Morphometric Characteristics and Reproductive Performance of Pasundan Cattle in the North Prianganese and Southern South Coast Region

Mas Yedi Sumaryadi¹ Euis Nia Setiawati²* Agus Triyanto² Vony Armelia¹

1. Faculty of Animal Science, Jenderal Soedirman University, Grendeng, Purwokerto, Central Java, Indonesia
2. Cinagara Animal Health Training Center, Snakma Pasir Buncir Village, Caringin District, Bogor Regency, West Java, Indonesia

ARTICLE INFO

ABSTRACT

This study aims to determine the morphometric characteristics and reproductive performance of Pasundan cows which are extensively reared on smallholder farms in the coastal areas of the south (Garut, Cianjur, and Sukabumi) and North Priangan (Bogor, Purwakarta, and Sumedang). This research is descriptive research with a qualitative approach. Production characterization was carried out using a simple method, namely by measuring the body surface including shoulder height, chest circumference, body length, and bodyweight of Pasundan cattle. Meanwhile, the reproductive characteristics discuss puberty, service per conception (S/C), conception rate (CR), calving rate, postpartum estrus, postpartum mating, days open (DO), calving interval (CI), calving birth weight, calving rate, and calves weight growth. Data were collected by survey, and the location was determined by purposive sampling in the area of the seed source with the largest population and the random sampling of livestock was determined purposively as many as 30 Pasundan cows from each region. Data were analyzed using quantitative descriptive analysis. The results showed that the morphometric characteristics of Pasundan cattle included mean shoulder height of 123.0 ± 3.06 cm VS 121.34 ± 2.82 cm in males and 110.34 ± 2.78 cm VS 108.00 ± 2.14 cm in females. Body length 115.74 ± 3.30 cm VS 115.34 ± 2.97 cm in males and 112.67 ± 2.97 cm VS 109.67 ± 1.82 cm in females. Chest circumference 145.67 ± 2.97 cm VS 142.67 ± 2.67 cm in bulls and 136.00 ± 2.95 cm VS 131.00 ± 2.92 cm in females. Bodyweight 268.0 ± 17.00 kg VS 246.00 ± 7.00 kg in males and 215.0 ± 15.00 kg VS 194.00 ± 54.00 kg in females. As for reproductive characteristics, it shows puberty of 20-24 months., S/C 1.4 - 1.6, Conception rate 65-70%, calving rate 62.5-65%, Postpartum Estrus 50-60 days, postpartum mating 72-104 days, day-open 94-126 days and a calving interval of 12-14 months. Calves' birth weight was 18.0 - 18.5 kg and daily body weight gain ranged from 0.48 to 0.50 kg. It was concluded that the morphometric characteristics and reproductive performance of Pasundan cattle in the Pesisir Selatan area were better than North Priangan.

Keywords:
Pasundan cattle
Morphometric characteristics
Reproductive performance

*Corresponding Author:
Euis Nia Setiawati,
Cinagara Animal Health Training Center, Snakma Pasir Buncir Village, Caringin District, Bogor Regency, West Java, Indonesia;
E-mail: e.niasetiawati@gmail.com
1. Introduction

Pasundan cattle are one of Indonesia’s germplasm and are the result of adaptation of more than ten generations between Bos sondaicus / banteng / Bali cows with Japanese cows, Madurese cattle and Sumba Ongole cows. The original distribution of Pasundan cattle is found in West Java Province including Pangandaran, Tasikmalaya, Garut, Cianjur, Sukabumi, Ciamis, Kuningan, Majalengka, Sumedang, Indramayu and Purwakarta districts, and is one of the potential new plasma to be developed.

Pasundan cattle are divided into two, namely the results of inbreeding Bali cattle to form non “gelambir” Pasundan cows, and the results of inbreeding PO cows to form sagged pasundan cows [1], while Indrijani et al. stated that Pasundan cattle have two types, namely Pasundan cow type gong/hump and not gongo / hump. Genetically, Pasundan cows come from interbreeding cows that are different from Bali and PO cows [2]. Then the offspring occur inbreeding for ten offspring resulting in small body size. Pasundan cattle have small bodies, are resistant to tropical diseases, and can withstand extreme environmental changes including those with low-quality feed [3]. Pasundan cattle morphometric characteristics include body size with a shoulder height average of 115 cm in males and 109 cm in females. The average body length of the bulls is 120 cm and 110 cm for the females. The average male cow’s chest circumference is 150 cm and 138 cm in females [4].

