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Reproductive performance of Belgian Blue and Wagyu cross cows

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Abstract. *Tampubolon YK, Agus A, Hartatik T, Bintara S, Ismaya, Widyobroto BP, Budisatria IGS, Leroy P, Antoine-Moussiaux N, Panjono. 2023. Reproductive performance of Belgian Blue and Wagyu cross cows. Biodiversitas 24: 5352-5358.* Double-Muscle (DM) cattle have been used in cattle breeding programs to increase body weight. This research aims to determine the reproductive performance of using DM cattle. Currently, cattle are produced from a cross between two breeds, namely Belgian Blue (BB) cross (50% BB, 50% BX) and Wagyu cross (50% Wagyu, 50% BX). Natural mating was carried out on nine BB cross cows mated with Wagyu cross bulls and nine Wagyu cross cows bred with BB cross cows. After calving, the cows were raised together with their calves for six months prior to weaning. The collected data were analyzed using One-Way analysis of variance. Calving Interval (CI), Cow Reproductivity Index (CRI), calf weaning weight, and Cow Productivity Index (CPI) of BB and Wagyu cross cows were 426.00±24.92 and 411.55±37.52 days, 0.86±0.05 and 0.89±0.08 head/year, 175.53±24.50 and 121.19±19.80 kg, and 148.46±24.61 and 102.41±20.84 kg/year, respectively. There was no significant difference in the CI and CRI between crosses. However, the weaning weight of BB cross calves was higher ($p<0.05$) than that of Wagyu cross calves, whereas the CPI of BB cross cows was higher ($p<0.01$) than that of Wagyu cross cows. It was concluded that the best reproductive performance was the BB cross, which had DM blood.

Keywords: Calving interval, cow reproduction index, crossbred cows, crossbreeding, weaning performance

Abbreviations: ADG: Average Daily Gain; BB: Belgian Blue; BL: Body Length; BW: Body Weight; BX: Brahman Cross; CI: Calving Interval; CF: Crude Fat; CFI: Crude Fiber; CP: Crude Protein; CPI: Cow Productivity Index; CRI: Cow Reproductive Index; DM; Dry Matter; HG: Heart Girth; NI: Nutrient Intake; PPM: Post-partum Matting; S/C: Service per Conception; TDN: Total Digestible Nutrient; WH: Wither Height

INTRODUCTION

According to the Directorate General of Livestock and Animal Health, Minister of Agriculture of the Republic of Indonesia (2020), Indonesia has a meat demand of 717,150 tons in 2020, which increased by 4.5% from the previous year. However, this increase was not followed by significant domestic meat production. The government imported 294,620 tons of meat to fulfill the lack of supply. Beef importation activities (frozen meat) impact the beef cattle industry, which might shift the feedlots (live cattle) sector to the meat trade. Feedlot activities that generate added value from feeder cattle to meat will disappear because there will only be trading of frozen meat from abroad to the domestic market. The increase in meat trading disincentives domestic beef cattle farming activities. This might affect the food security in Indonesia, and in turn, it will create dependency on meat importations (Sulfiar et al. 2022). Domestic livestock productivity must be increased, such as in slaughter weight, to avoid this issue. Koesmara et al. (2019) reported that the high slaughter weight of beef cattle will produce more carcasses. Cattle importation to Indonesia is dominated by Australia's Brahman cross (BX). These cattle have larger body frames and faster growth when compared to local cattle. They also possess high tolerance towards hot climates and feed of low quality while having better parasite resistance than their *Bos taurus* ancestors (Priyadi et al. 2017). Attempts to increase national meat production can be attained by population expansion and/or by improving the cattle's genetics. Crossbreeding is a common practice to genetically improve beef cattle within a short period.

