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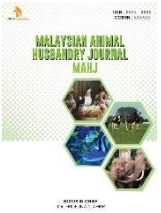

REVIEW ARTICLE

RESPONSE OF VARIED PROPORTIONS OF UREA TREATED RICE STRAW MIXED WITH NAPIER GRASS ON BUFFALO CALVES FATTENING

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ABSTRACT

An experiment was conducted on buffalo calves at Baibhav Krishi Farm at Torikhet, Bharatpur-5 Chitwan under the supervision of Animal Nutrition Division, Nepal Agriculture Research Council, Khumaltar, Lalitpur, Nepal aiming to strengthen the commercial fattening practices of the buffalo calves. An experiment was done for 4 months, from March 29th to 26th of July of the year 2022 with the primary purpose to createlow-cost buffalo fattening technology that emphasizes feeding management. Sixteen buffalo calves including males and females both aged 3.5-6 months were selected for the experimental trial. 10 calves were taken from the farm and 6 more were purchased from nearby farms at Torikhet. The experimental trial was done in a Completely Randomized Design with 4 treatments each replicated four times. Urea treated rice straw (UTRS), Rice straw (RS), silage Napier grass, Urea Molasses Mixture Block (UMMB) and concentrate were taken as main feed ingredients. The treatment details were T1: Feed 1(RS 50%+Silage 25%+Green Grass 25%+Concentrate 0.75% of BW+40gm UMMB),T2: Feed2(UTRS 25%+Silage 25%+Green Grass 50%+Concentrate 0.75% of BW), T3:Feed 3 (UTRS 50%+Silage 25%+Green Grass 25%+Concentrate 0.75% of BW, T4: RS 25%+Silage 25%+Green Grass 50%+Concentrate 0.75% of BW+40gm UMMB). The dry matter requirement has been fulfilled at the rate of 3%of the body weight. The concentration was supplied at the rate of 0.75% of the body weight. Tagging was done on the buffalo calves and calves were vaccinated against FMD and HS. Buffalo calves were weighedfortnightly and feed was provided as per the body weight.The result showed that a significantly higher average daily gain (Kg) was found for T2 (0.54 kg) followed by T4 (0.37 kg), T3 (0.28 Kg), and T1 (0.26 Kg) respectively. On the basis of economic analysis the net benefit per animal was determined to be highest inthe T2 group fed with UTRS 25%,Silage 25%,Green Grass 50%, and Concentrate 0.75% ofthe BW as Rs.9731.16.Thusthe addition of UTRS 25%, Silage 25%, Green Grass 50% and Concentrate 0.75% of BW in a diet of buffalo calves can be safely used to enhance the growth performance for the buffalo calves fattening.

KEYWORDS

Calves, UTRS, Dry Matter, Body Weight Gain

1. INTRODUCTION

1.1 Background

Nepal is recognized as an agricultural country because the agriculture sector employs the vast majority of the population. This sector employs approximately 60.4% of the overall population of the nation (MOALD, 2019/20). Livestock rearing is a vital subsector of the Nepalese agricultural system, accounting for approximately 25.83% of the agriculture GDP (Statistical Information on Nepalese Agriculture, 2020/21). The nation rears approximately 7.46 million cattle and 5.15 million buffaloes (MOALD, 2020/21). Currently, Nepal's total annual milk production is approximately 2.16 million tons which comprises 63.31% from buffalo and 36.68% from cattle (MOALD, 2019/20). Production of buffalo meat in Nepal rose by 0.59 % from 238,322 thousand tonnes in 2019 to 239,717 thousand tonnes in 2020. Since the 0.72 % decline in 2015, production of beef and buffalo meat leaped by 6.96 % in 2020 (World Data Atlas,2020).

Buffalo is a crucial component of the Nepalese agricultural system. Buffalo meat constitutes 58.3 percent of Nepal's overall meat production (MOAC, 2015). As contrasted to other meats such as sheep, goat, pig, as well as chicken, the buffalo meat is the cheapest source of animal protein.This meat is in higher demand in Kathmandu, Pokhara, as well as other larger cities in Nepal, and demand is supplied from Siraha, Nawalparasi, Banke, and Bara districts. As buffalo meat has a reduced cholesterol content, it is more appealing to consumers. According to Sinclair *et al*., 1982, the cholesterol level of buffalo meat is (46%), goat (58%),and sheep (68%).Rice straw is usually characterized by low levels of CP and high levels of structural polysaccharides, that drastically affects the digestion, DM intake, and ultimate performance (Wanapat et al., 1985; Chemjon, 1991; Safari et al., 2011).

According to a study, rice straw treated with urea (5%) improved overall intake, nutritional digestibility, VFA generation, and also the particle transit rate in rumen (Hart and Wanapat, 1992). Rice straw has high levels ofthe oxalates (1-2% DM), that lowers Ca concentrations thereby necessitating Ca supplementation (Soest, 2006; Jackson, 1979). Variety, N fertilization, duration between harvesting and storage, plant maturity (content oflignin goes on increasing with the maturity), plant health, as well as meteorological conditions all influence rice straw quality (Göhl, 1982; Drake et al., 2002). Rice straw is richas energy source, however, it accounts poor in protein (2-7%) and has limited digestion due to its high silica concentration (Drake et al., 2002). It is regarded as the low-quality, fluctuating roughage. Some minerals (especially sulphur) can be limiting (Doyle et al., 1986). According to a study, urea (5%) treated

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rice straw improved overall intake, nutritional digestibility, VFA generation, and particle transit rate in the rumen (Hart and Wanapat, 1992). Urea treatment is the easiest to apply. It can be done by smallholder farmers using plastic bags, with a 5% urea w/w solution. It can increase digestibility by 18% (Soest, 2006).

