Achievement of Artificial Insemination Performances in Bali Province

Ni Putu Sarini[1], Ni Made Paramita Setyani[2], Ni Nyoman Suryani[3], I Wayan Suarna[4], Putu Iin Sulistyawati[5]

[1]Lab. Animal Breeding and Biomolecular Sciences, Faculty of Animal Husbandry, Udayana University

[2]Animal Husbandry Study Program Faculty of Animal Husbandry, Maritime Affairs and Fisheries, Faculty of Animal Husbandry- Nusa Cendana University

[3]Lab. Animal Nutrition and Feed, Faculty of Animal Husbandry, Udayana University

[4]Lab. Forage Plants Faculty of Animal Husbandry-Udayana University

[5]Department of Agriculture and Food Security Service Bali Province

ABSTRACT: Increasing the beef cattle population and its productivity can be done by optimizing the implementation of Artificial Insemination (AI) technology. This research aims to determine the achievement of Artificial Insemination performances in Bali Province, using reported data of the Sikomandan program implementation from each district to the Department of Agriculture and Food Security Service in Bali Province. The report obtained was taken from Insikhnas including data on AI targets, AI realization, NRR (PKB), CR (pregnancy), and CvR (births) from 2019 to 2022. The parameters observed were the percentage achievement of AI realization from the set target, the percentage of PKB, pregnancy, and births from AI realization in all districts and cities in Bali Province. The calculation results of all these parameters were then analyzed descriptive qualitatively. The results of this research show that the achievement of AI realization in Bali Province was very good with an average achievement of above 100%, namely ranging from 87.5% to 151.11%. The NRR value shown by the number of successful PKBs carried out from 2019 to 2022 was namely 78.32%, 63.35%, 71.29%, and 16.2% while the CR was 57.28%, 35.48%, 34.55%, and 55.89 respectively. The AI indicator that determines the increasing population was the number of calves that harvested successfully (CvR) was 49.55% (2019), 69.10% (2020), 34.55% (2021), and 55.89% (2022).

KEYWORDS: Artificial Insemination of Cattle, AI Performance in cattle, NRR, CR, CvR

INTRODUCTION

Beef and buffalo meat consumption per capita in Indonesia in 2022 was estimated at around 2.5 kilograms or 695,390 tons with a population of around 274 million people (BPS, 2023), still very low compared to world meat consumption which averages 6.3 kilograms. The low level of meat consumption in Indonesia is due to two factors, namely price and supply. Economic law applies when demand and supply experience an imbalance which results in expensive beef prices in Indonesia. Fulfilling this need cannot be met by domestic beef production alone, so Indonesia also imports frozen meat amounting to 279.97 thousand tons per year (BPS, 2023). For this reason, domestic cattle production must be increased.

In response to this problem, the Government issued several policies to increase the domestic beef cattle population. The first was Upsus Siwab from 2016 to 2020, which was then continued with the Sikomandan program from 2020 until now. In principle, both programs have the same goals. The only difference lies in the commodity, namely Upsus Siwab's only commodity is cattle, while Sikomandan's is cattle and buffalo. Unfortunately, the high market demand for meat is inversely proportional to domestic meat production which is not yet optimal. The slow growth of domestic cattle and buffalo populations is generally due to suboptimal management of livestock reproduction. With the existence of Sikomandan which is run by the government through reproductive optimization activities, it is hoped that it can improve the livestock service system to the community, improve the management of reproduction and livestock production as well as improve the reporting and data collection system for livestock reproduction through the application of the National Animal Health Information System (Insikhnas) which is an electronic information collection system the most advanced field animal health in the world. With the ongoing program, it is expected that it can also encourage the realization of the goal of self-sufficiency in meat by 2026. To realize this goal, local resources, one of which is Bali cattle, must be optimized. Many factors influence efforts to achieve domestic beef self-sufficiency, one of which is the low population and productivity of local cattle. Increasing the beef cattle population and productivity in this program is carried out by optimizing the implementation of Artificial Insemination (AI) technology.