Currently, the Ministry of Agriculture Indonesia is attempting to develop Belgian Blue (BB) breed cattle. This breed of cattle has a double muscling trait; thus, it produces a high slaughter weight average of around 600 kg (Fiems et al. 2015). Many cases of calving difficulty were found in pure BB cows. The incidence of dystocia reaches 90% in pure BB cows; dystocia is caused by the combination of high birth weight and small pelvic size (Fiems and Ampe 2015). The solution for this problem is crossbreeding to lower the birth weight and, hopefully, lower the incidence of dystocia. Brahman cross (BX) is one of the cattle breeds with low dystocia incidence. According to a study by Haque et al. (2016), there was no report of calving difficulties or abnormal calf birth, with the average calf mortality rate being 2.96%. According to Priyadi et al. (2017), BX cattle are also adaptable to tropical environments and have high growth performance.

Recently, the quality of meat has become the main focus of consumers. L'Huillier and Primrose (2018) reported that Indonesian consumers prefer softer, sweet, tender, and delicious meat. Sensory quality traits were influenced by the level of meat intramuscular fat, where the genetic aspect plays an important role. Wagyu cattle have a high intensity of intramuscular fat or marbling. Motoyama et al. (2016) reported that Wagyu beef contains 40-60% intramuscular fat. Therefore, the crossbreeding program was designed to include Wagyu cattle for its beef quality traits.

The production performance of a cow is important in the economic profitability equation (Budisatria et al. 2021a). Productivity is often characterized by the efficiency of the cows. A cow's reproductive performance is related to its ability to produce one calf every year and the weaning weight of the calves (Baliarti et al. 2020; Budisatria et al. 2021b). The genetics of the cows contribute to the respective cow's efficiency, which can be evaluated by their growth and reproductive traits (MacNeil et al. 2017). To increase meat quantity and quality, the Faculty of Animal Husbandry, Universitas Gadjah Mada implemented a breeding program to produce composite breeds from BX, BB, and Wagyu. Currently, this program has produced BB cross cow (50% BB x 50% BX) and Wagyu cross cow (50% Wagyu x 50% BX). However, the performance of both cows has not yet been evaluated. Therefore, this study was conducted to observe and evaluate the reproductive performance of BB cross and Wagyu cross cows.

MATERIALS AND METHODS

Procedures

Animal and experimental procedures

The design and technical practices of this study have been approved by the Research Ethics Commission, The Faculty of Veterinary Medicine, Universitas Gadjah Mada, Yogyakarta (No: 0065/EC-FKH/EKs/2020)

The research was conducted on a research farm of PT. Widodo Makmur Perkasa in Klaten District, Central Java Province, Indonesia for 1,5 years in 2020-2021. Eighteen heads of 18-month-old heifers were used in this research, which comprised nine head BB cross (50% BB: 50% BX) and nine head Wagyu cross (50% Wagyu: 50% BX) heifers. The BB cross heifers were mated with Wagyu cross bull, whereas the Wagyu cross heifers were mated with BB cross bull. The breeding schema of the BB cross and Wagyu cross is presented in Figure 1.

The mating was done by introducing the bull into the heifer's colony during six months of the mating period. After mating, the heifers were moved to separate pens. The calf was raised together with their dams for six months before weaning. The cows were fed with commercial feed, rice straw, and corn stoves. The ration was given three times a day, and the commercial feed was given at 7 am and forage at 10 and 3 pm. The nutritional content of Dry Matter (DM), Crude Protein (CP), Crude Fat (CF), Crude Fiber (CFI), ash, and Total Digestible Nutrient (TDN) are presented in Table 1.

Data collection procedure

The collected data includes nutrient intake, body weight and size, calving ease and calf vigor scores, as well as reproductive performances. Nutrient intake during pregnancy and lactation (six months), including DM (Dry Matter), CP (Crude Protein), and TDN (Total Digestible Nutrients), were calculated monthly by weighing the given and leftover amount of feed. Feed intake data was collected on three consecutive days every month. DM intake was calculated by multiplying the consumption of fresh feed by the DM content of the feed. CP intake was calculated by multiplying DM consumption by the feed CP content. TDN intake was calculated by multiplying the consumption of DM by the TDN content of the feed.

