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Effect of Parity on Milk Yield and Calving Interval of *Thrabam* Cattle at Nucleus Herd, Tashiyangphu, Bhutan

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ABSTRACT

A study was carried out to understand the productive and reproductive performances in local *Nublang/Thrabam* cattle managed at the nucleus herd, Tashiyangphu, Bhutan. Data on performances were accessed and analyzed from 3794 individual animal records maintained at the farm for 21 years [1997 to 2018]. The record covered 1st to 8th parity for individual animals. The nucleus herd had a fair balance of young and old stock for regular replacement. Overall average daily milk yield of local *Thrabam* cows [all parity] was 3.54±0.23 kg [n=436] and take-home milk was 2.04±0.23 kg day^{-1}, excluding 1.5 kg day^{-1} estimated to be spared to suckling calves. The average daily milk yield increased from 3.11 kg day^{-1} in first parity to 3.78 kg day^{-1} in fourth parity. Similarly, the average lactation milk yield increased from 708±215 kg in first parity to 889±190 kg in fourth parity. Lactation yield in fourth parity was significantly higher than yields in all other parity. The average lactation length was 230.9±5.4 days [7.7 months], which had little or no improvement with advancing parity. Notably, calving interval had decreased from 16.1±3.6 months [n=173] in 1st/2nd parity to 12.1±1.1 months in 7th/8th parity [n=165], indicating improvement in reproductive efficiency of the nucleus herd.

The study concluded that the highest milk yield [daily and lactation yield] of *Thrabam* cattle is in fourth parity with no drastic decline till seventh parity, suggesting that cows fit for breeding can be retained in the nucleus herd beyond seventh parity based on their productivity. Further, *Thrabam* being draught purpose breed with short lactation length and low milk yield, it is unlikely to compete in milk production with recognized dairy breeds even if they are rigorously selected. Hence, apart from improvement in milk production, traits for diseases resistance, adaptability/ foraging ability] need to be given equal weightage while selecting this cattle breed.

1. INTRODUCTION

Nublang breed [*Nublang*-male and *Thrabam*-female], is popularly known to the scientific community as a Siri breed [*Bos indicus*]. This breed is a foundation stock for crossbreeding to develop superior breeds in Bhutan. The breed is selected over thousands of years of domestication and natural selection in a wide range of Bhutanese environments. The breed is more disease resistant than exotic dairy breeds, suitable for low input management system.

Many farmers strongly believe that Bhutan is the real home of *Nublang/Thrabam* cattle. Genetic analysis also suggests that this breed has prominence in Bhutan than any other neighboring countries [Arbenz and Tshering 2005]. Bhutanese legend links the origin of *Nublang* with the legendary Lake *Nob Tshonapata*, located on the mountain ranges above Nakha village, Sombay *Gewog* [block] of Haa *Dzongkhag* [district]. Payne and Hodges [1997] classify this breed as a stabilized indigenous breed evolved from crossing of humped cattle of the Indian subcontinent and humpless cattle migrated to southern slope of Himalayas. This breed is found in small number in the hill tracts around Darjeeling district, West Bengal and Sikkim States of India [Banerjee 1991]. *Nublang/Thrabam* is reared across all Bhutan.

In view of positive attributes of this breed, the Royal Government of Bhutan established the National *Nublang* Breeding Centre [NNBC] at Tashiyanghu [Tashigang district of Bhutan] in 1994 as a nucleus *Nublang/Thrabam* herd. The farm caters to breeding bull needs of the farmers. However, with the changing time, the mandate of the farm needs to be expanded not just for breeding bull production but also for overall herd improvement. As a mechanism to monitor

performance of the farms for herd improvement, the nucleus farm submits periodic progress report. However, information collected periodically through such reports, does not fully compliment the performance of the farm. Further, for improved production, this local cattle breed is crossed with Jersey and other exotic breeds at the farmer's level, resulting in gradual loss of valuable local cattle genetic diversity. Hence, it is essential to maintain a pure *Nublang/Thrabam* cattle breed through pureline breeding and selection at the farm for steady supply of quality bulls and heifers to needy farmers. Therefore, a study to assess the overall performance of the nucleus herd, including production and reproductive performance at different parity was undertaken. The objectives were to: analyze and interpret data on productive and reproductive performance of *Nublang/Thrabam* nucleus herd at NNBC, Tashiyangphu; and understand constraints and opportunities for improvement of *Nublang/Thrabam* cattle for milk production and draft-ability.

