

Buffalo Genetic Resources in Nepal: Review

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Abstract: *Buffaloes are the major genetic resources commodity in Nepal having significant contribution in food and nutrition security, employment and income of the marginalized as well as commercial farmers. According to Nepalese statistical information on agriculture of the Ministry of Agriculture and Livestock Development, Nepal holds 5.13 million buffalo population producing 194 thousand metric ton meat and 1.46 million metric ton fresh milk production which contributes 4.23 % and 7.28 % respectively in agriculture gross domestic product of Nepal. Data, figures and reports from Ministry of Livestock and agricultural development, department of livestock services, Nepal agricultural Research Council, and other government organizations are analyzed to review this paper with objective to describe the production and productivity potential trend and significance of buffalo genetic resource in Nepal. This paper review on the existing breeds, their breeding system, production system, population status, and way forward to increase the production and productivity of buffaloes. Due to prohibition of cattle slaughter in Nepal, buffalo remains an important meat animal and hence good source of animal protein. It is also known for its sturdiness and draught power where buffalo males extensively are used for draught and meat purposes. Findings reveled that Nepal is endowed with three indigenous buffalo genetic resources namely Lime, Parkote and Gaddi whose purity is declining due to cross breeding with Murrah breed and hence exotic crossbred Murrah breed is prevalent in large number. To improve the buffalo production and productivity, country is found to adopt the selection tools, assisted reproductive technologies and have cross breeding program with the Murrah to upgrade the un - descript native buffalo production.*

Keywords: Buffaloes, genetic resources, meat production, milk production

1. Introduction

The water buffalo (*Bubalus bubalis*), also known as the domestic water buffalo or Asian water buffalo, is a large - bodied bovid believed to have originated in the Indian subcontinent and Southeast Asia (Cockrill 1974, as cited in Zhang et al., 2020) . At present, it is also prevalent in Europe, Australia, North America, South America, and some African countries (Cockrill, 1977) . Although the buffalo population is declining in many countries due to decreasing requirements for draught animals, the global increase is mainly due to the growing demand for milk, cheese and processed dairy products in India, Pakistan, Italy, and the Americas. Despite steady growth in the global buffalo population, it is one of the world's most neglected domestic animals, but the one with a great untapped potential (Cockrill, 1977) .

About 60.4 % Nepalese people depends upon agriculture (AITC, 2023). Agriculture contributes to around 24.12% of the Nepal gross domestic product (GDP) of which, the livestock sector contributes about 24.01% of the agricultural gross domestic product (AGDP). Nepal have 5.13 million buffalo producing 194090 MT buffalo meat and 1464802 Mt buffalo raw milk from 1.67 million are milking buffaloes (MoALD, 2023). Buffalo milk contributes 7.28% in AGDP while Buffalo meat contributes 4.23 % in AGDP (MoALD, 2023). Buffalo population in Nepal is found to be distributed basically in hills and terai land reared mostly at subsistence level to support family income, as a source of manure and biogas production, as a source of animal protein for human nutrition, draft and transportation purpose (Osti, 2010) . Buffalo can efficiently convert low - quality feed stuff like straw and agro - industrial waste into human food, improve soil structure through bio - fertilizer, and as a financial asset that can be sold when needs arise (Pasha and Hayat 2012). Selected communities also eat buffalo meat, use hides to produce various products, and consider animals

as liquidity reserves. The growing demand for milk and diversified dairy products, such as cheese, yogurt, ice cream, paneer, chena, butter, cream, and other sweets, has led to the emergence of buffalo farming as a commercial enterprise. Nepali farmers prefer buffalo over cattle due to their multiple utilities, higher fat and other nutritional attributes, lower production risk and hardy nature against stresses.

Recent publications on Nepali Buffalo in researchers and reports of AnGR in international literature have generally been somewhat limited in outlook. They include papers and reports on production and reproduction performances, feeding experiments, and performances of cross - bred animals. The current paper is based on the knowledge and experience of the authors and aims at collating, complementing, and bringing up - to - date earlier publications on Nepali buffalo and providing information on the genetic resources of the country. It introduces some perceptions of numbers and output, providing descriptions of Nepalese indigenous breeds and exotic Murrah buffalo breed present or known to have been present in Nepal.

