Reproductive performance of Bali cattle following artificial insemination in Bali

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Abstract

Bali cattle, domesticated of Banteng (Bos javanicus), is one of the important beef breeds in Indonesia. Reproductive performance data of Bali cattle from 5176 services and 2940 cows were collected from Jan 1998 to Sep 2003 during an AI program in Bali. Non-return rate (65.5%), service per conception (1.7), and conception rate (58.3%) were comparable with other reports, both on Bali cattle and other breeds. However, calving interval (41±6.4 d) and days open (122±6.4 d) were longer than other breeds. In addition, there was a difference in conception rate between year and bull and number of services per month related to production site (A centre).

Introduction

Bali cattle originate from the wild Banteng (Bos javanicus, syn. Bos taurus javanicus, B. javanicus or B. taurus) and are well utilized in traditional farming on the island of Bali (Darmadja, 1980). As one of indigenous and important beef cattle breeds in Indonesia, Bali cattle contribute to the development of livestock and agriculture. The breed is predominant especially in eastern Indonesia (e.g. NTB, NTT (West Timor), and South Sulawesi) and Lampung (Talib et al., 2003). The cattle have a high heat tolerance, are well adapted to the dry land, efficiently utilize low quality feed, and is considered to have a high fertility in harsh environments. However, Bali cattle have a small birth and weaning weight, high calf mortality (Talib et al., 2003), low milk production (Oka, 2003), and are susceptible to infectious diseases, especially Jembrana disease (Soeharsono et al., 1995).

Although some reproductive performances of Bali cattle have been reported previously (Pane 1990, McCool 1992, Toelire 2003, Susilawati et al. 2004), reports on reproductive performance after artificial insemination (AI) are limited. A1 was first introduced in Bali cattle in southeast Sulawesi and Timor from 1975 to 1976 (Toelire, 2003). In Bali, as source of pure Bali cattle, A1 has been performed since 1980s with frozen semen produced by the National AI Centre of Singosari, East Java. Since 2001, frozen semen also has been produced by the local AI Centre of Bali province. The frozen semen was distributed throughout and also out of Bali. This report describes the reproductive performance of Bali cattle following AI on the island of Bali using frozen semen, produced by the Singosari AI Centre and a Local AI Centre. In addition, the effect of month, year, and bull on some traits was examined.

Material and Methods

Data were collected from one inseminator serving one area in the Badung district, Bali, from January 1998 to September 2003. Data include owner, address, cow identification, date of insemination, bull identification and batch of semen, pregnancy diagnosis, date of birth, birth weight, sex of calf and some remarks (for example: abortion or sold). From these data 90-days non return service rate (NRR90), service per conception (S/C), first calving interval (CI), days open, gestation length, and sex ratio were also evaluated based on month, year, and bull as well as proda data were analyzed by chi square comparing CR between year or bull and displaying seasonal effect of total service and CR.

Results and Discussion

Data of 5176 inseminations and 2940 cows were obtained (Table 1; 65.5%, 1.7, and 58.3%, respectively). CI and days open collected for each bull by month were 41±6.4 d (0.5±2.1 mo) and 122±6.4 d, respectively. Days and birth weight was 19±14±1.0 Kg. Sex ratio was almost equal, slightly higher than that of female (52.8% vs. 47.2%)

Table 1 Reproductive performance of artificial insemination in Bali (mean ± SE)