One of the most promising as well as high-yielding fodder is Napier, that produces a DM yield that is greater than that of other tropical grasses (Humpherys, 1994; Skerman and Riveros, 1990). If harvested once a year in fertile circumstances, Napier grass may yield more DM per unit area than several other crops (Bassam, 2010). Aside from its multiple beneficial properties for crop production, such as diazotrophic life, drought resilience, and compatibility with a wide range of types of soil (Morais et al., 2012). Napier grass may be readily propagated by immediately planting cuttings within the field (Lounglawan et al., 2014). Likewise, the use of silage is beneficial for the economic buffalo fattening process. In a study conducted by some researchers buffalo calves were fed maize silage and the results showed a significant increase in feed intake, weight gain, and feed efficiency (Bhatti et al., 2007). The researchers concluded that the maize silage inclusion in the diet of buffalo calves improved their performance and economic efficiency.

The major challenge for ruminants is improving the nutritional value as well as exsisting feedstuffs utilization. Strategic measures such as the use of urea, molasses, as well as enzymes to enhance digestibility of feed or the technology implementation for effectively preserving biomass from the forages that are seasonally available are necessary. Thus the use of locally available feed ingredients can help in cost reduction with profit maximization (Olaniyi et al., 2013).To address feed-related issues, cost-effective and widely accessible alternate feed options are required. Since grasses as well as other forages have large yields of dry matter (DM) and energy, including them in cattle feed may give nutrients at a reasonable cost (Wilkins, 2000). Forages supply more than 90% of the feed energy required by animals (Fitzhugh et al., 1978).

1.2 Statement of the problem

Despite of growing demand for buffalo meat in both domestic and international markets, there are several challenges facing the buffalo meat production industry in Nepal. One major challenge is the limited availability of high-quality feed and fodder for the animals, which can clearly affect the growth rate, quality of meat, and overall animal productivity. Another challenge is the limited access to veterinary services, which can lead to health problems in the animals and reduce their productivity. In addition, there are limited processing and storage facilities for buffalo meat, which can lead to spoilage and reduce the shelf life of the product. Buffalo meat accounts for 58.3 percent of Nepal's total meat production (MOAC, 2015). According to a study, buffalo meat has a cholesterol content of 46%, sheep has 68%, and goat meat has 68% (Sinclair et al., 1982). There is also a lack of coordination and cooperation among different stakeholders in the buffalo meat production value chain, including farmers, processors, traders, and government agencies. This can lead to inefficiencies, low-quality standards, and a lack of market linkages for smallholder farmers.

Furthermore, there is a need to improve the quality as well as safety standards of the buffalo meat production in Nepal to meet the requirements of international markets. This requires investment in research and development activities, and also capacity building for stakeholders and farmers to adopt best practices and meet international standards for food safety and quality. The higher demand of buffalo meat is in Kathmandu, Pokhara, as well as other big cities in Nepal, and is supplied from Nawalparasi, Banke, Bara, and Sirahadistricts. The demand for the buffalo meat is not fulfilled yet (Devkota and Kolachapati, 2008). Addressing such challenges will require a multi-pronged approach which involves improvement of the access to high-quality feed and veterinary services, developing better processing and storage facilities, promoting coordination and cooperation among stakeholders, and investing in research and development to improve the quality as well as safety of buffalo meat production in Nepal.

1.3 Justification of the study

The farmer's ultimate goal is to maximize production with low expenditure. The feed cost of animals is becoming a major issue for farmers. The expensive commercial feed and nutrient supplements are used to enhance the milk production of bovine animals which adds higher cost of production. Thus the use of locally available feed ingredients can help in cost reduction with profit maximization (Olaniyi et al., 2013). Green forages are usually rich and also the cheapest sources of carbohydrates, proteins, minerals, and vitamins for dairy animals. Hence providing enough amounts of green forage instead of various costly concentrates and feed can reduce the cost of dairy production (Chaudhary et al., 2011). One of the ways to generate income could be buffalo calf fattening.

Accordingly, small calves that are of10-12 months can be purchased from the local markets and then reared for time of 6-7 months before being sold for propose of meat. Despite the fattening option, farmer of Nepal have paid no attention to economically raising buffalo calves. The majority of Nepalese farmers culled male buffalo calves to enhance milk production of female bovine. Some researcher found buffalo calf fattening utilizing solely forage based with small quantity of concentrate addition, indicating that there is room for further research on buffalo calf growth performance when concentrate supplementation is increased in their diet (Devkota and Kolachapati, 2008). As a result, this study was conducted for the fattening of buffalo calves for economic meat production by developing the buffalo fattening technology utilizing feed stuff with low-cost as well as assessing the influence use of green fodder, untreated and treated rice straw for the buffalo calves' growth performance and its economics.