2. Materials and Methods

This paper is mainly based on the information available from scientific papers, publications on journals, proceedings, annual reports, and other project compilation. It covers information on historical background of buffalo research, its population growth trend and its distribution, genetic parameters, and other production systems of indigenous and exotic breeds of buffalo. Data, figures and reports from Ministry of Livestock and Agricultural Development, Department of Livestock Service, Nepal Agricultural Research Council, and other government organizations are analyzed to review this paper.

Background of buffalo program in Nepal

Buffalo has been one of the major commodities of high priority ever since the beginning of formal agriculture research program in Nepal. According to NARC (2022), conventional breeding program was initiated in 1965 to improve the production performance of buffaloes. Along with the establishment of NARC in 1991, Bovine Research Program (BRP) was initiated at Khumaltar, Lalitpur to carry out the need - based research on cattle and buffalo. Realizing the need for single commodity research programs, NARC separated cattle and buffalo research programs in 2013 and shifted National Cattle Research Program (NCRP) to Rampur, Chitwan and National Buffalo Research Program (NBRP) to Tarahara, Sunsari. The research facilities of current NBRP were developed in 1959 for buffalo research unit of Birat Agricultural Farm which was established two years earlier. The NBRP aims to contribute to national development and support livelihood of farming communities by generating, verifying, and disseminating improved technologies related to feeding, breeding, production management and health management of buffalo suitable for various agro - ecological zones of the country (NBRP, Annual Report, 2070/71). The NBRP also has mandates to decide priority areas for research, manage buffalo - related knowledge, conserve buffalo germplasms, establish linkages with international research agencies, and carryout capacity building training for livestock technicians and farmers. Also, Directorate of Agriculture Research, Lume, Kaski under NARC conserves the indigenous buffalo breeds for the research purpose. Faculty of Animal Science, Veterinary Science and Fisheries under Agriculture and Forestry University, Nepal also have buffalo genetic resource where various academic research are implemented.

In the financial support from USAID/LCC CRSP, Michigan state university project 'Improving nutrition and productivity of Buffaloes (INPB) to adapt to the climate change' was

launch in Dulegauda, Tanahun, Palungtar, Gorkha and Gunjanagar, Chitwan from 2012 to 2015 whose implementing institutions were Michigan state University, USA, Nepal Agriculture Research Council, Agriculture and Forestry university (AFU) and Department Livestock Services, Kathmandu.

CGIAR research initiatives on 'Sustainable Animal Productivity for Livelihoods, Nutrition, and Gender Inclusion (SAPLING) *Bhaisi*' is facilitating agreements between ILRI, the Ministry of Agriculture and Livestock Development (MoALD), Provincial Ministries and the Nepal Agricultural Research Council (NARC). National partnerships have enabled SAPLING *Bhaisi* to understand the development goals and context of buffalo productivity in Nepal. In Nepal, farmers face challenges in enhancing buffalo milk yields and strengthening the resilience of buffalo value chains. CGIAR's Sustainable Animal Productivity for Livelihoods, Nutrition, and Gender Inclusion (SAPLING) initiative, through the International Livestock Research Institute (ILRI), has been implementing the SAPLING model in Nepal under SAPLING *Bhaisi* (meaning buffalo in the Nepali language) to bundle genetics, feed and health technologies to tackle low buffalo productivity. A crucial part of SAPLING's design has been partnerships with international, national and local entities to develop these comprehensive innovation packages and pathways to disseminate them (<https://www.ilri.org/where-we-work/south-asia/nepal>). Recently, in the year 2023, India government provided 15 high breeding value buffalo bulls to Nepal which has been supported to National Livestock Breeding Offices at Pokhara, Lahan and Nepalgunj basically for the production and distribution of semen for the genetic improvement in buffaloes of Nepal.

