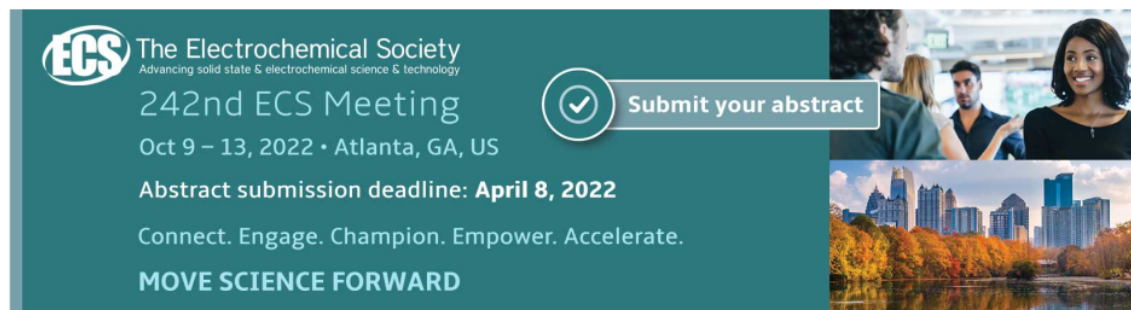# ARTIKEL ADISTI RASTOSARI IOP

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# Potential of Beef Cattle Breeding by Output Value-Based in Bayang Utara District, Pesisir Selatan Regency, West Sumatera

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# Potential of Beef Cattle Breeding by Output Value-Based in Bayang Utara District, Pesisir Selatan Regency, West Sumatera

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**Abstract**. This study aimed to determine the potential of beef cattle breeding in Bayang Utara District, Pesisir Selatan Regency, West Sumatera. The material in this study included 135 farmers as respondents and 256 beef cattle. This research was descriptive-analytic using survey method with census data collection technique. The data obtained were analyzed descriptively. The results showed the natural increase (NI) of beef cattle as a whole was 13.28% with the NI value of each breed of beef cattle were 50.00%, 19.23%, 16.67%, 13.01%, and 9.27% for Limousin Crossbred cattle, PO cattle, Brahman Cross cattle, Simmental Crossbred cattle, and Pesisir cattle, respectively. The net replacement rate (NRR) of male and female cattle is 75.18% and 174.76%, respectively. The estimated output of beef cattle was 13.28% of the population consisting of the remaining replacement male -1.39% and female 3.88% as well as 5.6% male and 5.19% rejected cattle with the output value of each breed beef cattle were 50.00% or 1 head for Limousin Crossbred, 16.67% or 5 heads for Brahman Cross cattle, 19.23% or 5 heads for PO cattle, 13.00% or 16 heads for Simmental Crossbred and 9.27% or 7 heads for Pesisir cattle. The estimated output value of beef cattle as a whole where beef cattle can be removed was 13.28% or 34 heads. The estimated value of livestock output could be used to consider the potential development of livestock breeding in an area so that there is a sustainable breeding program.

*Keywords: Beef cattle, Breeding potential, Natural increase, Net Replacement Rate, Output value*

## 1. Introduction

Pesisir Selatan Regency is a part of West Sumatra Province. Based on its geographical location, Pesisir Selatan Regency is located on the West Coast of Sumatera Island which consists of 15 sub-districts. The area of Pesisir Selatan Regency is 5749.89 km$^2$ or about 13.69% of the total area of West Sumatra Province (42,012.89 km$^2$). Based on its topography, Pesisir Selatan Regency has areas directly adjacent to the coastline/sea, areas located on slopes/ridges or mountains, watershed areas, and flat/flat areas [1]. The livestock population in Pesisir Selatan Regency includes beef cattle, horses, buffalo, goats, and poultry. The population of beef cattle in this district is quite large with the highest population in Lengayang District and the lowest population in District IV Nagari Bayang Utara.

Based on land use, District IV Nagari Bayang Utara has been widely used for agricultural land, amounting to 45.20% of the area consisting of 2.94% of rice fields and 39.22% of non-rice fields. Meanwhile, non-agricultural land was recorded at 57.84% of the total area. The types of livestock population developed in Subdistrict IV Nagari Bayang Utara consist of large livestock, small livestock, and poultry. Types of large livestock consist of beef cattle, small livestock consists of goats, while poultry consists of native chickens and ducks.