Conditions in the field still have several problems in terms of genetic resources, breeding, management, production, and diversity of Pasundan cattle such as diversity of body size of Pasundan cattle. Until now, scientific data for Pasundan cattle are still scarce and have not been documented in a unified whole, especially the morphometric characteristics and reproductive performance, therefore it is necessary to evaluate the morphometric characteristics and bodyweight considering that Pasundan cattle are a rich genetic resource of Indonesian local livestock which need to be developed, conserved and used sustainably as superior livestock that meets standardization. Morphometrics is a study that deals with variations and changes in livestock body size and is useful for identifying and describing livestock potential quantitatively [5].

The fact in the field of reproductive failure is one of the main factors that can cause a delay in estrus in Pasundan cattle, thus affecting the rate of the population development of Pasundan cattle. There are several indicators used to predict the suboptimal reproductive function of Pasundan cattle, including the low success of artificial insemination (IB), the high incidence of silent heat (calm estrus) in heifers Pasundan cattle [6]. Reproductive displays can be used to calculate cycle times for existing livestock breeding, and can also be used to estimate future livestock populations. The reproductive performances observed included age at first mating (Puberty), age at calf weaning, service per conception (S / C), age at first birth, and calving interval (CI). Postpartum estrus (PPE), postpartum mating (PPM), and days open (DO) [7].

Pasundan cattle productivity improvement can be done by increasing its efficiency, including by increasing the number of calving births, shortening the calving interval, extending the mother’s productive period, and optimizing mating management to prepare a sufficient number of feeders [8]. Many factors affect reproductive efficiency which includes external factors such as calf weaning management; quality of rations and limitations in the use of superior straws, altitude and internal factors such as cattle breeds and parent conditions [9]. Therefore, it is necessary to evaluate the morphometric and reproductive performance of cows as a selection of broodstock that will be used to produce feeder cows in the future.

Based on the background and existing problems, it is necessary to research with the aim of. Getting basic information about the genetic quality of livestock can be seen from the morphometric characteristics including shoulder height, body length, chest circumference, and bodyweight of female and male Pasundan cows aged 2 - 3 years and reproductive performance. The results of this study serve as a standard of selection and basic capital in the development of science on the formation of superior Pasundan cattle that are in the environmental and socio-cultural conditions of the community.

2. Material and Methods

The research was conducted with a survey method through direct observation and monitoring which was determined based on purposive random sampling. Respondents were determined purposively, namely following the research interests to gather information. The number of samples is determined by the conditions of the research area which can provide information and explain the research problem until it is satisfied so that the sample of respondents is limited by the target of information. Respondents consisted of: Pasundan cattle breeders (30 breeders/district), and formal figures that is 3 officers each from each district (Bogor District Animal Husbandry Service, Purwakarta District Animal Husbandry Service, Sumedang District Animal Husbandry Service, Sukabumi District Animal Husbandry Service, Cianjur District Animal Husbandry Service, and Garut District Animal Husbandry Service). Informant identity in terms of age (30-45 years),
informants who fall into the productive age group. At the productive age, physical strength is still good so that the response to taking action and efforts to increase knowledge and skills in receiving new information and technology to support livestock business and productivity is quite good (Wawan, A., dan Dewi. 2010.) [10]. Education (junior high school, high school and undergraduate), education can influence a person, including one’s behavior regarding life patterns. Irawati. 2017 [11] states that a good level of education has an important role in the productivity of the livestock business being carried out. Farming experience (between 10 years and 20 years). Generally the experience of farmers has a positive correlation with productivity (Irawati. 2017) [11]. This is included because it is thought to describe the general situation of breeders who are members of the Livestock Group.