<table>
<thead>
<tr>
<th>Variables</th>
<th>Bali cattle (Bos javanicus)</th>
<th>Other breeds</th>
</tr>
</thead>
<tbody>
<tr>
<td>NRR90 (%)</td>
<td>65.5%</td>
<td></td>
</tr>
<tr>
<td>S/C</td>
<td>1.7</td>
<td>1.8±2.3</td>
</tr>
<tr>
<td>CR(%)</td>
<td>58.3</td>
<td>41.6±5.7</td>
</tr>
<tr>
<td>Calving interval</td>
<td>41±6.4 d (0.5±2.1 mo)</td>
<td>122±6.4 d (1±4.2 mo)</td>
</tr>
<tr>
<td>Days open(d)</td>
<td>1±1 (0-4 mo)</td>
<td>1±1 (0-4 mo)</td>
</tr>
<tr>
<td>Days gestation (d)</td>
<td>289±45</td>
<td>270±30</td>
</tr>
<tr>
<td>Birth weight (kg)</td>
<td>16±1.0</td>
<td>12.0±2.1</td>
</tr>
<tr>
<td>Male</td>
<td>19±4.9</td>
<td>18±4.2</td>
</tr>
<tr>
<td>Female</td>
<td>18±4.1</td>
<td>11±2.5</td>
</tr>
<tr>
<td>Male(%)</td>
<td>52.8</td>
<td>60±4.7</td>
</tr>
<tr>
<td>Female(%)</td>
<td>47.2</td>
<td>40±4.7</td>
</tr>
<tr>
<td>Pregnancy mortality(%)</td>
<td>2.1±0.4</td>
<td>2±0.6</td>
</tr>
</tbody>
</table>

Reproductive performance of Bali cattle during the AI program w number of inseminations (5 3 cows), Susilawati et al. (2004) report on reproductive performance after artificial insemination (AI) on the island of Bali with frozen semen, produced by the National AI Centre of Singosari, East Java. Since 2001, frozen semen also has been produced by the local AI Centre of Bali province. The frozen semen was distributed throughout and also out of Bali. This report describes the reproductive performance of Bali cattle following AI on the island of Bali using frozen semen, produced by the Singosari AI Centre and a Local AI Centre. In addition, the effect of month, year, and bull on some traits was examined.
Reproductive performance of Bali cattle following artificial insemination in Bali

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Artificial insemination (AI) is one of the important beef breeds in Indonesia, Bali cattle contribute to the livestock and agriculture. The breed is predominant, especially in eastern Indonesia (Bali, East Nusa Tenggara, and South Sulawesi) and Lampung (Bali et al., 2003). The cattle need to have a high fertility in a harsh environment. However, Bali cattle have a low weaning weight, high calf mortality (Bali et al., 2003), slow growth rate (Malvy et al., 2003), and are susceptible to infectious diseases, especially reproductive performances of Bali cattle have been reported previously (Pare et al., 1999, Tausee et al., 2003, Susilawati et al., 2004). Reports on reproductive performance (AI) are limited. AI was first introduced in Bali cattle in southern and eastern Indonesia from 1975 to 1979 (Tausee et al., 2003). In Bali, as a source of pure Bali cattle, since 1980s with frozen semen produced by the National AI Center of the frozen semen was distributed throughout and also out of Bali. This report describes the reproductive performance of Bali cattle following AI on the island of Bali using frozen semen produced by the Singapura AI center and a local AI center. In addition, the effects of AI on some traits were examined.

Methods

Report from one inseminator serving one area in the Badung district, Bali, from September 2003. Data included owner, address, cow identification, date of insemination and batch of semen, pregnancy diagnosis, date of birth, birth weight, and some remarks (for example: abortion or stillborn). From these data 90 days after service return rate service rate (NRR590), service per conception (S/C), first-service conception rate (CR), calving interval (CI), days open, gestation length, and sex ratio were calculated. Variation of CR was also evaluated based on sex, month, year, and breed as well as producer of the frozen semen. The data were analyzed by chi square comparing CR between year or breed and decomposition fit for displaying seasonal effect of total service and CR.

Results and Discussion

Data of 5176 inseminations and 2546 cows were obtained (Table 1). NRR590, S/C, and CR were 66.5%, 1.7, and 58.3%, respectively. CI and days open collected from 659 cows and 1779 pregnancies were 411±4 (13.5±2.1 mos) and 122±64 d, respectively. Gestation length was 289±5 days and birth weight was 19±1.0 Kg. Sex ratio was almost equal with the proportion of male slightly higher than that of female (52.9% vs. 47.7%).

