# NUTRITIONAL EVALUATION OF SAMPOORNA (*Pennisetum glacum* × *Pennisetum purpureum*) FODDER IN BUFFALO CALVES

A thesis submitted to the

**DR. BALASAHEB SAWANT KONKAN KRISHI VIDYAPEETH, DAPOLI**
(Agricultural University)
Dist. Ratnagiri (MaharashtraState), India

*in partial fulfillment of the requirements for the degree of*

## MASTER OF SCIENCE

(AGRICULTURE)

In

**ANIMAL HUSBANDRY**

By

**Mr. SANTOSH SUKHDEV GANGATE**
**B.Sc.(Agri.)**

**DEPARTMENT OF ANIMAL HUSBANDRY AND DAIRY SCIENCE,**
**FACULTY OF AGRICULTURE,**
**DR. BALASAHEB SAWANT KONKAN KRISHI VIDYAPEETH,**
**DAPOLI - 415 712, DIST. RATNAGIRI (M.S.)**

**JUNE, 2017**

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**Approved by the Advisory Committee**

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# C E R T I F I C A T E

This is to certify that the thesis entitled**"NUTRITIONAL EVALUATION OF SAMPOORNA (*Pennisetum glacum* × *Pennisetum purpureum)* FODDER IN BUFFALO CALVES"** submitted to the Faculty of Agriculture, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli, Dist. Ratnagiri, Maharashtra State in the partial fulfillment of the requirements for the degree of **MASTER OF SCIENCE (AGRICULTURE)** in **Animal Husbandry,** embodies the results of a piece of *bona-fide* research carried out by **Mr. SANTOSH SUKHDEV GANGATE** under my guidance and supervision and that no part of the thesis has been submitted for any other degree or diploma or published in other form. All the assistance and help received during the course of investigation and the sources of literature have been duly acknowledged by him.

**Place:** Dapoli
**Date:**

**(A. J. Mayekar)**
Chairman,
Advisory Committee and
Research Guide

**DEPARTMENT OF ANIMAL HUSBANDRY AND DAIRY SCIENCE**
**COLLEGE OF AGRICULTURE, DAPOLI**

**DR. BALASAHEB SAWANT KONKAN KRISHI VIDYAPEETH, DAPOLI**

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| **Major Field** | **:** | Animal Husbandry |
| **Research Guide** | **:** | Dr. A. J. Mayekar |
| **Members** | **:** | Dr. B. G. Desai<br>Dr. V. S. Dandekar<br>Dr. J. S. Dhekale |
| **Title of Thesis** | **:** | Nutritional Evaluation of Sampoorna fodder (*Pennisetum glaucum* × *Pennisetum purpureum*) in buffalo calves. |

## ABSTRACT

An experiment was conducted on six Mehasana male buffalo calves. They were fed Sampoorna fodder for 28 days to determine its nutritive value. The chemical analysis of Sampoorna fodder revealed that, it contains 23.5, 32.39, 9.93, 5.9, -23.93, 51.35, 8.89, 0.13, 0.23 per cent DM, OM, CP, EE, CF, NFE, Ash, Ca and P respectively on DM basis. The average dry matter intake per 100 kg body weight was 2.78 ± 0.04 kg in calves fed on Sampoorna fodder. The nutritive values of Sampoorna fodder in terms of DCP and TDN in calves were observed as 8.90±0.09 and 86.18 per cent, respectively. The experimental calves showed gain in body weight of 449.53 ± 37.22 g/day. The feed conversion efficiency showed by calves fed on Sampoorna fodder was 1: 6.92 and was classified as narrow nutritive ratio. This is normally shown by healthy growing animals. Mineral balances observed for Calcium and Phosphorous was 3.42 ± 0.14, 6.22 ± 0.25 g/day, respectively. From the overall results it can be concluded that Sampoorna fodder can be used as good fodder for maintenance in buffalo calves in adverse climatic conditions.

# *ACKNOWLEDGEMENT*

*I am thankful to the god for his loving kindness in making the completion of this work possible. A research outcome is an embodiment of the concentrated efforts and co-ordination of all involved in the process. The consequent fruit with the concentrated efforts must be shared. This is humble attempt to remember all those who have been helpful in the course of preparing this thesis. Honestly today, I cannot find any words to express my feeling on this happiest moment of completion of my research work and this manuscript. And so comes the time to look back on the path traveled during this endeavors, which is only possible of blessings of my parents, well-wishers and a kind gentleman, my research guide.*

*In everyone's life the day arises when one has to shape the feelings in words. Even though carving the feelings is very difficult, their expression necessary at that time, for me, the spell has crone to gather words for expressing my gratitude towards all the people, who help in building up my career.*

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*Bhave, Director of Extension, Dr.B.S.K.K.V. Dapoli and Dr. U. V. Mahadkar, Associate Dean College of Agriculture, Dapoli.*

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*Now as I convey this thesis in my hand, I carry with me memories that will enrich my nostalgia.*

*Place: Dapoli*

*Date: May, 2017* *(Gangate Santosh Sukhdev)*

## APPENDIX – II

## WEEKLY METEOROLOGICAL DATA

| Weeks | Temperature ($^0$C) | | | Relative humidity % | Wind speed (km/hr.) | Sunshine (hr) | Rainfall (mm) |
|---|---|---|---|---|---|---|---|
| | Max. | Min. | Mean temp. | | | | |
| 1st (14.02.17 - 20.02.17) | 33.8 | 13.9 | 23.8 | 88 | 2.8 | 8.3 | 0 |
| 2nd (21.02.17 - 27.02.17) | 34.3 | 13.3 | 23.7 | 81 | 2.4 | 8.7 | 0 |
| 3rd (28.02.17 - 06.03.17) | 36.1 | 13.6 | 24.8 | 86 | 3.3 | 8.3 | 0 |
| 4th (07.03.17 - 13.03.17) | 31.3 | 13.6 | 22.4 | 90 | 3.8 | 8.7 | 0 |

## APPENDIX – I

## DETAIL DESCRIPTION OF EXPERIMENTAL BUFFALO CALVES

| Sr. No. | Animal No. | Breed | Sex | Initial age (Months) | Initial body weight (Kg) |
|---|---|---|---|---|---|
| 1 | 39 | Mehasana | Male | 14 | 98.10 |
| 2 | 35 | Mehasana | Male | 15 | 94.30 |
| 3 | 43 | Mehasana | Male | 13 | 89.53 |
| 4 | 45 | Mehasana | Male | 13 | 114.10 |
| 5 | 43 | Mehasana | Male | 14 | 93.66 |
| 6 | 39 | Mehasana | Male | 15 | 108.39 |

