Journal of the Indonesian Tropical Animal Agriculture
(J. Indonesian Trop. Anim. Agric.)
pISSN 2087-8273 eISSN 2460-6278
41(2):53-60, June 2016
DOI: 10.14710/jitaa.41.2.53-60

# ESTIMATION OF MOST PROBABLE PRODUCING ABILITY VALUE FOR CALF BIRTH'S PERFORMANCE IN SUMBA ONGOLE COWS

**S. Said[1], P. P. Agung[1], W. P. B. Putra[1], S. Anwar[1], A. S. Wulandari[1] and A. Sudiro[2]**
*[1]Research Center for Biotechnology - Indonesian Institute of Sciences,*
*Jl. Raya Bogor KM. 46, Cibinong 16911, West Java - Indonesia*
*[2]Karya Anugerah Rumpin (PT. KAR),*
*Jl. Raya Cibodas No. 99, Rumpin, West Java - Indonesia*
*Corresponding E-mail : syahruddinsaid01@gmail.com*

*Received February 26, 2016; Accepted April 04, 2016*

## ABSTRAK

Estimasi nilai most probable producing ability (MPPA) sangat penting untuk seleksi induk berdasarkan performan anak-anaknya. Data catatan kelahiran dari 48 ekor induk sapi Sumba Ongole (SO) dan data catatan performan lahir dari 52 ekor pedet digunakan untuk estimasi nilai MPPA. Nilai ripitabilitas (r) yang besar ($r \geq 0,30$) diperoleh pada sifat panjang badan (PB) lahir. Berat lahir (BL), tinggi gumba (TG) dan lingkar dada (LD) memiliki nilai r yang moderat ($0,10 \leq r \leq 0,30$). Nilai MPPA kumulatif performan lahir pedet pada induk berdasarkan satu catatan kelahiran tertinggi sebesar 4,64 (nomor sapi: 3770) dan terendah sebesar -4,64 (sapi nomor: 2283). Pedet nomor B2076 (induk nomor: 3586) memiliki rasio TG (115,70); PB (124,26); LD (118,90) tertinggi, sedangkan rasio BL tertinggi (168,35) dicapai pada pedet nomor B2095 (nomor induk: 3731). Sifat BL memiliki nilai r yang moderat sehingga masih akurat sebagai kriteria seleksi.

*Kata kunci: Sapi SO, MPPA, ripitabilitas, performan lahir, rasio performan*

## ABSTRACT

An estimation of most probable producing ability (MPPA) value based on the calves performance is very important for the cow selection. The birth data record of 48 Sumba Ongole (SO) cows and record data from 52 callf birth's performance were used to estimate the value of MPPA. High of r value ($r > 0.30$) was obtained at the body length (BL). Birth weight (BW), withers high (WH) and chest girth (CG) had a moderate value ($0.10 < r < 0.30$) of repeatability. The MPPA value of the cumulative calf birth's performance of cows based on the highest birth records was 4.64 (cow number 3770) and the lowest was -4.64 (cow number 2283). Calf number B2076 (cow number 3586) had the highest ratio of WH (115.70); BL (124.26); CG (118.90), while the highest ratio of BW (168.35) was obtained in calf number B2095 (cow number 3731). It was concluded that the BW of birth had a moderate value of r (0.10) and could be used as a selection criteria accurately.

*Keywords: SO cows, MPPA, repeatability, calf birth, performance ratio*

## INTRODUCTION

The main cattle breeding programs of production traits is conducted by using body weight at different ages for the selection criteria. These properties are easily measured and correlated positively with other value economic traits and response to the individual selection

(Boligon *et al*., 2010). One of the trait in the breeding of beef cattle is a calf's birth weight, because this trait is associated with other traits in the development of individual cattle. The birth weight of the calf to be very important in the beef industry (Bakir *et al*., 2004). Calf's birth weight is the one of production trait that affects the performance of the calf and became the first information concerning with the potential development of cattle (Oluwumi and Saloko 2010). Furthermore, the birth weight of calf becomes the main character due to phenomenon of calving ease (Vanmiddlesworth *et al*. 1977), and because this affects the viability, fertility rates and culling of calf (Guiturres *et al*., 2007).