Achievement of Artificial Insemination Performances in Bali Province

Bali, as an area with minimal natural resources, is blessed with a very productive germplasm, namely the Bali Cattle. This cow is known by the people to have very good adaptability, therefore it is suitable for development in various regions in Indonesia. Currently, Bali cattle are not only developed on the island of Bali but have become a prime source of meat in other areas such as Java, Sulawesi, and Nusa Tenggara. The increase in demand that has occurred is still not met by national meat production (Baihaqi et al, 2020). There is still a shortage of beef supply on a national scale, so this is a big market opportunity for Balinese beef commodities developed in Bali to take advantage of existing market gaps. Efforts to increase the Bali cattle population are an important issue to meet market demand and also aim to stabilize prices at all marketing institutions. This research was conducted to determine the achievements of artificial insemination performance of the two Government programs in Bali Province from 2019 to 2022.

AI performance can be known by looking at some indicators including the actual number of AI cows, Non-Return Rate (NRR), conception rate (CR), and calving rate (CvR) of AI cows. Research has been conducted to study those indicators such as the conception rate of several local cows that are inseminated with results varying from 65 – 75% (Pasino, 2020). Anika Fadila Sari et.al. 2022 got 75.86% of Bali cattle. The non-return rate (NRR) was found 41% to 85% (Ujang Kurniawan, 2019., Ahmad Rajul Dinul et al., 2022., and Rina Sumiarti et al., 2023) The calving rate is normally around 70% to 90 % (Wello,2011).

METHODOLOGY:
This research was conducted in Bali Province using secondary data obtained from the Department of Agriculture and Food Security Bali Province. This data was reported by the teamwork of the Upsus Siwab and Sikomandan programs in all districts in Bali Province from 2019 to 2022. The data includes AI targets (targets determined by the government based on AI realization in the previous year), AI realization, NRR (the number of females that did not come into heat again after being inseminated, obtained after Pregnancy Checks were carried out), CR (the number of cows that successfully became pregnant). CvR (the number of births from the total cows was inseminated). All eight districts and one municipality, namely Badung, Tabanan, Jembrana, Buleleng, Karangasem, Klungkung, Bangli, Gianyar, and Denpasar City reported data to that Department through insikhnas system.

Parameters to be observed:
The parameters observed were the Achievements of Artificial Insemination Performance which can be calculated from the reporting data, including the percentage of AI achieved from the AI target, the percentage of NRR from the results of AI (which is the percentage of female livestock that do not ask to mate again or do not experience heat again within a time interval of 30-60 days after artificial insemination (Susilawati, 2011)), the percentage of pregnancy from the AI realization, and the percentage of births from the AI realization (the number of calves that are successfully harvested from females that are successful in AI). The observed parameters use percentages to reduce the influence of population differences in each district.
Data analysis:

Data on the number of AI target records, AI realizations, NRR, CR, and CvR were grouped by year and location. The percentage of achievements in all Districts and City then was calculated, and the result was described qualitatively. The percentage of AI performance achievements calculation was carried out as follows:

1. Percentage of AI realization to AI target $= \frac{\text{AI realization}}{\text{AI Target}} \times 100\%$

2. Percentage of NRR from AI realization $= \frac{\text{NRR}}{\text{AI realization}} \times 100\%$

3. Percentage of CR from AI realization $= \frac{\text{CR}}{\text{AI realization}} \times 100\%$

4. Percentage of CvR $= \frac{\text{CvR}}{\text{AI realization}} \times 100\%$

RESULTS AND DISCUSSION
Percentage of AI realization from AI targets in Bali province:
The low productivity of cattle has an impact on the slow increase in the beef cattle population. Efforts to accelerate the growth of the livestock population in Indonesia are carried out, one of which is by implementing AI technology. So far the implementation of which is always being improved from year to year through programs, both Upsus Siwab and Sikomandan (Suprianto and Djuliansah, 2016). The performance achievements can be seen from the performance of AI indicators, namely the first is the number of female acceptors who succeeded in AI. In the implementation of the Sikomandan program, each province has an AI target to be realized, as does the Province of Bali. The number of AIs realized from 2019 to 2022 in all districts and cities in Bali Province is presented in Table 3.1 below.