**APPENDIX – II**

# WEEKLY METEOROLOGICAL DATA

| Week No. | Met. Week Period | Average Relative humidity ( % ) | Temperature ($^0$C) | | Rainfall (mm) |
|---|---|---|---|---|---|
| | | | Max. | Min. | |
| 1) | 06-10-2015 to 12-10-2010 | 84 | 32.0 | 22.9 | 0 |
| 2) | 13-10-2015 to 19-10-2015 | 78 | 34.7 | 22.6 | 1.0 |
| 3) | 20-10-2015 to 26-10-2015 | 80 | 34.4 | 22.7 | 0 |
| 4) | 27-10-2015 to 02-11-2015 | 79 | 34.3 | 21.6 | 0 |
| | | | | | |

## APPENDEX – III

## ABBREVIATIONS USED

| | |
|---|---|
| @ | At the rate of |
| AIA | Acid insoluble ash |
| ADF | Acid detergent fibre |
| *Ad-lib.* | Adlibitum |
| a.m. | After meridian |
| C | Calves |
| CC | Cell content |
| CF | Crude fibre |
| CP | Crude protein |
| Ca | Calcium |
| CHO | Carbohydrate |
| C.V. | Coefficient of variation |
| DCP | Digestible crude protein |
| DM | Dry matter |
| DMI | Dry matter intake |
| EE | Ether extract |
| *et al.* | And other |
| etc. | Etcectra (and other things) |
| g | Gram |
| i.e. | Idlest (that is) |
| kg | Kilogram |
| M | Meter |
| max. | Maximum |
| min. | Minimum |
| ml | Milliliter |
| mt | Metric tonnes |

| | |
|---|---|
| MMT | Million metric tonnes |
| N | Nitrogen |
| NDF | Neutral detergent fibre |
| NFE | Nitrogen free extract |
| OM | Organic matter |
| P | Phosphorus |
| S.D. | Standard deviation |
| TDN | Total digestible nutrient |
| Temp. | Temperature |
| *viz.* | Namely |
| $W^{0.75}$ | Metabolic body weight |
| $^{0}C$ | Degree Celsius |
| $^{0}F$ | Degree Fahrenheit |
| % | Per cent |
| SE | Standard Error |
| Lit | Liter |

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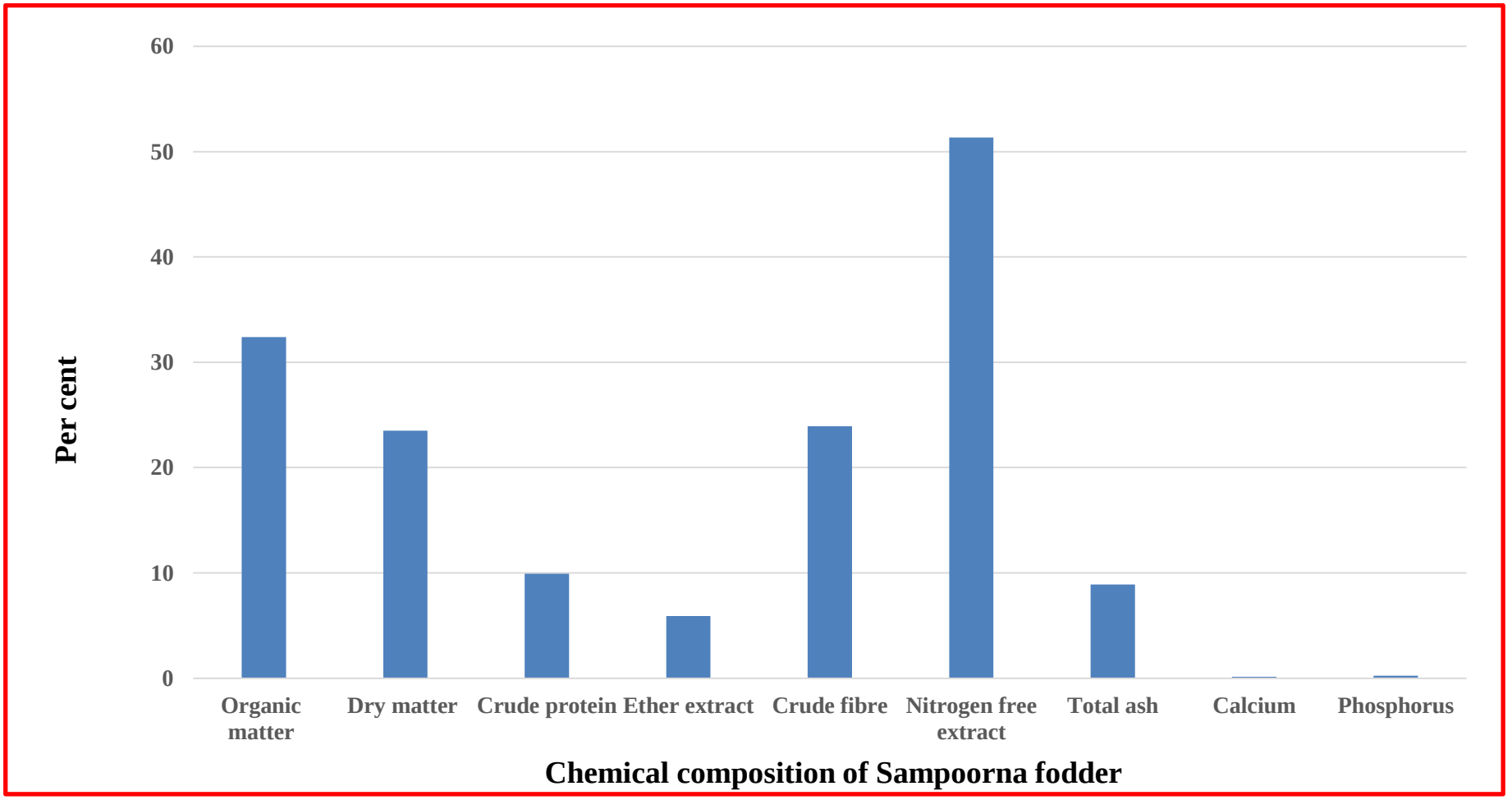
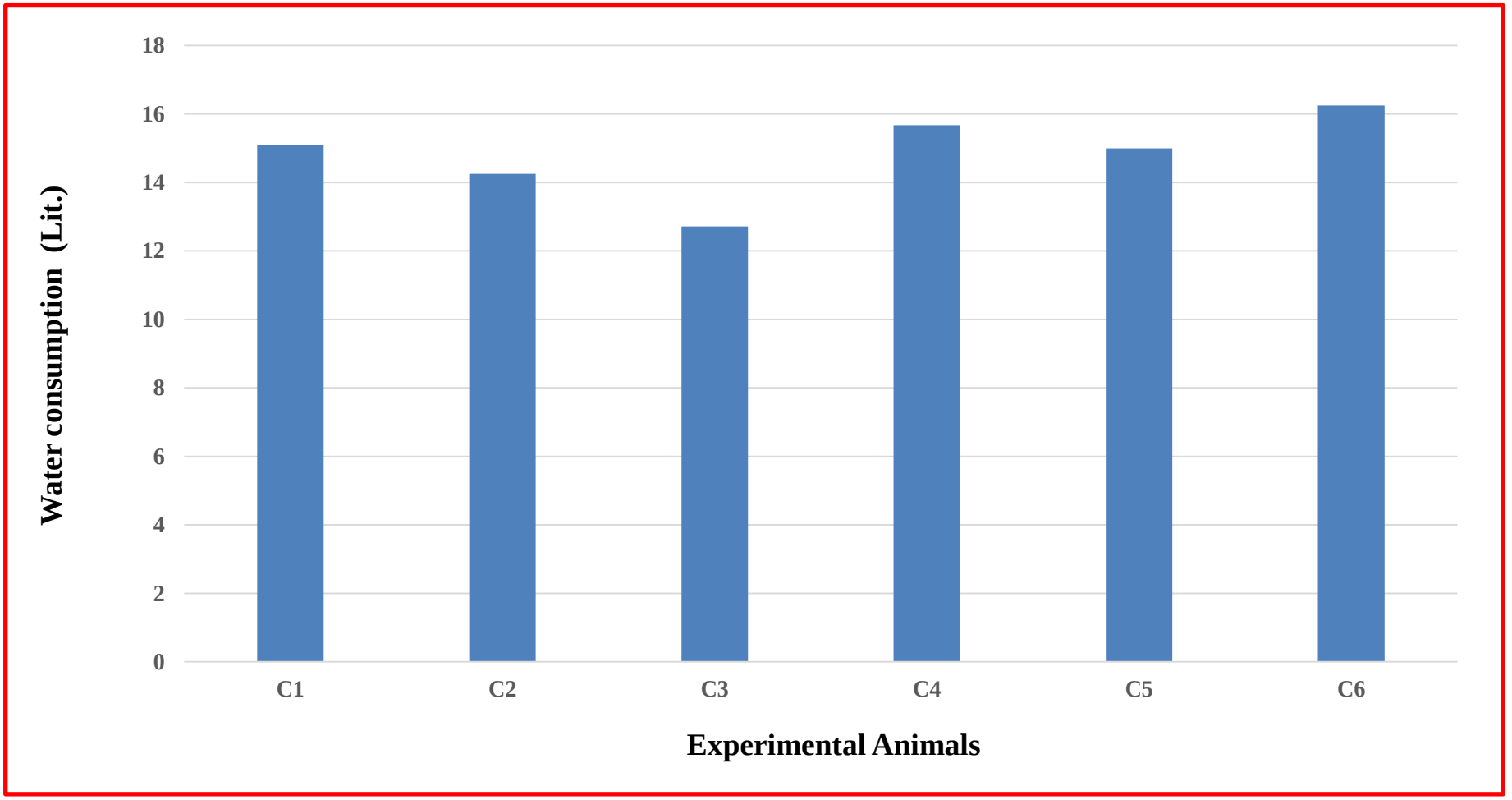