Value of genetic parameters in a population are described in animal genetic superiority, while the phenotype of livestock is a description of the influence of genetic and environmental factors as well as the interaction between genetic and environmental factors. The most important of this factor is genetic, because this could be passed down to the offspring (Warwick *et al*. 1990). The heritability ($h^2$) value in the animal breeding has an important role, because the heritability provides information about the value of a trait from elders those passed down to their offspring. Repeatability (r) value is used for indicating phenotype correlation between the current performance and the future performance of an animal. The range values of repeatability (r) in beef cattle for birth weight are 0.20 to 0.30 (Hardjosubroto, 1994).

The Sumba Ongole (SO) cattle is one of the genetic resources of Indonesian local cattle that need to be conserved and developed for their superiority, thus the program of breeding cattle would produce the superior livestock to their agro-ecosystem. The SO cattle is preferred by most raisers because of the quality of meat product (thickness and lean). Agung *et al*. (2015) reported that the hot carcass weight of male SO cattle with slaughter weight 401 to 425 kg obtain 218.73±9.15 kg. To maintain and improve the excellence of the SO cattle, it is necessary to conduct the selection and breeding program based on their MPPA value.

The present study estimated the value of MPPA based on the performance of birth (birth weight, body height, body length, chest circumference) as a first step to determine the genetic potential of SO cattle

## MATERIALS AND METHODS

### Place and Samples

The materials used in this study were the recording data of livestock throughout the year of 2014. The collected data includes birth records of 48 SO cows and measurement data of 52 calves were reared in the PT. Karya Anugerah Rumpin, Bogor, West Java.

### Standardization Data

Data of birth weight (BW) and calf birth's body size (withers height, body length, chest girth) were standardized or corrected based on the Hardjosubroto (1994) as follows:

$CF_{sex}$ = [Average of male calves birth performance/ Average of female calves birth performance], where $CF_{sex}$ is correction factor of sex for calves performance.

Correction factor (CF) only used for female calf. These factor was aimed to reduce the variance among population for each trait. Commonly, the CF was used for BW, but in this study CF also used for birth measurements. The average of dams age $\pm$ two years and the CF of dams age is not needed for BW correction.

### Data Analysis

**Repeatability.** Estimation of repeatability values were calculated using interclass correlation method based on two birth records as directed by Warwick *et al*. (1990) as follows :

$$r = \frac{\sum X_1X_2 - \frac{\sum X_1X_2}{N}}{\sqrt{\left[\sum X_1 - \frac{(X_1)^2}{N}\right]\left[\sum X_2 - \frac{(X_2)^2}{N}\right]}}$$

where

r = Repeatability

$X_1$ = The first birth performance recording

$X_2$ = The second birth performance recording

N = Number of individu

### Most Probable Producing Ability (MPPA)

Estimation value of MPPA cows were calculated based on intruction of Hardjosubroto (1994) as follows:

$$MPPA = \frac{Nr}{1 + (N - 1)r}(\bar{P} - \bar{\bar{P}})$$

$MPPA_{Cumulative} = MPPA_{(BW)} + MPPA_{(WH)} + MPPA_{(BL)} + MPPA_{(CG)}$

where
MPPA = Most probable producing ability
r = Repeatability
$\bar{P}$ = The average individual performance
$\bar{\bar{P}}$ = The average population performance
BW = Birth weight
WH = Withers height
BL = Body length
CC = Chest girth

**Performance ratio of calves.** The calculation of the performance ratio of the cattle is one alternative way to do the selection when information of cattle heritability value is not available. The calculation of the performance ratio of calves according Hardjosubroto (1994):

$$CPR = \frac{\bar{P}}{\bar{\bar{P}}} \times 100\%$$

where
CPR = Calf's performance ratio
$\bar{P}$ = The average individual performance
$\bar{\bar{P}}$ = The average population performance

## RESULTS AND DISCUSSION

### Birth Performance

Birth weight of SO male calf (23.86 kg) was greater than females (19.77 kg) as shown in Table 1. The SO cattle may have a superior genetic potency than other local Indonesian cattle, because the average of birth weight in SO cattle was greater than that in other local Indonesian cattle. The birth weight of male Madura, Bali, and Aceh cattle were 15.42, 17.73 and 14.08, respectively. The birth weight of female Madura, Bali and Aceh cattle were 13.60, 17.55 and 13.14 kg, respectively (Karnaen 2007; Gunawan and Jakaria, 2011; Bakhtiar, 2010).