1.4 Objectives

1.4.1 Broad Objectives

- To analyze the effects of urea treated rice straw, rice straw and Napier grass as the feed sources for buffalo calves fattening.

1.4.2 Specific Objectives

- To evaluate dry matter intake in buffalo calves under different fattening diets.
- To compare the body weight variations of calves under different feeding trials.
- To compare feed conversion ratios for various buffalo calves fattening diets.
- To compare benefit-cost ratios of various buffalo calves fattening diet.

2. Materials and Methods

2.1 Experimental site

The current study was conducted on buffalo calves at Baibhav Krishi farm at Torikhet, Bharatpur-5, Chitwan, Nepal. Experimental animals were kept in four separated pens for four different treatments. Pens are equipped with the cemented manger and feed rations twice daily. An experiment was conducted for 4 months. Sixteen buffalo calves including both males and females aged 3.5-6 months were selected for the experimental trial. The experimental site is situated in the central region of Nepal (27.6393°N latitude; 84.4079°E longitude and 197 masl) at Torikhet, Bharatpur, Chitwan. The annual rainfall is over 1500mm with a distinct monsoon period (>75% of annual rainfall) from mid-June to mid-September.

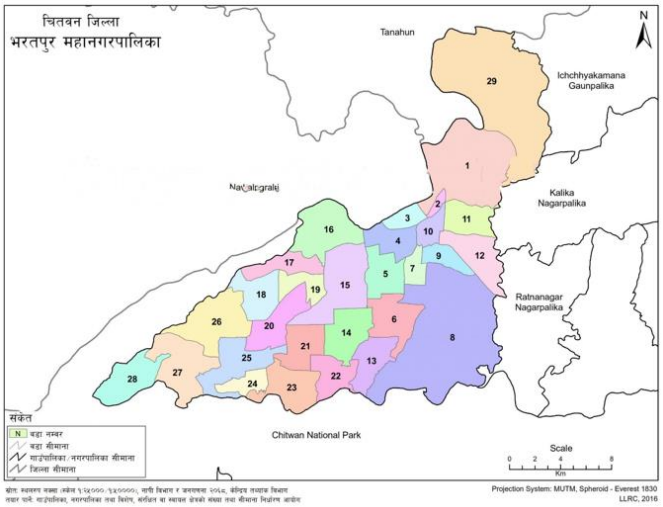

Figure 1: Map showing different wards of Bharatpur Metropolitan City, Chitwan, Nepal

2.2 Animals and Experimental Design

Sixteen buffalo calves including both males and females aged 3.5-6 months were selected for the experimental trial and the trial was conducted in a Completely Randomized Design (CRD) as shown in Table 1, stratified with 4 treatments each replicated four times. Ten calves were taken from the Baibhav Krishi farm and 6 more were purchased from nearby farms at

Torikhet.

Table 1: Design of experimental units			
T1R1	T1R2	T1R3	T1R4
T2R1	T2R2	T2R3	T2R4
T3R1	T3R2	T3R3	T3R4
T4R1	T4R2	T4R3	T4R4

2.3 General Management

Earlier produced faeces, cattle urine, dirt as well as other dust materials were dumped into the agricultural land for fertilizer. All the buffalo calves were washed and dirt over them was removed by the use of the brush. Equipment such as the feeder and waterer were thoroughly cleaned and disinfected by using a 5% phenol solution. The inner walls, the floor, the entrance, the window, as well as the roof, were all brushed and cleaned. After cleaning, the floor was disinfected using a 5% phenol solution and then thoroughly washed with clean water. The floor of the experimental house was cleaned using agricultural lime powder. Through ventilation, the animals were given adequate light and fresh air.

2.4 Experimental diets or treatments

The productional requirement of the experimental animal was fulfilled by offering 3% dry matter as per the body weight of the animal. The total dry matter percentage was maintained at 3% by body weight. Out of total dry matter, concentrated ration (18.2 % crude protein) was provided as 0.75 % of the body weight. The nutritional requirement of the animals was fulfilled by providing the feed mixture of Napier, rice straw, and urea-treated rice straw according to the body weight of the animals. Silage was provided as per 25% of the feed mixture for all four treatments. Urea Molasses Mineral Block (UMMB) was provided to animals of T1@40gm and the animals of T4 @40gm each as strategic feed supplements which provides a constant source of fermentable nitrogen throughout the day to provide growth of rumen microbes.

For the experiments, there were 4 types of diets. Diet-1(Treatment 1)-control: Rice Straw (50%)+ Silage(25%)+ Napier grass (25%)+ Concentrate (0.75% of BW)+ 40gm UMMB, Diet-2 (Treatment 2) Urea Treated Rice Straw (25%)+ Silage (25%)+ Napier grass(50%)+ Concentrate (0.75% of BW), Diet-3 (Treatment3) Urea Treated Rice Straw (50%)+ Silage(25%)+ Napier grass(25%)+ Concentrate (0.75% of BW), Diet-4 (Treatment 4) Rice Straw(25%)+ Silage(25%)+ Napier grass(50%)+ Concentrate (0.75% of BW)+ 40gm UMMB. The Napier grass was harvested after 3-4 months of planting and then chopped into small pieces and allowed to be fed to the animals. Likewise, maize silage was brought from a nearby silage factory in the locality. UMMB prepared in the National Animal Nutrition Research Center (NANRC), Khumaltar was used as feed supplements for T1 and T4. Rice straw was used from the store house of Baibhav Krishi Farm and Urea treated rice straw was prepared by using that rice straw and urea in the farm. Also, the low-cost feed was formulated with 18.2 % crude protein by utilizing locally available feed ingredients. Altogether there were four treatments replicated four times. The feeding regime was as given below:

