

## Breeding value of sires based on offspring weaning weight as a recommendation for selecting Kebumen Ongole Grade cattle

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### ABSTRAK

Penelitian ini bertujuan untuk menduga nilai pemuliaan pejantan sapi PO Kebumen berdasarkan berat sapih pedet. Penelitian ini dilaksanakan dari bulan Agustus sampai dengan Desember 2015 di Wilayah Urut Sewu Kabupaten Kebumen. Parameter genetik yang dihitung meliputi heritabilitas dan nilai pemuliaan berdasarkan berat sapih anak. Nilai heritabilitas dihitung berdasarkan data saudara tiri sebakap dengan menggunakan analisis variansi pola searah. Nilai pemuliaan pejantan dihitung berdasarkan nilai pemuliaan absolut. Materi yang digunakan meliputi data recording pertumbuhan ternak selama tiga tahun terakhir (2013-2015) terdiri dari 41 pejantan, 51 induk dan 244 pedet. Data berat sapih sebelumnya telah dikoreksi berdasarkan umur induk, jenis kelamin dan umur sapih 120 hari. Hasil yang didapatkan yaitu nilai heritabilitas berat sapih termasuk dalam kategori tinggi ( $0,36 \pm 0,21$ ). Nilai rinitabilitas berat sapih juga berada pada kategori tinggi ( $0,32 \pm 0,15$ ). Terdapat sepuluh besar pejantan dengan nilai pemuliaan tertinggi. Nilai pemuliaan pejantan tertinggi tertinggi yaitu KJ.J608 (49,76) dengan rasio sebesar 231,45%. Hasil dari penelitian ini diharapkan dapat dijadikan dasar pelaksanaan seleksi pejantan sapi PO Kebumen.

*Kata kunci : Nilai Pemuliaan, Berat Sapih, Sapi PO Kebumen*

### ABSTRACT

The objective of study was to estimate breeding value of sires of Kebumen Ongole grade cattle based on offsprings weaning weight. This research was carried out from August to December 2015 in Urut Sewu area, Kebumen. The calculation of genetic parameter estimation was heritability of weaning weight. The value of heritability was used to calculate the breeding value of sires based on offsprings weaning weight. Heritability was calculated using paternal half-sib correlation with the direct pattern variance analysis. Breeding Value (BV) of sire was calculated by absolute estimated breeding value. The materials used in this study included were data record during the last three years (2013-2015) consisted of 41 sires, 51 dams and 244 calves. Weaning weight data had been corrected based on age of dams, sex and weaning age of 120 days. The results showed that the heritability value of weaning weight was included in high category ( $0.36 \pm 0.21$ ). The highest BV was KJ.J608 (49.76) with a ratio of 231.45%. The results of this study were expected to be the basis recommendation for selecting sires in Kebumen.

*Keywords : Breeding Value, weaning weight, Kebumen Ongole Grade, cattle*

## INTRODUCTION

One of national assets in the field of animal husbandry in Kebumen that very potential to be developed is the Kebumen Ongole grade cattle. It is one of a good meat producers animal. Sutarno and Setyawan (2015) reported that the carcass of males and females cattle can reach more than 50%. Agung *et al.* (2015) and Haryoko and Suparman (2009) reported that the percentage of the carcass reach  $51.42 \pm 2.27\%$  and  $47.78 \pm 2.82\%$ . Kebumen Ongole grade cattle has been established as a new cattle strains in Indonesia through Decision Letter of Minister of Agriculture No. 358/Kpts/PK. 040/6/2015 on June 8<sup>th</sup> 2015 (Kementrian Pertanian, 2015).

The potential of Ongole grade cattle as one of livestock genetic resources and sources of animal protein should be increased, including through the selection. Growth traits like weaning weight is an economical trait that can be one of consideration as selection criteria in selecting animals. Weaning weight is a weight at the time of calf separated with the dam. It was obtained through the weighing at the age of six to eight months or 205 days (Hardjosubroto, 1994). The weaning weight can be used to know the ability of milk production of the dam, mothering ability of the dam and also the genetic growth information of the calf.

