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Research Article

Study on nutrient supply in relation to feeding system of buffalo in Chitwan, Nepal

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ABSTRACT

Livestock farming in Nepal, especially buffalo farming alone contributes a major share in livelihoods of farmers. Stall feeding of buffalo is common in Chitwan with occasional grazing. This raises questions about status of nutrients supplied to maintain productivity as feed resources varied in forest and crop land according to the season. A study was carried out in Chitwan from April 2015 to March 2016 to find out the status of nutrient supply in relation to the feeding system of buffalo. Total fifteen farms were selected from three villages, the amount of feedstuff fed to the animals was measured every month and the nutrient contents of the feed were analyzed. The mean concentrations of DM, CP, TDN, Ca and P were 641g/kg, 75.0 g/kg, 462 g/kg, 4.9 g/kg and 4.2 g/kg. A significant difference of CP contents among the villages was observed (72.0 g/kg, 70.7 g/kg and 81.2 g/kg ($P<0.01$), and the highest content of CP, TDN, Ca and P were found in July ($P<0.05$)). The study showed variation in nutrient supplied, irrespective of the status and condition of buffalo in the farms which need to be considered to maintain productivity of the animals.

Keywords: Nutrient content, feeding system, Buffalo, Nepal.

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INTRODUCTION

In Nepal, the agricultural sector contributed 39.9% of the gross domestic product (GDP) and livestock production was one of the main sub-sectors in the country accounting for 26.8 % of the agricultural GDP. The country raised 7.3 million cattle and 5.2 million buffalo and total yield of milk was 1.9 million ton: 34.8% was from cattle and 65.2 % was from buffalo reported by SINA (2016/17). Livestock sector is an important component of Nepalese economy in terms of generating income and employment. Buffaloes have been raised for draught power, dairy, meat, hide, manure and reserve capital for the Nepalese families. Therefore, buffaloes are essential livestock in the country. Sharma et al. (1994) reported that dairy in this region contributes more to the domestic milk production, expensive feed rations and fodder shortage are common constraints due to small farm size (0.6 ha/farm). Terai is a low –altitude, southern plain region and the country's main granary of Nepal, even though it constitutes only about 14% of the country's total area. Climate and vegetation of the Terai region are mainly tropical to sub-tropical with the major rainfall during the monsoon season. The major feed for the animals comes from the croplands and relatively small amount of concentrate is supplemented. However, there are limited reports on the details of feeding system and dairy production in small-scale farms in the region reported by Hayashi et al. (2005). The problems have been indicated as shortage of the quality feed resources during winter and early summer, inappropriate management practices, reproductive and health issues.

Hence, the present study was conducted to identify nutritional supply for buffalo in the region as it could normally vary due to seasonal and spatial variation.

METHODOLOGY

Total fifteen small-scales farms from three village namely Gunjanagar (Village A), Sardanagar (Village B) and Gitanagar (Village C) of Chitwan were selected for the study which was done for 12 months from April, 2015 to March, 2016. This region is in a sub – tropical climate with an annual precipitation of 1451 mm in 2016, and maximum and minimum temperatures of 41.0^0c 3.0^0c respectively (Meteorology data of National Maize Research Program, Rampur, Chitwan, Nepal). In each farm the feedstuff fed to the buffalo was weighed once in a month and samples of the available feed were collected, weighed and dried in an oven at 60^0c for 48 hours to measure dry matter (DM). The nutrient concentration of the feed resources was calculated using the composite representative samples in the survey area. These samples were analyzed for crude protein (CP) and Dry matters (DM) using the procedures of the AOAC (1990), nutrient content in each samples were analyzed. For analysis of calcium (Ca) and Phosphorus (P) of the resources the samples were digested by a 1:1 mixture of 60% nitric and perchloric acids. Gomori (1942) developed the method for concentration of Ca was determined by atomic absorption spectrophotometry and P by the colorimetric. The total digestible nutrient (TDN) were estimated using the following equations reported by Martin (1985) and Chandler (1990):

TDN (%) in rice straw = 96.35-1.15 × ADF (%)
TDN (%) in native grass = 105.2-0.68 × NDF (%)
TDN (%) in supplemental feed sources = 81.41-0.48 × NDF (%)

The concentration of CP, NDF, Ca, P and TDN in total feed supplied for each buffalo was calculated from the amount of DM in each feed resources supplied and composition in the representative samples in each survey time. The statistical analysis was conducted by GLM Procedure using SAS (1999) using the following mathematical model: $Y_{ijk}=\mu+V_i+M_J+(VM)_{ij}+e_{ijk}$, where: Yijk= observed value μ=overall mean, V_i=effect of villages, M_j=effect of months, $(VM)_{ij}$=interaction effect between villages and months and e_{ijk}=residuals.

