Phenotypic characteristics of Belgian Blue x Brahman Cross and Wagyu x Brahman Cross crossbred population

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Abstract.The aim of the study was to identify the phenotypic characteristics of Belgian Blue x Brahman Cross and Wagyu x Brahman Cross at PT. WMP,Central Java. The materials used were 9 F_1-B, 13 F_1-W, 6 F_2-B and 7 F_2-W. The data collected include the colour, ADG, BW, BL, WH, and HG at 90-days old. The results showed dominant blackin F_1-B, brown in male F_2-B and dark brown at the female. The F_1-W was black-brown, and F_2-W colour was light brown, brown, and dark brown. The ADG F_1-B was 0.70±0.15 kg, F_2-W was 0.58± 0.06 kg, F_2-B was 0.64 ± 0.17 kg, and F_2-W was 0.60 ± 0.25 kg. The BW (kg), BL (cm), WH (cm) and HG (cm) at F_1-B was 95.10±12.07; 77.98±3.80; 85.32±2.85; and 101.93±4.51, F_1-W was 86.21±9.60;77.64±5.92; 88.25±2.43; and 101.97±3.09, F_2-B was 88.22±4.50 kg, 87.29±13.45, 94.18±6.90, and 104.13±2.29, then F_2-W was 90.91±27.70, 80.77±15.41, 86.36±7.80, and 99.92±11.88 cm, respectifly. There were significant effect of crossing on ADG, BL andHG at F1 and F2 ($P>0.05$). The conclusion BB Cross cattle have a dominant trait in body posture, especially in the first offspring, while Wagyu Cross cattle tend to be more assertive in the coat colour.

1. Introduction

Crossbreeding of beef producers with high productivity continues to be developed in Indonesia to sufficient domestic meat demand. The arrival of a new type of cow, the Belgian Blue, was carried out to increase genetic diversity, especially in terms of growth. The development of Belgian Blue crossing cattle continues to be carried out to get animals that have superior properties and can develop well in Indonesia.

The Belgian Blue (BB) cow is the Bos taurus cattle produced by a cross between Holstein Friesian cattle (FH) and Shorthorn cattle that were developed in Belgium since 1850 [1]. The BB cattle are unique cause they have double muscling due to deletion of 11 nucleotides of exon 3 in the myostatin gene. BB cattle have a higher birth weight and ADG than cattle in general[2]. Wagyu beef is usually used more often for processed steak in restaurants because it has a relatively very high price. Wagyu

beef is like the Taurus cattle in general, has a low tolerance to heat stress, so it is not ideal if maintained in tropical regions such as Indonesia.

Crossing between Belgian Blue and Wagyu cattle with local cows began to be developed in Indonesia. The purpose of the crossing is to obtain calf that has fast growth and high carcass weight, have good meat with marbling, and resistant to tropical environments. So it is necessary to research the phenotypic characteristics cross breed Belgian Blue and Wagyu with local Indonesian cow, to see inheritance based on exterior properties. It can be a reference for development of cattle in the future.

2. Material and methods

2.1. Material

The materials used were 9 crosses of BB-BX (F_1-B), 13 crosses of Red Wagyu (Japanese Brown)-BX (F_1-W), 6 crosses of male F_1-B with female F_1-B, F_1-W, and BX (F_2-B) and 7 crosses of male F_1-W with female F_1-W, F_1-B and BX(F_2-W). The research was done in PT. Widodo Makmur Perkasa, Klaten, Central Java with average air temperatures of 28 to 30^0 C and an average rainfall of 140.17 mm/year.