The body weight of the cows was recorded every month during pregnancy and lactation. Bodyweight and body size of the calves were measured every month from birth to weaning. The calves' body size data includes Body Weight (BW), Body Length (BL), Wither Height (WH), and Heart Girth (HG). The calves' body sizes were measured using the Indonesian National Standardization Agency method (2020). The BL was defined as the distance from the humerus (tuberosity humerus) to the tip of the sitting bone (tuber ischii) using a measuring stick. The HG was measured by wrapping a measuring tape around the chest at the back hump. The WH was defined as the perpendicular distance from the ground to the highest point of the shoulder behind the hump is parallel to the front leg using a measuring stick. The BL and WH were measured using an FHK® ruler with the smallest unit of 0.1 cm. HG measurement was conducted using a tape with an accuracy of 0.05 cm. The change in daily body weight is estimated with the following equation:

$$\text{ADG} = \frac{\text{Final body weight - Initial body weight}}{\text{Duration of observation}}$$

Calves' body weight gain and body size were measured and calculated, as well as the changes in body weight of the cows. The body weight and body size of the calves were adjusted to the male calves. The adjustments were required before comparisons were made between male and female cattle. Body weight and body measurement data were adjusted towards male cattle following the formula of Hardjosubroto (1994), where:

$$Adjusted = Observed_{female} \times \frac{\overline{Observed}_{male}}{\overline{Observed}_{female}}$$

Calving ease and calf vigor scoring were conducted by trained assessors. The calving ease was scored as follows: 1: Normal without help, 2: Light assistance with hand pulls, 3: Heavy assistance such as hormones, and 4: Caesarian section, according to the condition of the cows at calving. Calf vigor was scored according to the condition after the calves were born as follows: 1: No assistance, 2: Assistance in getting up and suckling, 3: Major assistance required, including hand feeding with a tube, 4: Dead at birth (Amin et al. 2021).

Table 1. The nutritional content of feed ingredients (%)

Feed ingredients	DM	CP	CF	CFI	Ash	TDN
Corn straw[a]	27.53	7.93	1.79	24.03	12.15	50.84
Rice straw[b]	83.63	5.04	1.60	30.93	7.36	53.85
Commercial feed[c]	89.52	13.75	3.74	16.04	7.90	67.87

Note: [a]Syamsi et al. (2019), [b]Fidaus et al. (2023), [c]Company analysis of PT. Pasir Tengah (2020)

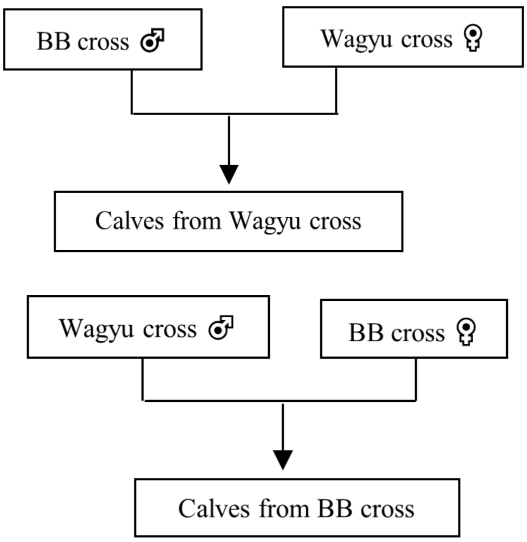

Figure 1. Breeding schema of BB cross and Wagyu cross

Reproductive performance variables included Postpartum Mating (PPM), Service per Conception (S/C), Calving Interval (CI), Cow Reproduction Index (CRI), and Cow Productivity Index (CPI). The PPM was calculated from the calving date to the first service, S/C was calculated from the number of mating to achieve pregnancy, CI was calculated by recording the time of calving to the next calving, whereas CRI and CPI were calculated based on the equations below:

Reproduction Index (RI):

$$RI = (\text{Litter size - mortality}) \times (365 / CI)$$

Productivity Index (PI):

$$PI = RI \times \text{Weaning weight}$$

Data analysis

The data collected, including nutrient intake, body weight, body size and reproductive performances, were analyzed with One-Way analysis of variance using the SPSS 20.0 version. However, the categorical variables, such as calving ease and calf vigor score data, were analyzed with quantitative descriptions. Each mean level of data is followed by the standard deviation (±SD).