Buffalo Population and its distribution

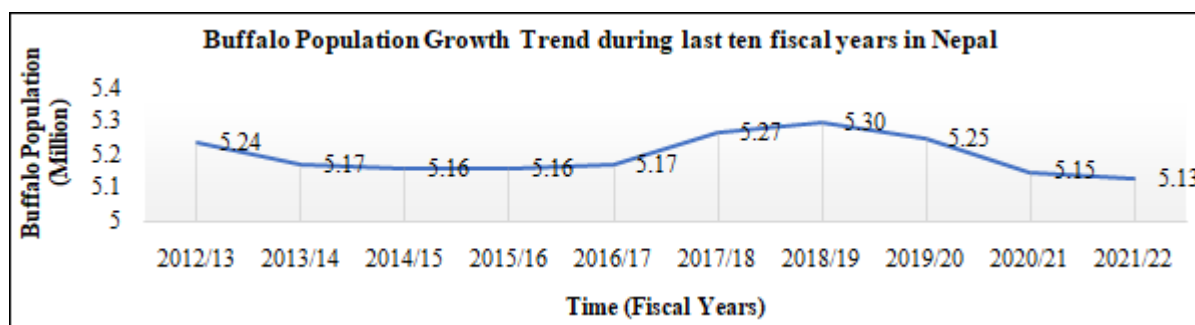


Figure 1 (a): Buffalo population growth trend of Nepal

Source: MOALD (Statistical Information on Nepalese Agriculture of different fiscal year)

According to MOALD statistical Information on Nepalese agriculture the total buffaloes' population growth trend in Nepal for last ten fiscal years from 2012/13 to 2021/22 is shown in figure 1a. Trend line of the graph figure 1a shows

decreasing rate in total buffalo population growth where 5.24 million head count in fiscal year 2012/13 decreased to 5.13 million in fiscal year 2021/22.

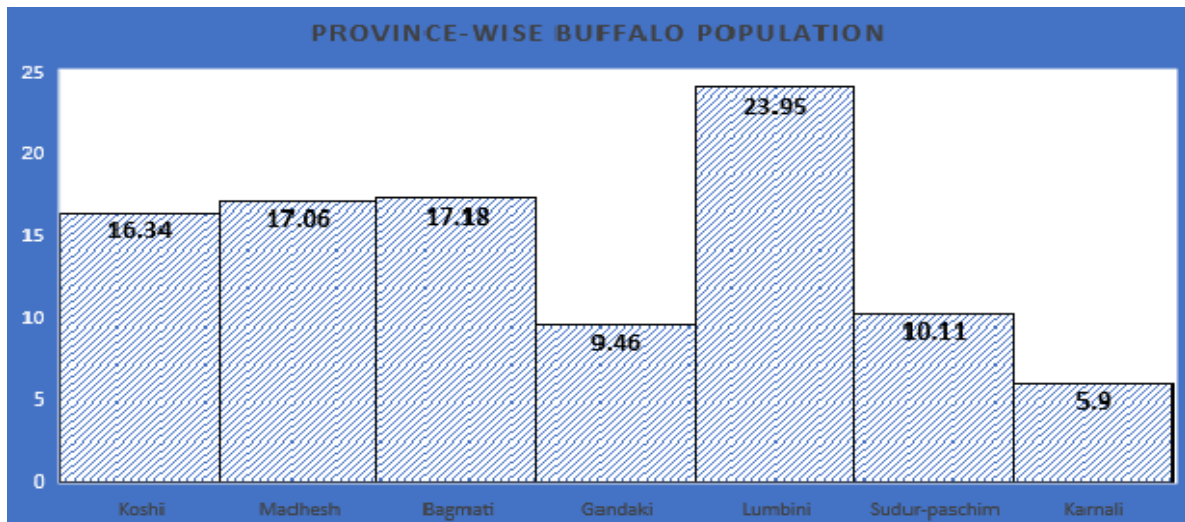


Figure 1b: Buffalo population distribution in Nepal

Source: MOALD, 2023 (Statistical Information on Nepalese Agriculture of fiscal year 2021/22)

According to MOALD, 2023 Statistical Information on Nepalese Agriculture of fiscal year 2021/22 as shown in figure 1b out of total buffalo population 5.13 million in fiscal year 2021/22, Lumbini province covers maximum 23.95% of population followed by Bagmati

province 17.18%, Madhesh province 17.06%, Koshi province 16.34%, Sudur - paschim 10.11%, Gandaki province 9.46% and least in Karnali province 5.90%.