Achievement of Artificial Insemination Performances in Bali Province

Table 3.1. Percentage achievement of AI realization from AI Target in Bali Province

District	Year			
	2019	2020	2021	2022
Badung	110,27%	145,95%	153,64%	80,27%
Bangli	98,92%	137,54%	126,96%	100,62%
Buleleng	119,55%	105,40%	140,40%	71,17%
Denpasar	121,82%	120,38%	152,23%	89,52%
Gianyar	107,61%	132,74%	164,44%	111,01%
Jembrana	96,03%	147,26%	164,88%	92,39%
Karangasem	103,34%	144,70%	141,14%	64,48%
Klungkung	124,60%	152,00%	174,99%	118,65%
Tabanan	113,69%	141,25%	141,36%	59,42%
Average	110,67 %	136,36%	151,11%	87,50%

Overall, the number of inseminations from 2019-2021 showed positive results with an increase in all districts and cities in the Bali Province. And then experienced a fairly large decline in 2022, possibly due to the spread of foot and mouth disease (FMD). It can be seen that the realization of AI before the outbreak of FMD in Bali was very good with a percentage above 90% and even exceeding the target (above 100%). It tends to continue to increase, this was also caused by targets set which also increase following the realization achieved. Before the outbreak of FMD, the lowest AI realization was in Jembrana Regency in 2019, amounting to 96.03% of the target set, namely 3300 cows. After the outbreak of FMD, realization dropped quite significantly, namely 59.42% of the target in Tabanan Regency. This happens because only healthy acceptor cows can be inseminated. These results showed that AI technology on the island of Bali has been well received by the community and can be seen at the same time as the role of inseminators as an extension of the Government in approaching and reaching the breeder community.

Percentage of cows that do not return to heat after AI (NRR):
To find out whether a cow that has not come back into heat is pregnant, those should do a pregnancy check. This pregnancy check is also one way to monitor and prove the results of artificial insemination quickly and appropriately. The lust cycle used as a basis for diagnosing AI results ranges from 28 to 35 days, its range still in the interval suggested by Susilawati (2011) is 30 to 60 days. In practice, the AI figures only show pregnant acceptor females after examination. In reality, many cows that have been inseminated do not show signs of heat again but are not permitted by the breeder to be examined, so the NRR figure, in reality, may be higher. Pregnancy checks for beef cattle are carried out by certified veterinarians or inseminators 50 ± 60 days after insemination.

The percentage of livestock that were checked for pregnancy 30-35 days after insemination is shown in Table 3.2. Overall, farmers' awareness of allowing their livestock to be inspected is quite good with the NRR percentage of AI realization above 50%, namely 78.32%, 63.35%, and 71.29% in 2019, 2020, and 2021 respectively. Only Jembrana Regency still low, was 38.58% (2019), 25.40% (2020), and 52.34% (2021). The decline in the NRR value in 2020 was likely

Table 3.2. Percentage Achievement of NRR from AI realization in Bali Province

District	Year			
	2019	2020	2021	2022
Badung	72,00%	89,27%	80,88%	24,17%
Bangli	65,69%	66,06%	67,11%	1,54%
Buleleng	98,82%	45,73%	67,61%	13,15%
Denpasar	86,55%	85,43%	67,56%	5,24%
Gianyar	70,99%	58,50%	79,52%	20,42%
Jembrana	38,58%	25,40%	52,34%	7,21%
Karangasem	83,19%	66,05%	68,54%	23,58%
Klungkung	115,07%	69,36%	110,22%	46,84%
Tabanan	73,97%	64,36%	47,82%	3,65%
Average	78,32%	63,35%	71,29%	16,2%

caused by restrictions on activities during the outbreak of the Covid 19 in Indonesia. Several research results have found that the percentage of female cows in AI that do not show signs of returning to heat was 41-85% (Ujang Kurniawan, 2019. Ahmad Rajul

Achievement of Artificial Insemination Performances in Bali Province

Dinul et al., 2022 and Rina Sumiarti et al., 2023). There are several factors that cause this, firstly the awareness of breeders, not all breeders allow their cows that are not in heat to be palpated again because they are worried about miscarriage. Second, because the inseminated livestock comes into heat again or the insemination fails. The success of AI is greatly influenced by the condition of the AI acceptor livestock, semen quality, and human factors (breeder and inseminator).

