

# Feeding Traits and Body Dimensions of Lime and Parkote Buffaloes Raised by Small-Scale Farms in Kaski, Nepal

Y. Hayashi<sup>1,\*</sup>, M.K. Shah<sup>2</sup> and H. Kumagai<sup>3</sup>

<sup>1</sup>Experimental Farm, Faculty of Agriculture, Meijo University, Kasugai, 486-0804, Japan

<sup>2</sup>Regional Agriculture Research Station, Nepal Agricultural Research Council, Lumle, Nepal

<sup>3</sup>Graduate School of Agriculture, Kyoto University, Kyoto, 606-8502, Japan

**Abstract:** Thirty farms that raised Lime or Parkote female buffaloes in Kaski were selected for the survey of animal census, feeding traits and body dimensions in the rainy season and the dry season. The average number per farm was 0.76 in Lime and 0.27 in Parkote. The average of age and parity was 8.2 years old and 4.4 in Lime, and 6.6 years old and 2.8 in Parkote, respectively. The mean dry matter (DM) supply of roughage, supplemental feed and total feed was higher in the dry season than in the rainy season (11.8 kg/head/day vs. 10.3 kg/head/day, 1.2 kg/head/day vs. 0.8 kg/head/day, 13.0 kg/head/day vs. 11.1 kg/head/day, respectively,  $P < 0.05$ ). Although the average DM supply of roughage per body weight (BW) and total feed supply per BW had no significant differences between the seasons, the mean DM supply of supplemental feed per BW was higher in the dry season than in the rainy season (0.35% of BW vs. 0.22% of BW,  $P < 0.01$ ). The BW, heart girth (HG) and hip born width (HW) of Parkote were higher than those of Lime (401.7 kg vs. 368.0 kg, 185.7 cm vs. 179.8 cm, 50.4 cm vs. 48.4 cm, respectively,  $P < 0.05$ ). However, the body length, wither height (WH) and criss-cross height showed no significant differences between Lime and Parkote (127.4 cm and 129.8 cm, 118.7 cm and 119.5 cm, 118.0 cm and 119.4 cm, respectively). The BW estimation using body dimensions may play a significant role to know about the buffalo body condition. With the measured BW, HG, WH and HW in this survey, the formulae to estimate BW of Lime and Parkote buffaloes were established.

**Keywords:** Body dimension, feeding trait, Lime, Nepal, Parkote.

## INTRODUCTION

Buffaloes have been raised for draught power, dairy, meat, hide, manure and reserve capital for the families in Nepal. Dairy and meat productions of buffaloes in the country contributed to 65.2% and 49.7% of the annual each production of Nepal in 2014, respectively [1]. Therefore, buffaloes are staple livestock in the country. The population of the buffaloes is 5.18 million in 2014 [1], and the most of them were raised by small-scale farmers across all the physiographic and ecological zones of Nepal. The existing breeds of buffalo in Nepal are Indian breeds, Terai buffaloes and Hill buffaloes. Murrah is one of the major Indian breeds in the country, and Terai buffaloes are considered as the non-descript type [2]. Hill buffaloes are the indigenous breeds such as Lime, Parkote and Gaddi. Among these indigenous buffalo breeds, Lime and Parkote are raised in the western hills of Nepal and the distinct breeds now. Lime possesses sickle shape horns and gray or brownish hair and skin. This breed is characterized with chevron marks around neck and brisket area [3]. On the other hand, Parkote has sword shape horns, black coat and black skin without any chevron markings [3]. Both the breeds are riverine type with  $2n=50$  chromosomes [4,

5]. In addition, the 305 days lactation of Lime and Parkote buffaloes was reported as 962 L and 1022 L, respectively, on an average [6].

Buffaloes are the most important animals, particularly in the western hills of Nepal. In this area, buffaloes are raised in the mixed farming systems. The buffaloes are mainly kept under stall feeding or semi-stall feeding systems and producing milk with feeding low quality forage such as crop residues. Lower production of the buffalo is the core issue in the area [6]. The problems have been indicated as the inherent genetic potential of the buffaloes, severe shortage of the quality feed resources during winter and early summer, inappropriate management practices, and various disease and parasitic problems. For better production of the buffaloes, the present status of feed supply and body size of buffaloes raised by small-scale farms should be understood. However, the feeding traits and body dimensions of Lime and Parkote buffaloes remain obscure. In the present study, an attempt has been conducted to identify the feeding and body conditions of the two breeds raised in small-scale farms of Kaski, Nepal

## MATERIALS AND METHODS

### Survey Site

Thirty small-scale farms with Lime or Parkote female buffaloes in Kaski district of Nepal were