Buffalo milk production in Nepal

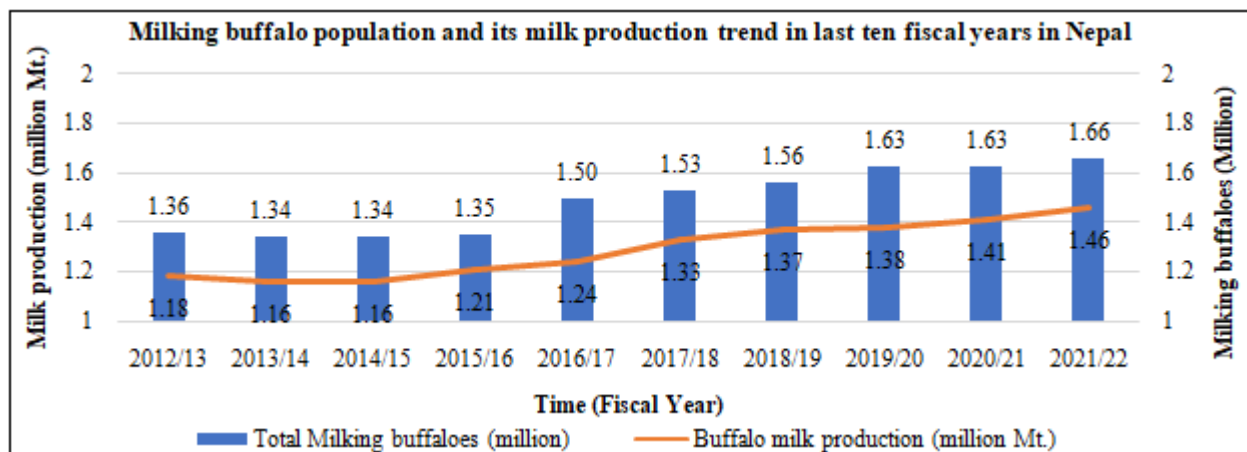


Figure 2 (a): Buffalo milk production trend of Nepal

Source: MOALD (Statistical Information on Nepalese Agriculture of different fiscal year)

According to MoALD statistical information buffalo milk production trend in Nepal is found to be increasing since last years as shown in figure 2a despite the decreasing rate of total buffalo population as in figure 1a, the head count of milking buffaloes is found to be increasing from 1.36

million in fiscal year 2012/13 to 1.66 million in fiscal year 2021/22. It was found 1.18 million Mt. milk production in fiscal year 2012/13 from 1.36 milking buffaloes which increased to 1.46 million Mt. in fiscal year 2021/22.

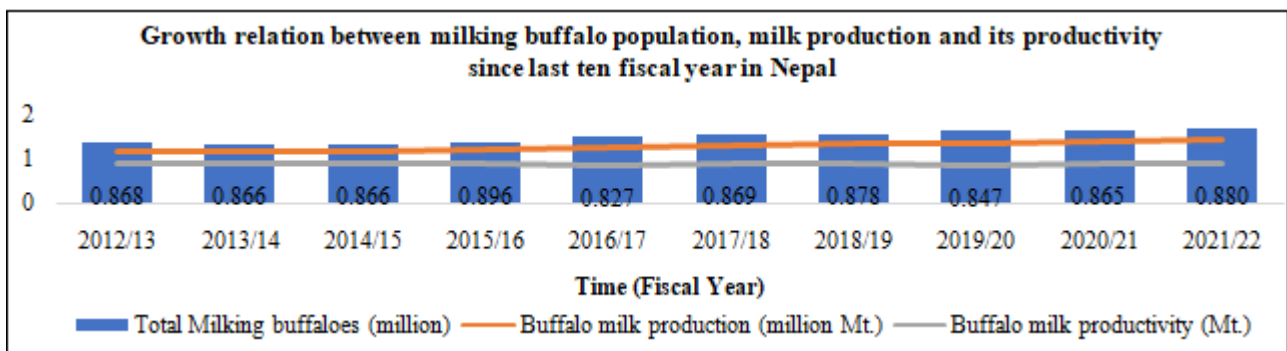


Figure 2 (b): Milk productivity improvement trend in Nepal

Data source: MoALD Statistical information on Nepalese Agriculture

Milk productivity was found to be 0.868 Mt. in fiscal year 2012/13 which has been increased to 0.880 Mt. in fiscal year 2021/22. Despite in increasing milking buffalo population and its production, the milk productivity improvement per milking buffalo per year is found to be more or less constant