Table 2: Experimental diet design	
Treatment	**Diet**
T1	RS (50%)+ Silage (25%)+ Napier grass(25%)+ Concentrate (0.75% of BW)+ 40gm UMMB
T2	UTRS(25%)+ Silage (25%)+ Napier grass(50%)+ Concentrate (0.75% of BW)
T3	UTRS(50%)+ Silage(25%)+ Napier grass(25%)+ Concentrate (0.75% of BW)
T4	RS(25%)+ Silage(25%)+ Napier grass(50%)+ Concentrate (0.75% of BW)+ 40gm UMMB

2.4.1 Preparation of UTRS

UTRS, or Urea Treated Rice Straw, is a popular livestock feed in Nepal, especially for dairy animals. UTRS is generally prepared by treating rice straw with urea, which improves its protein content and also makes it easier to digest for livestock. For this experimental trial, the UTRS was prepared at the farm to fulfill the treatment details of the trial. To prepare the urea-treated rice straw, first of all, rice straw was collected and chopped into small pieces, about 2-3 inches in length by using a chaff cutter. For 100 kg of rice straw, a solution of 4 kg urea and 40-litre water was made and the dissolved solution was prepared by maintaining 4% urea solution at the rate of the 40L/100 kg rice straw.

Then chopped rice straw was spread over the plastic sheet on the floor in a shady place and the dissolved urea solution was sprinkled uniformly over the rice straw to ensure that the urea was evenly distributed. After evenly mixing the urea solution and straw, it was wrapped in a large plastic bag by maintaining airtight conditions to prevent the escape of ammonia. After 21 days of fermentation, UTRS was ready to be fed to the experimental animals. UTRS was prepared and fed to the experimental animals as Urea treatment increases the crude protein (CP) content of the rice straw from 3.5% to 8.0% and also improves the digestibility of dry matter from 40% to 50%.

2.4.2 Feed formulation and composition

The necessary feed was formulated by calculating the feed ingredient's proportions by using Pearson's square method to maintain the protein-energy balance in the feed. Necessary feed ingredients were brought from the nearby market. The major ingredients such as maize grit, rice bran, wheat bran, soya meal, and mustard cake were mixed properly, and a pre-mix of feed mixture was made. After that minor ingredients such as minerals and salt were mixed thoroughly in the pre-mix mixture as feed additives and the final feed was formulated having 18.2% CP for the growing buffalo calves.

Table 3: Feed formulation table			
Feed Ingredients	**CP%**	**Parts**	**CP**
Maize Grit	10	25	2.5
Rice Bran	12	25	3
Wheat Bran	11	20	2.2
Soya meal	42	15	6.3
Mustard cake	35	12	4.2
Minerals	0	1.5	0
Salt	0	1.5	0
Total		**100**	**18.2**

2.5 Feeding schedule

The calculated amount of forage mixture according to the body weight of each buffalo calves was divided into 2 parts and feed mixture was offered twice a day. The first feed was offered in the morning time (7 AM) after measuring the refused feed of the earlier day. Also, the calculated amount of concentrate was given to each animal at the rate of 0.75% of the body weight. Secondly in the evening (5 PM) second part of the feed was offered. Ad libitum water is supplied throughout the day.

2.6 Data collection protocol

Forage mixture that contains green grass, rice straw/UTRS, and silage offered and refused by each animal were recorded daily. Proper feeding practices and the health status of each animal were recorded daily. The body weight variation of each animal was recorded every 15-day interval after the animals were kept for the 15-day adjustment period. The initial weight of each animal was recorded and then after 15 days, the final adjustment weight was again recorded. After this based on final adjustment weight, animals were weighed fortnightly till the end of the research for recording the data.

2.7 Laboratory analysis

Samples of rice straw, UTRS, Napier grass, silage, and concentrate feed offered were analyzed for the Crude Protein (CP), Crude fiber {CF, including Acid detergent Fibre (ADF), and Neutral Detergent Fiber (NDF)}, Acid detergent lignin (ADL),Total Ash (TA) as well as for Dry Matter (DM) by using the standard procedures of the Association of Offical Analytical Chemist (AOAC) at Animal Nutrition Division, Khumaltar. The DM was determined by oven drying at 100 °Cfor 24 hrs. The crude protein of the samples was determined by using the Kjeldahl method. Estimation of ADF and NDF was done by the use of the acid-alkali digestion method by using the Fibro TRON apparatus. Ash content was estimated by ashing the sample at 550°C in a muffle furnace for 16 hours (FSSI, 2015).