2.2. Method

Retrieving exterior characteristic data (color) is done by direct observation of livestock. Weighing is done by importing livestock into Kenko portable scales. Average daily gain (ADG) is calculated from the weight of livestock from birth to pre-weaning (90-days). The size of cattle data includes body weight (kg), body length (cm), wither height (cm), and heart girth (cm). Heart girth measurements were measured on the rib cage the very front is right behind the front foot is done by using a measuring tape with a precision number 1 cm. Body length was measured in a straight line with a measuring stictmerk FHK with precision number 0,1 cm from the elbow (*humerus*) to the lump of the filter bone (*tuber ischii*). Wither height is measured perpendicular to land to the top of the gumba or behind hump for Hisar and Ongole cows by using measuring stictmerk FHK with precision number 0,1 cm. Measurentment made by different person. The average daily gain (ADG) and body size of cattle has been standardized to 90-days old and were analyzed using T-Test

3. Result and discussion

3.1. Exterior characteristics

Comparison of exterior (coat colour) characteristics of cattle can be seen in Table 1. Based on Table 1, it can be seen that crossbreeding cows have varying colours, namely black, black-white, white, light brown, brown, dark brown and black-brown. Calf of BB Cross in the first offspring (F_1-B) mostly has the dominant colour black in males and females. Males F_1-B have coat colour black and black white, while females have a coat colour black. The second offspring of BB Cross (F_2-B) has more variation of coat colour than F_1-B such as black, light brown, brown, dark brown, and black-brown. Males F_2-B have coat colour black white, brown and dark brown. Females were black and dark brown. The coat colour of BB cattle tends to have the dominant trait when it has blood proportion 50% or more, however, if the blood proportion of BB under 50%, it has no dominant influence for coat colour. BB Cross at first offspring has a coat colour that can be identified that the cow is a BB breed because it has the same coat colour in general. BB Cross second filial began to be difficult to identify because it has more varied coat colour and different than BB coat colour in general.

Calf of Wagyu Cross in the first offspring (F_1-W) in males cattle has coat colour dark brown and black-brown, while females have coat colour white, light brown, brown and dark brown. The second offspring of Wagyu Cross (F_2-W) in males has coat colour including light brown, brown and dark brown. In males, the coat colour of the F1 Wagyu has a coat colour tends to be dark, but in F2 Wagyu Cross the coat colour becomes rather light. The female of F2 Wagyu has coat colour include light brown, brown and dark brown. Coat colour in females contrasts with males, where the colour in males

was getting brighter but in females, the colour becomes darker. Kahn et al.[3] stated that the Red Wagyu (Japanese Brown) has a dark brown to light brown colour. Wagyu Cross has a dominant colour brown when the cattle have blood proportion 50% or under 50%. Mohanty et al. [4] stated that coat colouring patterns in cows are regulated by different genes, namely agouti (A), extension (E), albino (C), brown (B), dilution (D) and roan (R). Gil et al. [5] stated that the combination of colours from the two different breeds will produce colour mixture (diluted) to produce variations colours in F1 and back cross. Coat colour on Wagyu Cross F1 and F2 is more easily identified because the coat colour still has a brown base colour.

Table 1. Comparison coat colour of Belgian Blue Cross and Wagyu Cross

Coat colour	F_1-B		F_2-B		F_1-W		F_2-W	
	Male (*N=4*)	Female (*N=5*)	Male (*N=4*)	Female (*N=2*)	Male (*N=4*)	Female (*N=9*)	Male (*N=3*)	Female (*N=5*)
Black	50%	100%		50%				
Black- white	50%		25%					
White						11%		
Light brown						33%	33%	40%
Brown			50%			45%	33%	20%
Dark brown			25%	50%	25%	11%	33%	20%
Black- brown					75%			20%

Note: N means the number of cattle

3.2. Average daily gain (ADG) and body size of cattle

The results of calculating average daily gain (ADG) and body size of cattle at 90 days old can be seen in Table 2. The results from Table 2 indicate that the F_1-B cattle have the highest ADG, which is equal to 0.70 ± 0.15 kg. Average daily gain (ADG) of BB Cross F1 and F2 have significantly different (P> 0.05). Coopman et al. [6], in their study, stated that the average ADG of BB cattle was 1.2 kg/ day. Belgian Blue Cross at second offspring show a decline ADG compared to previous breeds, both the first and second offspring of the BB Cross have ADG below the average BB cow in general. Lunt et al. [7] in their study, stated that the average of ADG Wagyu beef was 0.7 kg/day. The ADG of Wagyu Cross in this study was below average, according to Mir et al. [8], the ADG will decrease if the Wagyu blood in the cow was higher.