This research is a descriptive research with a qualitative approach. The Cattle selected as samples were adult Pasundan (male and female) Cattle from the South Pesisir region (Garut, Cianjur and Sukabumi) and the North Priangan region (Bogor, Purwakarta, and Sumedang). The number of samples of Cattle from each place was 30 Cattle (male 15 head and female 15 head), 2-5 years old and not pregnant to avoid bias in measurement, based on simple random sampling of 30 heads (male 15 head and female 15 head), which is a method in which all sample members are considered to have the same characteristics, so that the Cattle taken can represent their population [12]. The equipment used to measure variables in Cattle is tape measure, measuring stick 200 cm high with an accuracy level of 0.1 cm; measuring tape in units (cm) with an accuracy level of 0.1 cm, laptop, stationery, and camera. Measurements of body surface parts are taken while the cattle are in a normal standing condition. Meanwhile, the evaluation of reproductive characteristics was carried out using a questionnaire equipped with a structured list of questions aimed at breeders and to obtain further information. An in-depth interview was carried out with several key informants. The variables observed were morphometric characteristics which included shoulder height, body length, chest circumference, and body weight of female Pasundan cows aged 2.0–5.0 years who were not pregnant. The reproductive characteristics observed included puberty age, service per conception, S / C), conception rate (CR), postpartum estrus calving rate, postpartum mating, days open (DO) and calving interval.

2.1 Morphometric Characteristics Analysis

a). The height of the shoulders is measured based on the distance from the flat surface to the top of the shoulder which passes perpendicular to the Scapulla, using a measuring stick.

b). Body length is measured based on the distance from the shoulder blade (tuberosity humeri) to the end of the sitting bone (Tuber ischii), using a measuring stick.

c). Chest circumference is measured by wrapping a measuring tape on the chest behind the shoulders.

d). Body weight is the actual body weight of Pasundan cattle which is measured by scales in kilograms or using a Rondo measuring tape. Measurement body is performed while the cow is standing straight on a flat plane (“parallelogram” livestock position). Bust is measured in cm taken by following the circle chest or body just behind the forelegs cattle using a Rondo measuring tape.

Data were analyzed on average (Mean) and explained descriptively, which aims to describe the facts and explain the object of research as well as to dig up the information needed by the reality as it is.

Average / Mean (X)

\[
\bar{x} = \frac{\sum x_i}{n}
\]

Information:

\( X = \text{Average} \)

\( \sum x = \text{Number of data values} \)

\( n = \text{Number of samples} \)

Then the data sizes were analyzed using correlation analysis system (SAS) 9.1.3

2.2 Reproductive Characteristics Analysis

a). Puberty age is the age at which a female Pasundan cow occurs for the first time in heat which is determined in months.

b). Service per conception is the number of matings that are carried out until pregnancy or the average number of inseminations required by a female cow until pregnancy occurs in units of times [13].

c). Conception rate is the number of Pasundan Cattle that are pregnant as a result of the 1st IB (first) divided by the number of cows that were bred times 100 in units of percent, which were diagnosed perrectal [14] or the number of Cattle that were pregnant at the first IB divided by the total number of broodstock that has been bred is then multiplied by one hundred.

d). The calving rate is the number of children born at the first IB divided by the number of Cattle in IB multiplied by one hundred percent within a certain period.

e). Post partum estrus is the length of time the Pasundan Cattle emerge after giving birth in days.

f). Post partum mating is the length of time Pasundan Cattle are bred again after giving birth in days.

g). Days open is the length of time from delivery to pregnancy again in days.
h). Calving interval (range of birth, CI) is the length of time from birth to next child in months.

3. Results and Discussions

3.1 Morphometric Description of Pasundan Cattle

Descriptive information on the morphometric characteristics of pasundan cattle can be used as a database for selection. Selection to improve the performance of cattle can be done through the selection of prospective elders or selection of prospective bulls or selection of prospective broodstock [15], based on morphometrics of body size and body weight. The morphometric performance (body size) of Pasundan cattle provides information on quantitative characteristics. The average live weight and body size are presented in Table 1.

The data in Table 1 show that Pasundan cattle in the Pesisir Selatan area have a higher body size than North Priangan with the following mean shoulder height 123.00 ± 3.06 cm VS 121.34 ± 2.82 a for males and 110.34 ± 2.78 vs 108.00 ± 2.14a in females. Body length 115.74 ± 3.30 cm VS 115.34 ± 2.97 cm in males and 112.67 ± 2.97cm VS 109.67 ± 1.82 cm in females. Chest circumference 145.67 ± 2.97 cm VS 142.67 ± 2.67 cm bulls and 136.00 ± 2.95 cm VS 131.00 ± 2.92 cm in females, Body weight 268.0 ± 17.00 kg VS 246.00 ± 7.00 kg for males and 215.0 ± 15.00 kg VS 194.00 ± 54.00 kg. The results of correlation analysis showed that Pasudan cattle in the Pesisir Selatan area were significantly different (< 0.05) better than Pasundan cattle in North Priangan. The difference in the body morphometric size of the Pasundan cattle is thought to be very much influenced by the place of life associated with the maintenance management which has two agroecosystems with different topographies. On the other hand, it is suspected that in some areas of the population base in North Priangan, there have been changes in land use and changes in forest cropping patterns which have caused Pasundan cattle to lose their carrying capacity for grazing, so that the availability of forage is decreasing. This condition is thought to be a factor triggering the decline in the appearance of Pasundan cattle on an ongoing basis. The conversion of agricultural land to residential, industrial, and shopping centers causes the availability of forage to decrease, especially for farms located around cities (urban areas) [16].

