nb = total of samples in group b.

3 FINDINGS AND DISCUSSION

3.1 Business Model

The result of this research demonstrates that breeders in the highland, District of Minahasa, and the lowland, District of North Minahasa, had a varied scale of broiler raising, ranging from 750 broilers up to 22.000broiler in each period of raising. In this research, three business scales were obtained: small scale (<5.000 broilers), middle scale (>5.000-10.000 broiler) and large scale (>10.000 broilers). Distribution of business scale in the broiler raising from four Sub-districts representing the lowland and highland respectively was hardly equally distributed. It, then, was varied between 1.000 to 20.000broilers, and there were only some breeders raising above 20.000 broilers and some had 750 broilers. In detail, the different business scale of broiler husbandry had a relation with business's model and objective. Typically, breeders raising broiler under small-scale husbandry only aimed for side job and broiler's cage was placed close to breeder's house and residents. Contrastingly, breeders raising under medium and large scale of broiler husbandry had separated cages, which were far enough from residential.

Table 1: Mean of maximal and minimal temperature, and humidity in the lowlands and highlands

Detail	The Lowlands (Dimembe+Kalawat		The Highlands (Sonder +Tondano Utara)	
	Morning	After noon	Morning	After noon
Minimal Temperature (^{0}C)	25,87	26,46	19,75	23,54
Maximal Temperature (^{0}C)	30,25	33,00	29,50	30,25
Humidity (%)	84,60	75,00	89,00	79,00

Climatological environment in two research's sites based on data derived from BMKG of North Sulawesi (BMKG Sulut, 2018) is shown in following Table 1.Further, broiler's strains raised and commercial ransom given, in general, were depended on supply of local poultry shop. In the lowlands, broiler's strains raised wasIndian river andLohmann, and the ransom used was product of Comfeed and Charon Pokhpan. While, in the highlands, broiler's strains was Arbor and Anwar Sirat, using ransom of Charon Pokhpanand Cargill. Specifically, the result of this research against broiler's performance in the lowlands and highlands can be seen from below Table 2.

Table 2: Broiler's performance in the lowlands and highlands of North Sulawesi

Details	The Lowlands			The Highlands		
	Business Scale			Business Scale		
	S	M	L	S	M	L
Weight (kg/broiler)	1,32	1,19	1,26	1,53	1,40	1,69
Ration conversion	2,03	1,83	1,87	1,89	2,07	2,13
Broiler's index	1,72	1,74	1,92	1,63	1,58	1,53
Mortality (%)	9,50	5,14	7,04	5,30	5,62	7,24
Raising period per production period (day)	37	36	35	40	41	42
Profit (Rp/broiler)	11.200	11.375	11.850	10.645	9.500	9.250
Business model	Side job	Semi-commercial	Commercial	Side job	Semi-commercial	Commercial

Raising pattern and marketing	All in-all out	All in-all out	All in-all out	All in-all out	All in-all out	All in-all out
Pattern of production equipment	Partnership	Partnership	Partnership	Partnership	Partnership	Partnership
Labor	Family	Family and hired labors	Family and hired labors	Family	Family and hired labors	Family and hired labors

S=Small, M=Medium , L= Large

According to data mentioned in the Table 2, it depicts that typical breeders in the lowlands raised broilers within 36 days by its average weight of 1,2-1,3 kg/broiler. In the highlands, breeders raised generally broilers for 41 days with its average weight of 1,4-1,7 kg/broiler. It was due to market's demand in certain areas was likely different. In all business scales, all in-all out system was used since breeders run their business under partnership program with the main company, so that procurement of production equipment (feeds, seeds, medicines, vitamins, and technology) was mostly supplied by the main company, excluding labor, cages, and cage's tools.Theall in-all out system means that total of incoming and outcoming broilers going to be harvested is similar due to similar age. To know broiler's technical performance, the calculation of broiler's index was performed to show that small-scale business in the highlands had better technical performance than large-scale business; though, its value of broiler's index was smaller than large-scale broiler's husbandry in the lowlands. It was caused by the outbreak infection of broiler's disease in the highlands during the research performed. A disease is one of determining factors in decreasing productivity of broiler. Therefore, broiler's profitability in a large-scale business in the lowlands located in the District of North Minahasa was greater than a small-scale business, and profitability in a small scale-business of broiler's husbandry in the highlands had apparently relative higher than other business scales.

3.2 Total of Breeders Applying Biosecurity

Biosecurity is management action performed to prevent spreading of disease's seed existing in any husbandryand contaminating other husbandries or surrounding residential. In this research, it focused on application biosecurity observed and assessed. The biosecurity procedure in two application levels is in the Pre-entry, or before coming to husbandry's site, and Point of entry, or on-husbandry's site. These biosecurity applications performed in two different sites are aimed to prevent disease's seed directly interacted with broilers raised. Whereas any disease's seeds successfully penetrated the first level (Pre-entry), there is one level mandatorily secured by breeders to prevent such disease's seed contaminating other broilers within cages, which is biosecurity in the Point of entry. Hence, the finding of the research shows that total of breeders applying biosecurity in the Pre-entry located in the District of North Minahasa (the lowlands) and District of Minahasa (the highlands) had no significantly different. This can be seen from following Table 3.
Based on Table 3, it describes that biosecurity application in the Pre-entry conducted by breeders in the lowlands (District of North Minahasa) was higher than breeders in the District of Minahasa (the highlands) of all ownership scale.