The birth weight as a criterion of selection could be correlated positively with further potential growth of animal (Aziz *et al*., 2005; Oluwumi and Saloko, 2010). In addition, environmental climate and management may also alter the ability of dam and their calves to express a genetic change directly and maternal factors (Speidel *et al*. 2007). Baliarti (1991) reported that the birth weight of Indonesian local Brahman and

Table 1. Birth Calves Performance of Sumba Ongole (SO) Cattle

| Performance | Average | SD | CV (%) | Min. | Max. |
|---|---|---|---|---|---|
| Male (N = 14) | | | | | |
| Birth weight (kg) | 23.86[a] | 5.68 | 23.81 | 15.00 | 34.00 |
| Body high (cm) | 70.71[a] | 5.58 | 7.89 | 61.00 | 80.00 |
| Body length (cm) | 57.43[a] | 7.16 | 12.47 | 45.00 | 68.00 |
| Chest circum. (cm) | 65.71[a] | 6.93 | 10.55 | 53.00 | 78.00 |
| Female (N = 26) | | | | | |
| Birth weight (kg) | 19.77[b] | 3.19 | 16.14 | 15.00 | 25.00 |
| Body high (cm) | 68.69[a] | 3.79 | 5.52 | 60.00 | 78.00 |
| Body length (cm) | 55.77[a] | 4.97 | 8.91 | 45.00 | 67.00 |
| Chest circum. (cm) | 66.15[a] | 6.07 | 9.18 | 53.00 | 77.00 |
| Total (N = 40) | | | | | |
| Birth weight (kg) | 21.20 | 4.60 | 21.70 | 15.00 | 34.00 |
| Body hight (cm) | 69.40 | 4.53 | 6.53 | 60.00 | 80.00 |
| Body length (cm) | 56.35 | 5.80 | 10.29 | 45.00 | 68.00 |
| Chest circum. (cm) | 66.00 | 6.30 | 9.55 | 53.00 | 78.00 |

[a,b] Different superscrips in the same variable indicates significantly different (P≤0,05); SD= standart of deviation; CV= coefisien of variation

Ongole crossbred were 27 and 28 kg, respectively. The SO cattle was a type of *Bos indicus* which has bigger body size than Madura, Bali and Aceh cattle.

**Repeatability**

The estimation of repeatability (r) value in SO cattle are presented in Table 2. The r value in SO cattle was 0.10 for BW, this might be a moderate category. The high r value of calves BW was lower than Aceh (0.36) and local Ongole crossbred cattle (0.81) (Putra *et al*., 2014; Adinata, 2013). Simmental cattle had BW r value of 0.25 (Suhada *et al.*, 2009). A high value of r indicated that a trait have high repetition value (probability). Therefore the cattle selection may be conducted with a minimum of two records (Falconer and Mackay, 1996). A moderate r value indicates that the correlation between phenotypes in the genetic diversity is high, so that the selection based on the phenotype of BW individuals will be sufficiently effective. Thus the selection of the cattle BW may improve the quality for post weaning genetic traits of weaning weight, yearling and average daily gain (ADG) because of highly genetic correlations within these traits (Guiturres *et al*., 2007; Lasley 1978). This result study showed that the lowest r value reached by the BW. This means that the variation of BW between first and second parities were high. Therefore, the selection based on this trait was more effective than the birth measurements. The birth weight trait was is positively correlated with the character in trait of the future selection stage (Lasley 1978). In this study, BW might be correlated with weaning weight. However, some studies showed that high genetic correlation value ($r_g > 0.50$) between birth and weaning weights are obtained in Brangus (0.78) and Red Chittagong (0.53) cattle (Neser *et al*., 2012; Rabeya *et al*., 2009).

