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Physiology and Reproductive Responses of Crossing Beef Cow

Aryogi and Y. Adinata

Beef Cattle Research Station
Jl. Pahlawan, Grati - Pasuruan, East Java - Indonesia
E-mail: aryogia@gmail.com

ABSTRACT: Crossbreeding beef cattle cause genetic changes related to its physiology and reproductive traits. This study was conducted to evaluate physiology and reproductive responses of crossing beef cows, that maintained in locations with different temperature and air humidity. Crossing between Peranakan Ongole cow with Simmental (SIMPO) or with Limousin (LIMPO) bull, each as 10 heads, kept in lowlands and highlands area. Parameters observed : environmental conditions, physiology and reproduction performances of cow. Data obtained are analysed by t-test and or presented descriptively. The results showed: daily air temperature that comfortable for cows at 4 pm until 8 am in lowland or at 4 pm until 10 am in highland, resulting in high respiration and pulse frequencies cows in lowland (28.7 and 86.3 times/minute); nutrient rations intake that less (especially in cows at lowlands), causing slow secretion pattern of progesterone and too fast secretion pattern of estrogen hormones, so achievement of its concentrations at before until after estrus were still high (minimal levels of progesterone from 3.2 to 5.2 ng/mL; maximum levels of estrogen from 27.8 to 35.3 pg/mL); abnormality patterns and levels of reproductive hormones secretion, is thought to be because declining reproduction performance of the crossing beef cows (estrous cycles 19 until 38 days; calving interval 427 until 479 days). Concluded, crossing beef cows are better be maintained in highlands than in lowlands.

Keywords: Physiological Response, Reproduction Respons, Crossing Beef Cows

INTRODUCTION

Various attempts have been made by the Government to increase the production of beef in the country, such as grading up, through artificial insemination (AI), to local beef cattle with *Bos taurus*. The implementation of its AI program that has been going on large area application, then in smallholder farmers have formed various levels of crossing blood composition in almost region.

Straw are the most widely used in AI program are *Bos taurus* breed, they are Simmental and Limousin cattle. Then, they are crossed by Indonesian local cattle, such is Peranakan Ongole (PO), and produced offspring cattle that are called as SIMPO dan LIMPO cattle. *Bos taurus* cattle is cattle from temperate zone countries. Genetically, *Bos taurus* have high potential to growth rate, but its physiologically not resistant to tropical conditions (high temperature), also certain quality and quantity of feed and management standard maintenance (Astuti *et al*., 2002), so SIMPO or LIMPO cows will inherited trait half advantage and weakness of *Bos taurus*. The main consideration of using *Bos taurus* straw at AI program still based on size of body cow, limited ability to environmental conditions and patterns of maintenance adapt (Robertshaw, 1984) that affect to its physiologically and biologically status, still often neglected.

Beef cattle experiencing environmental stress will be tried by overcome (Williamson and Payne, 1993) through changes in behavior (Esmay and Dixon, 1986). If cow is still not able to cope with stress, will be followed by physiological changes, and last through enzymatic and hormonal changes (Robertshaw, 1984). Such changes, it will directly affect disturb fertility; some

informations from farmers reported that fertility rate of SIMPO and LIMPO cows that is traditional maintained, turned out to be no better than local cows (Aryogi, 2005).

Based on problems mentioned above, this study was conducted to determine physiology and reproductive responses of crossing beef cows that are kept in a location with different altitutes, and how its effects mechanism so can affect to reproductive performance of cows.

MATERIALS AND METHODS

This study is a combination between field activities (observations of environmental conditions and cows for 3 months during dry season) and laboratory activities (reproductive hormone analysis).

Materials

This study used 20 heads of crossing cows of SIMPO and LIMPO (blood composition 75% SIMPO/LIMPO : 25% PO) and 10 heads PO cows in farmers, each spread in low-land areas at a villages in Sleman regency and high-land areas at a villages in Magelang regency, Central Java province. For identification of reproductive hormones, used blood serum from five crossing cows and three PO cows. The tools used to identify : environmental conditions are thermometer and hygrometer; cattle condition used thermometer, stetoscope, stopwatch, a set of blood samples, ultra sonography equipment, also a set tools and materials analysis of reproductive hormones with ELISA method.

