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Limousin cattle production performance and farmer income post-FMD fed with super booster and immunobooster concentrate

Performa produksi sapi Limousin dan pendapatan peternak pasca PMK yang diberi super booster dan konsentrat immunobooster

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ABSTRACT

This study aims to evaluate the administration of super booster, and immunobooster concentrates on production performance and farmers' income following an outbreak of foot and mouth disease (FMD) by proving the improvements in production performance, including feed consumption, weight gain, and revenue of crossbred Limousin cattle farmers. This study used 18 male Limousin crossbred cattle selected based on age (1.5-2 years) and having been infected with FMD virus that is divided into three treatments: T0 (control feed consisting of forage and local concentrate), T1 (control feed + 40 g of a super booster), and T2 (control feed + 600 g of immunobooster concentrate). Data collection and observation were conducted over 42 days. Statistical analysis was performed using analysis of variance (ANOVA) based on the completely randomized design (CRD), followed by Duncan's multiple range test (DMRT). The results of the variance analysis showed a p-value of <0.05, indicating that the addition of super booster and immunobooster can improve feed consumption, body weight gain, and increase farmers income in crossbred Limousin cattle farming following an outbreak of FMD, so that it can be used as an alternative step in overcoming post-FMD losses and helping farmers maximize profits.

Kata kunci:
Persilangan limousin
Konsumsi pakan
Penyakit mulut dan kuku
Immunobooster
Super booster

ABSTRAK

Penelitian ini bertujuan untuk mengevaluasi pemberian super booster dan konsentrat immunobooster terhadap performa produksi dan pendapatan peternak sapi persilangan Limousin pasca terjangkit penyakit mulut dan kuku (PMK), dengan membuktikan adanya perbaikan performa produksi yang meliputi konsumsi pakan, pertambahan berat badan, dan pendapatan peternak sapi persilangan Limousin. Penelitian ini menggunakan 18 ekor sapi persilangan Limousin jantan yang dipilih berdasarkan umur (1,5-2 tahun) dan pernah terinfeksi virus PMK dan dibagi menjadi 3 perlakuan yaitu P0 (pakan kontrol berupa hijauan dan konsentrat lokal), P1 (pakan kontrol + 40 g super booster), dan P2 (pakan kontrol + 600 g konsentrat immunobooster). Pengumpulan data dan pengamatan dilakukan selama 42 hari. Analisis statistik dilakukan dengan menggunakan analisis varian (ANOVA) berdasarkan rancangan acak lengkap (RAL) yang dilanjutkan dengan uji DMRT. Hasil analisis variansi menunjukkan nilai P<0,05 yang berarti bahwa penambahan super booster dan immunobooster dapat meningkatkan konsumsi pakan, pertambahan bobot badan, dan meningkatkan pendapatan peternak pada usaha ternak sapi persilangan Limousin pasca terjangkit PMK sehingga dapat digunakan sebagai salah satu langkah alternatif dalam mengatasi kerugian pasca PMK serta membantu peternak memaksimalkan keuntungan.

INTRODUCTION

Beef cattle are one of the livestock commodities with a high population in Indonesia, reaching 18,610,148 heads in 2023, with East Java province contributing 5,070,240 heads (BPS, 2022). Beef cattle are specifically raised and fattened for their meat due to their characteristics, such as fast growth rates and relatively good meat quality (Isyanto and Sudrajat, 2019). One of the cattle breeds widely cultivated in Indonesia is the crossbred Limousin, as it has a larger body size compared to local cattle and a higher market-value quality (Widiarso and Teguh, 2013).

Beef cattle have a weakness as they are susceptible to disease, especially those caused by viruses (Adjid, 2020). One viral disease that can affect beef cattle is foot and mouth disease (FMD). FMD is a highly contagious animal disease and one of the most feared by countries worldwide. This disease can spread very quickly, even across national borders, and can cause significant economic losses due to decreased production and barriers to the trade of livestock and their products. FMD is an acute viral infectious disease, mainly affecting cloven-hoofed animals. This disease is characterized by the formation of vesicles or blisters and erosions in the mouth, tongue, gums, hypersalivation, udder/teats, and the skin around the hooves, which can even lead to hoof detachment. Symptoms of FMD in beef cattle, stated by Lestari, Rahardja, Sirajuddin, Yuliati, Nurlaelah, Saadah, & Abdullahi (2024) including weight loss and increased time spent lying down, while in dairy cattle, it causes a decrease in milk production. Other names for this disease include foot and mouth disease (FMD), aphthae epizootica (AE), and aphthous fever (Jamal and Belsham, 2013).