RESULTS AND DISCUSSION

Effect of breed on cow performance during pregnancy to parturition

The effect of breed on Nutrient Intake (NI) during pregnancy is presented in Table 2. There were no significant differences in DM, CP, and TDN intakes between BB cross and Wagyu cross cows. Freetly et al. (2020) reported that breed differences were not significantly affecting feed intake in mature cows. Jardstedt et al. (2018) reported that breed did not affect the percentage value of feed intake on body weight in pregnant cows. Hay and Roberts (2019) reported the existence of maternal genetics by prenatal nutritional environment interaction for birth weight. Therefore, the birth weight (Table 3) in this study did not have a significant difference because the cows consumed the same feed. Even though there is no difference in nutrient intake, the overall average daily gain (Table 2) for BB cross cows during pregnancy was higher ($P<0.05$) than the Wagyu cross.

Figure 2 shows that the BB cross has a higher body weight than the Wagyu cross. It is suspected that BB cross cows inherited 50% of BB genetic materials. BB breed has myostatin mutation that plays a key role in the double muscle trait. Myostatin deletion in BB leads mainly to increased muscle mass and reduced fat mass (Deng et al. 2017). Also, BB cattle carry rumen microbes that are more efficient in fermenting feed (De Mulder et al. 2018). The higher body weight of BB cross affects the percentage of birth weight to the body weight of the cow. Dry Matter (DM), Crude Protein (CP), and Total Digestible Nutrients (TDN) intake during pregnancy in this study were within the normal range. Pregnant cow's requirement was approximately 1.8-2.1% for DM, 0.57-0.66 kg/day for CP, and 4-4.6 kg/day for TDN (National Academies of Sciences, Engineering, and Medicine 2016). Dry matter intake for pregnant cows in this study was higher than consumption for pure BB cattle. De Mulder et al. (2018) reported BB cows have a dry matter intake of 8.10±0.67 kg/day.

Table 3 shows that BB has a lower percentage of birth weight to body weight ($P<0.05$) than Wagyu crosses. Williams et al. (2018) reported that cows with higher body weights had a lower percentage of birth weight than the body weight of the cows. A study by Yang et al. (2023) found that calf birth weight and the ratio of calf birth weight to maternal height can influence calving ease and calf vigor. Probo et al. (2022) stated that the ease of giving birth influences reproductive performance. Cows that have difficulty calving will have an impact on increasing the time between calving and conception and the dry period. Regarding lactation performance, cows assisted in calving have a higher risk of experiencing milk cessation (DIM) for 30 days and a lower risk of pregnancy at 150 DIM. Apart from that, calf strength also affects reproduction. Calves that are weak or sickly at birth may have difficulty nursing, which can lead to reduced growth rates and increased mortality rates. In addition, cows that have difficulty calving due to poor calf vigor experience reduced fertility and longer calving intervals (Orihuela and Galina 2021). In this study, the two breeds did not have a significant difference in the ease of delivery. The majority of cows in this study gave birth normally without assistance. This is because the percentage of birth weight to body weight of the cows was not more than 7.2%. Johanson and Berger (2003) stated that the ratio of calf to cow weight should not be more than 7.2% to minimize the incidence of dystocia and calf mortality. In this study, no deaths in calves were found. The calf vigor in this study showed that the majority of calves were able to stand on their own after birth, and only a small proportion of calves could not stand and needed assistance to suckle. Calving ease in this study was lower than a similar study on BB X Holstein, with calving ease of 1.38 (Fouz et al. 2013).