and hence no significant improvement in milk productivity since last ten years as shown in figure 2b.

Buffalo meat production in Nepal

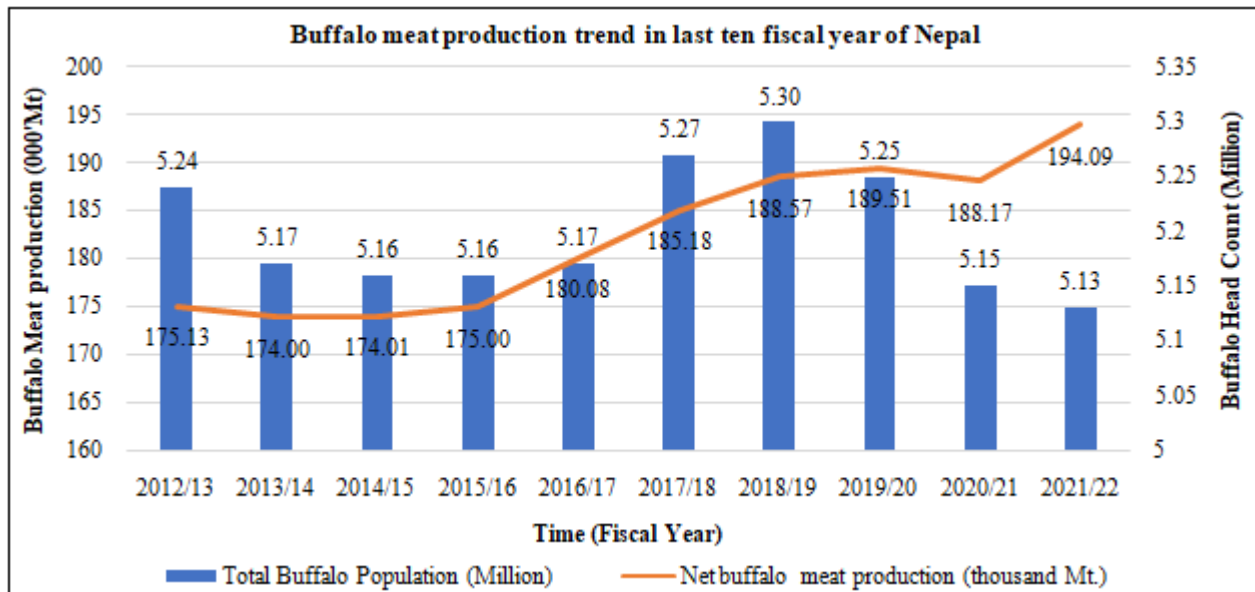


Figure 3 (a): Buffalo net meat production trend of Nepal

Data source: MoALD, Statistical information on Nepalese Agriculture

According to the data of MoALD Statistical information on Nepalese Agriculture, buffalo meat production trend has significantly found to be increased than the previous fiscal years as shown in figure 3a despite the decreasing trend in overall buffalo population. This may indicate buffalo meat consumption increased in Nepal. On the other hand, decreasing buffalo population but increasing milking buffaloes may indicate most of the farmers are avoiding to rear poor performed buffalo and hence culling them to slaughter purpose which might have led to increase the meat production since last few years and select only best performed milking buffaloes to enhance the milk production.