Table 3: Biosecurity application by broiler's breeders in the Pre-entry

Details	District of North Minahasa (%)			District of Minahasa (%)		
	Business scale			Business scale		
	S	M	L	S	M	L
There are no other breeders within the range of 1 km	40	40	60	0	0	0
There is no sharing of equipment with other breeders	60	80	80	20	20	20
All transportation tools are sprayed with disinfectant	20	20	40	20	20	20
Poultry's waste is not taken back into the cage	100	80	100	40	40	20

S=Small, M=Medium, L= Large

It was caused by husbandry's site in District of Minahasa relatively close to residential; while broiler's husbandry in District of North Minahasa was far enough from residential. This husbandry's site far from residential would be able to minimize direct contact of poultry and human, or with other poultry, so that it could reduce human's mobility, animals, disease's seed from one cage to residential, and *vice versa*. The further the husbandry's site from

residential and other husbandries, the smaller the possibility of disease's seed contamination [Jubb and Dharma., 2009; Ndem and Ogba.,2017; Ali et al., 2014).The designing of broiler's cages in District of Minahasa, initially, was far from residential, but the massive and rapid development of population made husbandry's site close to residential eventually.Also, another biosecurity having been implemented by breeders in both Districts of North Minahasa and Minahasa was spraying with disinfectant. In the level of Pre-entry,spraying was performed in broiler's distribution tools aimed to eliminate disease's seeds derived from outside of husbandry [Steenwinke et al.,].The breeders in the District of North Minahasa had better waste management than breeders in the District of Minahasa, nearly almost 100 % of breeders not taking broiler's waste to other husbandries that could spread disease's seeds. Further, breeders in the District of Minahasa were just 20-40% performing better waste management.

In the level of point of entry, breeders apply biosecurity aimed to prevent diseases, if there is disease contamination derived from the Pre-entry up to coming to the cages. This biosecurity applications are establishing fence and locking key, hiring medical expert, having bathroom and additional clothes for labors, maintenance using all in-all out system and removing unsold products from the cages (Table 4).

Table 4: Biosecurity application by broiler's breeders in the level of point of entry

Details	District of North Minahasa (%)			District of Minahasa (%)		
	Business scale			Business scale		
	S	M	L	S	M	L
Having fence and locking the cages' doors	40	20	40	60	80	60
Hiring medical expert	60	80	100	80	60	80
Having bathroom and additional clothes	40	60	80	0	20	20
Maintenance using all in-all out system	80	80	100	60	80	80
Unsold products not returned to the cages	100	100	100	100	100	100
Dead poultry was burnt/buried	60	80	100	80	80	80
Conducting early disease detection	80	80	100	60	80	100
Having SOP in conducting any activity in the cages	20	20	40	0	0	20
Vehicles should be cleaned as entering husbandry's site	20	20	10	0	0	20

S=Small, M= Medium, L= Large

Then, the findings of this research describe that breeders in both districts almost applied biosecurity measure.40% and 60% of breeders located in District of North Minahasa and Minahasa had fence and locked door. Locking the cage's doors was one of efforts to limit human's mobility, domestic pets and wild animals, which it was supported with previous researches [Lestari et al., 2011; Umam et al., 2014)stressing that fence and door locking are significant to limit human's mobility and vehicles that can assumedly bring disease's seeds coming inside of husbandry.Accordingly, breeders in both districts werebreeder conducting partnership, where its product/broiler marketing was performed by main company.As consequence, main company prohibited partner breeders to sell their broiler by themselves (retailing). Therefore, none of breeders did they sell their broiler in market, and there were no broilers back to the cages as they had been brought by main company to be sold. Broiler's health became main priority of both breeders in the research's site.Significantly, broiler's health during their raising had to be taken care by medical expert in order to take preventive caution whereas any issues related to broiler's health.To do so, most breeders had tohire medical expert in disease prevention program in their husbandry. In the context of raising, most of breeders had applied all in-all out system, implying that total of incoming and outgoing broilers had to be exactly the same in order to take supervisory of broiler's health. This finding is in line with previous research (Ali et al., 2014; Steenwinke et al., 2011; Herawati et al., 2016), stating that breeders adopt and apply principles of biosecurity to prevent contamination of disease's seeds in and out of husbandry's site. From above data in the Table 4, it depicts that breeders in the District of Minahasa were mostly not having bathroom and additional clothes for their labors and owner since the distance to their house was relatively near, while breeders in the District of North Minahasa (the lowlands) had bathroom and additional clothes for their labors and owner since the husbandry's site was relatively far from their house (residential). If broiler was infected and dead by any disease, breeders would take preventive caution of disease contamination by burying and burning dead broilers (60-100%). Moreover, breeders in both districts within all