The potential of cattle farming is more or less influenced by the breeder who manages it. The productivity of the cattle raised is influenced by the educational background of the breeder, the type of livelihood, the experience of raising livestock, the purpose and motivation of maintenance, and the area of agricultural land owned by the farmer. The breed of livestock chosen by the breeder is influenced by the condition of the breeder so that each observation area has a different national composition, population structure, livestock composition and number of livestock ownership [2]. One effort to increase the population is to improve the reproductive performance of livestock [17].

Output or the ability of a region to produce beef cattle, is the number of remaining substitute young cattle plus rejected adult cattle. The rest of the young cattle is the difference between the natural increase and the need for replacement livestock. Natural increase is the difference between births and deaths, therefore livestock breeding theory is used in estimating beef cattle output from an area based on the nature of its production and reproduction [10].

Estimated output is important to note to avoid the extinction of a type of livestock in an area. Expenditure on the number of cattle or output from an area can determine the productivity of beef cattle from that area. Output estimation can determine the breeding pattern of livestock in an area where output is strongly influenced by the natural increase (NI) [3]. According to [3], the effect of the natural increase on the amount of output is because the output value is calculated based on the difference between the natural increase and the need for substitute livestock for one year.

## 2. Methods

This research was carried out in IV Nagari Bayang Utara Sub-District, Pesisir Selatan District, West Sumatera Province from April 2nd to May 8th,2021. The material in this research was all beef cattle spread in IV Nagari Bayang Utara Sub-District, Pesisir Selatan District with farmers as respondents as many as 135 farmers with a total of 256 beef cattle. The tools used in this research are stationery, questionnaires, calculators, and cameras.

This research was descriptive-analytics used survey methods with census data collection techniques. Data taken included primary and secondary data. Primary data was taken by direct interviews with respondents, while secondary data was taken from the Department of Agriculture and Livestock in Pesisir Selatan District. The primary data taken include the identity of the farmer and the data of cattle.

The data on the identity of the farmer includes the age of the farmer, the length of experience of the livestock, the level of education, maintenance purpose, and the maintenance system carried out. The beef cattle data taken included the length of broodstock and males used in breeding, births, deaths, number of beef cattle ownership, and the number of beef cattle surveyed. Secondary data collected included population, income, expenditure, and withholding data from the Department of Agriculture and Livestock in Pesisir Selatan District.

Estimated NI, NRR, and output value are carried out based on the theoretical approach of livestock breeding by recommendations of [5] and [6] as follows:

$$\text{Male replacement needs (\%)} = \frac{\left(\frac{\text{number of adult male cattle}}{\text{population}}\right)}{\text{The length of time the use of bulls (years)}} \times 100\%$$

$$\text{Female replacement needs (\%)} = \frac{\left(\dfrac{\text{number of adult female cattle}}{\text{population}}\right)}{\text{The length of time the use of cows (years)}} \times 100\%$$

$$\text{Birth percentage (\%)} = \frac{\text{Number of calves (heads)}}{\text{population (heads)}} \times 100\%$$

$$\text{Death percentage (\%)} = \frac{\text{Number of dead beef cattle (heads)}}{\text{population (heads)}} \times 100\%$$

$$\text{Natural Increase (NI) (\%)} = \text{Birth percentage (\%)} - \text{Death percentage (\%)}$$

$$NI_{Male}\ (\%) = \frac{\text{Number of male calves (heads)}}{\text{Total number of calves (heads)}} \times NI\%$$

$$NI_{Female}\ (\%) = \frac{\text{Number of female calves (heads)}}{\text{Total number of calves (heads)}} \times NI\%$$

$$NRR_{Male}\ (\%) = \frac{NI_{Male}\text{(heads)}}{\text{Male replacement needs (heads)}} \times NI\%$$

$$NRR_{Female}\ (\%) = \frac{NI_{Female}\text{(heads)}}{\text{Female replacement needs (heads)}} \times NI\%$$

where the remaining amount of male replacement (%) = NI male (%) – Male replacement needs (%),
the remaining amount of female *replacement* (%) = NI female (%) – Female replacement needs (%),
culled male (%) = Male replacement needs (%),
culled female (%) = Female replacement needs (%),
output value = the remaining amount of male replacement (%) + the remaining amount of female replacement (%) + culled male (%) + culled female (%).

## 3. Result and Discussion

3.1 Natural Increase Value
The natural increase (NI) value was calculated to determine the rise and fell of the livestock population in an area. Natural Increase was the difference between the birth rate and the death rate in a certain area and time which is usually measured in one year [6]. The NI value of beef cattle in District IV Nagari Bayang Utara, Pesisir Selatan Regency in 2020 could be seen in Table 1.