Poor nutrition will not only reduce performance below its genetic potential but also increase the negative impact on the environment. On the other hand, differences in body size are also caused by environment and genetics. There is a high level of diversity in livestock, so it is necessary to apply genetic quality improvement through precise and accurate selection [17]. Animal body size can be used as a selection standard to obtain livestock that has a larger size [18]. It is estimated that 70% of livestock

Table 1. Average Body Size of Pasundan Cows in North Priangan and Pesisir Selatan

| Variable          | Gender | Southern South Coast Region | North Priangan region | Regulation of the Minister of Agriculture Number 1051 / Kpts / SR.120 / 10/2014 |
|-------------------|--------|----------------------------|-----------------------|-----------------------------------------------------------------------------|
| Body length (Cm)  | ♀      | 112.67 ± 2.97 a            | 109.67 ± 1.82 b       | 109.74 ± 6.30 c                                                             |
|                   | ♂      | 115.74 ± 3.30 a            | 115.34 ± 2.97 b       | 115.74 ± 8.40 c                                                             |
| Shoulder height (Cm) | ♀      | 110.34 ± 2.78 a            | 108.00 ± 2.14 b       | 110.09 ± 9.68 c                                                             |
|                   | ♂      | 123.00 ± 3.06 a            | 121.34 ± 2.82 b       | 120.09 ± 9.80 c                                                             |
| Chest size (Cm)   | ♀      | 136.00 ± 2.95 a            | 131.00 ± 2.92 b       | 138.22 ± 11.85 c                                                            |
|                   | ♂      | 145.67 ± 2.97 a            | 142.67 ± 2.67 b       | 150.22 ± 11.76 c                                                            |
| Body weight (kg)  | ♀      | 215.0 ± 15.00 a            | 194.00 ± 54.00 b      | 220.30±22.00 c                                                              |
|                   | ♂      | 268.0 ± 17.00 a            | 246.00 ± 7.00 b       | 240.40 ±34.00 c                                                             |

a, b, c superskrip yang berbeda pada baris yang sama menunjukkan perbedaan yang nyata (P<0.05).
productivity is influenced by environmental factors, while 30% is influenced by genetic factors [19].

In general, the body size of Pasundan cattle in the North Priangan and South Coastal regions has the same relative body size as the criteria for Pasundan cattle in the excerpt of the Decree of the Minister of Agriculture of the Republic of Indonesia Number 1051 / Kpts / SR.120 /10/2014. Likewise, when compared with the data available in the West Java Provincial Animal Husbandry Office[4], it includes the average height of the male Pasundan cattle 115 cm and 109 cm in females, the body length of the bulls is 120 cm and the females are 110 cm, this shows that the same result.

The variation in body size of Pasundan cows, presumably due to the spread of Pasundan cattle in one land that is not separated and the traditional system of grazing is thought to be an opportunity for livestock migration to allow the opportunity for undirected mating. Production is a manifestation of the interaction between internal/genetic and external/environmental factors [20]. The environment can be nutritional, climatological, and managerial. Factors of differences in location, maintenance management, and direction of selection can affect body size [17]. The difference in the body size of Pasundan cattle is influenced by their place of life-related to maintenance management and distribution of the population of Pasundan cattle in 11 districts which have two agroecosystems with different topographies, namely forest and coastal buffer zones [3]. Phenotypic of a livestock breed are caused by selection, migration, marriage, and genetics [21].

### 3.2 Pasundan Cattle Reproduction Performance

Research data regarding the reproductive performance of Pasundan cattle kept semi-intensively and extensively in the Pesisir Selatan and North Priangan areas were analyzed using quantitative descriptive statistical analysis. The reproduction performance description is presented in Table 2.