Table 1: Reproductive performance of artificial insemination in Bali Cattle and other breeds

<table>
<thead>
<tr>
<th>Variables</th>
<th>Bali cattle (Bos javanicus)</th>
<th>Other breeds</th>
</tr>
</thead>
<tbody>
<tr>
<td>NRR590 (%)</td>
<td>65.5%</td>
<td>-</td>
</tr>
<tr>
<td>S/C</td>
<td>1.7</td>
<td>1.7 (a)</td>
</tr>
<tr>
<td>CR (%)</td>
<td>58.3</td>
<td>52.6 (b)</td>
</tr>
<tr>
<td>Calving (normal)</td>
<td>411±4 d</td>
<td>430±6 (b)</td>
</tr>
<tr>
<td>Gestation length (d)</td>
<td>13.5±2.1 mos</td>
<td>12±1.4 (a)</td>
</tr>
<tr>
<td>Birth weight (Kg)</td>
<td>19±4.0</td>
<td>27±28 (a)</td>
</tr>
<tr>
<td>Female</td>
<td>18±6±4.0</td>
<td>11±2 (a)</td>
</tr>
<tr>
<td>Male</td>
<td>52±8</td>
<td>60±10 (a)</td>
</tr>
<tr>
<td>Fetal mortality (%)</td>
<td>41±5</td>
<td>41±5 (a)</td>
</tr>
<tr>
<td>Natal mortality (%)</td>
<td>3±2</td>
<td>5±2 (a)</td>
</tr>
</tbody>
</table>

Conversions from conception to calving:

- S/C: 1.7 (a) (Pare et al., 1999), (b) Pare et al., 1999
- CR: 58.3 (a) (Pare et al., 1999), (b) Chu et al., 1999, (c) Tausee et al. 2003
- Pregnancy rate (a) (Pare et al., 1999), (b) Bellos et al. 1999, (c) Hinojosa et al. 1990, (d) Zhang et al. 1999, (e) Wall et al. 2001, (f) Passino et al. 1995, (g) van Wijngaarden, Bellos et al. 1999, (h) Rome et al. 1999

Reproductive performance of Bali cattle during the AI program was moderate. With a limited number of inseminations (51 cows), Susilawati et al. (2004) have reported similar results for S/C, CR, CI, and days open of Bali cattle in Pringin, West Java. They reported that heavier cows had better reproductive performance than lighter cows. In this report, we did not record on the weight or body condition score (BCS) or on the age and parity of the cows that were used in the AI program. Performance of NRR and S/C in this report was similar with previous reports (Zhang et al., 1999; Wall et al., 2003). However, CI and days open in this report were better than in the Pare (1999) report on Bali cattle, but longer than other breeds, like taurine and zebu cows (Wall et al., 2003; Bellos et al., 1999; Hinojosa et al., 1990).

Reproductive efficiency in beef cows is influenced by nutrition, suckling, parity, genetic and environmental factors. Increasing nutrient intake after calving stimulated the secretion of anabolic hormones, promoted fat deposition, shortened the postpartum interval to estrus, and increased...
pregnancy rate at the first estrus (Ciccioli et al., 2003). The suckling effect and the maternal bond are important in regulating LH pulse frequency that influences ovulation of dominant follicles and shortened the postpartum anovular interval in beef cows (Stagg et al., 1998). The interval from parturition to first service and to conception was longer in primiparous than multiparous cows, because of the difficult recovery from the negative energy balance period and delayed initiation of ovarian cyclicity (Meikle et al., 2004). Pregnancy rate in primiparous cows was also influenced by body condition (DeRouen et al., 1994). High environmental temperature and humidity resulted in a marked decline in the quality of oocytes retrieved from Bos taurus cows but not from Bos indicus cows (Rocha et al., 1998). Dairy cows in US showed seasonality of days open and the highest occurred in the Southeast of the USA due to heat stress (Onseri et al., 2003). Zebu cows calving in the rainy season had a better calving interval than those in other seasons in a semi-humid tropical environment. This corresponds with abundant pasture, due to humidity and high temperatures (Hinojosa et al., 1980). In Bali cattle, the pre-weaning body weight gain was higher in the dry season than in the rainy season, especially prominent in males, both in pure breeds and bull-taurine crossbred (Wijjana and Yustam, 1990).