Effect of breed on cow performance during lactation

The effect of breed on Nutrient Intake (NI) during lactation is presented in Table 4. There were no significant differences in DM, CP, and TDN intakes between BB cross and Wagyu cross cows. Murphy et al. (2008) reported that DM intake in lactation cows was not affected by breed. Dry Matter (DM), Crude Protein (CP), and Total Digestible Nutrients (TDN) intake during lactation in this study were within the normal range. Lactating cows require approximately 2-2.5% of body weight for DM, 1.19-1.30 kg for CP, and 6.4-7.1 kg/day for TDN (National Academies of Sciences, Engineering, and Medicine 2016).

Early lactation is characterized by a decrease in body weight due to insufficient feed consumption with regard to the required amount for producing milk. Baliarti et al. (2017) also stated that cows, during lactation, use body reserves to produce milk, resulting in a low body condition score. Therefore, during the lactation period, the cows in this study experienced body weight loss, as shown in Figure 3. Table 4 shows that the BB cross had a greater body weight loss (P<0.05) compared to Wagyu cross. The degree of BW loss postpartum was influenced by genetic and milk production. In this study, there was no difference in the nutrient content of the feed provided during pregnancy and lactation. Hence, during lactations, the nutrients consumed by the cows were used to maintain their calves. Figure 4 shows that the BB cross has greater calf growth than the Wagyu cross. This is the reason why BB cross cows have greater body weight loss than the Wagyu cross.

Table 5 shows that calves from BB cross cows have a higher daily body weight gain (P<0.01) than calves from wagyu cross cows. The maternal genetic effect influenced the performance of growth traits of the preweaning calf (Lopes et al. 2013). Panjono et al. (2022) reported that during the pre-weaning period, maternal genetics was related to the growth of calf. The mothering ability was closely related to the maternal genetic traits of the cows that affect milk production and suckling behavior. The breed composition of the cow influenced milk yield and milk quality, which affected calf preweaning growth (Liu et al. 2015). Crossbreeding between *Bos taurus* and *Bos indicus* is effective in increasing milk yield and its nutrient contents, such as protein, fat, and total solid. A study by Buske et al. (2011) showed that the myostatin mutant gene was responsible for higher milk, protein, and fat yield in Belgian blue cows. Belgian blue have muscle hypertrophy (mh) that implicates higher milk production and reduced saturated fatty acid content in milk. It is expected that crossbreeding with these improved exotic cattle shall yield crossbred offspring that acquired both adaptability and productivity from their two distinct ancestors. The crossbreeding program would produce a better growth rate (Ngadiyono et al. 2019).

The reproductive performance of BB and Wagyu crosses cows is presented in Table 6. The long PPM duration and high S/C values resulted in CI, which was longer than normal. Baliarti et al. (2020) reported that high cows' productivity if they can maintain a calving interval of no more than 365 days. In this study, the CI is more than 365 days, which can be caused by low fertility (Irikura et al. 2018), PPM, and S/C (Berry et al. 2014). The reason for the reduced reproduction performance in BB cows is associated with DM phenomenon. Cattle with DM characteristics have several physiological traits concerning smaller skeletal systems, decreased internal organs, and reduced skin weight compared to regular cattle. These characteristics carried physiological consequences, especially from the reproductive aspects. DM cattle have narrower hip bones due to a smaller skeletal system (Fiems 2012), decreased pelvic area and pelvic opening compared to regular cattle, and bigger fetal weight, which often caused dystocia and perinatal mortality (Casas et al. 2011; Fiems 2012; Fiems and Ampe 2015). These problems include the prolonged calving interval resulting from longer interval calving to first service and interval from first service to conception compared to the normal cows (Fiems 2012). Because of the typical production system in DM Belgian Blue cattle, productivity was defined as dam weight gain per CI plus calf birth weight. Calving interval in BB cows tended to be longer due to main factors such as parity, suckling, calving season, and the ratio of calf birth weight to dam body weight (Fiems and Ampe 2015). Longer CI values were also found in Wagyu cattle. Sasaki et al. (2016) stated that the calving interval in Wagyu cows was strongly associated with many factors that interacted with each other, which are parity, season, herd size and the number of days between calving and insemination. The CI in this study was longer than BB cows, pure Wagyu and Brahman crosses. Khotimah et al. (2018) reported that Brahman cross cows in Indonesia have calving intervals of 420-441, and pure wagyu cattle have calving intervals of 402-414 days (Fiems and Ampe 2015).