2.8 Observations

- Green grass intake= Green grass offered- Green grass refused
- Rice straw/ UTRS intake= Rice straw/ UTRS offered- Rice straw/ UTRS refused
- Silage intake= Silage offered- Silage refused
- Concentrate feed intake= Concentrate feed offered- concentrate feed refused

- Body weight variation = Determined at every 15 days interval by weighing each animal
- Economic analysis= Comparative economic production analysis between the treatments was done at the end of the research.

2.9 Statistical Analysis

Data entry was done by the use of MS Excel 2007.Data on the body weight variation and feed intake were subjected to the one-way ANOVA for a Completely Randomized Design (CRD) by using Genstat to analyze the comparative effects of green fodder and rice straw feeding trials on commercial buffalo calves fattening. Least Significant Difference (LSD) was used for evaluating whether there was a significant difference between the means. The accepted level of significance was $p<0.05$.

3. RESULTS

3.1 Chemical composition of feedstuff

The samples of feed ingredients, prepared concentrate feed, UTRS, RS, and Silage were brought to the Animal Nutrition Division, Khumaltar, Lalitpur for the proximate analysis. Representative samples were analyzed for dry matter (DM), Crude protein (CP), Crude fiber (CF), and Total ash content (TA). The DM was determined by oven drying at 100°C for 10 hrs. By using the Kjeldahl method crude protein of the samples was determined. Ash content was determined by ashing the samples at 550°C in the muffle furnace for sixteen hours (AOAC,1980). By using the Van-Soest method crude fiber of the samples was determined (Goering and Van Soest, 1970).

Table 4: Chemical Analysis of Different Feeding Materials

Treatments	Dry matter(DM)	CP%		NDF%	ADF%	ADL%	Ash%
UTRS	85.5	6.3		95.48	80.52	20.53	12.92
RS	90.0	2.1		93.32	70.54	20.92	13.71
Silage	40.6	8.5		85.89	63.86	12.98	6.25
Green grass	20.2	10.6		90.46	66.00	19.64	8.99

3.2 Dry matter intake

The dry matter intake of buffalo calves in various treatment groups was presented in (Table 5). The dry matter intake through rice straw, urea-treated rice straw, green grass, silage, and concentrate was found highest in T2 followed by T4, T3, and T1 respectively.

Table 5: Dry matter intake for buffalo calves every 15 days

Trt	Day 15	Day 30	Day 45	Day 60	Day 75	Day 90	Day 105	Day 120
T1	18.87 ^{a} ± 3.13	26.41 ^{b} ± 2.55	30.14 ^{b} ± 1.44	34.05 ^{b} ± 1.43	38.48 ^{b} ± 2.30	40.69 ^{c} ± 1.81	47.57 ^{c} ± 1.68	51.84 ^{c} ± 2.72
T2	25.27 ^{a} ± 4.09	36.20 ^{a} ± 4.20	47.84 ^{a} ± 4.29	57.13 ^{a} ± 6.23	67.17 ^{a} ± 6.50	83.60 ^{a} ± 7.49	91.19 ^{a} ± 6.88	102.20 ^{a} ± 8.47
T3	17.87 ^{a} ± 2.78	24.04 ^{b} ± 2.96	31.05 ^{b} ± 2.89	36.65 ^{b} ± 3.30	42.78 ^{b} ± 4.24	46.56 ^{bc} ±4.31	51.54 ^{c} ± 4.17	56.66 ^{c} ± 4.55
T4	19.38 ^{a} ±2.51	26.41 ^{ab} ± 2.87	34.50 ^{b} ± 2.18	44.36 ^{b} ± 3.51	53.51 ^{ab} ±3.35	60.57 ^{b} ± 4.93	67.94 ^{b} ± 6.09	79.17 ^{b} ± 5.94
Grand Mean	20.35	27.94	35.88	43.05	50.48	57.86	64.56	72.47
p-Value	0.39 ^{ns}	0.071 ^{ns}	0.010*	0.007**	0.008**	<0.001***	<0.001***	<0.001***
CV%	31.3	23.0	18.6	18.6	20.0	17.5	15.8	16.0
SEM	3.19	3.21	3.35	4.00	5.06	5.06	5.12	5.81
LSD (5%)	9.81	9.88	10.31	12.33	15.59	15.58	15.76	17.91

Means in columns with different superscripts differ significantly by LSD ($P<0.05$), where CV= Coefficient of Variation, SEM= Standard error of the mean, LSD= Least significant difference, *, ** = Significant at 0.05 and 0.01 probability levels respectively, *** Significant at 0.01% level of significance

The result from table no 4. indicated that there was no significant difference in dry matter intake by buffalo calves of all four treatment groups in 15 days and 30 days however a significant difference in dry matter intake was seen in 45 days. Similarly, after 45 days to 120 days highly significant difference was seen in dry matter intake every fifteen days in all treatment groups. Among the treatments in last 15 days of research i.e. 120 days, maximum dry matter intake was seen as 102.20 ± 8.47Kg in T2(UTRS 25%+Silage 25%+Green Grass 50%+Concentrate 0.75% of BW) followed by T4 (RS 25%+Silage 25%+Green Grass 50%+Concentrate 0.75% of BW+40 gm UMMB) where dry matter intake was 79.17± 5.94 Kg, followed by T3 DM intake in T3 (UTRS 50%+Silage 25%+Green Grass 25%+Concentrate 0.75% of BW) where dry matter intake was 56.66± 4.55 Kg, followed by T1 (RS 25%+Silage 25%+Green Grass 50%+Concentrate 0.75% of BW+40 gm UMMB), where dry matter intake was found to be 79.17±2.72 Kg. There was a significant difference in average dry matter intake by animals in different treatment groups.