The results obtained showed that the bodyweight of F_1-B cattle at the age of pre-weaning (90 days old) had the highest body weight. There was significantly different on the bodyweight F1 and F2 BB Cross. There was a decrease in body weight in the F2 BB Cross and F2 Wagyu Cross. Coopman et al. (2007) stated that the bodyweight of BB cattle at 90 days ranged from 96 to 98 kg. The first offspring of BB Cross has a bodyweight close to the average range of BB cattle, but the second offspring has a bodyweight that was far from the average range. Mir et al.[8] stated that if Wagyu's blood was higher, then the ADG will decrease.

Measurement of body length (BL), wither height (WH) and heart girth (HG) showed that F_2-B cattle had the highest BL, WH, and HG. There was an increase in the size of BL, WH and HG in the of in the F2 BB breeds. The body length (BL) and wither height (WH) in Belgian Blue Cross cows had a significant difference (P> 0.05) in F1-B and F2-B. Further explained the most common relationship between alleles was codominant or dominant was not full. Codominant was the action of genes where the two alleles were not mutually exclusive dominate so that both of them will appear together. This study uses the same treatment and feeding for all cattle, so it can be said that environmental factors that influence can be eliminated. It can be said that the blood proportion of BB Cross and Wagyu Cross influences performance.

Table 2. Average and standard deviation of ADG and body size of cattle at 90 days old

Variables	Belgian Blue Cross	Wagyu Cross

	F_1-B (*N=9*)	F_2-B (*N=6*)	F_1-W (*N=13*)	F_2-W (*N=8*)
Average daily gain (ADG) (Kg)	0.70 ± 0.15^a	0.58 ± 0.06^b	0.64 ± 0.17	0.60 ± 0.25
Body weight (BW) (Kg)	95.10±12.07	88.22±4.50	86.21±9.60	90.91±27.70
Body length (BL) (cm)	$77.98±3.80^b$	$87.29±13.45^a$	77.64±5.92	80.77±15.41
Wither height (WH) (cm)	$85.32±2.85^b$	$94.18±6.90^a$	88.25±2.43	86.36±7.80
Heart girth (HG) (cm)	101.93±4.51	104.13±2.29	101.97±3.09	99.92±11.88

N means the number of cattle,
^{a,b} superscript in the same row indicated significant different (P> 0.05)

4. Conclusion

From the result of the study on coat color of BB Cross and Wagyu Cross foremost in the dominant coat color, for F_1-B cattle are dominant black and black white, F_2-B cattle are black and brown for the basic colour, F_1-W cattle was white, light brown, brown, dark brown, and black-brown, then F_2-W was light brown, brown, dark brown, and black-brown. The average daily gain (ADG) of BB Cross and Wagyu Cross was decreased at the second offspring. The measure of body statistics BB Cross shows that F_1-B has a bigger weight, and short body, while the F_2-B has a lighter weight, length and height posture. The second offspring of Wagyu Cross has body size bigger than the first offspring.

Acknowledgements

This research was founded by Rekognisi Tugas Akhir (RTA) UGM 2019 with contract no. 3274/UN1/DITLIT/DIT-LIT/LT/2019 and supported by PT. Widodo Makmur Perkasa, Bayat, Klaten, Indonesia. We also thanks to Pascal Leroy from Veterinary Medicine Liedge University as supplier semens and Tripartite Corporation UGM- Liedge University- PT. WMP. We also thanks to Riyan Nugroho Aji, Irfan Gemilang, Aditya Pamungkas and Iwan Setiawan for help collecting data

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