Table 2. Nutrient intake and body weight gain of BB and Wagyu crosses cows during pregnancy (Means±SD)

Variable	BB cross	Wagyu cross	Sig.
Dry matter (kg/day)	10.13±1.35	9.06±1.25	ns
Dry matter/body weight (%)	1.60±0.04	1.59±0.06	ns
Dry matter (g/kg $W^{0.75}$)	85.37±1.90	84.11±1.80	ns
Crude protein (kg/day)	1.02±0.05	0.93±0.09	ns
Total digestible nutrients (kg/day)	6.34±0.08	6.27±0.09	ns
Body weight gain (kg/day)	0.60±0.20	0.33±0.14	*
Body weight gain (%)	4.64±2.19	2.77±0.53	*

Note: *the superscript was showed the significant different (P<0.05), ns: non-significant

Table 3. The reproductive performance of the BB and Wagyu crosses cows (Means±SD)

Variable	BB cross	Wagyu cross	Sig.
Calf birth weight (kg)	27.25±4.39	29.78±6.77	ns
Calf birth weight (% cow body weight)	4.69±0.65	5.63±1.00	*
Calving ease score[1]	1.11±0.33	1.00±0.00	ns
Calf vigor score[2]	1.11±0.33	1.11±0.33	ns

Note: *p<0.05; [a]ns: non-significant, [1]Subjective calving easeness scores (1: Normal, without assistance, 2: Light assistance such as hand pulls, 3: Heavy assistance such as hormonal stimulation, 4: Caesarian section), [2]Subjective calf vigor scores (1: No assistance, 2: Assistance in getting up and suckling, 3: Major assistance and requires bottle feeding, 4: Dead at birth), *the superscript was showed the significant different (P<0.05), ns: non-significant

Table 4. Feed intake and body weight loss of BB and Wagyu crosses cows during lactation (Means±SD)

Variable	BB cross	Wagyu cross	Sig.
Dry matter (kg/day)	10.17±1.05	9.97±0.82	ns
Dry matter/body weight (%)	1.59±0.06	1.57±0.08	ns
Dry matter (g/kg $W^{0.75}$)	95.37±1.31	93.55±1.78	ns
Crude protein (kg/day)	0.99±0.07	0.91±0.08	ns
Total digestible nutrients (kg/day)	6.36±0.06	6.28±0.06	ns
Body weight loss (kg/day)	-0.35±0.09	-0.24±0.12	*
Body weight loss (%)	-2.37±0.28	-1.20±0.19	**

Note: *the superscript was showed the significant different (P<0.05), **the superscript was showed the significant different (P<0.05) ns: non-significant

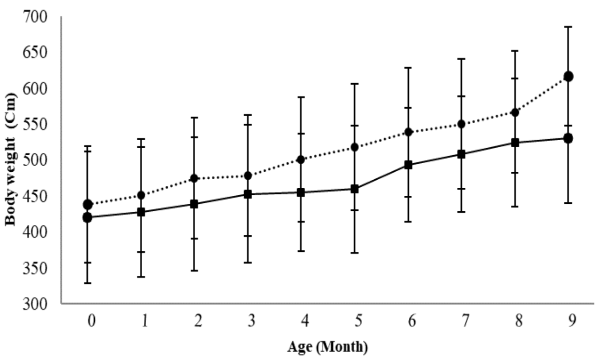

Figure 1. Body weight of BB cross and Wagyu cross cows during pregnancy (▪▪▪▪▪: crosses of BB and ▬: Wagyu cross)

