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Reproductive Traits Evaluation of Lime Buffalo (*Bubalus bubalis*) in Western Hills of Nepal

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Abstract

The data pertaining to variable reproduction traits of Lime buffaloes were collected from Baglung and Gulmi during January, 2017 and March, 2018 for evaluation. Total 182 buffalo samples from Baglung and Gulmi were selected and data were collected using semistructured questionnaire and farmers record. Data entry and data analysis was done by using MS-Excel and R-statistical package, respectively. The least square mean comparison was done using Duncan's multiple range test. The overall least-square means of age at first service, age at first calving, calving interval (CI), gestation length, postpartum estrus (PPE), and number of service were obtained as 1164.62±34.25 days, 1494.34±33.41 days, 448.47±21.02 days, 316.35±1.70 days, 107.47±17.14 days and 1.51±0.12, respectively. Location and parity had significant effect on PPE ($p<0.01$) and CI ($p<0.01$). The first postpartum heat in buffaloes varies greatly with parity and location. However, coat color had no significant effect on reproductive traits. The influence of nongenetic factors on the phenotypic expression of reproductive traits of buffaloes is important to determine the breeding competence in farm animals.

Keywords: *Breed, Bubalus bubalis, nongenetic, parity, postpartum estrus (PPE)*

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INTRODUCTION

Buffalo (*Bubalus bubalis*) is the major milk contributing dairy species after cattle in Nepal with various utilities. Buffaloes are the second most common milk source and occupies major milk source in many countries (Sachin *et.al,*2016). Buffaloes occupy an important part in national economy and contribute about 65% and 54.4% in terms of milk and meat, respectively (DLS, 2016). The buffalo population and milk production are increasing in recent years as compared to previous years. In 2014/15, the total buffalo reported were 5,167,737 and total milk production was 1,168,006 Mt while 5,168,809 and 1,210,441 Mt, respectively in 2015/16 [1]. The Agriculture Perspective Plan (APP 1995) has also considered livestock sector to be one of the main agricultural commodity group for contributing most to achieving the objectives of poverty alleviation, women empowerment and food sufficiency [2–4]. Buffaloes are one of the most important livestock commodities in Nepal. Buffalo is the most important livestock species in hills of Nepal. Farmers of western hills perceive buffalo as a first-choice livestock species for family income [5]. Buffalo contribute about 6% in GDP [1]. Milk and milk products are a major source of animal protein in Nepalese diet, and livestock and livestock products are the important source of family income especially in hills and mountains [6–8].

Buffaloes are the main source of milk and meat in Nepal with the total annual production of about 65.22% (milk) and 54.33% (meat) which is equivalent to 1.21 million metric ton of milk and 175 thousand metric ton of meat from 5.16 million heads of buffaloes (DOA, 2017). Buffalo is the major source of milk and meat production in Nepal producing about 70% and 65%, respectively of the total milk and meat production in Nepal. Roughly 70% of household kept some type of livestock including cow, buffalo, pigs and chicken [4]. More than half of cattle and buffalo are kept in hills and about one third in temperate, sub-alpine and alpine regions [4]. Buffalo is kept by 58% of households in hills in Nepal. The buffalo have been raised under Nepalese farming system throughout the known history.

Buffalo are the part of farming system of rural small land holding farm families. Out of total buffaloes, 57% are reared in mid-hills, 33.1% in south and mountains and 9.1% in hills [1]. Baglung have 79,620 number of buffalos with 18093 Mt. of milk and 2124 Mt. of meat production while Gulmi have 44479 buffaloes with 11233 Mt. milk and 1446 Mt. of buffalo meat production [1].

Water buffalo (*Bubalus bubalis*) have been divided into swamp and river buffalo based on various morphological, behavioral, geographical and chromosome number. Lime buffaloes are riverine type having 25 pairs of chromosome (2n=50) and belong to milch breed. The breed lime is believed to have originated from wild Arna (*Bubalus arnii*) and has been domesticated from the known history of Nepal. They are found mainly in hills of Nepal. About 33% of total indigenous buffalo population is lime in the hills and mountains of Nepal (Rasali, 2000) [1, 9–11]. Phenotypically, the lime buffalo are light brown in color and relatively small in body size, with characteristic chevrons of gray or white hair below the jaws and around the brisket, and small sickle-shaped horns curved towards the neck [12]. They have grey coat color, grey brown or blackish skin color, black muzzle, greyish or whitish eyebrow, grey brown or whitish leg markings [12, 13].