Methods

Environmental observation of research location conditions, such as temperature and humidity at around and in stalls, are done every 4 hours for 2 x 24 hours per month, each in five places. Observations on the first day at 00, 04, 08, 12, 16 and 20 o'clock, while on the second day at 02, 06, 10, 14, 18 and 22 o'clock.

Observation of environmental conditions effect on cows physiology, such as body temperature, respiration and pulse rates frequency, and nutrients ration consumption, are done at same time and place with environmental observations.

Reproduction observations performance of cattle is done visually, directly interview to farmers and officers, rectal palpation, checking ovaries by ultrasono-graphy tool, sampling blood in jugular vein using tubes with anti coagulant EDTA. Hormones are analysed by progesterone kit (PIA kit) and estrogen kit (EIA kit).

Blood sampling scheme are as follows:

Description:

a = the end of estrus before cow was observed (not taken blood samples)

b = one day before cow is expected estrus. Taken blood sampling 1 time

c = 24 hours during the day estrus. Taken blood sampling 4 times

d = 6-12 hours after the day estrus ends. Taken blood sampling 1 time

Parameters observed:

1. Environmental conditions : air temperature
2. Physiology performance cows : respiration and pulse frequency
   : quantity and quality rations that is consumptioned

3. Reproduction performance cows : anoestrus post partus (APP)
: service per conseption (S / C)
: secretion pattern and concentration of hormones

The data obtained were processed and presented descriptively or analysed by t-test (to compare among PO with SIMPO/LIMPO)

RESULTS AND DISCUSSION

A. Environmental Conditions

Environmental conditions in low land is a flat area; altitude between 30 - 75 m asl; dry land; hot temperature; rain season 5 months/year. Environmental conditions in high lands is hill area; altitude 800 - 1050 m asl; dry land; cool/cold temperature; rain season 6-7 months/year. Based on differences environmental conditions in two locations, expected to cause different effects on physiology and reproductive performance of crossing cows.

B. Air Temperature

Data air temperature observation at both sites, showed in Figure 1. It appears:

1. diurnal temperature in lowlands are always higher than in highlands area
2. comfort zone of sub-tropical cattle zone is 13 to 25 C, while tropical cattle is 22 to 30 C (Yousef, 1984b). If crossing cow inherited both genetic traits, it is predicted that comfort zone of crossing cow is about 18 to 28 C (Aryogi, 2005). From Figure 1 show that crossing cow in lowlands area, experienced comfort zone during at 16 to 8 o'clock; whereas crossing cow in highlands almost every time to experience comfort zone, except at 12 to 14 o'clock.

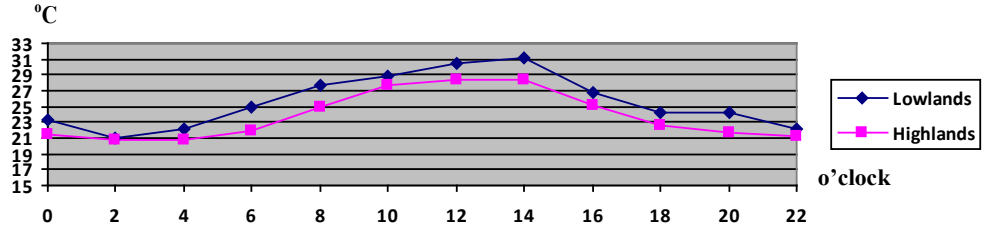

Figure 1. The diurnal air temperature at research locations

Environmental temperature conditions that are unfavorable for crossing cows (SIMPO and LIMPO), especially that in lowlands area, are estimated to cause interference with physiology of cow, being for PO cows that are genetically more resistant to heat, it is not expected to occur.

C. Physiology Performance of Crossing Cow

Observations on performance of crossing cow, consisting of physiology and reproduction performance. Data resulted of study showed in Figure 2 to 5.

