Selection of Bali candidate bulls based on the performance test and grading

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Abstract

This research was carried out to evaluate the performance test and grading results in 13 head of Bali cattle (*Bos javanicus*) at Bureau of Artificial Insemination (BAI) of Lelede, West Nusa Tenggara Province. The vital sign that measured in performance test including of age, body weight (BW), withers height (WH), body length (BL) and scrotal circumferance (SC). The average of vital sign after 306 days of the performance test were 1182.28 ± 50.78 (age), 214.54 ± 26.03 kg (BW), 114.46 ± 2.60 cm (WH), 113.92 ± 2.25 cm (BL), 151.15 ± 5.35 cm (CG) and 23.69 ± 0.75 (SC). The average of weight gain and growth rate after the performance test were 21.46 ± 11.04 kg and 0.05 ± 0.03 kg/days. The class classification (grading) based on the performance test only obtained four class III bulls (eartag number: 0874, 0885, 00744 and 0888). The best four bulls based on corrected final weight (CFW) were obtained on bull with eartag number: 0874, 0885, 0889 and 0880. The best two bulls according to CFW and grade were reached on bull ID: 0874 (267.29 kg) and 0885 (220.03 kg). It was concluded that bull ID: 0874 as the best bulls according to CFW and class category.

Key words: Bali cattle, performance test, heritability, final weight, class

Introduction

Bali cattle (*Bos javanicus*) is one of Indonesian native cattle that kept by smallhold as beef cattle. Several studies reported that the average of body weight in Bali cattle are 148.35 ± 0.01 kg for male and 133.09 ± 0.01 kg for female (Prahani and Juarini, 2006). Despite, the average of carcass weight and carcass percentage of Bali bulls were 135.22 ± 3.25 kg and 48.33 ± 1.14 % respectively (Aditia et al., 2014). Bali cattle capable to adapt well in most Indonesian area, included in Lombok island of West Nusa Tenggara (WNT) province. In year 2014, the population of

beef cattle in this province reached of 1.013.793 heads and the fourth higher population in Indonesia. Moreover, the number of slaughtering and output of beef cattle in year 2014 were 51.270 heads and 20.555 heads respectively and ± 7% from total population in WNT province. In addition, total beef production in WNT province at year 2014 was 10.847 tons (Kementan, R. I., 2015) and can be concluded that WNT province is potential for seedstock resource in Indonesia, included of Bali cattle.

Bureau of Artificial Insemination (BAI) of Lelede is one of institution under the Department of Animal Husbandry and Animal Health

of WNT province control that carried out to produce straw of Bali cattle. One of the effort to produce seedstock in BAI Lelede is selection based on performance test. The performance test is the one of method for selection of seedstock based on qualitative and quantitative traits with measuring and weighing (Richard and Bourdon, 2000; Yusuf et al., 2010). The performance test is important to get genetic potency in each tested animal. Commonly, the performance test was managed on candidate bulls as one of selection criteria before continued to the progeny test (Park et al., 2013; Crowley et al., 2011). The important information from performance test is final weight, average daily gain (ADG) or growth rate and feed intake (Raidan et al., 2016; Castilhos et al., 2011; Okanishi et al., 2008).

Several studies reported that the performance test was managed to get the best candidate bulls some beef cattle such as Bali (Patmawati et al., 2013), Aceh (Putra et al., 2016), Sumba Ongole (Said et al., 2016), Red Chittagong (Nahar et al., 2016), Nellore (Raidan et al., 2016), Japanese Black (Oikawa et al., 2006), Bonsmara dan Nguni (Mashiloane et al., 2012). The duration time for performance test is 12 months and the maximum age for tested bulls is 600 days (Hardjosubroto, 1994). Despite, Raidan et al. (2016) managed the performance test with two steps, in the pasture (294 days with 70 days for adaptation) and in the feedlot stall (168 days with 56 days for adaptation).

This study was carried out to evaluate the performance test results at BAI Lelede. The result of this study can be used as early information to select the best Bali bull for straw production in WNT province in the future.

Material and Methods

Location and sample

This study was conducted in the Bureau of Artificial Insemination (BAI) of Lelede placed at Lombok Island, West Nusa Tenggara Province of Indonesia. This area located at 115°46'–116°20' east longitude and 8°25'–8°55' south latitude. The average of rainfall in the research location about 2.000–4.000 mm/year with air temperature about 21.5–36.0 °C and relative hu-

midity about 44–100%. Total 13 heads of Bali candidate bull and records data from year 2013 to 2015 were used in this study for analyzed.