Table 2. Estimation of Repeatability Values (r) of Calf's Birth Performance in Sumba Ongole (SO) Cows

| Properties | N | r | Category |
|---|---|---|---|
| Birth weight | 16 | 0.10 | Moderate |
| Withers height | 8 | 0.26 | Moderate |
| Body length | 8 | 0.59 | High |
| Chest girth | 8 | 0.28 | Moderate |

N: The number of observations

**Most Probable Producing Ability**

The MPPA cumulative values based on the two birth records are shown in Table 3. A cattle numbers 5560 had highest (5.45) and cattle number 1746 was the lowest (-10.56) of MPPA. Cattle ranking based on the one record (first parity) of birth are shown in Table 4. The highest MPPA cumulative value (4.64) was obtained in cattle number 3770. The highest MPPA value of birth weight in Aceh cow by two records was 1.38 (Putra *et al*., 2014). In this study, MPPA value ranking was based on first birth merely. Thus, the basis of assessment criterion was reflected on the ranking of MPPA value. In addition, the MPPA estimation method such as anova analysis may be the best for calculating r value. The MPPA cumulative value > 0.00 was recommended for the cattle selection, because this may allow an improvement in animal performance (Figure 1).

Table 3. Most Probable Producing Ability (MPPA) Value of Calf's Birth Performance Based on Two Performance Records from Two Calves in Sumba Ongole (SO) Cows

| No. Cattle | MPPA | | | | Total (rank) |
|---|---|---|---|---|---|
| | BW | WH | BL | CG | |
| 5560 | 0.200 | 1.919 | 0.004 | 3.332 | 5.454 (1) |
| 1136 | -0.143 | -2.456 | -4.909 | -0.569 | -8.076 (3) |
| 1752 | 0.059 | 0.689 | -2.453 | -1.805 | -3.509 (2) |
| 1736 | -1.142 | -0.825 | -6.067 | -2.522 | -10.556 (4) |

BW= birth weight; WH= withers height; BL= body lenght; CG= chest girth

Table 4. Top Ten of Sumba Ongole (SO) Cows Based on the Most Probable Producing Ability (MPPA) Value for Calf Birth Performance using One Record of A Calf

| No. Cattle | MPPA | | | | Total (rank) |
|---|---|---|---|---|---|
| | Birth weight | Withers height | Body length | Chest girth | |
| 3770 | 1.28 | 2.76 | 6.28 | 3.36 | 4.64 (1) |
| 3586 | 0.71 | 2.83 | 8.07 | 3.49 | 4.20 (2) |
| 3731 | 1.45 | -0.11 | 6.24 | 1.55 | 3.00 (3) |
| 5566 | 0.59 | 2.83 | 7.46 | 2.38 | 2.97 (4) |
| 0584 | 0.38 | -0.36 | 1.56 | 2.52 | 2.90 (5) |
| 2299 | 0.96 | 0.16 | 3.21 | 1.55 | 2.50 (6) |
| 2302 | 0.96 | 0.69 | 2.60 | 1.27 | 2.22 (7) |
| 0023 | 0.96 | 2.03 | -1.05 | 1.27 | 2.22 (7) |
| 2297 | 0.59 | 1.76 | -1.65 | 1.55 | 2.13 (8) |
| 2284 | 0.68 | 0.42 | 5.10 | 1.12 | 1.80 (9) |
| 3721 | 0.78 | -0.36 | 2.74 | 0.84 | 1.62 (10) |