**Fig. 1. Chemical composition of Sampoorna (*Pennisetum glaucum x Pennisetum purpureum*) Fodder (% DM basis)**

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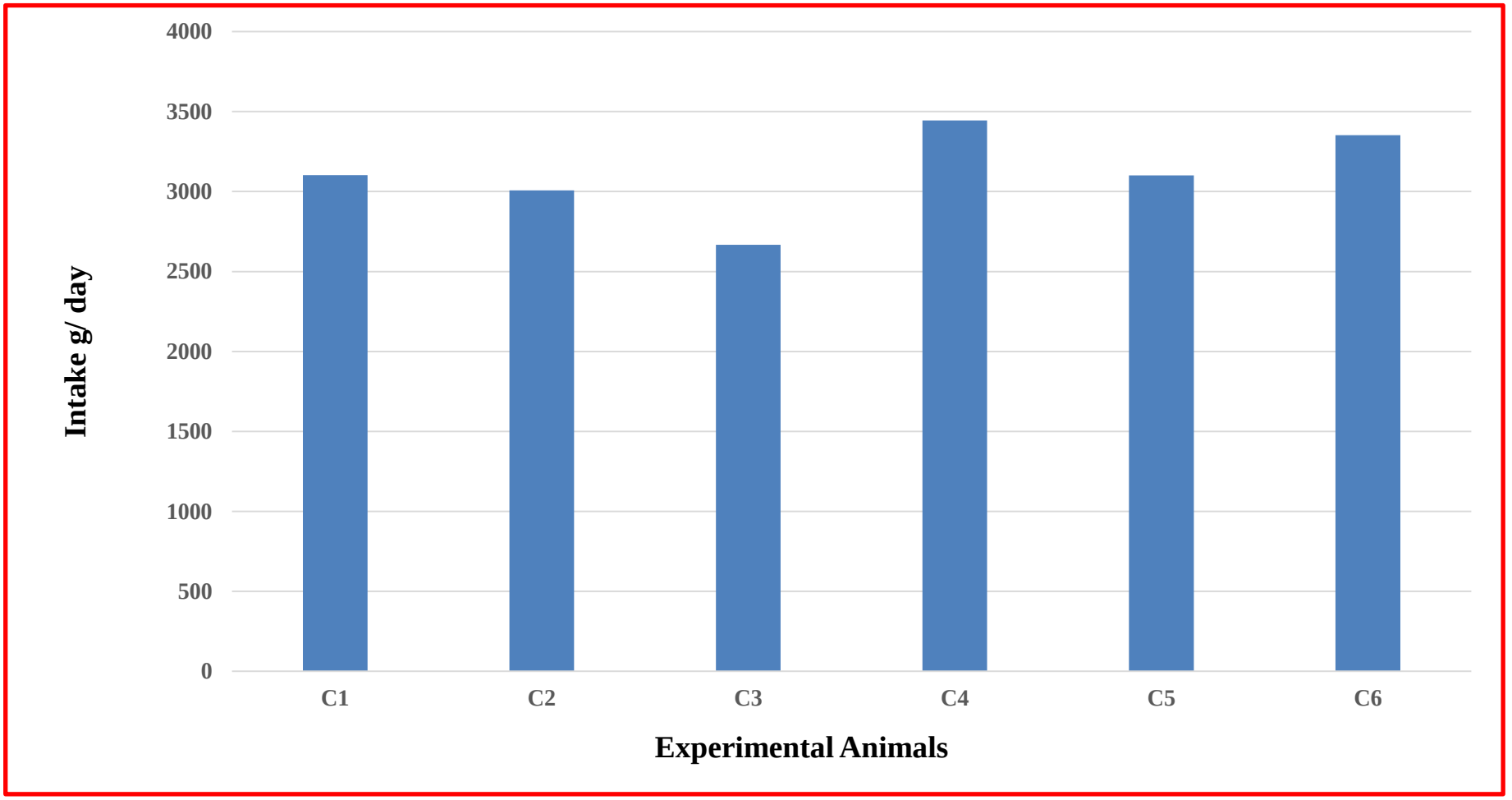



