

## Breeding value of candidate bulls based on birth weight in Kebumen Ongole Grade Cattle

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**Abstract.** The study was aimed to estimate breeding value of candidate bulls in Kebumen Ongole Grade cattle based on birth weight. One thousands and five (1005) heads of offsprings generated from 127 sires and 868 dams were used in this study. Heritability was calculated using paternal half sib correlation method. Breeding Value (BV) was calculated based on absolute dan relative value. The results showed that the heritability ( $h^2$ ) of birth weight was in high category ( $0.76 \pm 0.12$ ). Ten candidate bulls with the high breeding values (35.92 – 34.99) were obtained. These results are expected to be an initial recommendation in selecting candidate bulls in Kebumen based on BV.

### 1. Introduction

Kebumen Ongole Grade is one of the potential livestock in Indonesia. They are registered as local cattle by the Indonesian Ministry of Agriculture No.47/Kpts/SR.120/I/2015. The productivity of Kebumen Ongole grade cattle can be maintained with the effective breeding program. In Indonesia, livestock breeding program mainly uses economic traits such as birth weight (BW) which are positively correlated with other traits and responses to individual selection [1]. BW is one of the important breed characteristics in beef cattle and becomes the first initial reference point for cattle growth and it is important for cattle industry [2–3]. Calves having high BW grow fast and produce more beef [4]. BW are influenced by maternal genetic which could affect individual performance [5]. The high BW also affects to the fertility rate of the parent because it is often associated with increasing of perinatal calf mortality and cattle dystocia [6–7–8].

Selection can be done based on the value of genetic parameters in the population, such as heritability. The high value of heritability in a trait illustrates the high chance of a trait inherited from elders to their offsprings [9]. The range of heritability in beef cattle for BW is 0.20-0.58 [10]. The other studies on heritability of BW in beef cattle have been reported previously at  $0.686 \pm 0.525$ ;  $0.28 \pm 0.12$ ;  $0.09 \pm 0.99$ , 0.28; 0.25 and  $0.37 + 0.02$  [1–11–12–13–14]. The heritability could be used to calculate the Breeding Value (BV). BV is defined as the achievement value of an individual animal in a population [9–10]. BV could be used to describe their performance and reproductive capabilities in a population [15]. The BV is then used as a reference in selecting cattle. This study aims to calculate the BV of Kebumen Ongole Grade Cattle candidate bulls based on their BW.

### 2. Material and methods

This research has been carried out in Klirong district, Kebumen Regency, Central Java Province. The record data from a total of 1005 heads of offsprings generated from 127 sires and 868 dams were used

in this study. The data were analyzed by least squares analysis of variance by IBM SPSS Statistic v. 25. BW is corrected based on the gender and age of the parent. The estimation of heritability used paternal half-sib correlation data with the following model :

$$Y_{ik} = \mu + \alpha_1 + e_{ik}$$

Where,  $\mu$  as the average of the population,  $\alpha_1$  as the effect of the sire,  $e_{ik}$  as the effect of environmental and genetic deviation related to the individual in a group of a sire. Heritability is then calculated using the formula :

$$h^2 = \frac{4 \sigma_s^2}{\sigma_s^2 + \sigma_D^2}$$

$$SE(h^2) = 4 \sqrt{\frac{2(n-1)(1-t)^2 [1+(k_1-1)t]^2}{k_1^2(n-s)(s-1)}}$$

The value of heritability is then used to calculate BV with the following formula (Hardjosubroto, 1994) :

$$BV = h^2(P - \bar{P}) + \bar{P}$$

Where, BV is the Breeding Value;  $h^2$  is the heritability; P is individual performance;  $\bar{P}$  is the average performance of the population where the individual is measured. The BV value is then sorted from the highest to the lowest for top 10 candidate bulls with the highest BV value

### 3. Results and discussion

#### 3.1. Birth weight

The average BW of calf is  $29.05 \pm 2.90$  kg. This BW is higher than the other Ongole cattle which has been previously reported at  $26.1$ ,  $25.93 \pm 3.97$ ,  $23.3 \pm 2.8$  and  $28.75 \pm 2.82$  kg [11–16–17–18]. The difference in BW may due to the differences in data, time and place of calculation, climate change, seasons, parent factors and maintenance management [19]. Cattle with high BW have excellent growth and could reach adult weight faster [2]. BW has a positive genetic correlation with scrotal circumference. The previous study reported the genetic correlation between BW and scrotal circumference reached 0.12 and 0.24 [1]. Therefore, BW could be recommended as candidate bulls selection criteria.