Animals management

The management system at BAI Lelede was conducted by colony stall with 20 to 30 animals per colony and bulls were kept in individual stall. The breeding system that used in research site is artificial insemination (AI) and natural mating (NM) methods. The pregnancy examination was managed 3 months after AI program. Cows with service per conception (S/C) more than two times were kept in breeding stall for NM program. The weaning period of calves was managed at about four months age. Therefore, the weaned calves were kept in colony stall until ± 600 days of age. Hence, bull at 600 days of age mentioned candidate bull (bullock). Thus, all of bullock were managed for performance test program. The feed ration containing of king grass (*Pennisetum purpureum*), corncob and rice bran. The feed ration of corncob (4 kg) and rice bran (6 kg) were given to seven calves per day with one month for adaptation time. The yearling calves were given feed with king grass (10 kg/head/day), corncob (5 kg/head/day), field grass (8 kg/head/day), rice bran (4 kg/head/day) and commercial concentrate (3 kg/head/day). The water was given by ad libitum and health examination was performed every month.

Weighing and measuring

Weighing and measuring of cattle were performed since birth to adult age with hanging weight scale. Total of 13 bulls (about 1.94 years age) were used for the performance test along 306 days (27/09/2016 to 30/07/2017). The weighing and measuring of animal were performed before and after the performance test using digital weight scale (Iconix FX1, New Zealand) and measuring tape (Rondo, Switzerland). The measuring of cattle consisted of withers height (WH), body length (BL), chest girth (CG) and scrotal circumferance (SC). Data of WH were obtained by measuring the distance from the withers to the surface by the perpendicular line. Data of BL were obtained by measuring the dis-

tance between the shoulder point (*later tuberosity of humerus*) to the edge of pelvic bone. The measurements of BL and WH were measured by measuring stik (Hauptner, Germany). Data of CG were obtained by circling the measuring tape on the chest behind the shoulder. Data of SC were obtained by cycling by measuring tape on the scrotal.

Data analysis

The body weight and body measurements of animals were used for descriptive statistic analysis to calculate means, standard deviation, coefficient of variation, minimum and maximum values. Therefore, the performance test results were evaluated using formula from Hardjosubroto (1994) as follows:

$$CIW = \left(\frac{AIW - BW}{Age} \times \overline{X}_{Age} \right) + BW$$

$$WG = AFW - AIW$$

$$CFW = CIW + WG$$

$$GR = \frac{CFW - CIW}{T_2 - T_1}$$

Remark:
CIW = corrected initial weight (kg)
AIW = actual initial weight (kg)
BW = birth weight (kg)
WG = weight gain (kg)
AFW = actual final weight (kg)
AIW = actual initial weight (kg)
CFW = corrected final weight (kg)
GR = growth rate (kg/day)
T_2 = final age (days)
T_1 = initial age (days)
$\overline{X}_{Age}$ = average of age (days)

Identification of class type (grading) in the candidate bulls were performed based on Indonesian National Standard (INS) for Bali bull as presented in Table 1. Moreover, the phenotypic characteristics standard of a Bali bull were included as the selection criteria in the Bali bulls. Whereas, the standard characteristics for Bali bulls i.e. hair color is black, knee downward color is white, back white patch half moon, tip of the tail is black, horn is black and well developed, head has wider shape and neck is solid and strong (Kementan, R. I., 2015). The ilustration of phenotypic characteristics standard for a Bali bull was presented in Figure 1.

Results and Discussion

Initial weight

The average of vital sign of Bali bull candidate before his performance test was presented in Table 2.

Several studies reported that a yearling age was used as initial age before the performance test in some candidate bulls of Sumba Ongole (392 days), Red Chittagong (360 days), Bonsmara (355 days) and 371 days in Nguni (Said et al., 2016; Nahar et al., 2016; Mashiolane et al., 2012). Moreover, several studies also used the weaning age as initial age before the performance test (Garcia et al., 2004; Sbarra et al., 2009; Oikawa et al., 2006). The birth weight of Bali cattle in the present study (15.31 kg) was lower than Bali cattle at the breeding center of Denpasar, that is 18.04 kg (Setiyabudi et al., 2016) and 17.73 kg (Gunawan dan Jakaria, 2011).