3.3 Body weight

3.3.1 Body weight in every 15 days interval

The body weight of buffalo calves was recorded at every fifteen days intervals during the entire experimental period of 4 months. The mean body weight in every 15 days interval was presented in Table 6. On the 120th day highest body weight was seen in T2 followed by T4 by T3 by T1.

Table 6: Body weight in every 15 days interval

Trt	Day 1	Day 15	Day 30	Day 45	Day 60	Day 75	Day 90	Day 105	Day 120
T1	69.28^{a} ± 1.92	73.25^{a} ±2.22	77.03^{a} ± 2.74	80.71^{a} ± 2.56	84.35^{a} ± 2.18	86.53^{a} ± 2.20	92.4^{b} ± 2.47	96.3^{b} ± 2.50	101.7^{b} ± 2.26
T2	72.80^{a} ± 9.67	79.72^{a} ± 10.49	86.91^{a} ± 10.80	95.22^{a} ± 11.25	99.35^{a} ± 11.84	113.43^{a} ± 11.84	120.6^{a} ± 11.74	130.1^{a} ± 10.92	137.3^{a} ± 11.61
T3	69.88^{a} ± 1.89	73.90^{a} ± 2.20	78.65^{a} ± 2.87	82.33^{a} ± 2.68	86.25^{a} ± 2.25	88.30^{a} ± 2.53	94.0^{b} ± 2.61	97.4^{b} ± 2.63	103.5^{b} ± 2.37

Table 7 (cont): Body weight in every 15 days interval									
T4	68.83^{a} ±6.55	72.85^{a} ± 7.78	77.80^{a} ± 7.51	83.50^{a} ± 7.39	89.33^{a} ± 7.53	91.58^{a} ± 7.53	99.3^{ab} ± 7.41	106.7^{ab} ± 7.03	113.0^{ab} ± 7.67
Grand mean	70.2	74.9	79.8	85.4	89.8	95.0	101.6	107.6	113.8
p-Value	0.98^{ns}	0.90^{ns}	0.58^{ns}	0.58^{ns}	0.59^{ns}	0.13^{ns}	0.11^{ns}	0.037*	0.038*
CV%	19.9	19.8	19	18.7	18.2	17.4	16.7	14.8	14.7
SEM(±)	6.98	7.42	7.57	7.99	8.18	8.28	8.23	7.94	8.34
LSD (5%)	21.32	22.86	23.33	24.63	25.20	25.52	25.37	24.47	25.0

T1= RS (50%)+ Silage(25%)+ Green grass(25%)+ Concentrate (0.75% of BW)+ 40gm UMMB,T2= UTRS(25%)+ Silage(25%)+ Green grass(50%)+ Concentrate (0.75% of BW) T3= UTRS(50%)+ Silage(25%)+ Green grass(25%)+ Concentrate (0.75% of BW),T4= RS(25%)+ Silage(25%)+ Green grass(50%)+ Concentrate (0.75% of BW)+ 40gm UMMB on DM basis. Means in column with different super script differ significantly by DMRT (p<0.05). LSD= Least Significant Difference, CV= Coefficient Variance, SD= Standard Deviation. This means that the column with different super scripts (ab) differ significantly. ns not significantly different, *significantly different at 5% (p<0.05).

At the first fifteen days, 30 days,45 days, 60 days, 75 days, and 90 days of the experimental period, no significant difference was found in cumulative body weight among all the treatment groups. After 90 days, in 105 days the significant difference was found in the cumulative body weight of the animals of different treatment groups. The maximum cumulative body weight (130.1± 10.92Kg) was recorded significantly (P<0.05) and was found to be higher in T2(UTRS 25%+Green Grass 50%) which was statistically at par with T4(RS 25%+Green grass 50%) with body weight value as 106.7±7.03Kg.Similarly,the cumulative body weight of T3 (UTRS 50%+Green Grass 25%) was found to be 97.4±2.63Kg, which was found statistically similar to T1 (RS 50%+Green Grass 25%) in which minimum cumulative body weight (96.3±2.50Kg) was significantly (P<0.05) recorded.

The maximum cumulative body weight for the last fifteen days i.e 120 days was recorded significantly (P<0.05) highest (137.3±11.61 Kg) in T2 (UTRS 25%+Green Grass 50%) which was statistically at par with T4 (RS 25%+ Green grass 50%) with body weight value as (113.0± 7.67Kg). Similarly, significant (P<0.05) minimum cumulative body weight (101.7 ± 2.26 Kg) was observed in T1 (RS 50%+Green Grass 25%) which was statistically similar to cumulative body weight (103.5±2.37Kg) of T3 (UTRS 50%+Green Grass 25%).

3.3.2 Live weight gain (LWG) and Average daily weight gain (ADG)

The result from table 6 showed the higher average daily gain (Kg) was found for T2(0.54 kg) followed by T4 (0.37 kg), T3 (0,28 Kg), and T1 (0.26 Kg) respectively.