A fluctuation of CR was observed during the investigated period (Table 2). Using frozen semen from BBS Singsosari, CR in 1998 was 59.3% then decreased in 1999 (56.4%) but increased in 2000 (58.5%) and reached maximum in 2001 (63.3%). From 2001 onwards, also frozen semen produced at the local A1 centre was used. The CR for semen produced at the local A1 centre was similar to those using frozen semen from Singsosari A1 centre (63.3 vs. 62.0% for that produced at Singsosari A1 centre and local A1 centre, respectively), and then decreased dramatically in 2002 (54.4%, P<0.05) and then increased again in 2003 (58.7%).

Table 2 Annual fluctuation of conception rate (CR) during artificial insemination in Bali cattle during the period of 1998-2003

<table>
<thead>
<tr>
<th>Years</th>
<th>Frozen Semen of</th>
<th>Total Services</th>
<th>CR (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1998</td>
<td>Singsosari A1 centre</td>
<td>975</td>
<td>59.1</td>
</tr>
<tr>
<td>1999</td>
<td>Singsosari A1 centre</td>
<td>981</td>
<td>56.4</td>
</tr>
<tr>
<td>2000</td>
<td>Singsosari A1 centre</td>
<td>880</td>
<td>58.5</td>
</tr>
<tr>
<td>2001</td>
<td>a Singsosari A1 centre</td>
<td>417</td>
<td>63.3</td>
</tr>
<tr>
<td></td>
<td>b Local A1 centre</td>
<td>374</td>
<td>62.0</td>
</tr>
<tr>
<td>Sub total</td>
<td>791</td>
<td>62.7</td>
<td></td>
</tr>
<tr>
<td>2002</td>
<td>c Local A1 centre</td>
<td>924</td>
<td>54.4</td>
</tr>
<tr>
<td>2003*</td>
<td>d Local A1 centre</td>
<td>635</td>
<td>58.7</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>5176</td>
<td>58.3</td>
</tr>
</tbody>
</table>

*Data and hypothesis 2003. P<0.05

During the period of 1998-2003, two types of frozen Bali semen were used. The highest CR was found in 2001, while the production site did not significantly affect the results. Thus Bali province decided to use frozen semen which was produced locally. In 2002, the CR significantly declined. That might be caused by new management of the distribution of semen and new experience in frozen semen production. Later, CR increased to the standard level.

Variation of the CR was found between bulls with a total of more than 100 services (Table 3). The CR of top-bottom ranked bulls varied more between those of the local A1 centre than between those of Singsosari A1 centre. Based on a CR of more than 60%, the top three bulls were bull no. 19252, 18827, and 19034 from Singsosari A1 centre and bull from the local A1 centre.

Ranking of the bulls according to CR can be predicted by NFR. Because did not become pregnant were inseminated again, the CR was preferential fertility. Based on this parameter, some top ranking bulls were present at the local A1 centre.