**Fig. 2. Average dry matter intake by experimental buffalo calves (g/day)**

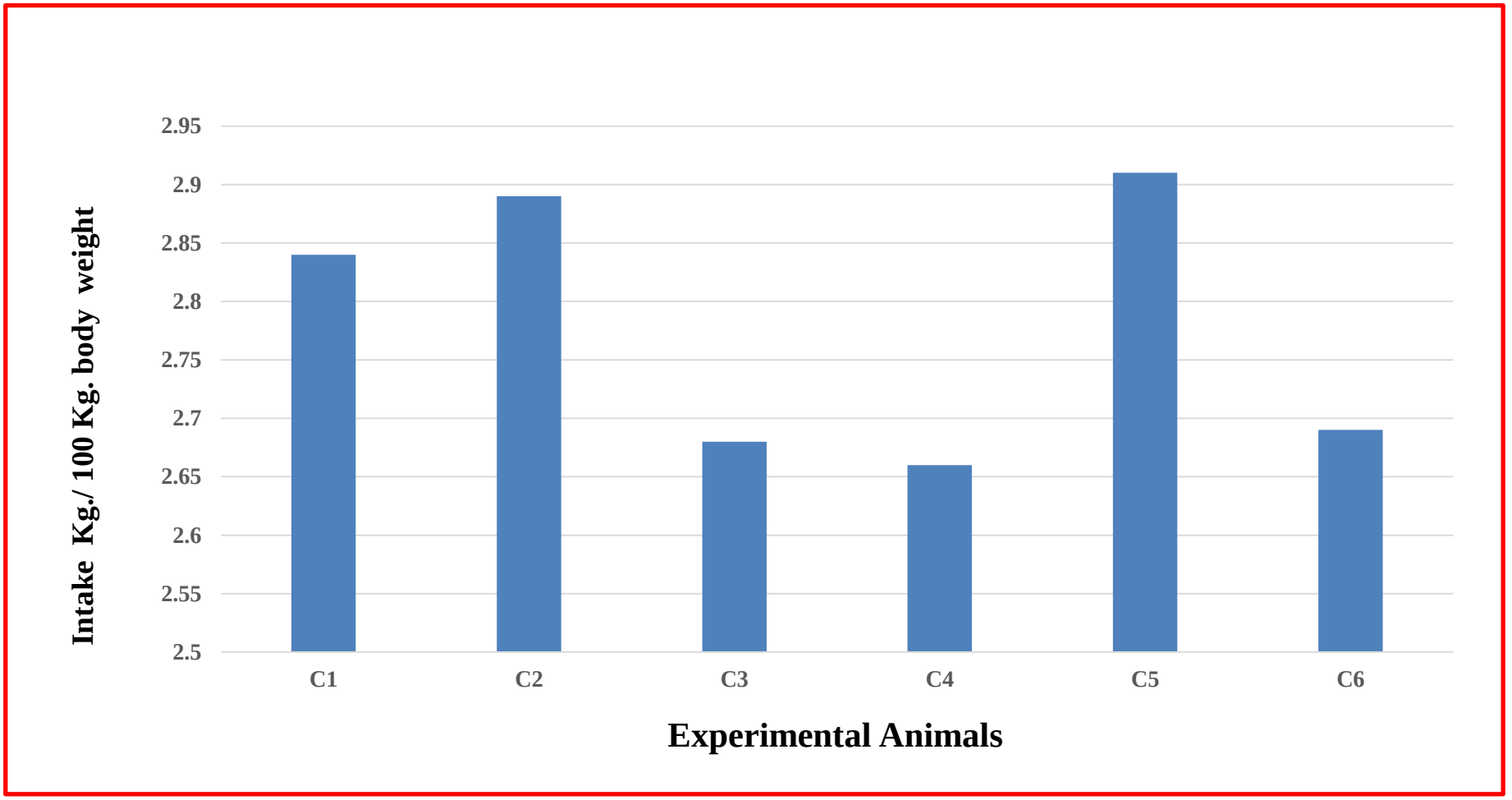



**Fig. 3. Average dry matter