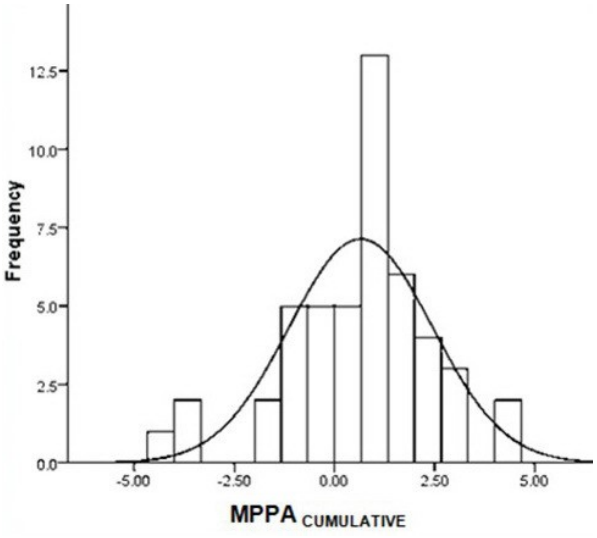


Figure 1. Histogram of MPPA Cumulative of Sumba Ongole (SO) Cows

Hardjosubroto (1994) stated that the determination of MPPA value is a maximum estimate for female production capability, because the estimation involves available performance data of the animal.

**Calf Performance Ratio**

Table 5 shows top ten of SO calves for selection purposes. The ratio of calf performance is used to select cattle based on the individual performance. This is compared then to the average performance of the population (Hardjosubroto, 1994). Table 4 shows that the calf number B2092, B2076, and B1613 were the best three calves based on birth performance and dam rank. The dams of those calves were 3770, 3586 and 5566, respectively, and those three cows were ranked in 1, 2 and 4, respectively. The dams for calves number B2053 and B2085 had 11$^{st}$ and 15$^{th}$ ranks, respectively (data were not shown in the Table). However, the selection of calf based on dam through MPPA is preferable, because the genetic potential is described by repeatability, so the calves selection results would be more accurately (Hardjosubroto, 1994). Figure 2 shows that the selection of calf can be done by selecting the calf with BW ratio values ≥120% and WH, BL and CG, respectively ≥110%.

## CONCLUSION

The repeatability of birth weight was in a moderate category. The ranking of calf that was based on the BW ratio could be used as a criterion of selection for SO bull as well as dam. The rangking of dams based on MPPA cumulative value may be used as the criterion of selection for

Table 5. The Birth Performance Ratio of the Top Five of Sumba Ongole (SO) calves

| No. Calfs (rank) | No. Cows | Calf Performance Ratio (%) | | | | Rank | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | BW | WH | BL | CG | BW | WH | BL | CG |
| B2092 (1) | 3770 | 160.38 | 115.27 | 118.90 | 118.18 | 2 | 1 | 4 | 2 |
| B2076 (2) | 3586 | 133.52 | 115.70 | 124.26 | 118.90 | 6 | 1 | 1 | 1 |
| B1613 (3) | 5566 | 127.72 | 115.70 | 122.44 | 112.88 | 8 | 1 | 2 | 4 |
| B2053 (4) | 1931 | 141.51 | 110.95 | 120.67 | 103.03 | 4 | 3 | 3 | 10 |
| B2085 (5) | 2108 | 127.72 | 108.28 | 109.65 | 103.85 | 8 | 6 | 9 | 10 |

BW= birth weight; WH= withers height; BL= body lenght; CG= chest girth. Ranking of calves based on score rank that less from 10 for each traits. Despite, rank of dam also used for calves evaluation.