#### 3.2. Heritability

Heritability value of BW is in the high category  $0.76 \pm 0.12$  ( $h^2 > 0.3$ ). Heritability calculated based on the variance in a population of 76 % is influenced by the additive genes and 24 % was influenced by environmental factors and non-additive. Variance component and the value of heritability presented in Table 1. The lower value of standard error (SE) could indicate that the result was accurate. The maintenance management in the population is almost uniform under the authority of the Kebumen Ongole Grade cattle Breeder Association. The heritability value of this study is higher than the previously study in Ongole Crossbred cattle at  $0.68 \pm 0.525$ ,  $0.28 \pm 0.12$ ,  $0.24$  [11–16–18], Bali cattle at  $0.09 \pm 0.15$  [20] and several tropical cattle in Santa Gertrudis, Brahman and Zebu cattle at 0.16, 0.33 and 0.28 respectively [13–21–22]. The heritability value in this study is also higher than heritability data in N'Dama and Nigerian cattle at  $0.10 \pm 0.05$  and  $0.10 \pm 0.002$  [23–24]. The differences value of these results is probably due to the number of samples, breed differences, statistical analysis (model) and environmental effect [23]. A high  $h^2$  value indicates that the correlation between various phenotypes with genetic variance is high so that selection based on the phenotype will be quite effective [25]. The heritability value of BW then used to calculate BV.

**Table 1.** Variance component and the value of heritability

Component	Value
S	127
P	1005
Var <sub>(s)</sub>	1.695
Var <sub>(p)</sub>	7.164
K	8.73
h <sup>2</sup>	0.76
SE	0.12

S= Total of sire; P= Total of progeny; Var<sub>(s)</sub>= Variance of sire;  
 Var<sub>(p)</sub>= Variance of progeny, K = constanta, h<sup>2</sup>= heritability; SE= standard error

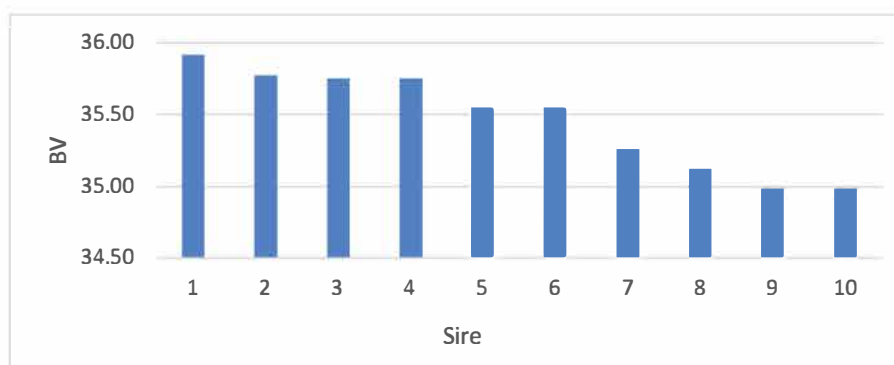
### 3.3. Breeding value

We use absolute calculation formula for calculating the BV. Table 2 and Figure 1 shown the top ten candidate bulls of Kebumen Ongole grade cattle based on the breeding value of BW. The highest BV of candidate bulls in this study is 35.92 kg (TA1210151) with the ratio of 116.73%, which mean the BV is 16.73 % higher than the average BV in the population. The previous studies showed the lower BV in Ongole and Nellore cattle at 45.96 and 30.4 kg respectively [26–27]. The completeness of animal records including the pedigree and performance will increase the accuracy of BV calculations [28]. BV could be used as an assessment and basic selection of the genetic quality of animals for a particular trait in the population [10–29]. These top ten candidate bulls of Kebumen Ongole grade cattle may be recommended as the future sire in Kebumen to keep animal productivity. However, BW is still influenced by maternal effects, so it is necessary to do further research on their performance.

**Table 2.** The top ten candidate bulls based on BV of birth weight

No	Individual	BV <sub>abs</sub>	BV <sub>r</sub>	Ratio (%)
1	TA1210151	35.92	5.11	116.73
2	MR154056	35.77	4.96	116.26
3	MR151006	35.75	4.94	116.20
4	KS1501059	35.75	4.94	116.20
5	150049	35.55	4.74	115.53
6	MR151015	35.55	4.74	115.53
7	MR151002	35.26	4.45	114.58
8	AP1410007	35.12	4.31	114.15
9	BC13150682	34.99	4.18	113.70
10	BC13150686	34.99	4.18	113.70

BV<sub>abs</sub> = Breeding value (absolute); BV<sub>r</sub> = Breeding value (relative);



**Figure 1.** BV of the top ten candidate bulls based on BW

#### 4. Conclusion

The BV of the top ten candidate bulls in Kebumen Ongole grade cattle based on BW could be used as a basic reference in selecting cattles. Further research needs to be done to see the performance of them because BW is still influenced by the maternal effect.

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