Description of the buffalo breeds of Nepal

Lime, Parkote and Gaddi are three indigenous buffalo breeds found in Nepal. Parkote breed is popular in high altitude regions, while Lime and Gaddi are popular in mid - hill and Terai regions, respectively. Farmers from the terai region mainly raise Murrah and its crossbreed. Milk yield, lactation duration and lactation interval of the Murrah and its crossbred are more desirable than those of indigenous breeds. Besides, an additional wild type buffalo breed called Arna is also found in the Koshi Tappu area of Nepal which can be exploited to develop meat - type cross breeds (Gorkhali et al., 2021).

3. Discussions

Nepal buffalo population statistics reveals availability of large genetic buffalo resources majority of them in the state of poor production performances may be due to large number of local and un - descript buffalo population. As per the information from National Livestock Breeding Policy 2078, there are only 35% improved buffaloes in Nepal

which could be possible reasons for the low milk productivity. Buffalo and its production improvement program has been found to be implemented in previous years highlighting the feeding management and artificial insemination mission in buffalo genetic improvement but could not have impact to change the productivity at appreciating level. In recent years due to the extensive application of artificial insemination in local and un - descript buffaloes it is expected to increase the improved buffalo population there by increasing the milk production and its productivity in milking buffalo and meat productivity in fattening buffaloes. Again, introduction of high breeding value buffalo bull for the semen production and its propagation has further expected to enhance the production and productivity of Nepalese buffalo genetic resources. On the other hand, buffalo local breeds are a pool of irreplaceable genetic material of unacknowledged merit and value that must not be lost but must be conserved for possible unknown and unseen future use (Wilson, 2009).

4. Conclusions

Buffaloes are the major genetic resources commodity in Nepal having significant contribution in food and nutrition security, employment and income of the marginalized as well as commercial farmers. Existing large numbers of poor performing local buffalo's productivity can be increased to its maximum potential through appropriate use of breeding program like utilizing the high breeding value Murrah breed in Nepalese base buffalo population, selection and culling tools and in conjunction with novel assisted reproductive technologies like artificial insemination, estrus synchronization and embryo transfer.

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References

- [1] Gorkhali, N. A., Sapkota, S., S., Bhattarai, N., Pokharel, B. R., & Bhandari, S. (2021). Indigenous Livestock Breeds of Nepal: A Reference Book. Published by National Animal Breeding & Genetics Research Center, National Animal Science Research Institute, Nepal Agricultural Research Council, Khumaltar, Lalitpur, Nepal
- [2] MOAD (2004). Country Report on Animal Genetic Resources Submitted to FAO through Ministry of Agriculture and Development, Gov of Nepal
- [3] MOALD (2023). Statistical Information on Nepalese Agriculture. Ministry of Agriculture and Livestock Development, Nepal
- [4] NBRP (2070/71). Annual report of National Buffalo Research Program, Tarahara, Sunsari, Nepal
- [5] Pasha T N and Hayat Z (2012). Present Situation and Future Perspective of Buffalo Production in Asian Journal of Animal and Plant Science 22 (3), 250 - 256
- [6] P. P Kumar & T. M. Raj (2007) Gaddi Buffalo: An Indigenous Breed of Far - western Nepal, Italian Journal of Animal Science, 6; sup2, 1230 - 1233, DOI: 10.4081/ijas.2007. s2.1230
- [7] Wilson, R. T. (2009). Fit for purpose – the right animal in the right place. Trop. Anim. Health Prod., 41: 1081–1090.
- [8] <https://www.ilri.org/where-we-work/south-asia/nepal>.
- [9] Zhang Y., Sun D., Yu Y. & Zhang Y. (2006) A Y - linked SNP in SRY gene differentiates Chinese indigenous swamp buffalo and introduced river buffalo. Asian - Australasian Journal of Animal Science 19, 1240–4.
- [10] Cockrill W. Ross (1977). The Water Buffalo: Animal Production, Protection & Health, Food and Agriculture Organization Rome, Italy.
- [11] AITC. (2020). Agriculture and livestock diary 2077. Agriculture Information and Training Centre, Ministry of Agriculture and Livestock Development, Government of Nepal.
- [12] Osti, N. (2010). Nepalese buffalo production trend and future prospective. Italian Journal of Animal Science DOI: 10.4081/ijas.2007. s2.1294.