RESULTS

The farmers had raised buffalo Murrah-local crossbred and cattle breed Holestein-local or Jersey –local cross. The mature animals number, age, weight and milk yield in survey farms (Table 1). The average number of buffalo, year of age, body weight in kg, milk yield (Average Lactation) in L was 1.5 (0-3), 7.8 (4-15, 429 (319-502) and 2.7 (1-5) respectively. Whereas, farmers had cattle with following information av. number of cattle, year of age , body weight in kg, milk yield (Average Lactation) in L was 1.1 (0-3), 6.3 (3-15), 352 (292-394), 8.5 (4-13)

Table 1. Mature animals number, age, weight and milk yield in survey farms

	Number of animals	Year of age	Body weight in kg	Milk yield (Av. Lactation) in L
Buffalo	1.5 (0-3)	7.8 (4-15)	429 (319-502)	2.7 (1-5)
Cattle	1.1(0-3)	6.3 (3-15)	352 (292-394)	8.5 (4-13)

The metrological data from April 2015 to March 2016 of the Chitwan research site (Figure 1). The mean maximum temperature 35.6^{0}C was in May month whereas minimum temperature was recorded in January month 8.7^{0}C. The annual precipitation was 1451mm during the research period.

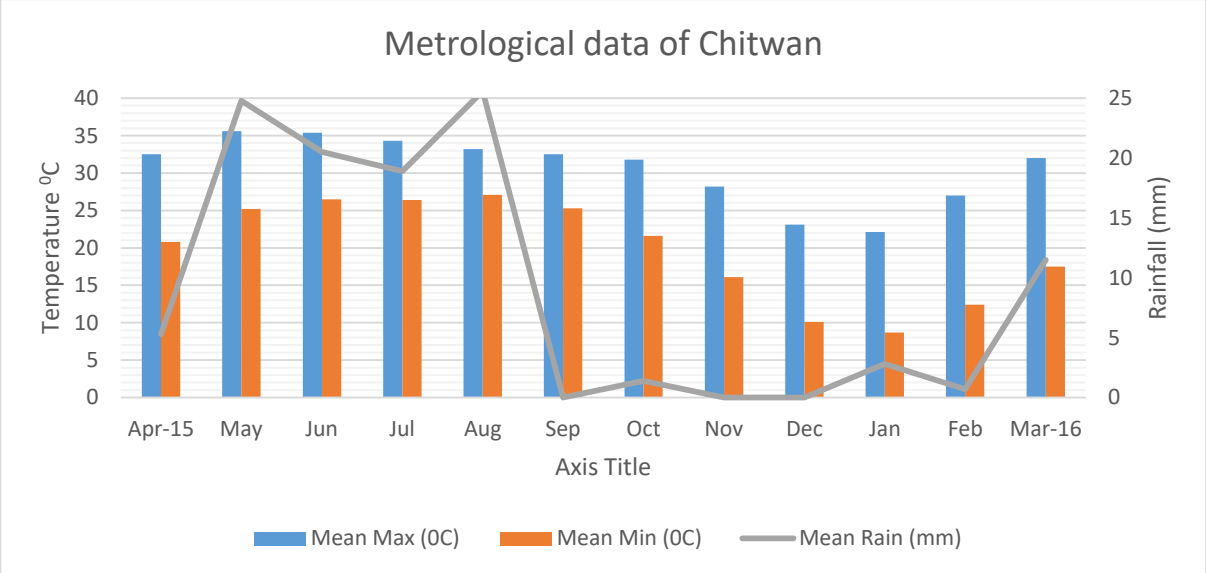

Figure 1. Twelve month metrological data of Chitwan district of Nepal

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The rice straw, native grasses, maize grass were fed as roughages sources whereas commercial feed, wheat bran, maize flour and rice bran concentration of DM, CP, TDN, Ca and P in major feed resources (Table 2). The lowest CP, TDN and P among the feeds were observed in rice straw showing 44g/kg, 385g/kg and 1.1g/kg, respectively, on an average. Commercial concentrate and wheat bran had the highest CP and Ca contents. Maize flour contained the highest TDN and P concentrations showing 752g/kg and 36.6g/kg, respectively. Thus, the supply of rice straw for the milking buffaloes was less than the rice straw or native grass throughout the survey periods. Thus, the survey area possibly did not keep an enough amount of maize grass as a main roughages feed. Wheat bran was utilized as the main supplemental feed throughout all the periods. The plenty amount of wheat bran was considered to be supplied to the farm.