As reproductive traits such as age of first service, age of first calving, calving interval (CI), postpartum estrus (PPE) etc. are highly dependent on management, climate and nutrition and these vary with location and altitude. A combination of these various traits is used to measure breeding efficiency or performance in farm animals. CI is highly dependent on management, climate and nutrition. The first postpartum heat in buffaloes varies greatly with season, breed altitude and individually. Cross-breeding with the exotic breeds, deficit in nutritive feeding, climate change, lack of suitable breeding sire, use of buffalo sire without assessment of acclimation and adaptation etc. led to declining population of indigenous buffalo breeds. The expressions of the phenotypic character are dependent in the function of genotype under the influence of environment. Singh & Chapagain [14] reported that the genetic and environmental characters are important for reproductive and productive traits. Interaction among genetic and environmental factors is responsible for determining the reproductive efficiency of a species. Buffalo as a livestock is a type of investment which is affected by its reproductive and productive performance. Research in the indigenous buffaloes is very less and the population of indigenous breeds is declining, therefore the study has been carried out for studying the effect of heritable and nonheritable factors on the reproductive traits. Also, the study aims for the estimation of the status of the breed lime in the two hill districts of Nepal i.e., Baglung and Gulmi. Furthermore, the findings of the study may be used for further research purposes [5, 12, 14, 15].

METHODOLOGY

The mid hills of western development region of Nepal were selected for this study. This study was carried out in two of the western hill districts of Nepal, i.e., Gulmi and Baglung.

Table 1: *Genetic and Nongenetic Factors.*

Factors	Categories
Coat color	1= Greyish, 2= Blackish
Parity Location	1= first, 2= second, 3= third, 4=fourth, 5=fifth and above 1= Gulmi 2= Baglung

Table 2: *Reproductive Traits.*

Traits	Description
Age at first service	Age of heifer when conceives for first time.
Age at first calving	Age of heifer when delivers for the first time.
Calving interval	Period between two successive calving.
Postpartum estrus	Time taken from calving to next successful insemination.
Gestation length	Period between conception and calving.
Number of service	Number of service for conception.

Households having at least one buffalo at various parity were selected by transact walking. During the study period, the animal farmers associated with the genotypes of buffalo, Lime were selected for research. Lime buffaloes are grey in color with typical distinguishing characteristics with chevron both in the neck and brisket regions, whitish to

greyish color as the leg marking and whitish eyebrows. Parkote can be easily distinguished with its black skin and coat color, black muzzle and absence of chevron. The study used purposive sampling technique in order to conduct household survey.

Age of buffalo, number of parity, age of first service, gestation length, PPE and other relevant information were recorded in recording sheet of the individual buffalo (Tables 1 & 2). Collection of data was done through semistructured questionnaires and farmers' record. Primary data were collected through household survey. The survey was conducted in Baglung and Gulmi districts in the months of Janaury, 2017 to March, 2018. Open and close type of questionnaire was prepared before conducting the survey. The respondents were selected randomly through transect walk. The effect of genetic and nongenetic factors affecting reproduction traits were studied by least-squares analysis using R-studio analysis software. Mean comparison was performed by Duncan's Multiple Range Test (DMRT) software.

RESULTS AND DISCUSSION

Reproductive performance of buffaloes in terms of different nongenetic factors such as; location, coat color and parity were studied and discussed (Figure 1).

Age at first service (AFS) as observed from this study was found to be 1164.62 days. The findings of this study were higher than report provided by Jamuna *et al.* [7] i.e., 1320 in Murrah buffaloes. Robinson *et al.* (2006) reported that better-quality nutrition during premating period stimulates ovulation and conception rates. Age at first calving (AFC) in this study was found to be 1494.34 days. The age at maturity in buffalo can be reduced to 2 years, with better feeding and management. Generally, the AFC is determined by age of first mating and number of services per conception. The AFC is an important parameter of reproductive efficiency and shorter the AFC, longer will be the productive life. Shrestha and Yazman (1990) reported the age of first calving in Murrah and Murrah * Nepalese crossbreed in Brazil as 52.3 and 48.3 months, respectively. Nonsignificant effect of location on AFS and AFC were observed in the study. Higher AFS and AFC was found in Gulmi (1143.53^{a}±34.96 days AFS and 1471.17^{a}±33.82 days AFC) as compared to Baglung (1099.41^{a}±34.96 days AFS and 1444.31^{a}±33.02 days AFC). Srivastava *et al*. (1988), Priya Raj (2002) and Kumar (2004) also reported nonsignificant effect of location on AFC. Intensive management practice and proper nutrition reduces the age of first calving. Rasali [5] reported that the AFC was significantly affected by the altitude. Higher AFS and AFC may be due to difference in nutrition, management, altitude etc.