The results in this study (Table 2) indicate that the reproductive performance of Pasundan cattle in semi-intensive and extensive rearing systems is the puberty of 20-24 months, S / C 1.4 - 1.6, conception rate 65-70%, calving

| Reproductive Parameters | Southern South Coast Region | North Priangan region |
|-------------------------|-----------------------------|-----------------------|
| Servic perconception (SC) (Time) | 1.4 | 1.6 |
| Conception rate, | 70.0 | 65.0 |
| CR (%) | 65.0 | 62.5 |
| Calving interval (Month) | Dec-13 | 13-14 |
| Post Partus Estrus (Days) | 50.0 | 60.0 |
| Post Partus Mating (Days) | 72-94 | 82-104 |
| Day-open (Days) | 94-104 | 104-126 |
| Puberty(Month) | 20-24 | 22-24 |
| Birth Weight (Kg) | 18.5 | 18.0 |
| Age Body Weight 120 days ( kg) | 78.5 | 75.6 |
| Calf Daily Weight Gain (kg) | 0.50 | 0.48 |
nant follicles smaller that low feed intake in female cattle can make the domi
by a decrease in the development of ovarian follicles so
atrophy. Low feed intake will delay puberty accompanied
is not treated immediately will lead to irreversible ovarian
versible ovarian hypofunction. Ovarian hypofunction that
addition to causing a decrease in ovarian function or re
jects to function normally, an appropriate environmental
temperature is needed, generally, cows need a comfortable
temperature of 13 °C - 18 °C [20].

Environmental temperature can affect livestock body
temperature and grazing (eating) activities, besides live-
stock that are kept at high environmental temperatures
will drink more to regulate their body temperature, so that
consumption and ration efficiency decrease and interfere
with metabolic activity in the body [27]. On the other hand,
in this research location, cows are kept extensively where
the cows only receive forage according to what is avail-
able in the pasture, and when the dry season occurs, the
availability of forages decreases in quality and quantity,
so it is suspected that there is a negative nutritional bal-
ance that will affect ovarian activity and response. Lack
of nutritional intake will affect metabolic compounds and
hormones such as insulin and insulin-like growth factor-1
which affect the hypothalamus and pituitary to respond to
the ovaries and the sensitivity of gonadotropin hormones
in the pituitary so that the body’s energy will suppress
the release of gonadotropin releasing hormone (GnRH)
and affect pulsatile frequency. Luteinizing hormone (LH)
which is needed for follicle growth. This condition will
cause delayed puberty due to the follicles not developing
into atresia-dominant or ovulation-dominant follicles, in
addition to causing a decrease in ovarian function or re-
versible ovarian hypofunction. Ovarian hypofunction that
is not treated immediately will lead to irreversible ovarian
atrophy. Low feed intake will delay puberty accompanied
by a decrease in the development of ovarian follicles so
that low feed intake in female cattle can make the domi-
nant follicles smaller [28]. Lack of feed, especially for hot
tropical areas, including Indonesia, is one of the causes
of decreased reproductive efficiency because it is always
followed by reproductive disorders that cause infertility in
female livestock [29].

The average service preconception (S / C) for PO cattle
is 1.28 times [30], lowlands 1.5 and uplands 1.3 (Iskandar
2011), lowlands 1.64 ± 0, 77 times and the plateau 1.94 ±
0.87 times [29], PO cattle 1.28 ± 0.32 times and Limousin
Cross-breed cattle 1.52 ± 0.39 times. Service per conception
is influenced by several factors, namely the accuracy
of detecting lust, the condition of livestock, and the skills
and accuracy of the inseminator in implementing insemi-
nation [31].

Conception rate (CR) is determined by male fertility,
female fertility, and insemination techniques [32]. A good
CR is 60-70%, while what is understandable for condi-
tions in Indonesia is based on considerations of natural
conditions, management, and distribution. Livestock that
spread is considered good if the CR reaches 45-50% [14].
day - open (DO) PO cattle 156.9 ± 29.33 days and Limou-
sin Peranakan cattle 172.9 ± 19.21 days [33]. Bali 351-440,
Post partus estrus (PPE) of Bali cattle between 106-165
days [35]; Postpartum mating (PPM) of PO cattle is 154.05
± 13.56 days [34].