Selection is the act of choosing males and females cattle that will be developed in the breeding area based on its genetic quality. Selection in cattle is usually based on a combination of several traits of economic importance which may be phenotypically and genetically related (Tsvetanova, 2004). Genetic progress in economic characters such as weaning weight cannot be measured directly, but it can be estimated on the basis of phenotypic (Lodhi *et al.*, 2016). The information on genetic parameters, such as heritability, repeatability, and genetic correlation is a prerequisite for making efficient selection strategies by the geneticists and breeders (Toghiani, 2012). Heritability is a ratio of variances as the total proportion of variances in a population for a particular measurement, taken at a particular time or age, that attributable to variation in additive genetic (Visscher *et al.*, 2008). The concept of heritability is commonly used in human, animal genetic or sub-population samples based on genetics (Hansen *et al.*, 2011). Several studies showed that the heritability of

weaning weight of Ongole grade cattle  $0.48 \pm 0.58$  (Putra, 2014) and  $0.24$  (Paputungan *et al.*, 2015), Friesian cattle  $0.74 \pm 0.19$  (Ramatsoma *et al.*, 2015), Nellore cattle  $0.45$  (Lobo *et al.*, 2003), Hanwoo cattle  $0.17$  (Roh *et al.*, 2015). The others publication also showed that repeatability of Ongole grade cattle in weaning weight reached  $0.64$  and  $0.42 \pm 0.11$  (Dib, *et al.*, 2009) which higher than Friesian  $0.15$  (VecihiAksakal *et al.*, 2009). Both values will be used to calculate the breeding value of cattle. One of the organizations that work in the selection of the cattle or the breeding of the cattle is the ASPOKEB (Association of Kebumen Ongole Grade Farmer). The aim of this study was to calculate the estimated breeding value of sires based on the offsprings weaning weight. This research was very important to choose sires that will be used as *pemacek* in Kebumen area. The results of this research are expected to help ASPOKEB in selecting sire. This research was still rarely done in Kebumen so it was very interesting to do.

## MATERIALS AND METHODS

### Research Site and Data Collected

This research has been carried out from August until December 2015 in Urut Sewu, Kebumen. Urut Sewu is lowland and coastal area in Kebumen. Kebumen Regency geographically located at  $7^{\circ}27'1''$  to  $7^{\circ}50'1''$   $109^{\circ}33'1''$  to South latitude and  $109^{\circ}50'1''$  East longitude. The materials used in the study was the growth record data of last 3 years i.e. 2013 to 2015. This data include the pedigree, cattle performances, weaning age and the age of the dams. Pedigree data consists of 41 Sires, 51 dams and 244 offsprings.

### Data Analysis

**Standardization of data.** Data correction was used to minimize variations in the environment. Weaning weight was corrected to weaning age of 120 days, sex and the age of dams based on Hardjosubroto (1994) as follows:

- Correction factor of sex

$$CF_{sex} = \frac{WW_{male}}{WW_{female}}$$

Where  $CF_{sex}$  = correction factor of sex,  $WW_{male}$  = weaning weight of male cattle and  $WW_{female}$  = weaning weight of female cattle.

- Correction factor of dams age

$$CF_{\text{dam age}} = \frac{WW_5}{WW_a}$$

Where  $CF_{\text{dam age}}$  = correction factor of dams age,  $WW_5$  = the weight of the dams at 5 years, and

$WW_a$  = weaning weight at the actual age  
- Corrected weaning weight

$$WW_{120} = \left[ \frac{WW - BW}{WA} \times 120 + BW \right] \times CF_{\text{sex}} \times CF_{\text{dam age}}$$

Where  $WW_{120}$  as corrected weaning weight at 120 days of age,  $WW$  = actual weaning weight,  $BW$  = birth weight and  $WA$  = actual weaning age.

**Heritability.** The data were analysed by least squares analysis of variance by R program v. 3.3.2 to identify the fixed effects with significance ( $P < 0.05$ ). Heritability estimation 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 sire,  $e_{ik}$  as the effect of environmental and genetic deviation related to the individual in a group of sire.

$$h^2 = 4t$$

$$t = \frac{\sigma_s^2}{\sigma_s^2 + \sigma_D^2}$$

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

$$k = \frac{1}{S-1} \left( N - \frac{\sum n_i^2}{N} \right)$$

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

Where  $h^2$  = heritability,  $\sigma_s^2$  = variance of sire,  $\sigma_D^2$  = variance of dams,  $SE$  = standard error,  $k$  = constant,  $S$  = number of sire,  $N$  as total of progeny or number of progeny per sire

**Estimated Breeding Value.** The estimation of breeding value for sires was calculated based on the progeny performance data with the following equation according to Hardjosubroto (1994):

$$EBV = \frac{nh^2}{4 + (n-1)h^2} (\bar{P} - \bar{P}) + \bar{P}$$

Where

EBV : Breeding Value

$h^2$  : heritability of weaning weight

$\bar{P}$  : the average of individual performance,

$\bar{P}$  : the average of population performance

$n$  : number of progeny per sire

**Relative accuracy (RA).** The estimation of RA values for each sires was calculate with the following model (Warwick *et al.*, 1990):

$$RA = 0.5h \times \sqrt{\frac{n}{1 + (n-1)t}}$$

$$t = 0.25h^2$$

Where RA = relative accuracy,  $n$  as number of progeny per sire, and  $t$  ( $0.25h^2$ ) paternal half-sib correlation.