Percentage of pregnancy achieved from IB realization (CR)

The third performance used to assess the success of AI was the percentage of conception (CR). Table 3.3 displays the percentage of conception in eight districts and one city in Bali Province. It can be seen that the pregnancy percentage or conception rate of cows that are successfully inseminated was relatively low with an average ranging from 34.55 - 57.28%, where according to Pasino et al., (2020) the CR value considered good was 65-75%. Several researchers reported CR from Bali cattle such as Mardiansyah et al., 2016, Kurniawan, 2019, Asih Deskayanti et al., 2019, Suranjaya et al., 2020, Ahmad Rajul Dinul et al., 2022, Isra Miradja et al., 2023 found 60-72% in several places in Indonesia. According to Fanani et al., (2013), CR was determined

Table 3.3. Percentage Achievement of CR from AI Realization in Bali Province

District	Year			
	2019	2020	2021	2022
Badung	51,71%	38,17%	34,57%	62,29%
Bangli	64,32%	33,28%	40,40%	49,69%
Buleleng	53,23%	40,81%	31,91%	70,25%
Denpasar	52,24%	62,70%	38,60%	55,86%
Gianyar	59,13%	33,39%	33,66%	45,04%
Jembrana	66,27%	11,84%	26,04%	54,12%
Karangasem	61,58%	32,31%	35,17%	77,55%
Klungkung	51,07%	33,58%	44,85%	42,14%
Tabanan	55,97%	33,31%	25,78%	84,14%
Average	57,28%	35,48%	34,55%	55,89%

by male fertility, female fertility, and insemination technique. Male fertility is one of the responsibilities of the Regional Artificial Insemination Center, Baturiti (BIBD-Baturiti) which produces frozen semen, in addition to storage management at the inseminator level. Female fertility is the farmer's responsibility, assisted by a veterinarian who is tasked with monitoring the health of the cow. Meanwhile, implementing AI is the responsibility of the inseminator. To find out which position is the main cause of low CR, further studies need to be carried out regarding the journey or distribution of semen from BIBD Baturiti to the breeder's location, how to handle semen before it is inserted into the reproductive organs of AI acceptor cows.

Seeing that the realization of AI in 2020 and 2021 has increased to 170% (Klungkung Regency, Table 3.1) while only 44.85% of those who succeeded in getting pregnant, perhaps there were things that need to be confirmed for the excess realization of the target, one of which was the availability of frozen semen used for the excess target.

Percentage of calves harvested from AI realization (CvR)

The main objective of the cattle population increase program is to obtain a high of harvested calves. The livestock population can increase if there are calves harvested and imports of livestock. Considering that the island of Bali is a place for Bali cattle conservation, importing cattle from any breed is prohibited by the Government. One of the factors thought to be the main cause of population decline in this area is the low of calving rate. The calving rate (CvR) from the Upsus Siwab and Sikomandan programs for 2019-2022 is presented in Table 3.4. The average of calving rate in Bali Province was 49.55%, 69.10%, 46.06%, and 87.48% in 2019, 2020, 2021, and 2022, respectively. Meanwhile, normal CvR figures range from 70-90% (Wello, 2011). Reports reveal that the low birth rate was related to various factors, including; heat without ovulation, low body condition, and management errors (failure to detect heat and failure to breed cows in heat). Success in overcoming these obstacles can increase the pregnancy rate to 70-80% (Toleng, 2009). The highest average was obtained in 2022, namely 87.48%, where in that year the realization of IB dropped drastically due to the spread of foot and mouth disease (FMD). During this period, livestock operators will be very careful in carrying out activities related to their livestock. Farmers monitor their livestock very closely, fearing that their livestock will be infected with FMD. This is likely to have a positive influence on monitoring estrus so that insemination can be carried out on time, resulting in high success. Besides that, the inseminator has more time because only healthy females were allowed to be inseminated. However, the data reporting the number of births needs clarification from the Department, where there were reports of births exceeding 100% (Klungkung Regency at 103.21% and Denpasar City at 122.70%).