Table 2. DM, CP, TDN, Ca and P contents in major feed resources for buffalo

Feed	DM $\bar{X}(\sigma)$	CP $\bar{X}(\sigma)$	TDN $\bar{X}(\sigma)$	Ca $\bar{X}(\sigma)$	P $\bar{X}(\sigma)$
Commercial Feed	785(12)	159(51)	662(21)	9.6(0.4)	16.2(1.0)
Concentrate					
Maize flour	864(19)	95(13)	752(15)	0.1(0.0)	36.6(0.4)
Rice bran	874(9)	146(16)	719(12)	0.6(0.1)	20.0(5.6)
Wheat bran	855(15)	170(6)	618(34)	1.0(0.2)	10.6(1.4)
Roughages					
Native grass	207(53)	134(34)	550(32)	8.5(5.9)	4.0(1.0)
Maize grass	331(44)	91(21)	492(43)	7.2(2.8)	2.8(0.8)
Rice straw	988(7)	44(6)	385(36)	4.4(1.2)	1.1(0.3)

g/kg on a DM basis : ,mean $\bar{X}$, standard deviation (σ). DM: dry matter, CP: crude protein,

TDN: total digestible nutrient, Ca: calcium, P: phosphorus.

Status of nutrient supply in each village and month (Figure 2, Figure 3, Table 3 and Table 4) presented. The overall supply (g/head/day) of DM, CP, TDN, Ca and P was 10950, 800, 5016, 53.3 and 44.6, respectively. The highest DM, CP, TDN, Ca and P supply was recorded in village C among the three villages ($P<0.05$). Supply of DM, CP, TDN, Ca and P was different among the months ($P<0.05$). Namely, the highest DM, CP, TDN and Ca supply was recorded in May, and the highest P supply was recorded in April. The variances in nutrient supplies were influenced by the differences of feed resources in seasons and villages.

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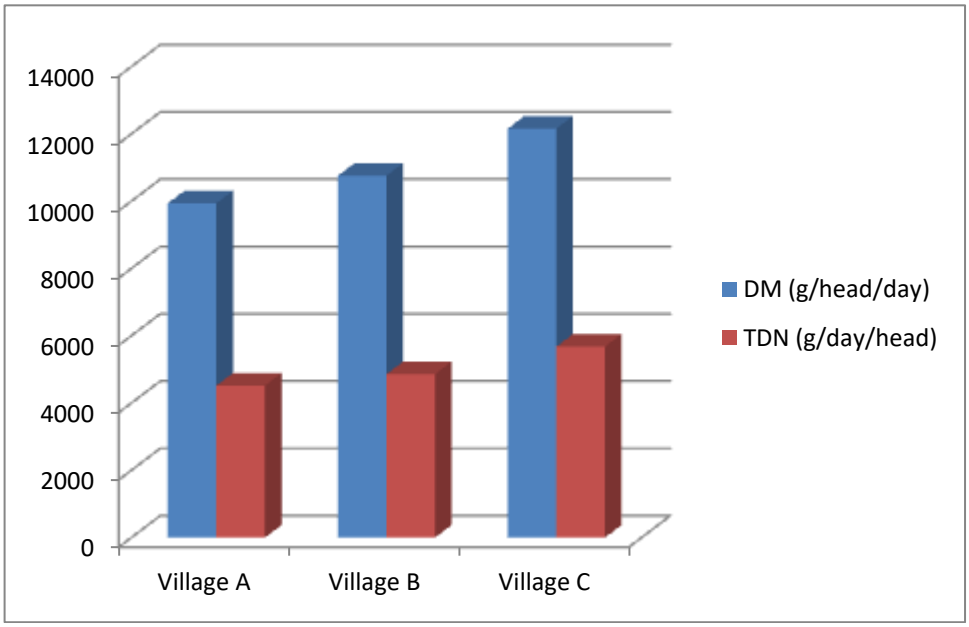

Figure 2. Village wise mean value DM and TDN supply for buffalo in Chitwan

Table 3 . Village wise CP, Ca and P nutrient supply for buffalo in Chitwan

	CP $\bar{X}(\sigma)$	Ca $\bar{X}(\sigma)$	P $\bar{X}(\sigma)$
Village A	700 (195)	49.0 (13)	38.0 (15)
Village B	735 (158)	52.0 (10)	46.0 (21)
Village C	965 (279)	59.0 (23)	50.0 (17)
Significance Villages (V)	**	*	**

g/head/day ,mean $\bar{X}$, standard deviation (σ) . CP: crude protein, Ca: calcium, P: phosphorus.*:P<0.05, **: P<0.01, NS: not significant.