Table 3 Bull variation based on conception rate (CR) of artificial inseminating the period of 1998-2003

| Frozen Semen of | CR | | |
|-----------------|----|---|
| Singsosari A1 centre | 74 | 94 |
| 19252 | 95 | 96 |
| 18827 | 90 | 91 |
| 19034 | 77 | 78 |
| 19032 | 69 | 70 |
| 18629 | 62 | 63 |
| 19032 | 52 | 53 |
| 18613 | 53 | 54 |
| Local Bali A1 centre | 74 | 94 |
| Pan | 74 | 94 |
| Ker | 74 | 94 |
| Bk | 74 | 94 |
| Trs | 74 | 94 |
| Trs | 52 | 53 |
| Trs | 56 | 57 |
| Kdr | 74 | 94 |
| Kdr | 74 | 94 |
| Kdr | 74 | 94 |
| Kdr | 74 | 94 |
| Kdr | 74 | 94 |

The total number of services per month also varied, with higher number from dry to rainy season (late of dry season and beginning of rain in November) (Figure 1). The pattern of CR per month is illustrated in Figure 1.
at the first estrus (Giacozzi et al., 2003). The suckling effect and the maternal bond in regulating LH pulse frequency that influences ovulation of dominant follicles at the preovulatory anovular interval in beef cows (Stagg et al., 1998). The interval to first service and to conception is longest in primiparous than multiparous due to the difficult recovery from the negative energy balance period and delayed estrus cyclicity (Medentz et al., 2004). Pregnancy rate in primiparous cows was also body condition (DeReus et al., 1994). High environmental temperature and humidity caused a marked decline in the quality of oocytes retrieved from Italian cows but Indicus cows (Rocha et al., 1998). Dairy cows in US showed seasonality of days highest occurred in the Southeast of the USA due to heat stress (Otek et al., 2003).

living in the rainy season had a better calving interval than those in other seasons in tropical environment. This corresponds with abundant pasture, due to humidity and temperatures (Hinojosa et al., 1980). In Bali cattle, the pre-weaning body weight gain was dry season than in the rainy season, especially prominent in males, both in pure-breed crossbreed (Wijono and Yasunari, 1990).

Table 3 bullied variation based on conception rate (CR) of artificial insemination in Bali cattle during the period of 1998-2003

<table>
<thead>
<tr>
<th>Farrowing Season</th>
<th>Total Services</th>
<th>CR (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sengon AI centre</td>
<td>925</td>
<td>59.2</td>
</tr>
<tr>
<td>Sengon AI centre</td>
<td>981</td>
<td>56.4</td>
</tr>
<tr>
<td>Sengon AI centre</td>
<td>830</td>
<td>56.4</td>
</tr>
<tr>
<td>a) Sengon AI centre</td>
<td>417</td>
<td>65.3</td>
</tr>
<tr>
<td>b) Local AI centre</td>
<td>374</td>
<td>60.2</td>
</tr>
<tr>
<td>Sub-total</td>
<td>791</td>
<td>60.2</td>
</tr>
<tr>
<td>Local AI centre</td>
<td>924</td>
<td>54.9*</td>
</tr>
<tr>
<td>Local AI centre</td>
<td>625</td>
<td>58.7</td>
</tr>
<tr>
<td>Total</td>
<td>1576</td>
<td>59.2</td>
</tr>
</tbody>
</table>

The total number of services per month also varied, with highest numbers occurring in the transition from dry to rainy season (Fig. 1). The pattern of CR per month is illustrated in Fig. 1.

![Figure 1. Monthly fluctuation of total service number and conception rate (CR) of artificial insemination in Bali cattle during the period of 1998-2003](image-url)
The number of calvings per month is a good indicator of a seasonal effect on fertility, but not all calving data were recorded. The total number of services might have correlation with seasonality of fertility in this breed. This was relatively high in August to November similar to observations on Bali cattle in West Timor (Banks, 1980). Although the CR varied between months, a pattern was not as clear. The data suggest that the CR was not only influenced by season but also by other factors.

Acknowledgements

Financial support for this research was provided by Asia Link Project on ‘Reproductive technology to improve livestock production under traditional Asian condition’. Thanks are due to the government of Bali province for permission doing this research, drh Lis and dra Lis for assisted collecting data, and I Made Nisa for his recording data.

References


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