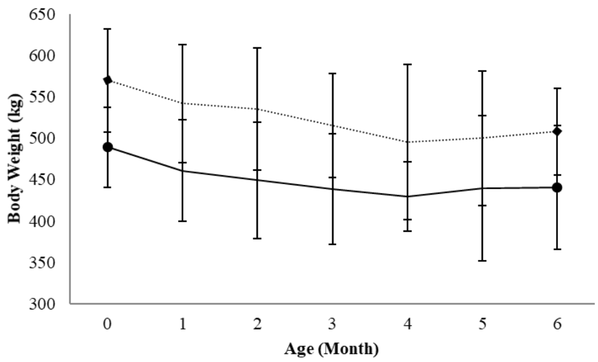

Figure 3. Body weight of BB cross and Wagyu cross cows during lactation (▪▪▪▪▪: BB cross and ▬: Wagyu cross)

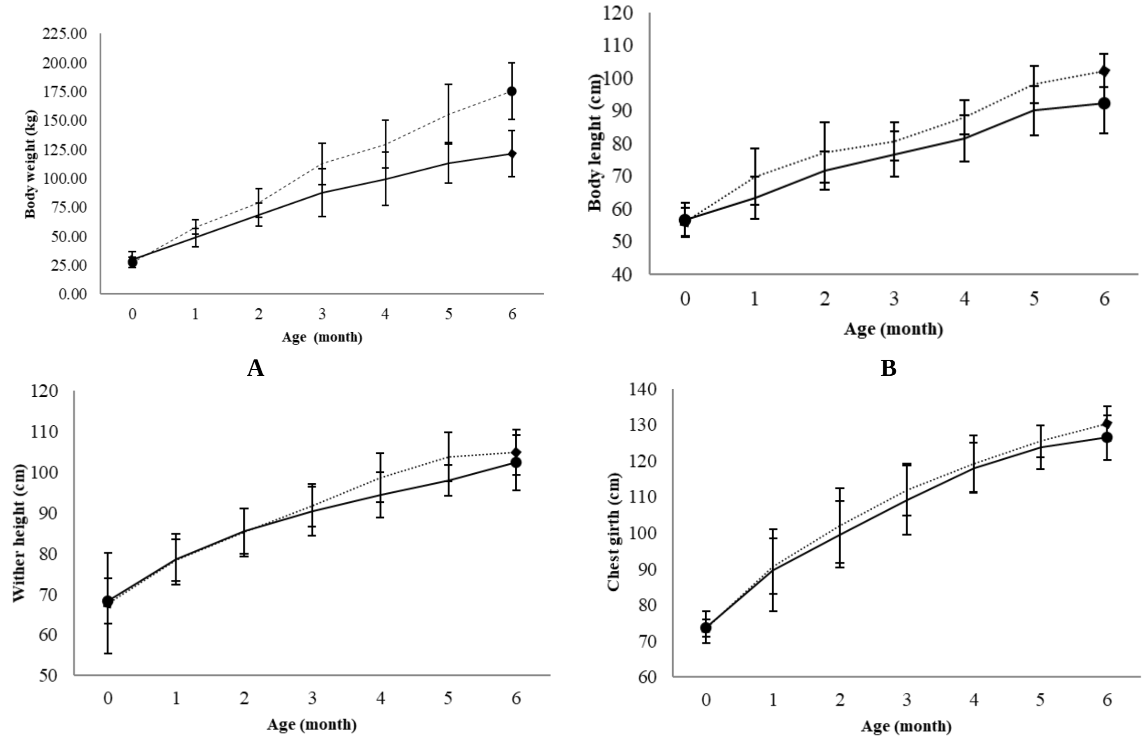

Figure 4. Body weight and body size growth of calves for BB cross and Wagyu cross from birth to weaning (▪▪▪▪▪: BB cross and ▬ Wagyu cross). A. Body weight, B. Body length, C. Wither height, D. Chest girth