The reproductive performance (service preconception,
calving rate, and calving interval) of Pasundan cattle in
the Pesisir Selatan area is relatively better than cattle in
the North Priangan region. This difference is thought to
be influenced by different maintenance, feeding, and envi-
ronmental management. The feed given in the North Pri-
angan region is likely to be in a negative energy balance,
as a result of relatively warmer temperatures (21.8 - 30.4
degrees).

Centigrade affects the body’s metabolism of livestock.
Dietary nutrition given before and after childbirth will
affect the CR value because nutritional deficiency before
childbirth will cause a delay in the estrous cycle [30].
The timing of ovulation of the dominant follicle and energy
balance in a negative condition results in decreased post-
partum LH secretion, consequently slowing Resumption
of ovary activity [35]. Studies on the importance of ade-
quate feed (forages and concentrates) on the success of
postpartum insemination have been widely reported. Inadequate feed-
ing will inhibit the development of reproductive organs
and interfere with hormone secretion. On the other hand,
the excess feed will cause excess body weight or obesity
which will interfere with the development of the heifer’s
body and ovulation disorders in adults cows, but there
was a miscarriage or the pregnancy was safe until the
child was born but the child was weak because the moth-
er lacked nutrition. Lack of crude protein in the feed of female cows will cause the potential for silent heat to be higher, so that heat is difficult to detect and delay in mating. Factors that affect reproductive efficiency include the nutritional feed contained in the ration which affects the reproductive organs and the function of the glands that produce hormones, management or management, temperature and season greatly affect reproductive traits. Reproductive performance including days open, calving interval, and service per conception highland dairy cows are significantly better than lowland cattle, this condition is related to a decrease in feed consumption and digestibility in cattle experiencing stress due to hot environmental temperatures.

Pasundan cattle genetically have good reproductive potential even in extreme environmental conditions, can utilize low-quality feed, and have good reproductive power, which is able to produce children between 12-14 months and can give birth between 10-20 times throughout their life.

Many factors affect the individual reproductive performance of Pasundan cattle which are often difficult to identify. Even in optimum conditions, the reproduction process of Pasundan cows can be imperfect due to the contribution of various influencing factors during the pregnancy process until the calf is born safely. Understanding the relationship of various factors in influencing livestock fertility is of course essential to optimize the reproductive performance of each Pasundan female cow and livestock business. To increase the reproductive efficiency of Pasundan cattle, it is necessary to pay attention to complex processes related to reproductive traits that involve aspects of genetics, physiology, nutrition, management, and the environment. Therefore, livestock productivity depends on these factors which are limiting factors. The low productivity of local livestock is probably due to the very large role of genetic factors as limiting, although the influence of environmental factors also exists. Based on these conditions, changes in genetic composition can make an important contribution to efforts to increase livestock productivity, while environmental improvement plays a role in providing an atmosphere that supports the appearance of its genetic potential. Livestock with good genetic traits will not express their genetic potential without being supported by a supportive environment. It is even known that in shaping appearance, the environment has a greater effect than genetic traits.

Almost all of the Pasundan cattle business are semi-intensive community farming business, which is an activity to take advantage of free time, available land and labor, and agricultural by-products to produce more valuable products for income improvement. This condition influences the characteristics of the management of livestock raising carried out by livestock farmers, which is indicated by relatively inadequate feeding procedures and disease control efforts.

4. Conclusions

The morphometrics of Pasundan cattle in the Southern South Coast Region (Garut, Cianjur, and Sukabumi) are better than those in North Priangan Region (Bogor, Purwakarta, and Sumedang), although they start with almost the same birth weight and calf weight gain. The reproductive performance of Pasundan cattle in the Pesisir Selatan area is better than in the North Priangan area, but in general, it is almost the same as other local Indonesian cattle.