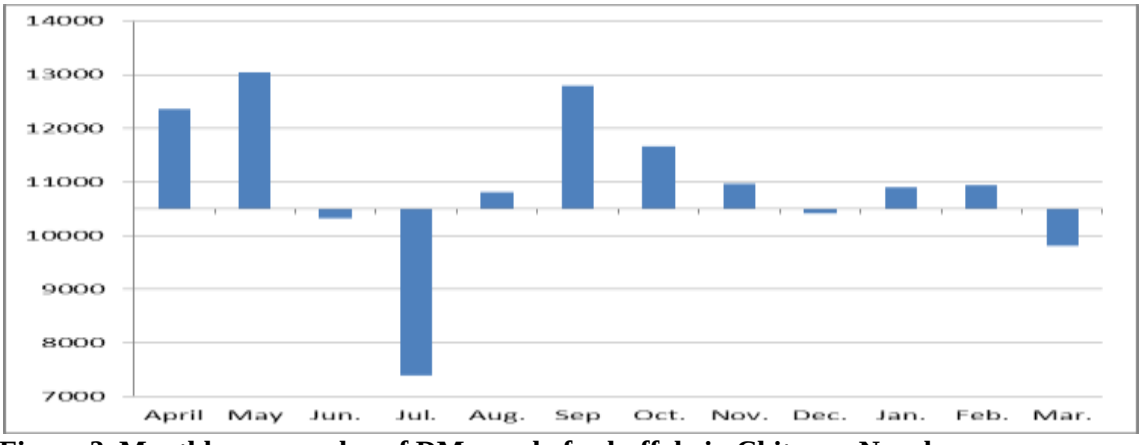

Figure 3. Monthly mean value of DM supply for buffalo in Chitwan, Nepal

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Table 4. Month wise nutrient TDN, CP, Ca and P supply for buffalo in Chitwan

	TDN $\bar{X}(\sigma)$	CP $\bar{X}(\sigma)$	Ca $\bar{X}(\sigma)$	P $\bar{X}(\sigma)$
Apr.	5928(2344)	982 (447)	56.6(26.2)	66.4(33.0)
May	6379(1154)	1113(289)	71.7(16.8)	63.1(22.0)
Jun.	5270(769)	993(262)	63.2(14.5)	53.9(22.0)
Jul.	3895(502)	786(185)	47.1(11.5)	40.3(16.0)
Aug.	5246(1190)	969(342)	66.2(38.9)	46.6(17.0)
Sep.	5703(1172)	896(478)	66.9(26.2)	44.9(17.0)
Oct.	4986(696)	691(237)	48.2(11.3)	43.2(21.0)
Nov.	4636(492)	635(174)	44.3(9.0)	35.2(14.0)
Dec.	4502(92)	640(107)	43.7(7.6)	33.6(9.0)
Jan.	4733(422)	661(165)	48.8(8.0)	34.9(15.0)
Feb.	4769(510)	659(211)	44.6(13.8)	40.3(16.0)
Mar.	4146(204)	584(159)	38.7(8.9)	32.4(11.0)
Overall mean	5016(1942)	800(254)	53.3(17.7)	44.6(19.16)
Significance				
Month (M)	**	**	*	*

g/head/day mean $\bar{X}$, standard deviation (σ) . DM: dry matter, CP: crude protein, TDN: total digestible nutrient, Ca: calcium, P: phosphorus.*:P<0.05, **: P<0.01, NS: not significant.