2. MATERIALS AND METHOD

The available raw data were accessed from 3794 individual animal records maintained at the farm for 21 years [1997 to 2018]. The record covered daily milk yield/ production, breeding/reproduction from 1st to 8th parity of individual cows at the nucleus herd. The data on daily milk yield and daily milk production, monthly milk production, days in milk, milk suckled by calves, take home milk for home consumption/ sale were aggregated parity-wise/lactation number-wise for analysis. Besides breeding records, age at first service, age at first calving, and calving interval in different parity were assessed. Informal discussion was held with Farm Manager and staff to understand constraints faced and opportunities to improve the pureline breeding of *Nublang/Thrabam* cattle at the nucleus herd, NNBC. The data was analyzed in Microsoft Excel to generate descriptive statistics and a standard statistical package Minitab Version-18 was used for inferential statistics.

3. RESULTS AND DISCUSSION

3.1 Milk yield of local Thrabam cows in different parity

3.1.1 Daily milk yield

The daily milk yield of cows at nucleus herd, NNBC is presented in Table 1. The increase in parity [lactation number] effected the daily milk yield of cows. The mean daily milk yield increased from 3.11 kg day^{-1} in first parity to 3.78 kg day^{-1} in 4th parity. Lactation yield in 4th parity was significantly higher than the yields of all other parity [$p<0.000$]. The overall mean milk yield was 3.54±0.23 kg day^{-1}. Champion cow [NBIN 150000047] produced the highest milk yield of 6.5 kg day^{-1}. The animal producing more than 5 kg milk day^{-1} was recorded for 65 counts and 6 kg milk day^{-1} was recorded for 4 counts [out of the total records], indicating that under good management, *Nublang* cattle selected for its genetic superiority can produce above 5 kg total milk day^{-1}. Tamang and Perkins [2005] reported that assessment of actual milk yield of *Bos indicus* cows is often difficult because of partial suckling by their calves. Efforts have been made to correct actual milk yield by estimating the allowance for the quantity of milk taken by calves. Padersen and Madsen [1998] weighed calves before and after suckling to estimate the amount consumed by calves. Likewise, Coulibaly and Nialibouly [1998] and Sandoval-Castro et al. [1999] also estimated milk consumed by calves using the same method. These authors found that mean daily milk consumption by calves falls within the range of 0.75 to 2.7 kg per calf per day. Though measurement was not done at NNBC, assumption on amount of milk suckled by calves falls within the prescribed range.

Table 1: Daily milk yield of cows at nucleus herd, NNBC

Parity	Sample size [n]	Mean yield/day [kg]	Take home milk/day [kg]	Milk consumed by calves [%]
1	129	3.11	1.61	48.2
2	93	3.41	1.91	44.0
3	70	3.51	2.01	42.7
4	47	3.78	2.28	39.7
5	41	3.67	2.17	40.9
6	34	3.64	2.14	41.2
7	21	3.69	2.19	40.7
Overall mean		3.54	2.04	42.5
SD [mean]		0.23	0.23	2.89

3.1.2 Lactation milk yield

Similar to daily milk yield, parity of cows has direct effect on lactation milk yield [Table 2]. The highest lactation yield was achieved in 4th parity, and there was a gradual decrease in yield until most cows were culled after 7th parity. The

mean lactation milk yield of cows was highest [889 kg, n=47] in 4th lactation, which is significantly higher than all parity/lactation numbers [p<0.000]. The results suggest that unless the cows have deformity and/or are very low producers, the cows may be retained in the herd till 7th lactation and beyond before taking a decision to cull them.

3.1.3 Lactation length

The mean lactation length of cows at NNBC Tashiyangphu was 230.9±5.4 days [7.7months], ranging from 221 to 236 days [Figure 1]. Increase in lactation length from parity 1st to till 7th parity was not significant [p<0.674]. Hence, any effort to increase lactation yield, has to consider increasing the average lactation length of the breed. Tamang and Perkins [2005] reported lactation length of eight to nine months in local *Thrabam* cows in Bhutan, which is slightly longer than the findings of present study. This could be because the cows at the village farms are milked for longer period if they fail to conceive or milked until next calving. The days in milk or lactation length are proportionate to lactation milk yield.