intake by experimental buffalo calves (Kg/100 Kg. body weight)**

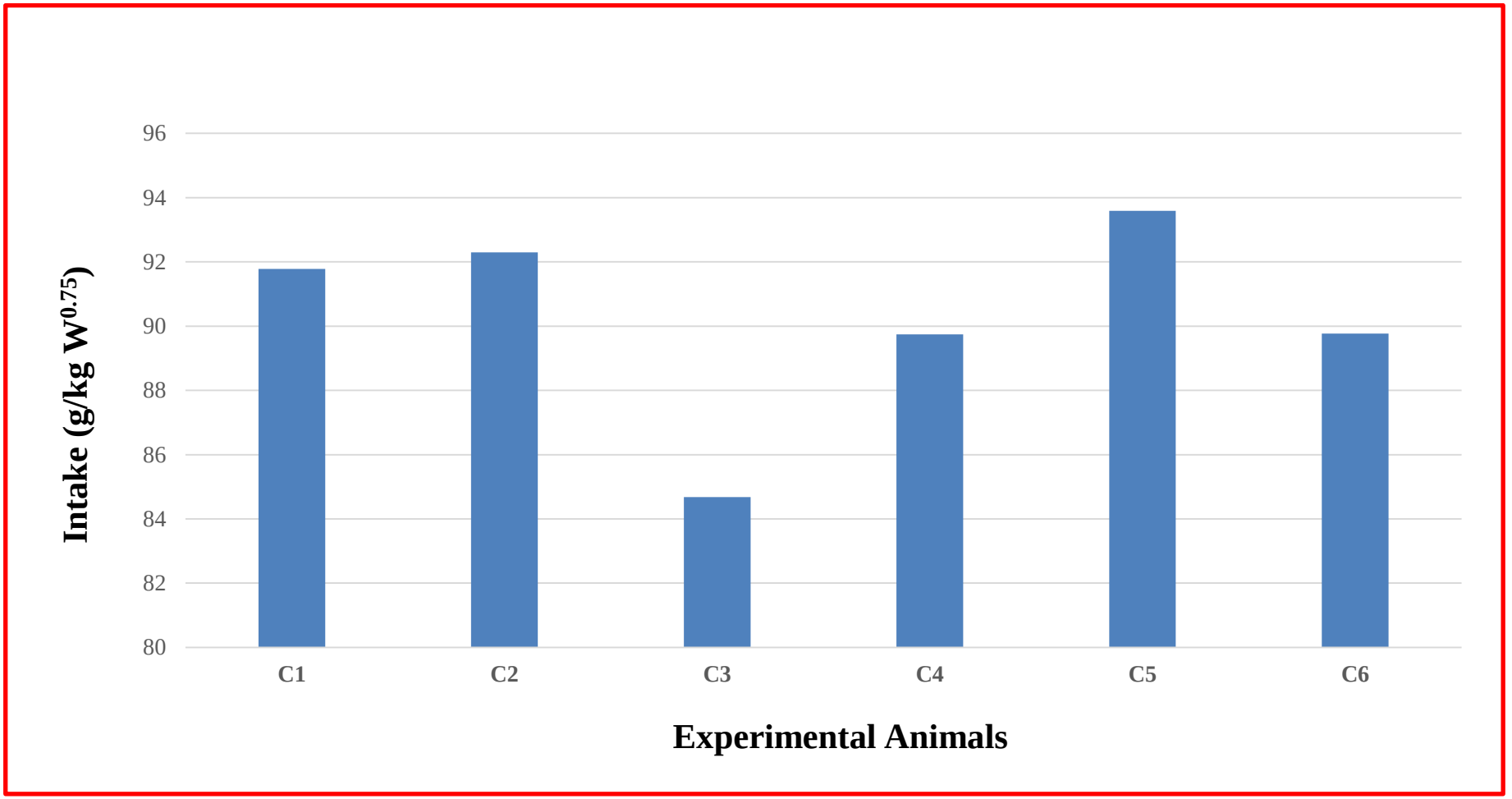
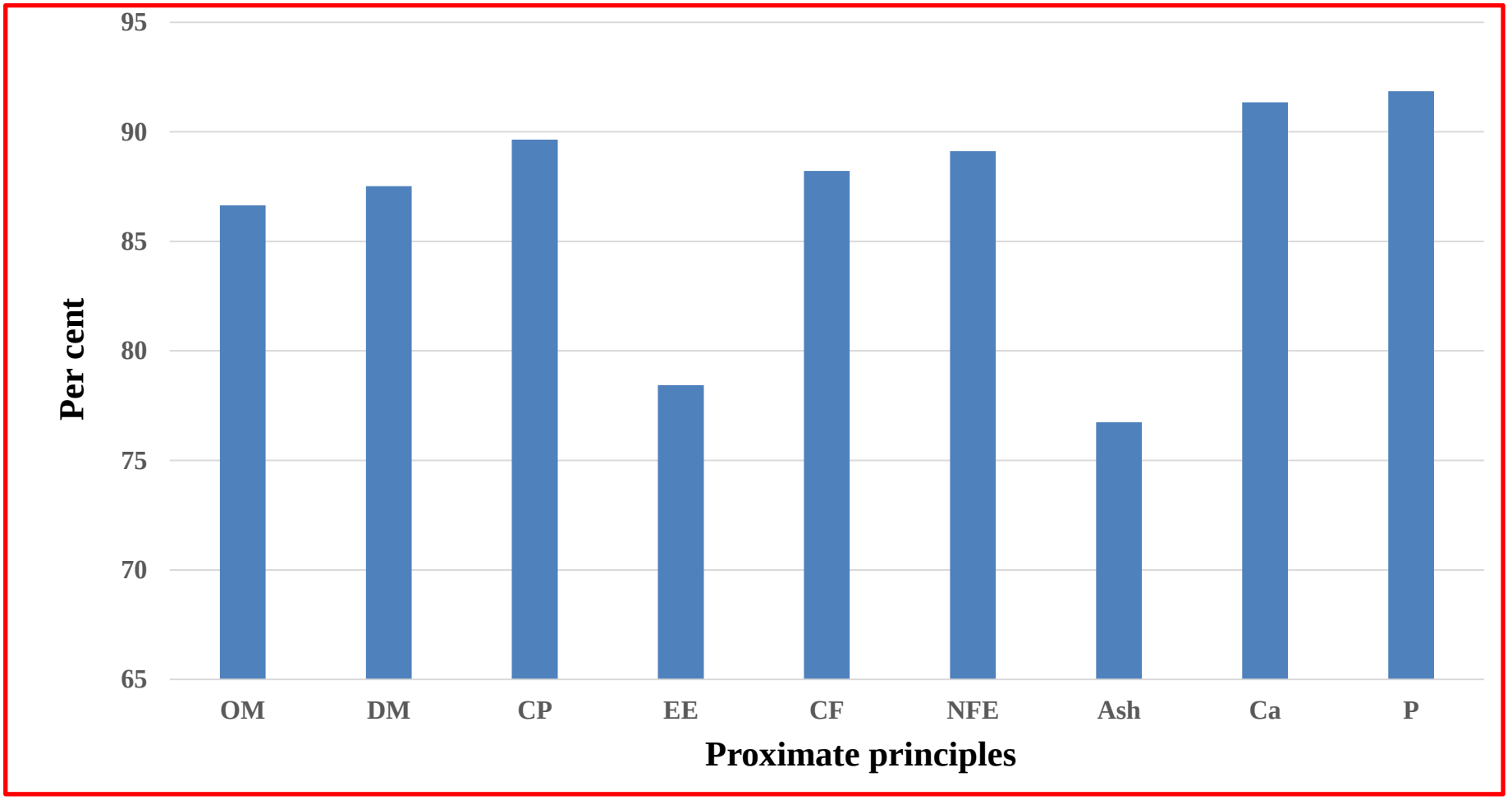