Achievement of Artificial Insemination Performances in Bali Province

Table 3.4. Percentage of calves harvested from AI realization (CvR) in Bali Province

District	Year			
	2019	2020	2021	2022
Badung	40,16%	61,92%	42,93%	78,60%
Bangli	57,56%	74,30%	45,64%	77,92%
Buleleng	43,34%	73,46%	47,69%	77,81%
Denpasar	56,42%	95,92%	59,97%	122,70%
Gianyar	43,76%	73,83%	44,30%	82,67%
Jembrana	35,34%	58,61%	33,37%	67,64%
Karangasem	54,80%	62,56%	44,97%	94,99%
Klungkung	66,94%	58,37%	53,59%	103,21%
Tabanan	47,66%	62,96%	42,05%	81,78%
Average	49,55%	69,10%	46,06%	87,48%

It was probably possible that the report on the number of calves consists of AI calves and natural mating calves, so that the performance of AI in terms of the number of calves harvested cannot be fully demonstrated from the reporting data. The percentage of births of local Indonesian cattle (CvR) was reported to range from 44%-84% (Ujang Kurniawan, 2019., Arif Haryanto et.al., 2020., and Ahmad Rajul Dinul et.al., 2022).

Performance Achievements of Artificial Insemination in Bali Province

Table 3.5. is a table of AI performance achievements in Bali Province. It can be seen that the AI targets in the province from 2020 fell from 2019 even though the realization of AI in 2019 exceeded the target, this was probably because of the government's focus on overcoming the Covid-19 pandemic. The budget for population increase was also absorbed to overcome the pandemic so the AI target was lowered. However, the realization of AI in Bali was in the very good category because it was greater than the target except for 2022 when the FMD outbreak occurred. This means that from the realization achieved, the livestock farming community has quite accepted the application and implementation of AI in the Province. However, this was not the case with the three other indicators of AI, namely NRR, CR, and CvR which still need to be improved so that population increase can be achieved.

Table 3.5. Achievement of Artificial Insemination Performance in Bali Province

AI performaces	Year			
	2019	2020	2021	2022
AI target (cows)	77.000	64.776	54.519	70.000
AI realization (cows)	85.551	86.936	82.288	60.383
NRR (cows)	64.267	39.905	41.278	35.490
Conception (cows)	49.000	30.200	29.966	28.800
Calves harvest (calves)	40.895	27.488	29.966	24.921

CONCLUSION

From this study, it can be concluded that the achievements of Artificial Insemination performance in Bali Province when viewed from the realization achieved was in the very good (high) category, but have not been followed by the achievements of the other three performances, namely NRR, CR and CvR.

ACKNOWLEDGMENT

REFERENCES

1) Ahmad Rajul Dinul., Tjuk Imam Restiadi., Prima Ayu Wibawati., Hermin Ratnani., Amung Logam Saputro., Ragil Angga Prastiya. 2022. Service per Conception, Conception Rate, Calving Rate, and Non-Return Rate in Beef Cattle in Kalipuro, Banyuwangi. Jurnal Medik Veteriner, vol.5 No.1. DOI: 10.20473/jmv.vol5.iss1.2022.54-61

Achievement of Artificial Insemination Performances in Bali Province

2) Anika Fadila Sari, Dwi Junita Zega, Yusni Atifah. 2022. Potensi Inseminasi Buatan Pada Sapi Bali. Prosiding Semnas Bio 2022 UIN Syarif Hidayatullah, Jakarta.