\*Address correspondence to this author at the Experimental Farm, Faculty of Agriculture, Meijo University, Takaki-cho, Kasugai, 486-0804, Japan; Tel: +81-568-41-8838; Fax: +81-568-81-1589; E-mail: yoshiha@meijo-u.ac.jp

selected for the survey from January to December 2014. The survey site was in the subtropical region which received the highest precipitation in the country (5328 mm in 2014, Lumle Agriculture Research Center, Nepal Agricultural Research Council, Lumle, Nepal). The maximum monthly rainfall was 1813 mm in August 2014 and the minimum monthly rainfall was 1 mm in November 2014. There are two seasons based on rainfalls: the rainy season, characterized by increased pasture from June to October; and the dry season, characterized by decreasing pasture due to cool or rainless climate from November to May.

### Data Analysis

One hundred eighty five female buffaloes were totally collected as samples in this survey. Breed, age and parity of the buffaloes were recorded. Variety and quantity of feed supplied were examined in both the seasons. Body weight (BW) and body dimensions such as body length (BL), wither height (WH), criss-cross height (CH), heart girth (HG) and hip born width (HW) were measured. The effect of data collection time on feed supply was analyzed using Student's t-test. The multiple regression equations to estimate BW from body dimensions of buffaloes were developed with stepwise method.

## RESULTS AND DISCUSSION

### Feeding Trait of Buffaloes

Field mixed grass was fed as main roughage, and Khar (*Eulaliopsis binate*) and corn stover (*Zea mays*) were also utilized as roughage in some farms in the rainy season (Table 1). Field mixed grass was much present in the rainy season attributable to more rainfall in the season than in the dry season. On the other hand, rice straw (*Oryza sativa*) and finger millet straw (*Fagopyrum esculentum*) were mainly provided in the dry season. The other roughage resources such as Bedulo (*Ficus clavata*), Badahar (*Artocarpus lakoocha*), Chuletro (*Brassaiopsis hainla*), Pakhuri (*Ficus glaberrima*), Kutmiro (*Litsea monopetala*), Nimaro (*Ficus roxburghii*) and Khar were fed to the buffaloes in the dry season. Fodder trees are used as green fodder during the dry season in Nepal. More than 300 species of fodder trees are present in the country and more than 50% of them are *Ficus* species [7]. Therefore, the availability of Bedulo, Pakhuri and Nimaro is considered to be high around the surveyed area. In particular, Bedulo was reported to be highly preferred species for its propagation easiness, fast growth and

less competitive with the other agricultural crops [8]. Badahar is also fodder tree with high palatability in Nepal. This plant has been known to have high nutritious values. The crude protein contents in this plant was reported from 13.2% to 28.6% [8-10]. Majority of the farmers in Kaski district was reported to agree with this plant as being a highly preferred species compared to *Ficus*, *Litsea*, *Monardella* and *Brassaiopsis* species [8]. In addition, Chuletro was also found very fast growing fodder tree species in Kaski [8]. However, Nimaro, Pakhuri and Chuletro were not preferred for their competitions with the other agricultural crops [8]. Kutmiro was also reported to be fast grown in Kaski district. However, this plant is generally harvested before maturity to avoid the roughness for animals. Since Khar is defined as a perennial grass of Gramineous family and clump-forming grass growing in Asia, this grass species was fed in both the seasons. In addition, this grass was reported to have 92.0% organic matter, 5.7% CP and 78.3% neutral detergent fiber [11].

A plentiful amount of rice straw and finger millet straw were present in almost all the year because rice and millet were staple cereals in the survey area. Rice was harvested in 1.49 million ha with 5.05 million t of production in the country in 2014 [12]. In addition, the production area and amount of millet yield in Nepal were 271 thousand ha and 304 thousand t in 2014 [12]. The amount of rice and millet productions was the first and the fourth most of the cereal productions in the country, respectively. Rice and finger millet were usually harvested in October and their straw was dried and preserved as fodder in the following season. Thus, the feeding amount of these roughage materials might have been controlled by the availability of the other roughage resources. The buffalo farmers in Terai area where is the southern low altitude zone in Nepal also controlled the feeding amount of staple cereal straw in dry season [13]. On the other hand the farmers were utilizing corn flour, rice bran and wheat bran as supplemental feed resources (Table 1). Availabilities of the supplemental feed resources are enough in the surveyed area due to plenty production of corn, rice and wheat in the country. The production amount of corn and wheat in Nepal was 2.28 million t and 1.88 million t in 2014, respectively [12]. The production amount of corn and wheat was the second and the third most of the cereal productions in the country, respectively. Although corn flour was higher supplied in the dry season than in the rain season ( $P < 0.05$ ), the supply of rice bran and wheat bran did not show