Efforts to address the issue of economic losses include preventing the spread of the FMD virus through vaccination, restricting livestock movement, implementing proper sanitation and biosecurity measures, providing nutrition according to the livestock's needs to boost immunity, as well as recovery and maintaining production performance in cattle by administering feed additives. Some of the feed additives that can be used are agromix booster and immunobooster concentrate. The agronomic booster feed additive and immunobooster concentrate contain balanced nutrients and can improve feed consumption efficiency. A balanced nutritional content in feed positively impacts digestive organ health, enhances the immune system, and increases digestive enzyme secretion, thereby improving digestibility (Gading, Agus, Irawan, & Panjono, 2020). According to Anam, Agus, Yusiati, Hanim, Astuti, Bintara, & Anas, (2021), the addition of feed additives can also improve feed quality, which stimulates growth and production in cattle.

Based on the issues described, a study was conducted on the effect of adding super booster and immunobooster concentrate to feed on production performance (feed consumption and weight gain) and the income of male crossbred Limousin cattle farmers following an outbreak of FMD.

MATERIALS AND METHODS

This research was experimental, and it used beef cattle from Limousin who were 1.5–2 years old and diagnosed with foot and mouth disease (FMD). The research material used was grass, brand local concentrates Jabfeed, 40 g super booster, and 800 g of immunobooster concentrates (Sumartono, Sri, Widya, Anam, & Imam, 2023). The research was conducted for 42 days and implemented in the CV Nanik Jaya Farsm, Sidoarjo Regency.

Eighteen Limousin cattle in this research were divided into three groups treatment by each group consisting of six Limousin cattle. The control group (T0) was given standard feed in the form of grass and brand local concentrates Jabfeed. The treatment group (T1) was given standard feed and 40 g/tail/day super booster with details (20 g/tail/day in the morning and 20 g/tail/day in the afternoon) given by mixing it into the feed and without changing the default concentrate (Sumartono et al., 2023). The treatment group (T2) was given standard feed and 800 g/tail/day immunobooster concentrates in the afternoon and mixed into local concentrates by Jabfeed.

Data collection on feed consumption was conducted daily for 42 days. Each day, before the cattle were fed in the morning, the leftover feed from the previous day was gathered and weighed. Feed consumption was calculated using methods such as those used by Rahmawati, Ertika, Didik, Muladno, & Afton (2019) by subtracting the amount of uneaten feed (feed leftovers) from the total feed provided during the study and then dividing it by

the number of maintenance days. Data on body weight gain were obtained by weighing the cattle before and after the study calculated using the Hynd (2019) formula, conducted in the morning before feeding. Financial and business analysis data were collected through direct observation at the research site and interviews with the resource person, in this case, the owner of CV Nanik Jaya Farm. The data collected includes fixed cost, variable costs, total revenue, and total income so that the break-even point (BEP) and R/C Ratio can be calculated to find out how much profit is obtained and the extent to which the livestock business being run is feasible (Murti, Setyowati, & Karamina, 2021).

The data obtained during the study were tabulated using Microsoft Excel and then statistically analyzed using Analysis of variance (ANOVA) based on the Completely randomized design (CRD) method with the SPSS program. If the results showed significant or highly significant differences between treatments, Duncan's multiple range test (DMRT) was performed to conclude (Sudarwati, Natsir, & Nurgiartiningsih, 2019).

RESULTS AND DISCUSSION

Feed Consumption

Feed consumption is the most important indicator used to evaluate livestock feed utilization. Additionally, Rahmawati et al. (2019) stated that feed consumption is related to meeting the requirements for both maintenance and production. The average feed consumption results in this study can be seen in Table 1.

Based on Table 1, it is evident that adding of super booster and immunobooster concentrate to the feed had a significant effect (P<0.05) on the feed consumption of male crossbred Limousin cattle post-FMD. This effect is likely due to adding of super booster and immunobooster concentrate in the feed. The agronomic booster feed additive and immunobooster concentrate contain balanced nutrients that can affect feed consumption efficiency. Feed consumption was higher in T1 and T2 compared to T0. A balanced nutrient content in the feed positively affects the health of digestive organs, enhances the immune system, and increases the secretion of digestive enzymes, thereby improving digestibility (Gading et al., 2020).

Table 1. Feed consumption of crossbred limousin cattle post-FMD given super booster and immunobooster concentrate (g/day)

Treatment	Feed consumption (g/day)
T0	19,733.67 ± 34.92[a]
T1	26,429.17 ± 5,163.65[b]
T2	24,797.50 ± 5,492.77[ab]

[abc]Different superscripts in the same column indicate significant differences (P<0.05)

Super booster consists of macro and micro minerals as well as multivitamins, including Ca (calcium), P (phosphorus), K (potassium), Mg (magnesium), Na (sodium), S (sulfur), Fe (iron), Zn (zinc), Cu (copper), Se (selenium), Co (cobalt), and essential oils derived from herbal plants. These vitamins can enhance the immune system and appetite, play a role in blood and tissue formation, and regulate livestock metabolism (Angraini, 2014). Essential oils are reported to have antioxidant functions and help balance the condition of the digestive tract, which improves feed digestion and nutrient absorption, resulting in better livestock growth (Froehlich, Abdelsalam, Chase, Koppien-Fox, & Casper, 2017). The addition of immunobooster concentrate, composed of ingredients such as corn kernels, corn gluten meal (CGM), pollard, soybean meal (SBM), and wheat flour, can improve rumen microbial performance, particularly with the mineral Zn. Feed with high nutrient content positively affects feed degradation due to an increase in rumen microbial populations, which is driven by higher protein content in the feed as a nitrogen source for microbial growth. This, ultimately, results in higher body weight gain (Chuzaemi, Huda, & Ardiansyah, 2021).