3) Arif Haryanto1, Rudolf O. Faidiban2, Andoyo Supriyantono2. 2020. Artificial Insemination Program of Beef Cattle in Manokwari Regency. IOP Conf. Series: Earth and Environmental Science 518. doi:10.1088/1755-1315/518/1/012011

4) Asih Deskayanti., Trilas Sardjito., Agus Sunarso., Pudji Srianto , Tri Wahyu Suprayogi, Herry Agoes Hermadi. 2019. Conception Rate and Service per Conception at Artificial Insemination of Bali Cattle in West Sumbawa District 2017. Ovozoa, Vol.2 No.2.

5) Baihaqi, M., Aditia, E.L. 2020. Efisiensi dan Nilai Ekonomi Daging Sapi untuk Potongan Pasar Tradisional Berdasarkan Potongan Komersial yang Berbeda: Jurnal Ilmu Produksi dan Teknologi Hasil Peternakan Vol.08 No. 2 (hlm 86-90). Departemen Ilmu Produksi dan Teknologi Peternakan, Fakultas Peternakan, Institut Pertanian Bogor.

6) Central Bureau of Statistics (BPS). 2023. bps.go.id

7) Isra Miradja Pa , Eka Meutia Sari , Cut Intan Novita. 2023. (Evaluation of the Success of the Artificial Insemination Program in Female Local Beef Cattle in Kuala District, Langkat Regency, North Sumatra Province. Jurnal Ilmiah Mahasiswa Pertanian. Vol. 8 No. 1.

8) Mardiansyah., Enny Yuliani., and Sugeng Prasetyo. 2016. Respon Tingkah Laku Birahi,Service Per Conception,Non Return Rate, Conception Rate pada Sapi Bali Dara dan Induk yang Disinkronisasi Birahidengan Hormon Progesteron. Jurnal Ilmu dan Teknologi Peternakan Indonesia Volume 2(1): 134-143. DOI: https://doi.org/10.29303/jitpi.v2i1.24

9) Pasino, S., Waru, A.T., & Mirnawati. 2020. Peningkatan Produktivitas Sapi Betina Melalui Inseminasi Buatan dengan Metode Rektovaginal. Jurnal Peternakan Lokal, 2(2), 39–45.

10) Rina Sumiarti., Ahmat Endang Two Sulfiara., and Muh. Andika Prasetia. 2023. Evaluasi Kinerja Program Sapi Induk Wajib Bunting (SIWAB) Di Konawe Selatan, Sulawesi Tenggara, Indonesia. Journal of Tropical Animal Research, Vol 4 (1):1-16.

11) Suprianto S. dan D. Djuliansah. 2016. Kajian aplikasi teknologi inseminasi buatan dalam upaya peningkatan produktivitas dan pendapatan usaha ternak sapi potong di Kabupaten Tasikmalaya. Mimbar Agribisnis,1(3): 211-225.

12) Suranjaya, I G., N. P. Sarini., dan M. Dewantari. 2020. Identification Of Factors Affecting The Inseminator Performance in Supporting the Success of Artificial Insemination at Artificial at The Upsusu Siwab Program in Bali. Majalah Ilmiah Peternakan, vol. 23 No. 2.

13) Susilawati,T. 2011. Tingkat Keberhasilan Inseminasi Buatan dengan Kualitas dan Deposisi Semen yang Berbeda pada Sapi Peranakan Ongole. Ternak Tropika, vol 12 No.2. https://ternaktropika.ub.ac.id/index.php/tropika/article/view/109

14) Ujang Kurniawan. 2019. Evaluasi Tingkat Keberhasilan Program Inseminasi Buatan (IB) pada Sapi Potong di Kabupaten Pasangkayu, Sulawesi Barat. Thesis. Program Studi Ilmu Ilmu Pertanian, Pascasarjana Universitas Tadulako. Palu.

15) Wello, B. (2011). Manajemen Ternak Sapi Potong. Jakarta: Masagena Press, Makassar.