Table 8: Live weight gain (LWG) and Average daily weight gain (ADG)		
Treatments	**Total Live weight gain (Kg)**	**Average daily weight gain (Kg)**
T1	31.15	0.26
T2	64.48	0.54
T3	33.58	0.28
T4	44.13	0.37

T1= RS (50%)+ Silage(25%)+ Green grass(25%)+ Concentrate (0.75% of BW)+ 40gm UMMB,T2= UTRS(25%)+ Silage(25%)+ Green grass(50%)+ Concentrate (0.75% of BW) T3= UTRS(50%)+ Silage(25%)+ Green grass(25%)+ Concentrate (0.75% of BW),T4= RS(25%)+ Silage(25%)+ Green grass(50%)+ Concentrate (0.75% of BW)+ 40gm UMMB on DM basis.

3.3.3 Covariance of body weight

Table 9: Covariance matrix of body weight variation for 120 days(Kg)									
	bw1	**bw15**	**bw 30**	**bw 45**	**bw 60**	**bw 75**	**bw 90**	**bw 105**	**bw120**
bw1	153.61								
bw15	169.29	190.30							
bw30	172.48	195.44	203.53						
bw45	181.53	207.33	218.32	239.54					
bw60	184.11	211.52	222.55	243.69	249.63				
bw75	193.06	226.60	244.64	277.22	281.93	344.33			
bw90	192.88	226.76	245.91	278.99	283.86	347.53	352.84		
bw105	187.23	224.02	246.28	283.93	289.67	363.61	371.25	397.97	
bw120	196.86	235.56	258.69	297.60	303.83	381.27	389.29	416.84	437.57

The table above represented the covariance between different body weights measured at various time points (bw1, bw15, bw30, ..., bw120). The diagonal elements represented the variance of each body weight variable. Here the top-left entry (153.61) represented the variance of body weight at bw1. Likewise, the off-diagonal elements represented the covariance between pairs of body weights. For instance, the entry at the intersection of 'bw1' and 'bw15' was found to be 169.29, indicating the covariance between body weights at 'bw1' and at 'bw15'.

3.4 Feed conversion ratio

The feed conversion ratio of buffalo calves during the fattening period in different feeding regimes has been presented in Table 9.

Table 10: Feed conversion ratio in buffalo calves fattening			
Treatments	**Total DM intake (Kg)**	**Total Live weight gain (Kg)**	**Feed Conversion Ratio (Kg DM/Kg LWG)**
T1	286.92	31.15	9.2
T2	510.60	64.48	7.89
T3	307.15	33.58	9.1
T4	385.85	44.13	8.71

The result showed that the highest FCR was found as 9.2 in the T1 (RS 50%+Green Grass 25%) group of animals which was statistically similar to the FCR of the T3 (UTRS 50%+Green Grass 25%) group of animals which was found to be 9.1. Likewise, the lowest FCR was found as 7.89in the treatment 2 (UTRS 25%+Green Grass 50%) group of animals which was statistically found similar to the FCR of the T4 (RS 25%+Green Grass50 %)group of animals which was found as 7.89. The better feed conversion ratio was found in T2 among all four treatment groups.

3.5 Economic analysis

The cost of fattening calves in different feeding regimes and output has been presented in (Table 10). The net benefit (Rs) per animal was found highest in treatment 2 i.e. Rs.9731.16 per animal followed by T4, T3, and T1 i.e. Rs.4393.43, Rs.916.387, and Rs.520.12 respectively.

Table 11: Economic Analysis of buffalo calves fattening (Mean ± S.D.)

S.N	Treatment groups	Total cost (NRs)	Total Output (NRs)	Net benefit (NRs)	B/C ratio
1.	T1	11,161.13	11,681.25	520.12	1.04
2.	T2	14,446.97	24,178.13	9,731.15	1.67
3.	T3	11,674.25	12,590.63	916.387	1.07
4.	T4	12,153.44	16,546.88	4,393.43	1.36

Note: Concentrate @Rs.45/kg, Silage @Rs.13/kg, and Green grass @ Rs.5/kg for all four treatments on a DM basis. Also for treatments 1 and 3 Rice straw @Rs.15/kg and for T2 and T4 Urea Treated Rice Straw @ Rs.16/kg. The green grass cost also includes labor costs for calf management. The buffalo calf cost has been estimated @ Rs.375/kg live weight.

4. Discussion

4.1 Dry matter intake

With the use of urea-treated rice straw and a substantial proportion of green grass in the diet, dry matter consumption demonstrated the nutritional balance of diets. T2 was determined to have the greatest overall dry matter intake. A group researcher showed that the 18 male calves from native, crossbred (Holstein *Native), along with buffalo (six animals within each group), with an average body weight (BW) of 160 kg, were fattened to 300 kg ((Azary et al., 2007). Three times every single day, each animal got a total mixed ration of food (5% more than animal appetite). Buffalo, native, & crossbred (HN) were found to increase on average by 777, 641, and 912 grams per day (gm/day). The significant dry matter intakes (Kg/day) had been 5.58, 5.31, and 6.3, respectively, while the feed ratios for feed conversion were 7.2, 8.3, and 6.9, respectively. A group researcher, which showed that the dry matter intake was found to be higher than in the current study while the feed conversion efficiency was discovered to be identical (Azary et al., 2007).