References

[1] Handiwirawan E, RR Noor, Muladno, L Schuler. 2003. The use of HEL9 and INRA035 microsatellites as specific markers for Bali cattle. Arch Tierz, Dummerstorf. 46(6): 503-512.
[2] Indrijani H, Arifin J, Anang A. 2013. Proposal for The Establishment of Pasundan Cattle Clumps. Bandung. Livestock Office of West Java Province.
[3] Arifin, J. 2009. Empowerment of Cattle Farmers in South Garut Coast through Knowledge Introduction in Genetic Quality Improvement. Proceedings of the National Sustainable Seminar. Faculty of Animal Husbandry UNPAD. Bandung.
[4] Livestock Office of West Java Province 2014. Report of Beef Cattle Population in West Java Province in 2014. Bandung.
[5] Tsegeye D, Belay B, Haile A. 2013. Morphological Characterization of Indigenous Hararghe Highland Goat Breed in Their Native Environment, West hararghe, Ethiopia. American-Eurasian Journal of Scientific Research. 8(2):72-79. ISSN 1818-6785. IDOSI Publications.
[6] Setiawati, E.N., D. M. Saleh and M.Y . Sumaryadi. 2018. Reproductive Performance of Pasundan Cows in West Java. Proceedings of Livestock Technology and Agribusiness Seminar VI: Development of Genetic Resources of Local Livestock Towards Animal Food Self-sufficiency ASUH, Faculty of Animal Husbandry, Jenderal Soedriman University, July 7, 2018.
[7] Lake SL, Scholljegerdes EJ, Atkinson RL, Nayiglihugu V, Paisley SI, Rule DC, Moss GE, Robinson TJ, Hess BW. 2005. Body Condition Score at Parturition and Postpartum Supplemental Fat Effects on Cow and Calf Performance. J Anim Sci. 83:2908-2917.
Affandy, L., P. Situmorang, P.W. Prihandini, D.B. Wijono and A. Rasyid. (2003). Performance of Reproduction and Management of Beef Cattle in smallholder Conditions. *Proceedings of the Seminar on Animal Husbandry and Veterinary Technology Innovation. Puslitbang Ranch, Bogor.*

Yendrafitz, B.P. Zespin, Z. Udin, and Jaswandi. 2012. Post-partum Reproductive Appearance of Buffalo at Various Levels of GnRH and Synchronized with PGF2α. *JJTV.* 17(2): 107-111.

Wawan, A., and Dewi. 2010. Theory and Measurement of Human Knowledge, Attitudes and Behavior Equipped with Sample Questionnaires. Yogyakarta: Nuha Medika.

Irawati. 2017. The Influence of Education, Training and Financial Compensation on the Performance of Extension Officers at the Muna District Forestry Service. [http://download.portalaraguda.org/article.php?article. Journal of Management Science. Halu Oleo University, Kendari. Retrieved 11 August 2017. Vol 14 No 2, 2017. Pp267-271.](http://download.portalgaruda.org/article.php?article)

Setiawan, A., Dinasi, E., Zamanti, D., 2017. The use of progesterone preparations and the hormone GnRH in the determination of estrus in the superovulation program of limousine cows. *Agricultural Journal.* 8(1): 8-16.

Iskandar. (2011). Performance of PO Cattle Reproduction in LowLand and Highlands in Jambi Province. *Scientific Journal of Animal Husbandry Sciences, 14 (1): 51-61.*

Fanani, S., Y.B.P.Subagyo and Lutojo. (2013). Reproduction Performance of Peranakan FriesianHolstein Cattle (PFH) in Pudak Subdistrict, Ponorogo Regency. *Journal Tropical Animal Husbandry, 2 (1): 21-27.*

Hardjosubroto W, Astuti JM. 1993. *Farm Smart Book.* Jakarta. PT Gramedia Wijayasana.

Aslimah S, Yamin M, Astuti D. 2014. Productivity Of Rams Carcasses Garut Rams on Feeding Types and Different Times. *Journal of Production Science.*

Gunawan A, Sumantri C.2008. Estimating the value of phenotypic mixture and genetic distance of Garut sheep and their crosses. *J.Indonesian Trop Anim Agri* c 3:176-185.

Utomo BN. 2015. Central Kalimantan Local Cow Katingan Cow and Its Conservation Efforts. *Agriculture Lithbang Journal.*

Syukur SH, Afandi. 2009. The difference in feeding time in local bulls to income over feed cost. *J Agrolland.* 16(1): 72-77.

Soeharsono, R.A. Saptati, and K. Diwyanto. (2010). Reproduction Performance of Local Beef Cattle and Cattle Crossing Artificial Insemination Results in Special Region of Yogyakarta. *National Seminar on Animal Husbandry and Veterinary Technology. pp. 89-99.*

Noor RR. 2008. *Livestock Genetics.* Jakarta (ID) Penebar Swadaya.

Novita, C.I., Sari, E.M. and E. Rahma. 2018. Characterization of Reproduction Appearance of Aceh Betina Cattle as Genetic Resources of Local Livestock in Subulussalam City. *Agripet.* 18(1): 36-40.