**Fig. 4. Average dry matter intake by experimental buffalo calves (g/kg $W^{0.75}$)**

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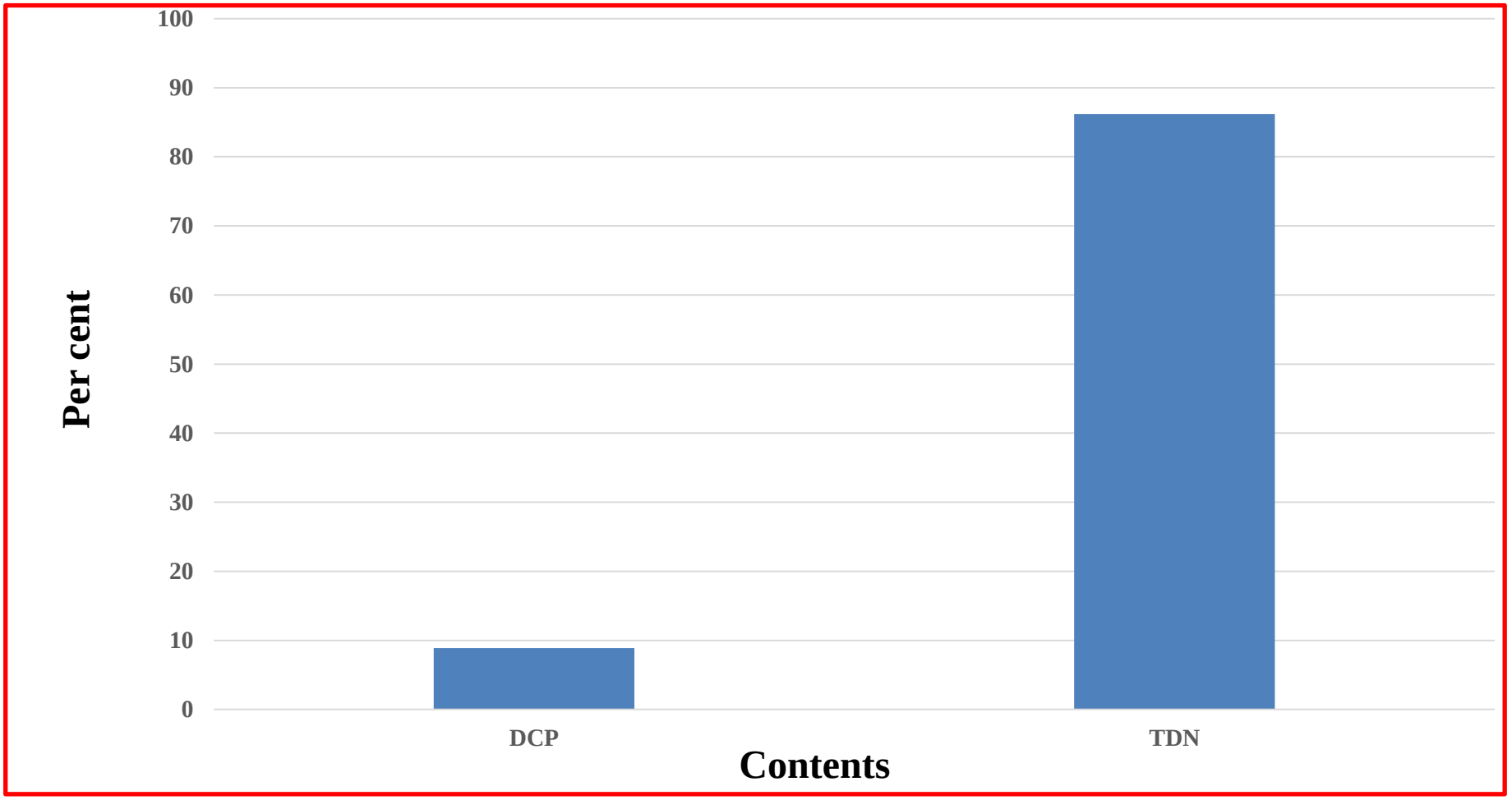