## RESULTS AND DISCUSSION

### Weaning Weight

The weaning weight of the cattle was corrected to 120 days according to environmental conditions in the field. The farmer in Kebumen do weaning at the age of 120 days so this research correspond with the weaning age that used by them. The average of  $WW_{120}$  in Kebumen Ongole grade cattle in this study was  $119.40 \pm 36.61$  kg. This result was higher than the weaning weight of several Indonesian native cattle are Bali  $90.5 \pm 15.46$ , Sumba Ongole  $113.67 \pm 25.24$  kg, Brahman cross  $107.13 \pm 19.25$  kg and  $44.68 \pm 11.00$  kg for Aceh (Praharani, 2009; Kaswati *et al.*, 2013; Putra *et al.*, 2014). It was also lower than weaning weight of Charolais  $229.10 \pm 12.73$  kg, Hungarian Grey  $191 \pm 5.05$  kg, Hungarian Simmental  $236 \pm 3.40$  kg, Angus  $212 \pm 3.61$  kg, Hereford  $204 \pm 5.06$  kg, Blonde d'Aquitaine  $242 \pm 7.95$  kg, Limousin  $203 \pm 2.99$  kg, Angus-Nellore  $247.74 \pm 5.63$  and Simmental-Nellore  $248.16 \pm 7.31$  (Contreras *et al.*, 2015; Szabó *et al.*, 2012; Szabó *et al.*, 2013 and Ítavo *et al.*, 2014). The difference in the weaning weight was caused by the difference of the weaning ages and breeds. Kebumen Ongole grade cattle have lower weaning weight than the others because they are weaned at the age of 120 days, while the other at the age of 205 days. Sutarno and Setyawan (2015) reported that Ongole grade catlles are suitable as draught animals due to a big and strong body, docile and quiet, tolerant to heat, have high adaptability over different environmental conditions, able to grow in limited

Table 1. Variance component and the value of heritability in Kebumen Ongole grade cattle

| Component          | Value  |
|--------------------|--------|
| S                  | 41     |
| P                  | 244    |
| Var <sub>(s)</sub> | 40.907 |
| Var <sub>(p)</sub> | 421.70 |
| K                  | 6.08   |
| h <sup>2</sup>     | 0.36   |
| SE                 | 0.21   |

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= standar error

Table 2. The top ten sires of Kebumen Ongole grade cattle based on breeding value of offspring weaning weight

| Rank | Sire        | n  | BV <sub>abs</sub> | Ratio (%) |
|------|-------------|----|-------------------|-----------|
| 1    | KJ.J608     | 9  | 49.76             | 231.45    |
| 2    | MRN         | 11 | 44.62             | 207.53    |
| 3    | JIMIN       | 18 | 42.78             | 198.99    |
| 4    | MRJ17638    | 3  | 36.98             | 172.02    |
| 5    | MRJ17115    | 6  | 36.49             | 169.70    |
| 6    | TUNJANG     | 6  | 35.87             | 166.85    |
| 7    | NASIR       | 4  | 33.28             | 154.77    |
| 8    | KG 13 J 401 | 9  | 32.09             | 149.25    |
| 9    | K S J       | 5  | 30.51             | 141.92    |
| 10   | TAJ12008    | 14 | 30.48             | 141.78    |

n= the number of progeny per sire; BV<sub>abs</sub> =Absolute breeding value; Ratio = the comparison of individual BV with the average of BV in population

forageconditions, and high reproductive activity.

### Heritability

The result of heritability of weaning weight using paternal half sib correlation data was in high category ( $h^2 > 0.3$ ). Estimated value of heritability calculated based on variance component in Table 1. These values may indicate that the diversity of

weaning weight in a population of 36% was influenced by the additive genes and 64% was influenced by environmental factors and non-additive. The value of standard error (SE) which obtained in this study were lower than its heritability, its can indicate that the value of heritability was accurate. The heritability value of this research was lower than Sumba Ongole and Aceh cattle at  $0.77 \pm 0.68$ ;  $0.49 \pm 0.59$  respectively (Said *et al.*, 2016; Putra *et al.*, 2014) and also higher than several research of Indonesian cattle such as Ongole-crossbreed and Bali at 0,24;  $0.27 \pm 0,16$ ;  $0.09 \pm 0.15$  and  $0.33 \pm 0.09$ , respectively (Paputungan *et al.*, 2015; Gunawan and Jakaria, 2011). Some research has also been done on Asturiana de los Valles cattle, Northeastern Thai Indigenous Cattle, Hanwoo, Friesian and Charolais cattle at 0.29;  $0.27 \pm 0.06$ ; 0.15;  $0.13 \pm 0.09$  and  $0.36 \pm 0.01$  (Goyache *et al.*, 2003; Intaratham *et al.*, 2008; Park *et al.*, 2001; Atil *et al.*, 2005; El-Saied *et al.*, 2006). Environmental conditions and management of maintenance in research site were estimated in compliance with the status of physiology so that environmental condition alleged to be relatively uniform. The difference in these value caused by the genetic variety and different environments. The value of certain properties of a heritability in a population is the population of a specific character (Kurnianto, 2009). This heritability value can be used as a basis of selection for Kebumen Ongole grade cattle by ASPOKEB in Urut Sewu. Furthermore, this value also can be used to calculate the breeding value (BV) for sires based on offsprings weaning weight.