Table 1 shows the average value of Natural Increase for beef cattle in District IV Nagari Bayang Utara is 13.28%. The mean value of NI in this study is lower than that of [7] in Pesisir Selatan Regency, which is 29.46%, [8] in Bayang District by 17.64, [9] in Benai District by 15.45%, [10] in Banyuasin Regency by 24.39%, and [11] in Klaten Regency by 25.7%. The level of natural increase is influenced by the magnitude of the birth rate.

The NI of each breed of beef cattle are Limousin cattle 50.00%, PO cattle 19.23%, Brahman Cross cattle 16.67%, Simmental Crossbreed cattle 13.01%, and Pesisir cattle 9.27%. The NI value of Limousin cattle is the highest compared to other cattle breeds. This is because the population of limousine cattle is less and the birth rate is higher than other breeds of cattle, while the NI for Bali cattle is 0% because there will be no births in 2020.

Table 1. The Natural Increase Value of Beef Cattle in Bayang Utara District, Pesisir Selatan Regency, West Sumatera

| No | Variable | Cattle Breed | | | | | | All Breed |
|---|---|---|---|---|---|---|---|---|
| | | Simmental Crossbred | Pesisir | Bali | PO | Brahman Cross | Limousin Crossbred | |
| 1 | Total Population (heads) | 123.00 | 72.00 | 3.00 | 26.00 | 30.00 | 2.00 | 256.00 |
| 2 | Population (%) | 48.05 | 28.13 | 1.17 | 10.16 | 11.72 | 0.78 | 100.00 |
| 3 | Cow Population (heads) | 31.00 | 26.00 | 2.00 | 11.00 | 12.00 | 0.00 | 82.00 |
| 4 | Cow Percentage | 25.20 | 36.11 | 66.67 | 42.31 | 40.00 | 0.00 | 32.03 |
| 5 | Total birth number (heads) | 18.00 | 10.00 | 0.00 | 5.00 | 5.00 | 1.00 | 39.00 |
| 6 | Birth Percentage | 14.63 | 13.89 | 0.00 | 19.23 | 16.67 | 50.00 | 15.23 |
| 7 | Total number of death/year (heads) | 2.00 | 3.00 | 0.00 | 0.00 | 0.00 | 0.00 | 5.00 |
| 8 | Death Percentage (%) | 1.63 | 4.17 | 0.00 | 0.00 | 0.00 | 0.00 | 1.95 |
| 9 | Natural Increase (%) | 13.01 | 9.72 | 0.00 | 19.23 | 16.67 | 50.00 | 13.28 |

3.2 Net Replacement Rate

The value of the net replacement rate (NRR) was the ratio of the number of young cattle that were potential replacements to the need for replacement livestock per year multiplied by 100%. The NRR value was used to determine whether the number of livestock could cover the need for replacement livestock so that the population remains constant [12]. The need for substitute livestock is fulfilled if the NRR value is >100%, on the other hand, the need for replacement livestock was not met if the NRR is < 100% [13]. The net replacement rate (NRR) of beef cattle in District IV Nagari Bayang Utara in 2020 is shown in Table 2.

Table 2 shows the net replacement rate (NRR) of each breed of male and female beef cattle in this study, namely 61.30% and 179.29% Simmental Crossbreed cattle, 80.09% and 143.80% Pesisir cattle, 83%, 38%, and 227.38% Ongole Peranakan cattle and 150.00% and 200.00% Brahman Cross cattle, respectively. The NRR value of all breeds of male beef cattle is 75.18% and female is 174.76%. The NRR value of bulls obtained is less than 100%, which means that District IV Nagari Bayang Utara lacks male substitute livestock. The value of female NRR is much higher than male NRR because breeders tend to sell male cattle to meet urgent needs or deliberately sell them during Eid al-Adha. Sales of male livestock are higher than female livestock because female livestock is reared to produce offspring and are bred.

The NRR value in this study was lower than the NRR value in the study of [8], namely 1307.79% in males and 674.34% in females, research by [10] namely 143.26% in males and 220.15% in females. The female NRR value in this study was higher than that of [7] which is 121.03% and the male NRR value is higher than this study, which is 87.68%.