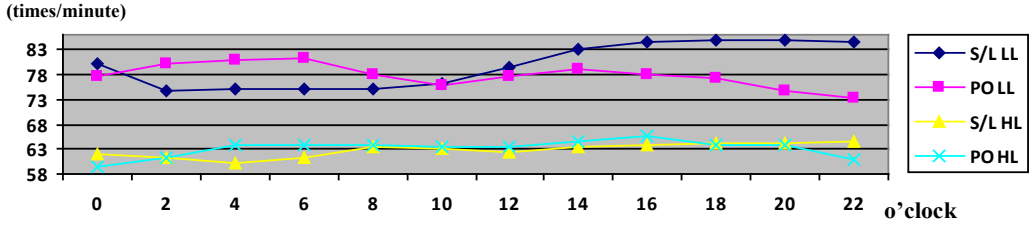

Figure 2. Pulse frequency of cow

Note : S/L = SIMPO/LIMPO ; LL = lowland ; HL = highland

Figures 2 showed that pulse frequency: cow in lowland (LL) greater than in highland (HL); crossing cow (S/L) higher than PO cow.

Figures 3 show that, respiration frequency: cow in lowlands greater than in highlands; crossing cow higher than PO cow.

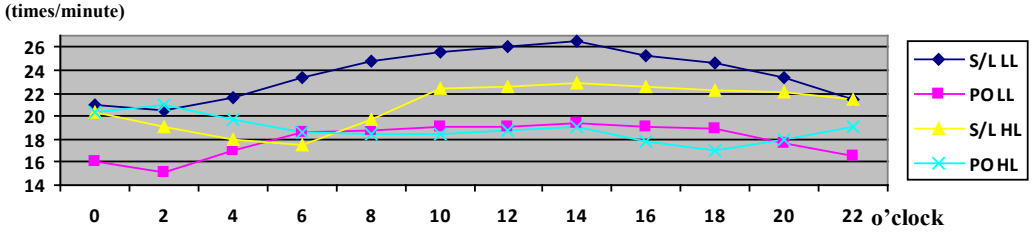

Figure 3. Respiration frequency of cow

D. Reproduction Performance of Crossing Cow

Reproduction performance data of cow listed in Table 1. It appears that cow in lowlands showed lower reproduction performance than cow in highlands; crossing cow lower than PO cow ; and crossing cow in lowlands lower than cow in highlands. It is believed as effect of interaction between environmental conditions and genetic crossing cow. At local cows (PO) looks hot temperature in lowlands did not significantly affect.

Table 1. Performance of reproductive cows

Observations	Location	PO	SIMPO	LIMPO
APP (days)	LL	118.73 ± 19.66^{b}	120.21 ± 14.37^{b}	112.73 ± 13.67^{a}
	HL	119.95 ± 9.78^{b}	114.15 ± 7.12^{a}	110.47 ± 9.89^{a}
SE (days)	LL	19.75 ± 1.68^{a}	2.92 ± 5.22^{a}	33.05 ± 4.76^{b}
	HL	20.45 ± 1.72^{a}	21.64 ± 1.58^{a}	31.63 ± 2.60^{b}
S/C (times)	LL	1.56 ± 0.75^{a}	2.02 ± 0.69^{b}	1.97 ± 0.72^{b}
	HL	1.31 ± 0.47	1.55 ± 0.66	1.61 ± 0.67
LB (days)	LL	284.40 ± 3.82	287.61 ± 4.25	287.23 ± 3.50
	HL	283.38 ± 3.74	288.13 ± 3.53	286.17 ± 2.73
CI (days)	LL	432.36 ± 11.78^{az}	446.55 ± 19.18^{bz}	461.23 ± 17.67^{cz}
	HL	413.87 ± 26.49^{y}	422.73 ± 24.16^{y}	420.62 ± 27.13^{y}

Description : APP = anoestrus post parturition ; S / C = service per conseption ;
: SE = estrus cycle ; LB = long bunting ; CI = calving interval
: a, b different superscript in same row, significantly different (P <0.01)
: y, z different superscript in same coloum, significantly different (P <0.01)

Reproduction performance of crossing cows (especially in lowlands) that are lower than in highlands or than local cow, allegedly because it is associated with occurrence of abnormalities (quantity and or quality) secretion of reproductive hormones such as progesterone, estrogen and luteinizing. Results of progesterone and estrogen analysis in cows at before until after estrus, showed in Figure 4 and 5.

Alleged decline in reproductive performance of crossing cow, is caused by abnormalities of

reproductive hormones as influence of environmental conditions that unfavorable to physiological cows, it is strengthened by results of follicle development via rectal palpation and using ultrasonography tool which indicates that crossing cows do not immediately experience estrus although its follicle development has reached stage ready for ovulation. Follicle size from 10 x 8 mm, at PO cow proved can be used as a benchmark estimate that cow will experience estrus 2 to 4 days later, but crossing cow proved will experience estrus between 7 to 11 days later.