The average daily feed consumption of crossbred Limousin cattle post-FMD in treatment T0 is 19,733.67 g, in T1 it is 26,429.17 g, and in T2 it is 24,797.5 g (Table 1). The variation in feed consumption values occurred due to several factors, such as the quality of the feed provided, the condition and type of the livestock, and management practices (feed management, environmental management, pen density, feed and water availability, and disease control) (Rachma, Sri, Miyayu & Setiawan, 2020).

Body Weight Gain (BWG)

The statistical analysis showed a significant difference (P<0.05) among treatments regarding

of body weight gain in cattle. The average body weight gain of crossbred Limousin cattle post-FMD can be seen in Table 2.

Table 2. Body weight gain of crossbred limousin cattle post-FMD given super booster and immunobooster concentrate (kg)

Treatment	Body weight gain (kg)
T0	23.33 ± 14.034[a]
T1	37.83 ± 5.577[b]
T2	59.08 ± 7.92[c]

[abc]Different superscripts in the same column indicate significant differences (P<0.05)

The addition of 600 g of immunobooster concentrate in the T2 feed showed the best response resulting in the highest body weight gain (BWG). The high BWG in T2 is likely due to practical microbial protein synthesis in the rumen, facilitated by the easily digestible carbohydrate source from the immunobooster concentrate, which enhances productivity. Rapid livestock growth requires a higher protein content in the diet. This is consistent with the statement of Fitasari, Reo, & Niswi (2016) who stated that high protein consumption is followed by high protein retention, and body weight gain will occur if the energy in the ratio is sufficient. The body requires protein to repair and replace damaged cells and production. Protein is obtained from feed ingredients derived from plants and grains (Chuzaemi et al., 2021). Meanwhile, Yakin, Nono, & Ristianto (2012) stated that protein deficiency in cattle can inhibit growth because protein plays a role in repairing tissues, promoting the growth of new tissues, metabolism, energy sources, antibody formation, enzymes, and hormones.

The treatment T0 resulted in the lowest body weight gain (BWG) compared to the other two treatments, at 23.333 kg. The low BWG in P0 could be affected by feeding without adding minerals, which may affect body weight due to the lack of extra nutrients. The low BWG in control treatment happened because of mineral deficiencies in the cattle, which caused disruptions in enzyme function, leading to weight loss. This aligns with the research by Khalil and Zaitun (2019), who stated that nutritional needs, including minerals, play an important role in the physiological processes of livestock nutrition related to health, growth, and reproduction. Therefore, complete nutritional needs are essential for livestock, especially to improve production performance.

Financial Analysis and Business Analysis

The financial and business analysis indicators used in this study are the break-even point (BEP) and return cost ratio (R/C ratio) to determine the feasibility and success of a livestock business. The BEP and R/C ratio was obtained through cost analysis, which included variable costs, total variable costs, revenue, and profit. The financial and business analysis results provided the average variable costs, total variable costs, revenue, profit, BEP, and R/C ratio, as shown in Table 3.

The production costs include fixed and variable costs calculated per period (42 days). Fixed costs consist of the following: depreciation of the barn amounting to IDR 207,123; depreciation of equipment amounting to IDR 103,562; property tax amounting to IDR 28,767; electricity costs amounting to IDR 700,000; water costs amounting to IDR 150,000; labor costs amounting to IDR 3,780,000; and operational and transportation costs amounting to IDR 500,000. The total fixed costs over 42 days amounted to IDR

Table 3. Body weight gain of crossbred limousin cattle post-FMD given super booster and immunobooster concentrate (kg)

	Treatment		
	T0	T1	T2
Total variabel cost (Rp)	6,649,185.70 ± 263.71[a]	6,715,044.83 ± 39,036.83[b]	7,906,744.98 ± 41,525.83[c]
Revenue (Rp)	10,304,166.67 ± 1,169,659.85[a]	16,650,000.00 ± 3,382,676.46[b]	17,079,166.67 ± 2,710,692.56[b]
Profit (Rp)	3,351,122.52a ± 1,169,547.00[a]	9,631,096.72 ± 3,351,151.87[b]	8,868,563.24 ± 2,680,820.06[b]
BEP unit (kg)	17.99 ± 3.31[b]	10.62 ± 1.63[a]	11.63 ± 1.35[a]
BEP price (Rp)	899,695.03 ± 165,682.089[b]	531,102.11 ± 81,486.879[a]	581,733.58 ± 67,279.108[a]
R/C ratio	1.48 ± 0.1682[a]	2.37 ± 0.4720[b]	2.08 ± 0.3220[b]