**Fig. 7. Average nutritive value of Sampoorna fodder in experimental animals in terms of DCP and TDN (%).**

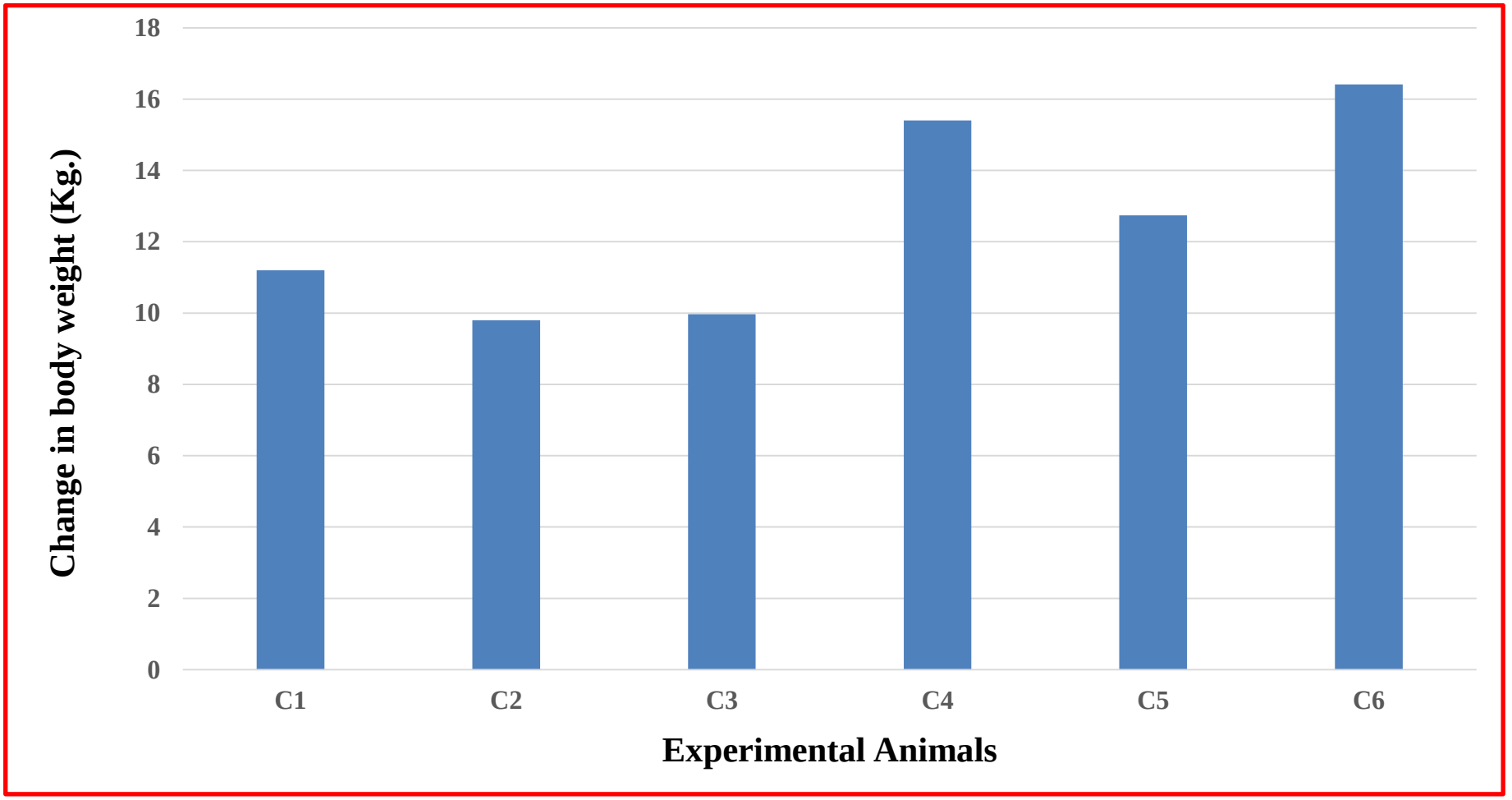


**Fig. 8. Average live weight changes in experimental animals (Kg.).**

# CHAPTER I
# INTRODUCTION

India basically is an agricultural country and livestock economy is the backbone of the agriculture. About 70 per cent of Indian population is concentrated in rural parts with agriculture as a source of livelihood. Apart from crop production, livestock rearing is also practiced to a considerable extent. Today livestock rearing has become a multifarious activity for rural Indians, which acts as a source of a steady income. This change in scenario is mainly due to increase in livestock population and rural development programmes. India possesses livestock population comprising of 512.05 million out of these 92.5 million buffalo population (Anonymous, 2012).

Present livestock enterprise has taken a shape of business especially when government has introduced many programmes for small/marginal farmers and agricultural labours for their economic and social upliftment. Livestock business requires a contingent use of available inputs to achieve maximum productivity and profitability. Availability of scientific information about the latest technology and their effective transfer from scientist venue to the farmer is of immense utility.

The country is ranking first in buffalo population, while among small ruminants sheep and goat occupied fifth and second position, respectively in the world population. Thus, India is a commanding position of the livestock map of the world. India has large number of breeds of cattle (39), buffalo (07), goat (26) and sheep (40) (Anonymous, 2016). It indicates that India has richest germplasm of livestock of the world.

The productivity of animals depends upon the amount and nutritive quality of vegetation available to the animals. The nutritional demands of livestock vary with age and physiological functions of the animals such as growth, maintenance, gestation, fattening and lactation, etc. So the nutrition

plays a major role in the productive performance of livestock. (Fialho *et al.*, 1995).

The increase in the livestock population along with the intensive rearing system has resulted in increased demands for fodder and feed in the country. Green fodder is an essential component of the dairy ration, otherwise the productive and reproductive performance of the dairy animals is adversely affected. Therefore, quality green fodder should be fed regularly to the dairy animals. Adequate nutrition is important for body maintenance, growth and reproduction of animal. Now, Maharashtra state is facing a severe shortage of livestock feed and fodder due to irregular rainfall. For managing the shortage of feed and fodder in this situation from last two decades, considerable work done on animal new feed resources (Anonymous, 2012).

Konkan region have large biodiversity, which can provide good quality green fodder. Out of total expenditure of dairy farming 70 per cent expenditure was done on cost of feeding. Reduction in the feed cost is aimed to increase the profitability of any of the dairy/sheep/poultry farm. Utilization of high quality green fodders/forages as feeds for ruminant animals could save some expenditure on feed by replacing/sparing some of the costly concentrate feed ingredients in the ration.

Forages produce more than 90 per cent of feed energy required by herbivorous livestock of the world (Givens *et al*., 2000). Forages particularly tree leaves form more potential economic source of forage for the livestock (Srinivasulu *et al*., 1998). In order to ensure green fodder supply to animals, a combination of cultivated fodder and nutritious but palatable tree foliage holds a promise.

The present availability of dry roughages, green fodder and concentrates in the country is to the extent of 393.38, 462.05 and 35.32 million tonnes, respectively (Sampath *et al*., 2005). It was estimated that, India is deficit in dry fodder by 13 per cent, green fodder by 33 per cent and concentrates by 25 per cent (Birthal and Jha, 2005). These deficiencies are mainly because of

dwindling of the grazing and cultivable lands for growing fodder crops/trees because of increased human population which needs land for food crops, rapid urbanization and swift industrialization. In this regard, there is a need to evolve/develop new strains and varieties of high yielding and nutritious hybrid green fodders to provide balanced nutrients to the ruminant animals as well as to reduce the cost of feeding by substituting the green with costly concentrate feed ingredients to some extent in the ration.

Grazing or harvesting of forage crops grown in association with planted trees represents a dominant form of silvopastoralism in many parts of the world. Although land use systems of this kind are thought to be highly productive owing to the vertical stratification of the above and below ground components, they are extremely dynamic with available resources and environmental conditions changing over time. Changes in environmental conditions alter growth and abundance of underdestroy components. (Kumar *et al*., 2001).

Among various improved grass species, Sampoorna fodder *(Pennisetum glaucum* × *Pennisetum purpureum)* is perennial crop and also known as DHN – 6. Samporna fodder developed from Indian Grassland and Fodder Research Institute at Sub-Centre Dharwad by crossing of Bajra × Napier Hybrid. Ratooning also offers an opportunity of continuous supply of green forage. It has 9-10 per cent crude protein and 27-30 per cent crude fiber with 225-275 t/ha productivity (Anonymous, 2013). It is suitable for intensive crop production where irrigation is available. It responds very well to the fertilizers. It is a fast growing fodder crop with high yield. It has more tillers and leaves. However, it cannot tolerate water logging conditions and cannot be stored as hay. It is ideal to cut between 50 to 55 days as it denatures rapidly, becomes rough and steamy if delayed (Anonymous, 2010).

It is popular among livestock owners because of its high yielding capacity, palatability, nutritive value and suitability to varying climatic and soil conditions (Singh *et al*., 2002). To increase the production potential of calves

in term for meat, milk and skin it is necessary to incorporate proper feeding schedule. Approximately 1351.09, 640.22 and 188.70 million tonnes crop residues, green fodder and concentrate respectively are required per annum (Anonymous, 2013) for proper growth of bovine. Therefore, the present study entitled “Nutritional evaluation of Sampoorna fodder in buffalo calves” was conducted for evaluation of newer feed resources for sustainable livestock producing under Konkan region with the following objectives.

1. To determine the chemical composition of Sampoorna grass.
2. To study the dry matter intake in buffalo calves.
3. To determine the nutrient digestibility in buffalo calves.

# CHAPTER II

# REVIEW OF LITERATURE

Hundreds of species of fodder grasses are available for the feeding of livestock, but not all of these have been studied properly and systematically for their nutritive values. Fodder grasses are the main source of roughages for livestock. Management under intensive system has been received much attention in recent days. Buffalo under the intensive system of management round the year in urban areas and particularly during summer season in rural areas, the various fodder grasses are the main source of roughages for calves. During the scarcity period, grasses could be used for the feeding large ruminants.