4.2 Body weight variation

Throughout the whole four-month trial, the body weight of buffalo calves was measured at intervals of fifteen days. According to the data analysis, T2 had the largest body weight on day 120, followed by T4, T3, and T1. According to a study, 15 buffalo calves were housed on a farm in three treatment groups, with three animals in each treatment reproduced five times (Devkota and Kolachapati, 2008). For 150 days, the treatment combinations were untreated rice straw and berseem (1:1 ratio, with 80% dry matter from straw and 20% from berseem), treated rice straw and berseem (1:1 ratio, with 1.5 kg Berseem and little molasses (5% of dry matter requirement), and urea untreated rice straw with little concentrate (10% of total dry matter requirement). There were daily weight increases of 360 g, 323 g, and 305 g. The greatest net profit per kilogram of meat produced in the urea-untreated and berseem feeding groups was calculated to be Rs 39.61. The urea-treated cumberseem feeding and molasses-supplemented groups showed increased growth rates. Condition straw and berseem might be used for feeding in the absence of molasses. Compared to reports, the growth rates in the present research were greater (Devkota and Kolachayapati, 2008).

According to a study, feeding small cattle breeds resulted in 20% less crude protein (CP) than the National Research Council (NRC) recommends (Singh et al., 2009). They found that the decreased protein content did not negatively affect feed intake or dietary fiber absorption while allowing Bhadawari calves to grow at a rate of 400 g per day (Banstola et al., 2004). A group researcher experimented with fattening buffalo calves using different meals. Three different ration categories—T1, T2, and T3—were compared. T1 contained mixed grass and straw ad libitum; T2 contained mixed grass, rice straw, and concentrate (roughage and concentrate ratio were 70:30 on a dry matter basis); and T3 contained mixed grass, rice straw, and concentrate (roughage and concentrate ratio were 50:50 on a dry matter basis). Body weight increased at the greatest rate in T3 (618 g/day), second in T2 (455 g/day), and slowest in T1 (202 g/day). The most economical combination was T2, which had a roughage-to-concentrate ratio of 70:30.

Thapa et al. (1997) reported that buffalo calves fed concentrate saw a growth rate of 389 g/day. Most of researchers all noted growth rates in the 200–550 g/day range (Langer et al., 1985; Punia and Sharma, 1988; Kakker et al., 1991). A high-protein, high-energy lunch caused a daily weight gain of 576 g, according to (Pathak et al., 1987). These growth rates line up with the findings of the most recent study.

4.3 Feed conversion ratio

The feed conversion ratio of buffalo calves under various feeding regimens throughout the time of fattening was examined in this study. According to the data, treatment 2 had the best feed conversion ratio with a value of 7.89 kg, followed by treatment 4 with FCR value of 8.7, followed by treatment 3 with FCR value of 9.1, and finally treatment 1 with the highest FCR value of 9.2. According to the feed conversion values for buffalo calves were 11, 5, 6, and 5.7 kg for the group supplemented with only roughages, 50% concentrate (1:1 roughage and concentrate supplemented group), and 80% concentrate ration in addition to the group supplemented with only 20% roughages (El-Ashry et al., 1972). According to roughages were only fairly high and FCR Value was lower in the 50% and 80% concentrate-supplemented groups (Banjade et al., 2017).

4.4 Economic analysis

Analysis of the expenses of fattening calves under various feeding regimes & output revealed that Treatment 2 had the largest net benefit per animal, at Rs. 9731.16, followed by Treatments 4 (Rs. 4393.43), T3 (Rs. 916.387), and T1 (Rs. 520.12). a group researchers used 18 male calves comprising native, crossbred (Holstein * Native), and buffalo groups where they grew the weight as 300 kg in weight (Azary et al., 2007). Three times a day, a complete mixed ration was fed to each animal. The average daily gains were 777, 641, and 912 grams for buffalo, native, and crossbred (Holstein * Native) calves, respectively. The dry matter intakes were significant when taking into account the values of 5.58 kg/day, 5.31 kg/day, & 6.3 kg/day for buffalo, native, & crossbred calves, respectively. It was established that the feed conversion ratio, which was 7.2, 8.3, and 6.9, was unremarkable.

5. Conclusion

The present studies indicate that urea-treated rice straw has the potential to be utilized as a suitable source of feed for animals when mixed with the appropriate amount of nutritious green grass. Based on the findings of this experiment, it is possible to conclude that feeding with urea-treated rice straw and a greater proportion of green grass leads to increased body weight gain. Furthermore, UTRS and a higher proportion of green grass improve the fattening process of buffalo calves, resulting in a higher financial return and, as a result, increased farmer profitability. According to the studies, the inclusion of UTRS at 25% and green grass at 50% yields good results in terms of palatability, dry matter intake, as well as growth performance for buffalo calves fattening. However, before any recommendations, these findings must be validated in terms of the critical level of addition in the farmer's management circumstances. However, before making any recommendations, these findings must be validated in terms of the crucial degree of addition in the farmer's management circumstances, and yet various research efforts are required for the confirmation of these findings and to provide appropriate findings for buffalo calves fattening technology.

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