[abc]Different superscripts in the same row indicate significant differences (P<0.05)

5,469,452. The variable costs include livestock feed and additional mineral costs incurred during the 42 days. The total usage of super booster (0.24 kg) and immunobooster concentrate (3.6 kg) for treatments T1 and T2 affected the variable costs, requiring different calculations for each treatment. This is consistent with Haloho, Fauzul, & Natalia (2021), who stated that the most significant production costs in livestock businesses are feed, artificial insemination, and labor. The average total variable costs incurred during the study for each treatment were T0 IDR 6,649,185 per head, T1 IDR 6,715,044 per head, and T2 IDR 7,906,744 per head.

The revenue in the crossbred Limousin cattle farming business depends on the weight and the selling price at the time of sale. The selling price of cattle is IDR 50,000 per kilogram of body weight per head, following the market price around the farm. The average total revenue from cattle sales was the lowest in treatment T0, amounting to IDR 10,304,166, and the highest in treatment T2, amounting to IDR 17,079,166, while T1 was IDR 16,650,000. The ANOVA analysis of the average revenue showed significant differences between T1 and T2 compared to T0 ($P<0.05$), indicating that T1 and T2 experienced significantly higher profits than T0.

The average income earned by farmers for each treatment was as follows: T0 had the lowest value at IDR 3,351,122; T2 had IDR 8,868,563; while T1 had the highest value at IDR 9,631,096. The higher income for farmers in T1 and T2 occurred due to the addition of super booster and immunobooster concentrate in the feed, which allowed the livestock to absorb nutrients effectively, leading to higher weight gain and ultimately maximizing the farmers' income.

The feasibility of a livestock business can be determined using BEP (break-even point) analysis. Murti et al. (2021) state that BEP is a situation where a business neither makes a profit nor incurs a loss. A business is considered break-even when the total revenue equals the total costs, meaning that the contribution margin can only cover the costs. From the BEP value, one can determine at what level of production and price a livestock business neither generates a profit nor experiences a loss. The highest average BEP price value was found in T0 at IDR 899,695.03/head, T2 at IDR 581,733.58/head, and T1 at IDR 531,102.11/head (Table 3). The high BEP price value in treatment T0 indicates that the production costs in the maintenance of crossbred Limousin cattle during the study were not optimal, resulting in less-than-optimal weight gain. In contrast, treatments T1 and T2 showed lower BEP price values because the increase in variable costs was followed by maximum production results, thus reducing the BEP price. The BEP price range in this study is lower than the selling price by the farmers, indicating that the farmers are making a profit because they can sell at a price higher than the BEP price.

The BEP unit analysis results show different values for each treatment. The highest BEP unit value was found in T0 at 17.99 kg, followed by T1 at 10.62 kg and T2 at 11.63 kg. This means that the crossbred Limousin cattle farming business post-FMD at CV Nanik Jaya Farm reaches the break-even point when maintaining more than 14 cattle, so if CV Nanik Jaya Farm only keeps 13 cows or less, it will not make a profit or will incur a loss. During the study, 18 cattle were maintained, indicating that the BEP value was already met at CV Nanik Jaya Farm.

The success of the crossbred Limousin cattle farming business post-FMD can be assessed using the R/C ratio analysis to determine the efficiency of the business. The R/C ratio (revenue cost ratio) is obtained by comparing total revenue with all costs incurred in the production process. The highest efficiency, indicated by the R/C ratio, was found in treatment T1 at 2.37, followed by T2 at 2.08, and lastly, T0 at 1.48. This shows that the addition of feed supplements such as super booster and immunobooster concentrate is worthwhile, as it proves beneficial for farmers, demonstrated by the high R/C ratio values in T1 and T2. An R/C ratio of 2.37 indicates that for every IDR 200,000 spent on feed costs, the revenue generated would be IDR 237,000. This situation aligns with research by Hanum, Miswar, & Utari (2021) that a business with an R/C >1 means the income received is greater than the costs incurred and the more efficient the livestock business, it is feasible and continues to be developed.

CONCLUSIONS

The addition of super booster and immunobooster can increase feed consumption and weight gain, as well as improve the income of crossbred Limousin cattle farmers post- foot and mouth disease (FMD). Overall, the addition

of super boosters showed the best results in production performance and farmer income because the maximum increase in body weight resulted in high profits based on the R/C ratio and BEP calculation.

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