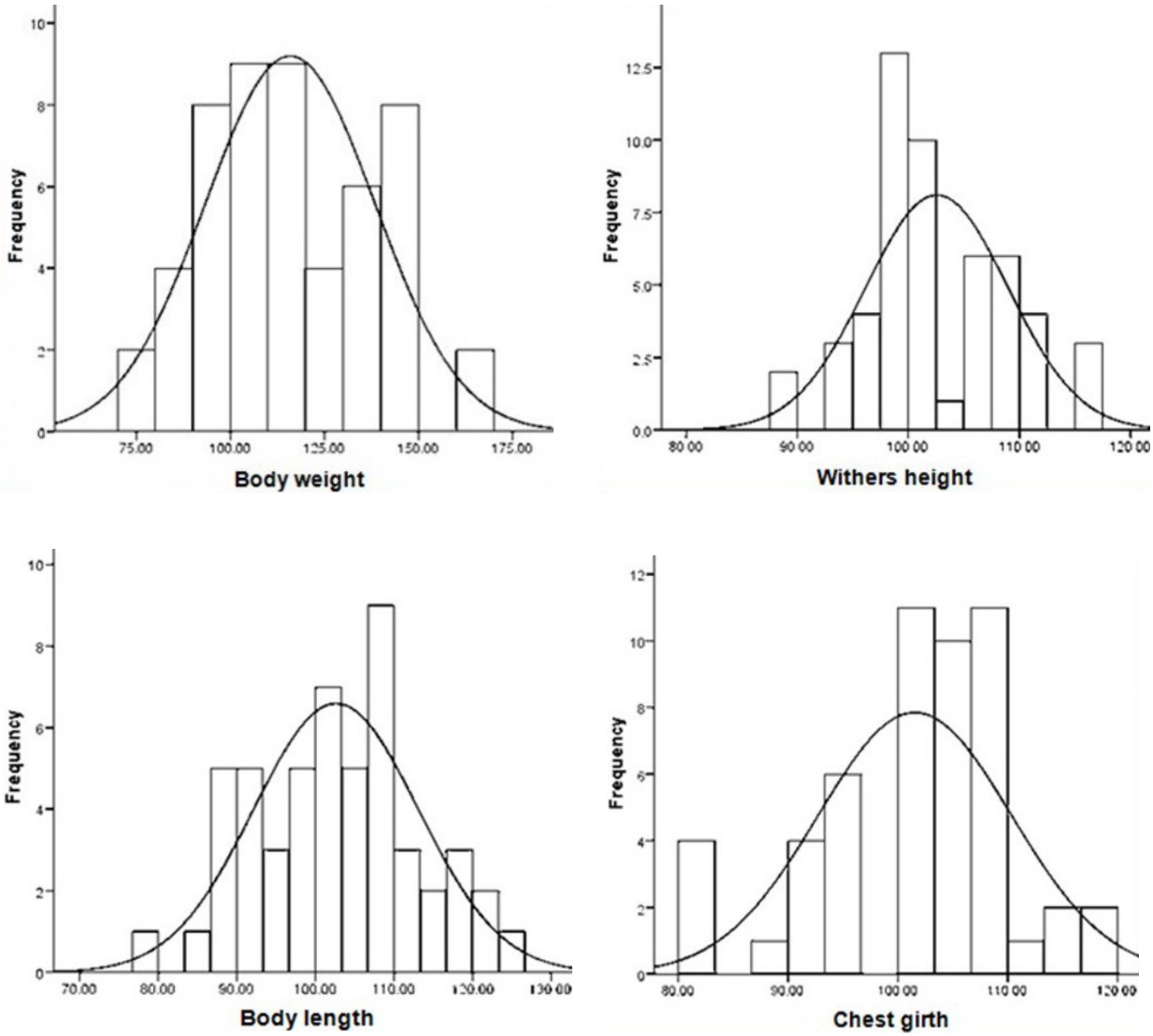


Figure 2. Histogram of calves Birth Performance Ratio of Sumba Ongole (SO) Cows

the breeding program with male SO cattle to produce an optimal birth weight and a calf body size according to the animal standards.

## ACKNOLEDGEMENTS

This research funding was supported partly by Ministry of Research, Technology, and Higher Education, the Republic of Indonesia. A sincere appreciation is expressed to Head of Research Center for Biotechnology, Indonesian Institute of Sciences, and Director of PT. Karya Anugerah Rumpin, for experimental farm facilities. Author gratitude is also expressed to all members of Animal Research Group in Research Center for Biotechnology, Indonesian Institute of Sciences.

## REFERENCES

Adinata, Y. 2013. Estimasi nilai pemuliaan bobot lahir di Unit Pengelolaan Bibit Sumber di Loka Penelitian Sapi Potong. Seminar Nasional Teknologi Peternakan dan Veteriner. Medan, 3 – 5 September 2013. P. 66-73.

Agung, P.P., S. Anwar, A.S. Wulandari, A. Sudiro, S. Said and B. Tappa. 2015. The potency of Sumba Ongole (SO) cattle: a study of genetic characterization and carcass productivity. J. Indonesian Trop. Anim. Agric. 40: 71-78.