Progesterone profile is a sharp decline in last 6 hours before estrus, to reach its lowest level in about 6 hours during estrus, then levels increased quickly in hours after occurrence of estrus. The pattern of progesterone profile was not different between cows in lowlands and highlands, only in lowlands levels decline is lower but speed increase is higher, and there is a tendency that level of hormone levels of PO, SIMPO or LIMPO cows in lowland greater than in highlands.

Decreased levels of progesterone in PO cows is the biggest, followed by LIMPO and the smallest is SIMPO cows ; the lowest level of progesterone around 6 hours of estrus occur, achieved by PO cows (1.7 and 2.2 ng/mL), then LIMPO cows (2.3 and 2.2 ng/mL) and the last SIMPO cows (4, 0 and 4.7 ng/mL).

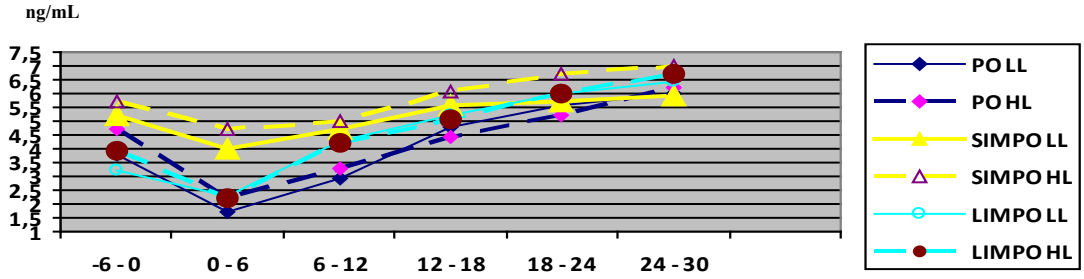

Figure 4. Profile of progesterone of cow

For estrogen profile it is opposite with progesterone,which increased sharply in last 6 hours before estrus, so achieve the highest levels in about 6 hours during estrus, then levels dropped back quickly in hours after occurrence of estrus. Estrogen profile pattern is also not different between cows in lowlands and high-lands, only that in highlands speed increase higher and decrease speed slower, so hormone levels of all cows in highlands greater than in lowlands.

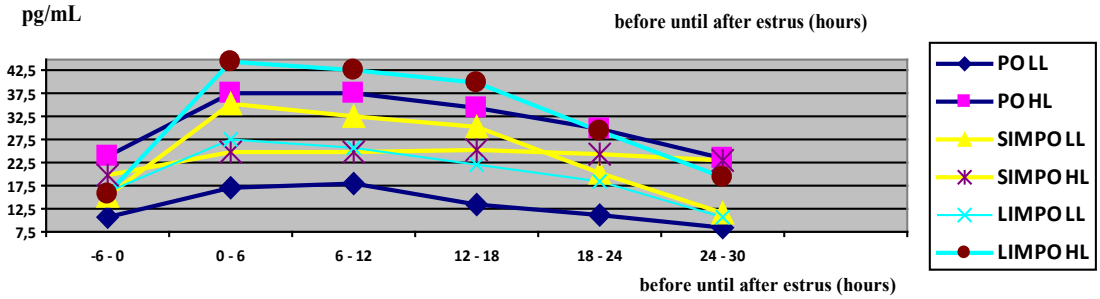

Figure 5. Profile of estrogen of cow

Achievement highest level of estrogen done in hours of estrus occur, looks different between cows in lowlands and in highlands. In the lowlands, highest level of estrogen are achieved by SIMPO cows (35.31 pg/mL), then LIMPO cow (27.83 pg/mL) and the last PO cow (17.09 pg/mL);

while in highlands are reached by LIMPO cow (44.38 pg/mL), then PO cow (37.85 pg/mL) and the last SIMPO cow (24.81 pg/mL).

CONCLUSION

Observation of respiration, pulse, rectal palpation, ultrasound and analysis of reproductive hormone profiles, showed that temperature and humidity identifiable effect on physiology and reproduction performance of crossing cows.

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