**Table 1: Dry Matter Supply of Feed for Lime and Parkote Buffaloes (kg)**

	Rainy season	Dry season
Roughage		
Field mixed grass	9.9 <sup>a</sup> (0-15.6)	0.4 <sup>b</sup> (0-8.0)
Rice straw ( <i>Oryza sativa</i> )	0 <sup>b</sup>	4.4 <sup>a</sup> (0-12.6)
Finger millet straw ( <i>Fagopyrum esculentum</i> )	0 <sup>b</sup>	3.3 <sup>a</sup> (0-20.0)
Bedulo ( <i>Ficus clavata</i> )	0 <sup>b</sup>	1.3 <sup>a</sup> (0-7.3)
Badahar ( <i>Artocarpus lakoocha</i> )	0 <sup>b</sup>	1.0 <sup>a</sup> (0-15.6)
Khar ( <i>Eulaliopsis binate</i> )	0.4 (0-11.8)	0.04 (0-3.4)
Chuletro ( <i>Brassaiopsis hainla</i> )	0 <sup>b</sup>	0.2 <sup>a</sup> (0-6.6)
Corn stover ( <i>Zea mays</i> )	0.1 <sup>a</sup> (0-2.4)	0 <sup>b</sup>
Pakhuri ( <i>Ficus glaberrima</i> )	0 <sup>b</sup>	0.2 <sup>a</sup> (0-6.5)
Kutmiro ( <i>Litsea monopetala</i> )	0 <sup>b</sup>	0.1 <sup>a</sup> (0-8.2)
Nimaro ( <i>Ficus roxburghii</i> )	0 <sup>b</sup>	0.1 <sup>a</sup> (0-8.8)
Supplemental feed		
Corn flour ( <i>Zea mays</i> )	0.3 <sup>b</sup> (0-1.4)	0.6 <sup>a</sup> (0-3.2)
Rice bran ( <i>Oryza sativa</i> )	0.2 (0-1.7)	0.2 (0-1.7)
Wheat bran ( <i>Triticum</i> )	0.2 (0-1.9)	0.1 (0-1.2)
Roughage	10.3 <sup>b</sup> (1.2-15.6)	11.8 <sup>a</sup> (3.0-22.6)
Supplemental feed	0.8 <sup>b</sup> (0.1-1.7)	1.2 <sup>a</sup> (0.1-3.6)
Total feed	11.1 <sup>b</sup> (2.2-17.0)	13.0 <sup>a</sup> (4.7-23.2)

Mean (Minimum-maximum). <sup>ab</sup>Means with different superscripts significantly differ (P<0.05).

significant differences between the seasons. The differences of feeding amount of corn flour might have been caused by the price change of the flour in a year. The price of corn flour is usually cheaper in the dry season than in the rainy season due to the stocking amount of the flour.

The mean dry matter (DM) supply of roughage, supplemental feed and total feed was higher in the dry season than in the rainy season (11.8 kg/head/day vs. 10.3 kg/head/day, 1.2 kg/head/day vs. 0.8 kg/head/day, 13.0 kg/head/day vs. 11.1 kg/head/day, respectively, P<0.05) (Table 1). Although the average DM supply of roughage per bodyweight (BW) and total feed supply per BW had no significant differences between the seasons, the mean DM supply of supplemental feed per BW was higher in the dry season than in the rainy season (352 g/kg BW vs. 223 g/kg BW, P<0.05) (Table 2). The different DM supply of feed in the two seasons might have been caused by the varied psychological attitudes of the farmers. The farmers might have tried to collect feed materials and supply them as much as possible because the amount of feed resources is limited in the season. However, the nutrient intake of

the buffaloes was not investigated in this survey. Further research on the nutrient intake of the buffaloes is necessary.

### Body Dimensions of Buffaloes

Body dimensions of Lime and Parkote buffaloes were shown in Table 3. The BW, HG and HW of Parkote were higher than those of Lime (401.7 kg vs. 368.0 kg, 185.7 cm vs. 179.8 cm, 50.4 cm vs. 48.4 cm, respectively, P<0.05). However, the BL, WH and CH showed no significant differences between Lime and Parkote (127.4 cm and 129.8 cm, 118.7 cm and 119.5 cm, 118.0 cm and 119.4 cm, respectively). Lime buffaloes were reported to have a relatively small body size and their average BW, BL, WH and HG are 373 kg, 125 cm, 121 cm and 175 cm, respectively [14]. On the other hand, the BW, BL, WH and HG of Parkote buffaloes were 389 kg, 130 cm, 121 cm and 175 cm [14]. Although our results of heavier BW in Parkote than in Lime corresponded to the previous report, the difference of HG between the two breeds was not agreed with the past results. The distinct feeding management between the surveyed farmers might