The overall least square means of CI was found to be 448.47±21.02 days. Long calving interval and delay in onset of puberty contribute to low reproductive performance and productive losses leading to reduced income (Abdulkareem, 2008. The main factor controlling variations in the calving interval is the service period, which in turn depends on PPE days and number of services per conception. In addition, many other additional factors have been implicated in extended CIs, such as embryonic mortality, high milk production, seasonal and environmental factors, age of cow and sire used for service. The least mean square of CI in Baglung (403.32^{a}±20.99) is slightly lower than Gulmi (478.56^{a}±21.58); this may be due to short PPE and difference in nutrition and management practices. There was significant effect of parity in CI. Slightly longer CI in early (first and second) parities decreases in later (third and above) parities, it has been observed in buffaloes that postpartum uterine involution occurs simultaneously with increasing parity which probably leads to better fertility. The trend of decreasing CI from first to third parity as observed in the present study was also reported by Singh & Chapagain [14]. The nonsignificant effect of coat color in CI was observed in lime buffaloes in our study. The CI for blackish coat color (442.18^{a}±21.76) was somewhat higher than that of greyish coat color (439.70^{a}±21.01).

The overall least square mean of gestation length was found to be 316.35±61.70 days. This value is slightly higher than value of Shah *et al.*

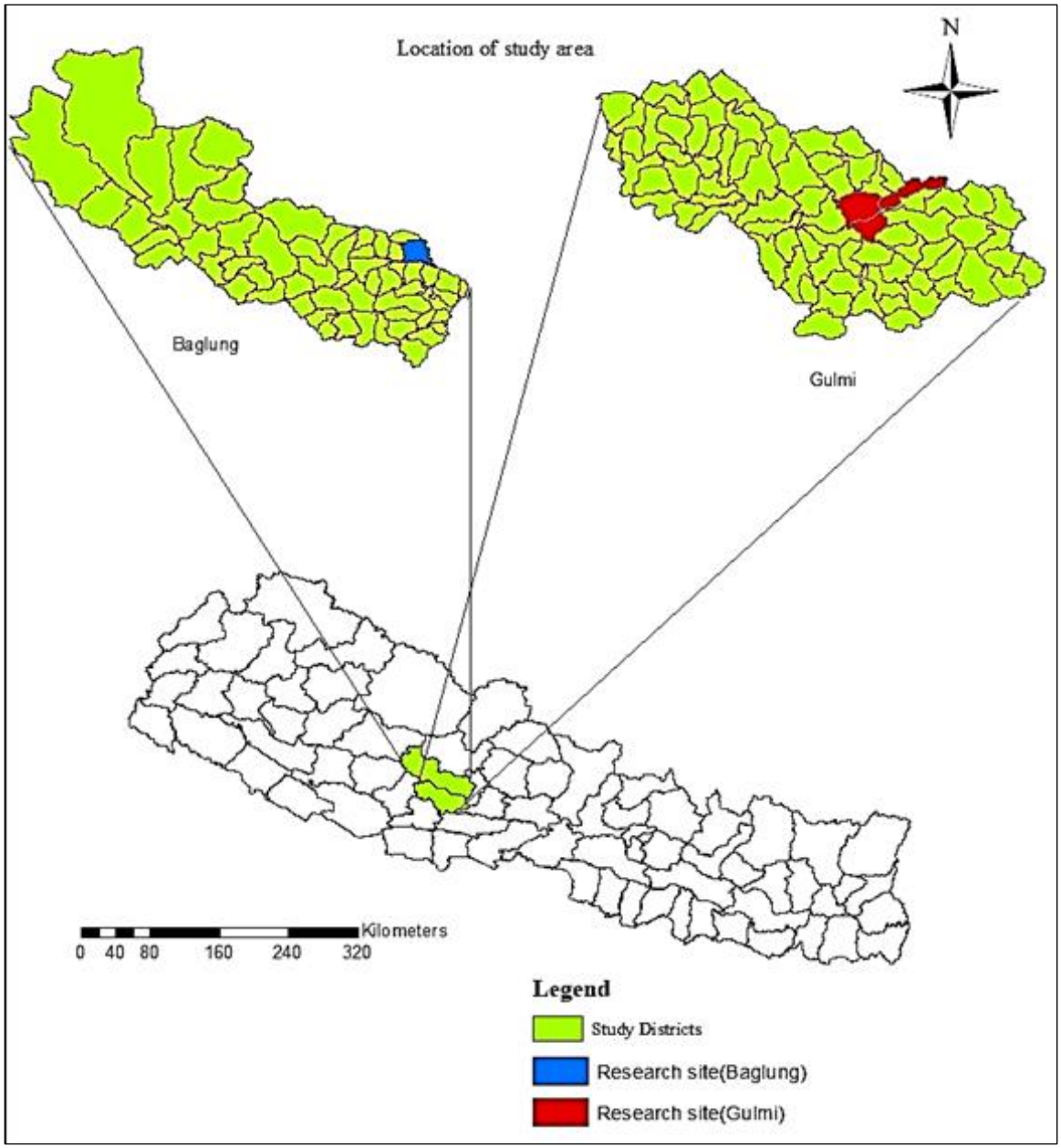

Fig. 1: *Location of Study Area.*

(2011), who reported that the gestation period in lime buffaloes was found to be 304.07±6.56. This outcome was found to be higher than the results of Hafez, (1992) who reported the gestation length to be 315 days extending from 305 to 330 days in Murrah buffaloes. Bhandari (2016) in his study found the gestation length to be 330.71±0.97 days in indigenous buffaloes in hills of Nepal. The gestation length of Lime buffaloes in Gulmi was slightly higher than that of Baglung. The gestation length of lime buffaloes in Baglung was found to be 312.02^{b}±0.90 days and that of Gulmi was found to be 319.36^{a}±0.84 days. Bhandari and Bhatta (2016) observed shorter gestation