Table 2: Mean lactation yield of nucleus herd in different lactation numbers

Lactation number	Sample size [n]	Mean lactation yield [kg]	±SD mean
1	129	708	215
2	91	759	224
3	69	834	183
4	47	889	190
5	40	820	271
6	34	710	299
7	21	763	215
Overall mean		783	
SD [mean]		67.25	
p-value		0.000	

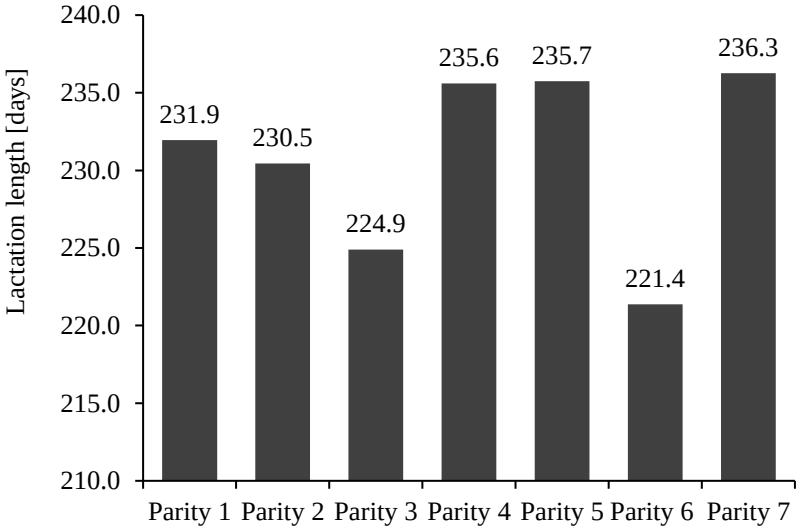

Figure 1: Average lactation length [1st to 7th parity]

3.2 Reproductive performance of local Thrabam cows in different parity

3.2.1 Age at first calving

The mean age at first service [AFS] was 37.5±8 months [n=173] and age at first calving [AFC] was 47.6±8.5 months [n=165]. Tamang and Perkins [2005] reported age at first calving for local cattle as five years [60 months] in most cases at the village farms. It indicates that NNBC's good feeding and management of animals has lowered AFS and AFC compared to village farms where fodder shortages and underfeeding are common.

3.2.2 Calving Interval

With the increase in parity, calving interval had decreased. The mean calving interval between 1st and 2nd lactation was 16.1±3.6 months [n=106], which progressively decreased to 12.2±1.1 months [n=22] in 7th & 8th lactation [Figure 2]. Sharma [1999] also reported that mean calving interval of 17.6 months [528±162 days] for 22 *Nublang/Thrabam* cows in first lactation. It is therefore, evident that the adoption of good breeding practices has improved the reproductive performances of animals in the farm.

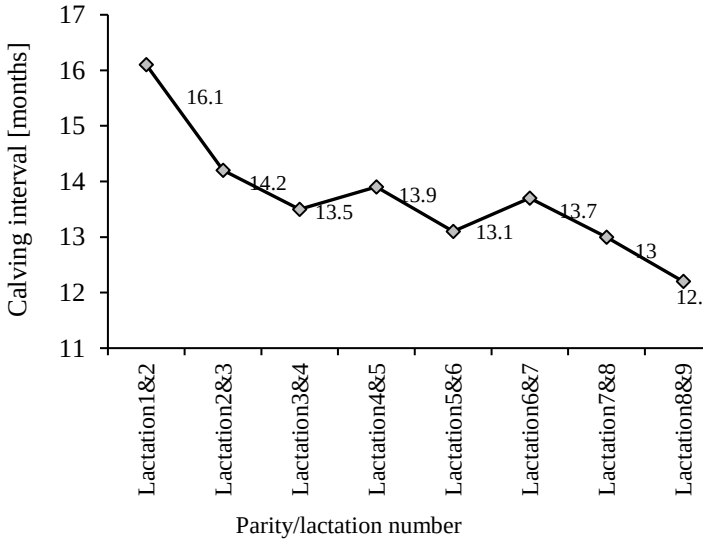

Figure 2: Mean calving interval in different stage of lactation.

3.3 Breeding and management

Different category of animals [heifer, breeding bull, young bulls, milking cows, dry cows, and calves] were housed and managed separately. Yet in absence of Artificial Insemination [AI] services at the farm, mating of cows through natural service of breeding bulls is advocated. But bulls at times are difficult to control and unplanned mating has been reported.