### Estimated Breeding Value

The completeness of animal recording, which includes pedigree and performance recording, is advisable for all breeds to allow for accurate estimates of breeding values (Abin *et al.*, 2016). Estimated breeding values (EBVs) is important to selecting animals for a range of traits that have direct impacts on productivity (Johnston *et al.*, 2007). EBVs can also be used to determine genetic trends by regressing the average EBVs on birth year (Enns *et al.*, 2008). Parameters for population structure also provide important insights for monitoring maintenance of genetic variation (Groeneveld *et al.*, 2009). The breeding values (BV) that calculated in this research was absolute breeding values. The top ten sires of Kebumen Ongole grade cattle based on the breeding value of offspring weaning weight are

presented in Table 2. The highest BV of sires in this research was 49.76 kg (KJ.J608) with the ratio 231.45 %, it means that the BV value of it was 131.45 % higher than the average BV in population. Several previous studies showed the higher BV in SO, PO, and Nellore cattle were 66.05 kg, 45.96 and 20.75 kg respectively (Said *et al.*, 2016; Paputungan *et al.*, 2015; Rodriguez and Guerra, 2013). The sire breeding values based on the offsprings weaning weight can be used as one of the selection criteria for choosing the superior sire. The breeding value based on birth weight in this study do not calculate because birth weight is not a good selection criteria because it can cause distoxia and also it still largely influenced by the dams environment (Hardjosubroto, 1994). In the previous study, weaning weight had negative genetic gain due to a negative genetic correlation, especially between cow weight and weaning rate, a complex trait that includes fertility, maternal ability and survival (Laske *et al.*, 2012). The proposed index and the relative economic importance of the identified traits can guide selection decisions in selecting their replacement animals (Laske *et al.*, 2012). These top ten sires then can be recommended as the best sire Kebumen Ongole grade cattle. Furthermore, the sire with a lower BV can be culled in order to keep livestock productivity.

#### Relative Accuracy (RA)

RA was useful for selecting sires based on number of progeny. It was calculated to support the result of estimated breeding value for sires. Because of there was no correlation between phenotype that caused by non genetic factor or environmental factor so the value of  $t = h^2/4$  (Warwick *et al.*, 1990). The results of RA estimation are presented in Table 3. The highest RA of sires in this research was 0.80 (JIMIN) and the lowest was 0.48 (MRJ17638). JIMIN has the highest value of RA because of offsprings number. The previous studies showed the RA values on Aceh Cattle of BB<sub>205</sub>, BB<sub>365</sub>, BB<sub>550</sub>, respectively was 0.95, 0.98, and 1.15 (Putra *et al.*, 2014). Based on the results, it can be concluded that the higher value of offsprings number per sire will deliver a higher value of RA. Therefore, Hardjosubroto (1994) stated that to increase the value of RA, the number of observations (data) should also be improved. JIMIN, MRN and KJ.J608 have the top three of RA value with the higher value of EBV, so they can be the main recommendation for selecting sire.

Table 3. The Relative Accuracy Values for Each Sire

| Sire        | n  | RA   |
|-------------|----|------|
| KJ.J608     | 9  | 0.69 |
| MRN         | 11 | 0.72 |
| JIMIN       | 18 | 0.80 |
| MRJ17638    | 3  | 0.48 |
| MRJ17115    | 6  | 0.61 |
| TUNJANG     | 6  | 0.61 |
| NASIR       | 4  | 0.53 |
| KG 13 J 401 | 9  | 0.69 |
| K S J       | 5  | 0.58 |
| TAJ12008    | 14 | 0.76 |

N= the number of progeny per sire; RA = Relative accuracy

#### CONCLUSION

The highest breeding value of the top ten sires was KJ.J608 (49.76) with a ratio of 231.45%. The results of this study can be used as a basic reference in selecting sires of Kebumen Ongole grade cattle. In addition, the results of this research can be used as a material for the evaluation of the activities of the livestock breeding, primarily for repair the recording by ASPOKEB. Further research needs to be done about the response selection to find out the result of the selection is based on this breeding values.

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