length (330.26±0.9 days) in Parbat than Myagdi (330.96±0.89 days). There was nonsignificant alteration in the gestation length with respect to the parity of dam. The gestation length is almost similar in early and mid-parity but slightly higher in later parities. The gestation length ranges from 314 days to 317 days. There was nonsignificant effect of coat color in the gestation length.

Results revealed that the overall least square means of PPE was found to be 107.47±17.14 days. Neupane *et al*., [11] found the service

period of Lime buffalo to be 190 days and that of Parkote buffalo to be 175 days. Location had significant effect ($p<0.01$) on PPE. Baglung is favorable for short PPE in indigenous buffaloes. The improved nutrition during premating period stimulates ovulation and conception rates (Robinson et al., 2006). PPE is longer in first ($97.72^{ab}\pm17.05$ days) and second parity ($136.07^{a}\pm11.38$ days), shorter in third ($136.07^{a}\pm11.38$ days) and fourth parity ($97.79^{b}\pm13.75$days) and again longer in above parities ($100.44^{ab}\pm10.87$ days). The first postpartum heat in buffaloes varies greatly with season, breed, altitude and individually. Kundu *et al*., (2003) and Suresh *et al*., (2004) reported the significant effect of the parity in the PPE. The effect of coat color on PPE was found to be nonsignificant.

CONCLUSION

The reproductive traits of the indigenous buffaloes were influenced by the nongenetic factors such as location, age and parity of dam, so the phenotypic expression of the reproductive trait was not only genetic but was also affected by the environment. Location and parity had significant effect on PPE ($p<0.01$) and CI ($p<0.01$) Coat color had no significant effect on the reproductive traits of lime buffaloes. As there was nonsignificant effect of coat color to the reproductive traits it can be said that coat color was not an important factor to be considered while evaluating the reproductive traits. The differences in the reproductive traits over the location may be due to the differences in the altitude, feeding, management practices and the availability of the fodder. Phenotypic characters in relation with the environmental conditions should be considered for the improvement of lime buffaloes.

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