Table 1. The body measurements standard for Bali bull ages > 24–36 months (INS 7651.4:2015)

Body measurements (cm)	class		
	I	II	III
Withers height	127	120	113
Body length	133	124	115
Chest girth)	179	158	148
Scrotal circumferance	26	26	26

Fig. 1. The phenotypic characteristics standard of a Bali bull (*Bos javanicus*)

Table 2. Descriptive statistic of age and body weight in Bali candidate sires before the performance test at BAI of Lelede

Variable	Mean	SD	CV (%)	Min.	Max.
Initial age (days)	722.15	79.85	11.06	618.00	876.00
Birth weight (kg)	15.31	0.75	4.91	14.00	16.00
Actual initial weight (kg)	196.92	22.17	11.26	168.00	238.50
Corrected initial weight (kg)	198.62	28.01	14.10	160.14	267.29

SD: standard deviation; CV: coefficient of variation; Min.: minimum value; Max.: maximum value

The actual initial weight (AIW) of candidate bull before the performance test was reported on several studies in Sumba Ongole (181.22 ± 25.59 kg), Aceh (138.65 ± 19.46 kg), Bonswana (251.91 kg), Nguni (180.54 kg), Japanese Black (260.80 kg), Nellore (245.90 kg), Red Chittagong (63.02 kg), Angus (304.34 kg), Charolais (321.93 kg) and 277.47 kg for Hereford (Said et al., 2016; Putra et al., 2016; Mashiolane et al., 2012; Oikawa et al., 2006; Reis et al., 2013; Nahar et al., 2016; Garcia et al., 2004). The average of AIW in the present study was 196.92 ± 22.17 kg and showed higher than SO, Aceh and Nguni cattle.

Final weight
The average of vital sign in the Bali candidate bull before the performance test was presented in Table 3. The average final age in tested Bali candidate bulls were about 3 years and reached of the body and sex maturities. In 3 years age, the coat colour changes was occured in Bali bulls from reddish to black colours. The coat colour changes in Bali bulls can be caused by testosteron hormonal factor. The average of actual final weight (AFW) in Bali bulls from performance test along 9 months at Bureau Breeding and Forage Center (BBFC) at Pulukan District was 261.56 ± 81.20 kg (Patmawati et al., 2013) and more higher than in this study. With similar methodology, the average of AFW in Aceh (967 days of age) and Sumba Ongole (977 days of age) candidate bulls were 141.58 ± 25.81 kg and 355.14 ± 87.41 kg respectively. Meanwhile, the average weight gain in Aceh and Sumba On-

gole candidate bulls were 28.22 ± 7.01 kg and 210.71 ± 92.53 kg respectively (Putra et al., 2016; Said et al., 2014).

The average of weight gain in Bali bulls at BAI Lelede (21,46 ± 11,04 kg) was lower than Bali bulls at Nusa Tenggara Timur province (27,33 ± 4,50 kg) as reported by Tahuk et al. (2017). The average of AFW in Bali bulls at BAI Lelede was 214.54 ± 26.03 kg and lower than other Bali (260,67 ± 15,31 kg) and Sumba Ongole bulls (Tahuk et al., 2017; Said et al., 2016). Mashiolane et al. (2012) reported that the final weight of Bonsmara dan Nguni from one year of performance test were 389.71±29.21 kg and 304.33±27.23 kg respectively. Meanwhile, the average ADG in both bulls based on the performance test were 0.66 ± 0.14 kg/day (Bonsmara) and 0.60 ± 0.10 kg/day (Nguni).