Aziz, M.A., S. Nishida, K. Suzuki and A. Nishida. 2005. Estimation of direct and maternal genetic and permanent environmental effects for weights from birth to 356 days of age in a herd of japanese black cattle using random regression. J. Anim. Sci. 83:519-530.

Bakhtiar. 2010. Performans reproduksi dan produksi sapi Aceh. Tesis. Universitas Andalas. Padang.

Baliarti, E. 1991. Berat badan anak sapi peranakan Ongole dan peranakan Brahman hasil inseminasi buatan di Kabupaten Gunung Kidul. Buletin Peternakan. 15: 30-37.

Bakir, G., A. Kaygisiz, H. and Ulker. 2004. Estimates of genetic and phenotypic parameters for birth weight in holstein friesian cattle. Pakistan J. Biol. Sci. 7:1221-1224.

Boligon, A.A., J.A.V. Silva, R.C. Sesana, J.C. Sesana, J.B. Junqueira and L.G. Albuquerque. 2010. Estimation of genetic parameters for body weight, scrotal circumference and testicular volume measured at different ages in nellore cattle. J. Anim. Sci. 88:1215-1219.

Guiturres, J.P., F. Goyache, I. Fernández , I. Alvarez and L.J. Royo. 2007. Genetic relationship among calving ease, calving interval, birth weight, and weaning weight in the asturiana de los valles beef cattle breed. J. Anim. Sci. 85:67-75.

Gunawan, A. and Jakaria. 2011. Genetic and non genetic effect on birth, weaning and yearling weight of Bali cattle. Media Peternakan. 34: 93-98.

Falconer, R. D. and T. F. Mackay. 1996. Introduction to Quantitative Genetics. 4th ed. Department of Genetics. North Canada State University. Prince George.

Hardjosubroto, W. 1994. Aplikasi Pemuliabiakan Ternak di Lapangan. Gramedia Widiasarana Indonesia, Jakarta.

Karnaen. 2007. Model kurva pertumbuhan prasapih dari sapi Madura jantan dan betina. Jurnal Ilmu Ternak. 7: 48-51.

Lasley, J.E. 1978. Genetics of livestock improvement. New Jersey: Prentice Hall Inc. Englewood Cliffs.

Neser, F.W.C., J.B. van Wyk, M.D. Fair, P. Lubout, B.J. Crook. 2012. Estimation of genetic parameters of growth traits in Brangus cattle. S. Afr. J. Anim. Sci. 42: 469-473.

Oluwumi, S.O. and A.E. Saloko. 2010. Genetic Parameters and Factors Affecting Reproductive Performance of White Fulani Cattle in South Western Nigeria. Global Veterinaria. 5: 255-258.

Putra, W.P.B., Sumadi dan T. Hartatik. 2014. Estimasi nilai pemuliaan dan most probable producing ability sifat produksi sapi Aceh di Kecamatan Indrapuri Provinsi Aceh. Buletin Peternakan. 38: 1-7.

Rabeya, T., A.K.F.H. Bhuiyan, M.A. Habib and M.S. Hossain. 2009. Phenotypic and genetic parameters for growth traits in Red Chittagong cattle of Bangladesh. J. Bangladesh Agril. Univ. 7: 265-271.

Speidel, S.E., R. Erns and D.J. Garrick. 2007. Weaning weight inheritance in environments classified by maternal body weight change. J. Anim. Sci. 85: 610-617.

Suhada, H., Sumadi, dan N. Ngadiyono. 2008. Estimasi parameter genetik sifat produksi sapi Simmental di Balai Pembibitan Ternak

Unggul Sapi Potong Padang Mengatas, Sumatera Barat. Buletin Peternakan. 33:1-7.
Vanmiddlesworth, J., C.J. Brown and Z.B. Johnson. 1977. Repeatability of calf weight to cow weight in Hereford and Angus. J Anim Sci. 45: 1247-1253.
Warwick, E. J., J. W. Astuti, W. Hardjosubroto. 1990. Pemuliaan Ternak. Gadjah Mada University Press, Yogyakarta.