**Table 2: Dry Matter Supply of Feed Per Bodyweight for Lime and Parkote Buffaloes (g/kg)**

	Rainy season	Dry season
Roughage		
Field mixed grass	2633 <sup>a</sup> (0-5075)	113 <sup>b</sup> (0-1824)
Rice straw ( <i>Oryza sativa</i> )	0 <sup>b</sup>	1195 <sup>a</sup> (0-4270)
Finger millet straw ( <i>Fagopyrum esculentum</i> )	0 <sup>b</sup>	885 <sup>a</sup> (0-7277)
Bedulo ( <i>Ficus clavata</i> )	0 <sup>b</sup>	322 <sup>a</sup> (0-2204)
Badahar ( <i>Artocarpus lakoocha</i> )	0 <sup>b</sup>	249 <sup>a</sup> (0-4409)
Khar ( <i>Eulaliopsis binate</i> )	103 (0-3449)	1 (0-847)
Chuletro ( <i>Brassaiopsis hainla</i> )	0 <sup>b</sup>	62 <sup>a</sup> (0-1705)
Corn stover ( <i>Zea mays</i> )	11 <sup>a</sup> (0-563)	0 <sup>b</sup>
Pakhuri ( <i>Ficus glaberrima</i> )	0 <sup>b</sup>	6 <sup>a</sup> (0-1541)
Kutmiro ( <i>Litsea monopetala</i> )	0 <sup>b</sup>	3 <sup>a</sup> (0-2062)
Nimaro ( <i>Ficus roxburghii</i> )	0 <sup>b</sup>	2 <sup>a</sup> (0-2146)
Supplemental feed		
Corn flour ( <i>Zea mays</i> )	81 <sup>b</sup> (0-355)	140 <sup>a</sup> (0-689)
Rice bran ( <i>Oryza sativa</i> )	63 (0-544)	60 (0-502)
Wheat bran ( <i>Triticum</i> )	35 (0-295)	55 (0-469)
Roughage	2815(317-4669)	3008(1116-6596)
Supplemental feed	223 <sup>b</sup> (38-545)	352 <sup>a</sup> (94-896)
Total feed	3038 (572-4950)	3360(1209-7021)

Mean (Minimum-maximum). <sup>ab</sup>Means with different superscripts significantly differ (P<0.05).

**Table 3: Body Dimensions of Lime and Parkote Buffaloes**

	Lime	Parkote
Body weight (kg)	368.0±58.4 <sup>b</sup>	401.7±39.8 <sup>a</sup>
Body length (cm)	127.4±9.7	129.8±8.1
Wither height (cm)	118.7±4.3	119.5±4.0
Criss-cross height (cm)	118.0±4.3	119.4±4.0
Heart girth (cm)	179.8±12.8 <sup>b</sup>	185.7±10.2 <sup>a</sup>
Hip born width (cm)	48.4±2.8 <sup>b</sup>	50.4±2.4 <sup>a</sup>

Mean±SD. <sup>ab</sup>Means with different super scripts significantly differ (P<0.05).

have caused the difference.

The multiple regression equations to estimate BW using body dimension of Lime and Parkote buffaloes were developed as followings.

$$\text{Lime BW} = 1.57 \times \text{HG} + 10.87 \times \text{HW} - 439.74 \quad (R^2=0.55)$$

$$\text{Parkote BW} = 5.69 \times \text{WH} - 5.65 \times \text{HW} + 6.08 \quad (R^2=0.31)$$

These formulae may contribute to estimate the growth of Lime and Parkote buffaloes on the farms, because the measurement of HG, WH and HW is available. When the owners of Lime and Parkote

buffaloes control the feed supply according to the BW variety with these formulae, the dairy development of these two indigenous buffalo breeds can be accelerated efficiently.

In conclusion, the different seasons caused the variance in feed supply for Lime and Parkote buffaloes. The raisers of the two buffalo breeds relied on the field mixed grass in rainy season. On the other hand, rice straw, finger millet straw and fodder trees became major roughage feed materials in the dry season. Although the total DM feeding amount was higher in the dry season than in the rainy season, the DM supply

of feed per BW between the seasons did not have a significant difference. The mean BW, HG and HW were higher in Parkote than in Lime. The formulae to estimate BW of Lime and Parkote buffaloes was established with HG, WH and HW.

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