Table 2. The net replacement rate of beef cattle in Bayang Utara District, Pesisir Selatan Regency, West Sumatera

| No | Variable (%) | Simmental Crossbred | Pesisir | Bali | PO | Brahman Cross | Limousin Crossbred | All Breed |
|----|----|----|----|----|----|----|----|----|
| 1 | Male Replacement | | | | | | | |
| | Place | 8.94 | 2.31 | 0.00 | 3.85 | 2.22 | 0.00 | 5.60 |
| | Availability | 5.48 | 1.85 | 0.00 | 3.21 | 3.33 | 50.00 | 4.21 |
| | NRR | 61.30 | 80.09 | 0.00 | 83.38 | 150.00 | 0.00 | 75.18 |
| 2 | Female Replacement | | | | | | | |
| | Place | 4.20 | 5.16 | 11.11 | 7.05 | 6.67 | 0.00 | 5.19 |
| | Availability | 7.53 | 7.42 | 0.00 | 16.03 | 13.34 | 0.00 | 9.07 |
| | NRR | 179.29 | 143.80 | 0.00 | 227.38 | 200.00 | 0.00 | 174.76 |

### 3.3 Output Value

The number of livestock that can be removed to be sent or slaughtered from a certain area without disturbing the balance of the livestock population is called output [5]. The amount of output is influenced by the number of remaining substitute livestock. The rest of the replacement livestock is the availability of substitute livestock minus the need for replacement livestock [14]. The estimated output is obtained from the analysis of each population by calculating the number of livestock removed and the remaining number of replacement livestock [15]. The output of beef cattle in District IV Nagari Bayang Utara, Pesisir Selatan Regency in 2020 is shown in Table 3.

Table 3. The Details of Beef Cattle Breeding Potential based on output value in Bayang Utara District, Pesisir Selatan Regency, West Sumatera

| No | Variable (%) | | Simmental Crossbred | Pesisir | Bali | PO | Brahman Cross | Limousin Crossbred | All Breed |
|----|----|----|----|----|----|----|----|----|----|
| 1 | Culled Cattle | | | | | | | | |
| | a. Male | (%) | 8.94 | 2.31 | 0.00 | 3.85 | 2.22 | 0.00 | 5.60 |
| | | (heads) | 11.00 | 2.00 | 0.00 | 1.00 | 1.00 | 0.00 | 14.00 |
| | b. Female | (%) | 4.20 | 5.16 | 11.11 | 7.05 | 6.67 | 0.00 | 5.19 |
| | | (heads) | 5.00 | 4.00 | 0.00 | 2.00 | 2.00 | 0.00 | 13.00 |
| 2 | *Replacement Remain* (%) | | | | | | | | |
| | a. Male | (%) | -3.47 | -0.46 | 0.00 | -0.64 | 1.11 | 50.00 | -1.39 |
| | | (heads) | -4.00 | 0.00 | 0.00 | -1.00 | 0.00 | 1.00 | -4.00 |
| | b. Female | (%) | 3.33 | 2.26 | -11.11 | 8.97 | 6.67 | 0.00 | 3.88 |
| | | (heads) | 4.00 | 4.00 | -1.00 | 1.00 | 1.00 | 0.00 | 10.00 |
| 3 | Total | (%) | 13.00 | 9.27 | 0.00 | 19.23 | 16.67 | 50.00 | 13.28 |
| | output | (heads) | 16.00 | 7.00 | 0.00 | 500 | 5.00 | 1.00 | 34.00 |

Based on the research, District IV Nagari Bayang Utara, Pesisir Selatan Regency can produce male and female cattle of each breed of beef cattle as much as 50.00% or 1 Limousin cattle, 16.67% or 5 Brahman Cross cattle, 19.23% or 5 PO cattle, 13.00% or 16 Simmental Crossbreeds and 9.27% or 7 Pesisir cattle. The estimated total beef cattle output that can be issued is 13.28% or 34 heads. The output value obtained in this research area was equivalent to its NI value. [16] stated, if the value of livestock output was higher than the NI value, then population depletion had occurred, whereas if the livestock output value was lower

than the NI value, there will be an increase in population. Estimation of livestock output can be used in making considerations on livestock management that is carried out [5].

The results showed that the remaining replacements for Simmental Peranakan bulls were -3.47%, Pesisir cattle -0.46%, and PO cattle -0.64%. This was because the livestock population was small and farmers tended to sell young bulls. Following the opinion of [7], the tendency of farmers to sell cows under the age of 2 years causes the residual replacement value to be negative.

## 4. CONCLUSION

Based on the results of the study, it could be concluded that the Bayang Utara District has the potential as a beef cattle breeding area. The estimated output value of beef cattle as a whole where beef cattle can be removed was 13.28% or 34 heads. The estimated value of livestock output could be used to consider the potential development of livestock breeding in an area so that there is a sustainable breeding program.

## ACKNOWLEDGEMENTS

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