Table 5. Nutrient contents in feeds for buffalo in Chitwan

	DM $\bar{X}(\sigma)$	CP $\bar{X}(\sigma)$	TDN $\bar{X}(\sigma)$	Ca $\bar{X}(\sigma)$	P $\bar{X}(\sigma)$
Village A	623(232)	72.0(20.4)	458(40)	5.0(1.2)	3.8(1.2)
Village B	640(236)	70.7(23.8)	457(54)	4.9(1.1)	4.4(2.4)
Village C	661(226)	81.2(23.1)	471(51)	4.8(1.4)	4.3(1.7)
Apr.	604(177)	81.4(20.2)	488(53)	6.0(3.3)	6.0(3.3)
May	444(93)	86.6(15.1)	491(36)	4.8(1.9)	4.8(1.9)
Jun.	363(74)	97.7(14.4)	513(34)	5.2(2.2)	5.2(2.2)
Jul.	329(93)	110.0(21.7)	533(40)	5.5(1.9)	5.5(1.9)
Aug.	413(111)	93.9(21.5)	494(44)	4.6(2.0)	4.6(2.0)
Sep.	646(144)	67.7(15.4)	442(27)	3.5(1.2)	3.5(1.2)
Oct.	848(102)	58.1(10.8)	426(22)	3.6(1.7)	3.6(1.7)
Nov.	898(19)	57.3(7.1)	421(15)	3.1(0.8)	3.1(0.8)
Dec.	774(119)	61.5(7.1)	432(18)	3.2(0.8)	3.2(0.8)
Jan.	729(143)	60.0(9.0)	432(25)	3.1(1.0)	3.1(1.0)
Feb.	789(139)	60.3(9.3)	437(26)	3.7(0.9)	3.7(0.9)
Mar.	884(28)	59.9(13.0)	425(22)	3.3(1.1)	3.3(1.1)
Overall mean	641(231)	75.0(22.4)	462(48)	4.9(1.2)	4.2(1.7)
Significance					
Village (V)	NS	**	**	NS	NS
Month (M)	**	**	**	**	**
V × M	NS	NS	NS	NS	NS

g/kg on a DM basis. mean $\bar{X}$, standard deviation (σ) DM: dry matter, CP: crude protein, TDN: total digestible nutrient, Ca: calcium, P: phosphorus.*:P<0.05, **: P<0.01, NS: not significant.

Status of nutrient contents of feeds (Table 5). Mean contents (g/kg) of DM, CP, TDN, Ca and P were 641, 75.0, 462, 4.9 and 4.2, respectively. Among the villages the highest CP and TDN was recorded in village C (P<0.01). The contents of DM, CP, TDN, Ca and P were different

among the months (P<0.01). Namely, DM content was highest in November, CP and TDN contents were highest in July, and Ca and P were highest in April. Whereas minimum nutrient contents were recorded in July for DM and in November for CP, TDN, Ca and P. Result obtained from this study indicated that nutrient contents significantly varied according to season for all nutrients.

DISCUSSION

Nepalese livestock are undernourished, getting nutrients below their maintenance level however traditionally reared with low inputs system hence are often fed with least concentrate. In Nepal, the majority of cropland is found in the Terai (52%), and mid hills (40%) regions reported by Shrestha (2005). The highest DM, CP, TDN, Ca and P supply recorded in Gitanagar village among three village (P<0.05). They supplied good quantity of locally available concentrate feed as well as commercial feeds compared to the Gunjanagar and Sardangar farmers in survey area. In Terai region, rice was harvested twice a year, in June and November, leading to its utilization as a major roughage resource for buffalo throughout the survey. Native grass was used as the major roughage feed resources from June to October due to the availability of the grass with more rainfall in this season which enhances CP, TDN, Ca and P in buffalo feed status. Thus, the feeding amount of rice straw

was probably reduced due to the availability of other roughages feed resources in rainy season. Ranjhan (1992) reported that buffalo have a higher efficiency of roughages utilization. Wheat bran and rice bran were used as the main supplemental concentrate feed throughout the year in survey area. In the country as a whole, crop by-products and residues contributes about 47% of the total available daily livestock nutrition, in terms of dry matter content, there is a 31% shortage of DM to fulfill the requirement of existing livestock in the country (Upreti and Shrestha, 2006). As the dairy buffalo farmers fed rice straw as a main basal diet throughout a year, the farmers might have had a prior to feed rice straw for milking buffaloes reported by Hayashi et al. (2005) and Kumagai et al. (2005). Additional feed resources, such as maize grass, wheat straw, maize flour and commercial feed were supplied occasionally when they were available to farmers in survey site. Farmers fed very small quantity of commercial feed as well as concentrate feed resources to buffalo survey sites. The nutrient supply might have been caused by the psychological attitudes and economic conditions of the farmers. The farmers tried to harvest and supply as much as possible and availability of feed resources for the buffaloes in the different season. It will be important to balance the nutrient requirements of buffalo by increasing the production of forage and fodder through the implementing program of year round forage and fodder production.

CONCLUSION

This study revealed that nutrient supplies and contents of feeds in Chitwan condition well varied as through season and also in terms of feed constituent. Such variation could be linked to the productivity status of buffalo, indicating requirement of thorough and detail planning of feeding management to suit with the productivity performance. The results of this study contribute towards most efficient buffalo production, but further studies are necessary to define the effects of on farm feed intake and breeding management.

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Author Contributions

Shah, M.K. and Tabata, Y. designed and performed experiments, analysed data and wrote paper; Kumagai, H. and Hayashi, Y. developed analytical tools.

Conflicts of Interest

The author declare that there is no conflict of interest regarding the publication of this paper.

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