Body measurements and grading

The average of body measurements in Bali bulls from performance test at BAI Lelede was presented in Table 4. The performance test results in Bali candidate bulls at BAI Lelede commonly included of class III category according to WH, BL and CG. The average of SC in tested Bali bulls was 23.69 ± 0.75 cm and lower than INS value (26 cm). The average of body measurements in Bali candidate bulls (1–2 years age) at Breeding Station at Pulukan according to Patmawati et al. (2013) were 117.61 ± 6.40 cm (WH), 123.08 ± 10.07 cm (BL) and 156.89 ± 15.15 cm (CG) and included of class II category (based on BL dan CG). Total of 69% (9 bulls) of tested Bali candidate bulls were not classified because of lower WH or BL values than INS of class III (Table 5). Furthermore, Soekardono et al. (2009)

Table 3. *Descriptive* statistic of age and body weight in Bali candidate sires after the performance test at BAI of Lelede

Variable	Mean	SD	CV (%)	Min.	Max.
Final age (days)	1182.28	50.78	4.29	1062.00	1244.00
Weight gain (kg)	21.46	11.04	51.44	2.00	38.00
Actual final weight) (kg)	214.54	26.03	12.13	162.00	263.00
Corrected final weight (kg)	216.23	34.57	15.99	147.38	297.29
Growth rate (kg/day)	0.05	0.03	68.48	0.01	0.13

SD: standard deviation; CV: coefficient of variation; Min.: minimum value; Max.: maximum value

Table 4. Descriptive statistic of body measurements in Bali candidate sires in the performance test at BAI of Lelede

Performance test	Body measurements (cm)	Mean	SD	CV (%)	Min.	Max.
Before	Withers height	111.31	3.35	3.01	105.00	117.00
	Body length	109.69	3.90	3.56	103.00	116.00
	Chest girth	141.46	6.23	4.40	134.00	155.00
	Scrotal circumferance	18.85	1.99	10.58	16.00	23.00
After	Withers height	114.46	2.60	2.27	112.00	119.00
	Body length	113.92	2.25	1.98	112.00	118.00
	Chest girth	151.15	5.35	3.54	144.00	160.00
	Scrotal circumferance	23.69	0.75	3.17	23.00	25.00

SD: standard deviation; CV: coefficient of variation; Min.: minimum value; Max.: maximum value

Table 5. Result of the performance test along 306 days in 13 Bali candidate sires at BAI of Lelede

No. bull	Sire	Dam	Date of birth	BW (kg)	CIW (kg)	CFW (kg)	GR (kg/days)	Age (days)	Body measurements (cm)				Rank of CFW	Class*
									WH	BL	CG	SC		
0888	03482	02437	12/09/2014	16	176.48	200.48	0.05	1200	117	116	150	23	9	III
0750	02951	01841	25/08/2014	15	187.36	189.36	0.01	1121	113	112	150	23	13	-
0758	02951	01774	30/09/2014	16	195.38	197.38	0.01	1157	115	113	157	24	11	-
0887	03482	02443	26/12/2014	14	188.30	215.80	0.05	1244	112	113	147	24	7	-
0871	02641	1784	13/11/2014	16	197.27	213.27	0.03	1201	113	112	147	23	8	-
0886	03482	02454	12/10/2014	16	160.62	195.62	0.09	1169	112	112	151	24	12	-
0875	11012/003	01116	20/10/2014	14	160.14	198.14	0.09	1177	112	113	144	24	10	-
0744	03482	03482	27/06/2014	16	199.42	222.92	0.13	1062	118	117	158	25	6	III
0885	00718	00711	29/11/2014	15	220.03	242.03	0.04	1217	118	117	160	23	2	III
0880	11012/003	01149	15/12/2014	15	219.49	231.49	0.02	1233	113	112	150	23	4	-
0889	03889	03893	26/09/2014	16	210.51	233.51	0.05	1153	113	114	145	24	3	-
0882	11012/003	01143	22/11/2014	15	199.76	223.76	0.04	1210	113	112	148	23	5	-
0874	11012/003	05KYT	09/12/2014	15	267.29	297.29	0.05	1227	119	118	158	25	1	III

*BW: birth weight; CIW: corrected initial weight; CFW: corrected final weight; GR: growth rate; WH: withers height; BL: body length; CG: chest girth; SC: scrotal circumferance ; *)class identification based on WH, BL and CG*

reported that about 60% of Bali cows at Lombok island had grade 2. Hence, the genetic improvement of Bali cattle can be performed at Lombok Island through selection program.

Conclusions

The performance test and grading (according to INS) are two selection criteria that important to obtain the best candidate bull. Bull ID: 0874 in this study was showed the best bull according to corrected final weight (CFW) and class category (grading). In the future, the selection of Bali bulls based on estimated breeding value (EBV) is important to increase of selection accuracy.

Acknowledgement

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