Wibowo, F.C.P., N. Isnaini and S. Wahjuningsih. (2014). Performance of Reproduction of PO Cows and Peranakan Limousine Cows in Berbek Subdistrict, Nganjuk Regency.

Mabjeesh, S. J., C. Sebastian, O. Gal-Garber, and A. Shamy. 2013. Effect of photoperiod and heat stress in the third trimester of gestation on milk production and circulating hormones in dairy goats. *Journal Of Dairy science.* 96; 189—197. [http://dx.doi.org/10.3168/jds.2012-25624. Diakses pada 07 November 2018.](http://dx.doi.org/10.3168/jds.2012-25624)

Umiyasih,U and Anggraeney, Y. N. (2007). *Technical Guidelines for Balanced Rationing, Feed Strategies in Beef Cattle, Research Reports, Center for Livestock Research and Development, Agricultural Research and Development Agency, Agricultural Department, Jakarta.*

Chantaklanhana, CH. and P. Skumnun, (2002). *Sustainable Smallholder Animal Systems in the Tropics.* Kasetsart University Press, Bangkok.

Muthalib, R.A. (2002). Study of Several Genetic and Non-Genetic Factors on The Productivity of PE Goats in Batanghari District of Jambi Province. *Scientific Journal of Livestock Sciences. Vol. 5(3). hlm. 112-119.*

Putro, P. P. 2008. Dynamics of development of dominant follicles and corpus luteum after synchronization of estrus in Friesian Holstein Peranakan Cows. *Postgraduate Dissertation. Gadjah Mada University, Yogyakarta.*

Qisthon, A. and Y. Widodo. 2015. Effect of concentrate ratio density in Peranakan Ettawa goat rations in natural heat environments limited ration consumption, physiological response, and growth. *Journal Zootek.* 35 (2): 351-360.

Nuryadi and Wahjuningsih, S. (2011). Reproduction Performance of Peranakan Ongole and Peranakan Limousine Cows in Malang Regency. Faculty of Animal Science, Brawijaya University, Malang. *J. Ternak Tropika Vol 12, No. 1: 76-81.*

Pramono, A., Kustono and H. Hartadi. (2008). Calv-
ing Interval Dairy Cows in Special Region of Yog-
yakarta Reviewed From Reproductive Performance. 
*Buletin Peternakan* 32(1): 38-50.

[32] Susilawati, T. (2005). Success Rate of Orchards and 
Gender Accuracy resulting from Artificial Insemina-
tion Using Frozen Cement Sexing in Peranakan On-
gole Cows. *Journal Animal Production*, 7 (3): 161-
167.

[33] Ihsan, M. N and S. Wahjuningsih. 2011. Appearance 
of beef cattle reproduction in Bojonegoro Regency. *J. 
Ternak Tropika*. 2 (2) : 76-80.

[34] Apriyanto, D. 2005. Effect of Place Height And Par-
ent Lactation Level on Service Per Conception (S/C) 
Of Friesian Holstein Peranakan Cows. Kab. Malang. 
Jawa Tengah.

[35] Butler. W. R. 2005. Inhibition of Ovulation in the 
Postpartum Cow and the Lactating Sow. *Liv. Prod. 
Sci.* 98: 5-12.

[36] Astuti M. (2004). Potential and Genetic Resource Of 
Peranakan Ongole Cows (PO). *Wartazoa* 14(3) : 98-
106.

[37] Hess, B.W., S.L. Lake., E.J. Scholljegerdes., T.R. 
Weston., V. Nayigihugu., J.D.C. Molle., G.E. Moss. 
2005. Nutritional Controls of Beef Cow Reproduc-
tion. *J Anim Sci.* 83:E90-E106.

[38] Diskin, M.G and D.A. Kenny. 2014. Optimizing Re-
productive Performance of Beef Cows and Replace-
ment Heifers. *Animal*. 1:27-39.

[39] Endrawati, E., E. Baliarti and S.P.S. Budi. 2010. 
Performans Of Simental-Peranakan Ongole Cross 
cow and Peranakan Ongole Cow Mother with Forage 
Feed And Concentrate. *Bulletin Peternakan*. 34 (2): 
86-93.

[40] Tjatur, A. N. K. and M. N. Ihsan. 2011. Reproductive 
Appearance of Friesian Holstein Dairy Cows (FH) on 
Various Parietas and Lactation Moons at Different 
Altitudes. *Journal Ternak Tropika*. 11: 1-1.