business scales had performed activity in detecting broiler's disease. For biosecurity aspect concerning that vehicles entering husbandry's site had to be cleaned, only small part of breeders in the District of North Minahasa had applied it, but, contrastingly, most breeders in the District of Minahasa did not apply such biosecurity aspect. As reasons, particularly, breeders in the District of Minahasacould not clean vehicles since there were many vehiclespassing through husbandry, so that it required additionally huge costs used to clean each vehicle. Meanwhile, small part of breeders in the District of MinahasaUtaraperformed such biosecurity action since there was only one vehicle from main company delivering day old chick (DOC) and feed supply entering husbandry's site.

3.3 Statistical Analysis of Biosecurity Application by Broiler's Breeders

The finding of this research demonstrates that the level of biosecurity application in the pre-entry located in the District of apNorthMinahasa wasreallydifferent ($P<0.05$) with biosecurity application conducted in the District of Minahasa. Furthermore, biosecurity application in the level of point of entry was really similar ($P>0.05$) between breeders in both districts within all business scales (Table 5).

Table 5: Analysis of biosecurity application in the District of North Minahasa and Minahasa

Biosecurity's Site	District		STD
	North Minahasa	Minahasa	
Prior to enter husbandry's site	2,38[a]	1,18[b]	0,43
On-husbandry's site	0,79[a]	0,71[a]	0,51

Note: Value of different letters in the similar row shows really different ($P<0.05$). STD is Standard Error of Treatment Means

The biosecurity application in the level of pre-entry in the District of North Minahasa was much better than biosecurity application in the District of Minahasa ($P<0.05$). It can be seen from above Table 5, where breeders located in the District of North Minahasa had mostly applied biosecurity aspects in this level than breeders in the District of Minahasa, only small part of breeders applying biosecurity in this level. One of causing factors was that husbandry's site involved in this research, District of North Minahasa, was far from residential, and husbandry's site located in the District of Minahasa was close to residential.Subsequently, biosecurity application in the level of point of entry was relatively similar ($P>0.05$) conducted by breeders located in both districts. It means that those breeders in both districts had mostly mastered better technique of broiler cultivation and they also concerned on surrounding environment.Breeders had understood significance of biosecurity aspects to minimize loss risk in managing broiler husbandry since they had obtained training on how to plan, apply, and evaluate biosecurity aspect [Ndem and Ogba., 2017; Ali et al., 2014; Herawati et al., Abdurofil at al., 2017.,Balamrigan at al., 2014).

3.4 Sustainability of Biosecurity Application and Raise Pattern on Broiler Farming in North Sulawesi Province

How far is the implementation of biosecurity in sustainable broiler chicken business in North Sulawesi? In general, various principles of biosecurity in broiler chicken farms in North Sulawesi have been carried out at a certain level, for example at the level before entering on the farm and point of entry of farming. To ensure the sustainability of this program, there is a need for ongoing coordination and cooperation between related institutions such as the Agriculture and Livestock Services, partnership companies, farmers, and the community. Cooperation and coordination have not been going well. This is what needs to be corrected immediately given the importance of sustainable biosecurity for the protection of humans, animals, plants and the environment, including farmers from the threat of unwanted organisms that can harm all parties. The use of detector devices for parasites and germs around broiler farms can be considered to be applied so that it can minimize the threat of decreasing broilers' productivity.

The results of this research showed that the application of biosecurity by farmers was quite good because they had already received previous training but to ensure the sustainability of the application of the technology it was necessary to evaluate it regularly so that it could be identified repair. Biosecurity sustainability in broiler farms will have a positive impact on livestock health and the environment around the farm so that it will positively influence broiler chicken technical performance and farmer's income.

On the side the performance of broiler chicken farms in North Sulawesi, the partnership business pattern that has been running so far must be maintained to ensure the availability of raw materials such as seeds, superior feed, vitamins and medicines

continuously and market guarantees that are often obstacles for breeders who have consequences at the close of business. Therefore various of cooperation agreements made must benefit both parties, namely core companies and farmers.

4 CONCLUSION

1. Raising pattern of broilers in the lowlands of District of North Minahasa and the highlands of District of Minahasahad no different, excluding raising period of each production period. In detail, raising period in the lowlands was averagely 36 days, and 41days in the highlands.Small-scale business in the highlands had better technical performance than large scale; though, its broiler's index was lower than broiler husbandry in the lowlands under large-scale business.
2. The biosecurity application performed by broiler's breeders in the pre-entry level in the District of Minahasa was much better than breeders in the District of Minahasa. Meanwhile, the biosecurity application performed by breeders in both research's sites in the point of entry level did not show significant difference.

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