3.4 Culling and replacement

NNBC practices annual culling and replacement of

herd with more promising younger generation. In 2017-2018, about 18% of animals were culled [Dendup *Pers. Comms* 2018]. This is lower than the culling rate of 26 to 33% practiced in Canada [CDIC 2018] and 25.4% in Dutch dairy farms [Norihari et al. 2013]. Nevertheless, the level of culling practiced at NNBC is adequate to maintain a sizable herd.

3.5 Herd dynamics

The herd dynamics at NNBC is conducive with 44 heifers and 22 young female calves available to replace 54 aging cows [32%] [Figure 3]. Equally, it has a good number of breeding bulls at the farm to ensure periodic reshuffling in successive generation to avoid inbreeding. Norhari, et al. [2013] supplemented the view that rearing own young stock heifers, has positive economic gains and should be proportionate to the number of dairy cows that has to be culled from the herd.

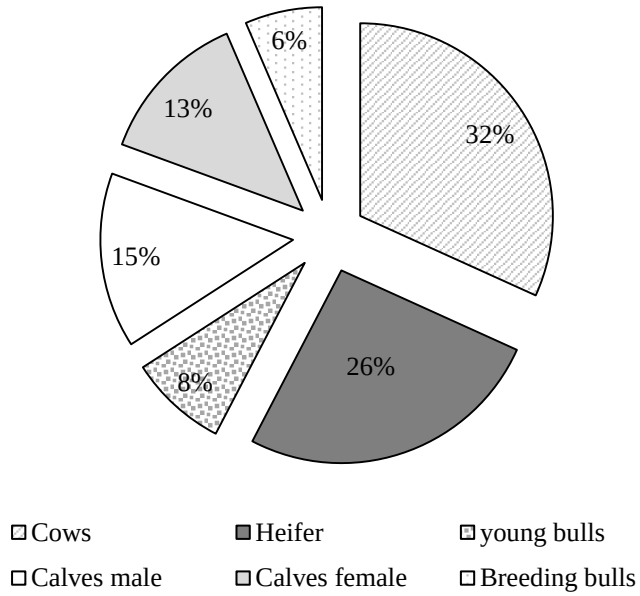

Figure 3: Herd dynamics at NNBC

3.6 Challenges and opportunity for nucleus herd improvement at NNBC

- Mixing of other cattle breeds such as Karan Fries and Black Angus during the 11th Five Year Plan [FYP] period diluted the mandate of nucleus farm. Unless proper breeding plan for the nucleus is prepared and implemented based on defined mandate, advancement of breeding program in the farm is likely to be at stake.
- Though, all required data are recorded in bovine register. Digitalization of these data needs to be expedited. There is also a felt need to develop a simple and user-friendly database for recording required farm parameters, and train staff on how to regularly update the data for periodic analysis.
- With an adequate infrastructure, pastureland and other basic facilities in place, the farm will be able to sustain a reasonable number of animals for targeted herd improvement. However, placing suitable AI Technician to perform breeding services and Administrative Assistant to maintain proper records at the farm is a felt necessity.

4. CONCLUSIONS

- Owing to short lactation length and low lactation yield, *Nublang/Thrabam* cattle may not catch-up in milk production with recognized dairy breeds even if they are rigorously selected. Hence, multiple traits selection giving equal importance to milk production, disease resistance, adaptability, and foraging ability is necessary. Besides, efforts should be made to improve lactation length for higher lactation yield.
- Daily/lactation milk yield of *Nublang/Thrabam* cattle is highest in 4th parity with gradual decline till 7th parity. Hence, cows in nucleus herd if necessary, could be retained beyond 7th parity based on their productivity and fitness.
- Interrupted AI services at the farm owing to staff unavailability are hampering the implementation of planned breeding program to maintain quality pure-bred herd. Hence, human resource gap at the farms needs to be periodically reviewed and timely remedial measure must be taken.
- Mixing of other breeds of cattle during 11th FYP had major implications to the farm management to pursue pure line breeding of *Nublang/Thrabam* nucleus herd. Such actions undermine the mandate and hinder the farm's progress.
- There is a need to develop a simple, yet effective breeding guidelines/strategies and user-friendly parameters recording database for herd recording.

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