Table 5. Body weight and body size preweaning growth of calves from BB cross and Wagyu cross cows (Means±SD)

Variable	BB cross	Wagyu cross	Sig.
Body length (cm/day)	0.26±0.06	0.22±0.05	ns
Wither height (cm/day)	0.21±0.06	0.19±0.05	ns
Heart girth (cm/day)	0.32±0.04	0.30±0.04	ns
Body weight (kg/day)	0.86±0.12	0.58±0.10	**

Note: *the superscript was showed the significant different (P<0.05), **the superscript was showed the significant different (P<0.05) ns: non-significant

Table 6. The reproductive performance of BB and Wagyu crosses cows (Means±SD)

Variable	BB cross	Wagyu cross	Sig.
Postpartum mating (day)	93.78±5.24	97.00±11.01	ns
Services per conception (time)	3.38±1.12	2.60±1.80	ns
Calving interval (day)	426.00±24.92	411.55±37.52	ns
Cow reproductivity index (head/year)	0.86±0.05	0.89±0.08	ns
Calf weaning weight (kg)	175.53±24.50	121.19±19.80	*
Calf weaning weight (% cow body weight)	35.89±5.39	26.74±4.38	*
Cow productivity index (kg/year)	148.46±24.61	102.41±20.84	**

Note: *the superscript was showed the significant different (P<0.05), **the superscript was showed the significant different (P<0.05) ns: non-significant

Cow Reproduction Index (CRI) shows the ability of cows to produce calves in a year. CRI is affected by calf mortality and CI. Table 6 showed thatBB cross and Wagyu cross have similar CRI. This is because of the same value of CI in both breeds and no calf mortality is 0. Bunter et al. (2013) reported that composite calves have lower mortality rates with higher survival rates than Brahman calves. The CRI value in this study was higher than the Brahman cross cattle. Arifiani et al. (2018) reported a CRI value for Brahman cross cattle was 0.59 head/year, but lower than CRI of Bali cow, which was 1.16 head/year (Baliarti et al. 2021).

Cow Productivity Index (CPI) shows the cow's ability to produce weaned calves in a year. CPI value is affected by WW and CPI. Table 6 showed that CPI of BB crosses was higher (P<0.01) than Wagyu crosses. This is because WW of the BB cross calves was higher (P<0.05) than the Wagyu cross calves. CPI has a positive correlation with weaning weight. Budisatria et al. (2021a) reported that cow's productivity was measured starting from calf birth until weaned. The mothering ability of BB crosses is better supported by the percentage of the calves' weaning weight relative to the cows' body weight was higher (P<0.05) in BB crossbreeds than Wagyu crossbreeds. The weaning weight of the calves in this study was higher than the weaning weight of the Brahman cross calves. Widi et al. (2019) reported that Brahman Cross weaning weight under an intensive farming system in Central Java was 121.32±32.87 kg and under a palm-oil integrated farming system in South Kalimantan, which was 174.28±20.74 kg. Compared with Wagyu crosses, the weaning weights of calves in this study were similar. Yanez-Munoz et al. (2023) reported that the weaning weight of Wagyu cross calf in Brazil was 125.6 kg. However, compared to BB crosses, it was lower according to Casas et al. (2011), who reported the weaning weight of BB cross calf was 237 kg. The CPI value of the BB crossbreeds in this study was higher than the Brahman cross (101.56 kg/head/year) (Arifiani et al. 2018).

In conclusion, under conditions of nutritional consumption that are not different for the two breeds (DM and Non-DM), cows that have DM traits (Belgian Blue cross) have a higher weaning weight than non-DM (Wagyu cross). It was concluded that the best reproductive performance was a BB cross that had DM blood muscle. However, the cows in this study experienced decreased fertility with long PPM duration and high S/C values, which resulted in a CI that was longer than normal. We are aware that the weaning time or separation of cow and calf is too long, which affects the decline in fertility levels. It is suggested to shorten the weaning time. BB cross cow can be used as a breeding program option to increase weaning body weight.

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