The detailed review of literature related to chemical composition, utilization and nutritive value of fodder grasses for calves is presented under the following heads in this chapter.

2.1 Chemical composition

2.2 Dry matter intake

2.3 Digestibility coefficient

2.4 Mineral balance

2.5 Nutritive value

2.6 Body weight gain

2.7 Physiological responses

2.8 Water intake

2.9 feed intake

## 2.1 Chemical composition

Thomas and Antony (2014) reported the chemical composition of hybrid Napier cultivars grown under rained ecosystem, as shown in following table.

**Table 2.1 Chemical composition of hybrid Napier cultivars (% DM basis)**

| Cultivars | CP | CF | EE | NFE | TA |
|---|---|---|---|---|---|
| **CO-2** | 11.52 | 34.75 | 2.30 | 47.44 | 8.07 |
| **CO-3** | 14.06 | 28.62 | 2.30 | 52.21 | 8.33 |
| **CO-4** | 11.46 | 28.98 | 2.80 | 54.29 | 8.27 |
| **KKM-1** | 13.23 | 33.67 | 2.32 | 49.26 | 7.40 |
| **Suguna** | 11.50 | 29.87 | 1.85 | 47.19 | 7.87 |
| **Supriya** | 12.50 | 28.03 | 1.77 | 55.73 | 8.47 |
| **IGFRI-3** | 14.17 | 31.48 | 2.16 | 51.73 | 6.03 |
| **IGFRI-7** | 10.73 | 36.22 | 1.47 | 48.81 | 6.13 |
| **DHN-6** | 13.54 | 31.50 | 2.37 | 53.06 | 5.50 |
| **PTH** | 12.50 | 34.33 | 1.67 | 53.22 | 5.20 |
| **PBN-16** | 13.54 | 30.12 | 1.92 | 52.49 | 7.50 |

Manzoor *et al.* (2013) evaluated the chemical composition of grasses for ruminants. The chemical analysis of *Fusca ciliaris*, *Leptochloa fusca*, *Chloris gayana*, *Cynodon dactylon* and *Panicum colunum* for ruminants. They observed that DM, OM, CP, NDF, ADF, HC, ADL, ASH in *Fusca ciliaris* as (21.7, 90,.16, 11.13,67.5,46.3,21.2, 4.8, 9.84 on % dry matter basis), *Leptochloa Fusca* as (18.75, 85.30, 9.00, 66.5, 43.1, 23.4, 6.6, 13.70 on % dry matter basis), *Chloris gayana* as (11.38, 89.91, 9.34, 63.0, 40.5, 22.5, 3.5, 10.09 on % dry mater basis), *Cynodon dactylon* as (28.36, 88.44, 10.53, 70.7, 42.2, 28.5, 3.0, 11.56 on % dry matter basis*), Panicum colunum* as (22.41, 86.39, 7.90, 63.3, 41.5, 21.8, 4.3, 13.4 on % dry matter basis).

Anonymous (2010) studied the nutritive evaluation of Buffalo grass (*Paspalum conjugatum*) in cattle and reported the chemical composition as DM-21.7, CP-11.5, CF-30.2, NDF-68.1, ADF-35.6, Lignin-4.4, EE-2.4, Ash-10.2 per cent, respectively.

Venkat Krishan (2010) studied the nutritive evaluation of Para grass (*Brachiaria mutica*) in cattle and reported the chemical composition as DM-27.5, CP-7.9, CF-35.7, NDF-68.5, ADF-41.9, lignin-6.2, EE-1.6, Ash- 9.6 per cent, respectively.

Jagdamba *et al.* (2010) studied the nutritional evaluation of perennial fodder varieties suitable for low irrigation input areas in male Buffalo calves, and reported the chemical composition as shown in following table.

**Table 2.2 Chemical composition perennial fodder varieties (% DM basis)**

| Variety | DM | CP | CF | EE | TA | NFE |
|---|---|---|---|---|---|---|
| **APBN-1** | 19.22 | 8.04 | 34.06 | 0.98 | 12.72 | 44.20 |
| **CO-3** | 11.93 | 6.59 | 45.46 | 0.66 | 13.30 | 34.99 |
| **CO-63** | 26.66 | 3.34 | 40.94 | 0.76 | 12.11 | 42.85 |
| **Congo signal** | 29.01 | 3.66 | 44.72 | 1.52 | 14.00 | 36.10 |
| **BH-18** | 23.69 | 5.48 | 38.66 | 0.77 | 13.81 | 41.28 |
| **CO-2** | 25.22 | 5.42 | 26.43 | 0.83 | 10.22 | 57.10 |
| **Australian Napier** | 25.22 | 3.49 | 36.68 | 1.47 | 11.61 | 46.75 |
| **African Napier** | 27.41 | 4.10 | 34.07 | 1.19 | 11.80 | 48.84 |
| **Punjab Napier** | 28.08 | 3.32 | 39.46 | 1.61 | 12.11 | 43.50 |
| **Elephant grass** | 24.39 | 3.78 | 33.62 | 1.81 | 10.20 | 50.59 |
| **Green panic** | 23.69 | 5.10 | 37.56 | 1.80 | 11.41 | 44.13 |
| **Blue panic** | 28.28 | 3.15 | 39.42 | 0.88 | 11.51 | 45.04 |
| **Gatton panic** | 26.66 | 4.96 | 38.72 | 2.12 | 10.23 | 43.97 |
| **Grazing guinea** | 23.16 | 3.82 | 31.82 | 1.51 | 11.82 | 51.03 |
| **Macuini** | 27.63 | 2.96 | 46.15 | 1.32 | 11.40 | 38.17 |
| **Colonial** | 26.82 | 4.52 | 41.31 | 1.56 | 12.01 | 40.60 |
| **Hamil** | 26.79 | 2.58 | 41.85 | 2.99 | 10.22 | 42.36 |
| **Tanazania** | 30.08 | 3.78 | 36.90 | 2.01 | 11.55 | 45.76 |
| **Mombasa** | 26.88 | 4.37 | 37.17 | 0.82 | 11.61 | 46.03 |
| **Brejanthe** | 25.78 | 4.48 | 38.20 | 1.75 | 12.01 | 43.56 |
| **Bracheria** | 25.63 | 4.25 | 33.04 | 1.74 | 14.02 | 46.05 |

Tauqir *et al*. (2009) evaluated the nutritive value of Jumbo grass in lactating Nili-Ravi Buffaloes and reported the chemical composition as DM-15.9, CP-11.0, NDF-75.2, ADF-39.7, ADL-4.3 Hemicellulose-35.5, Cellulose-35.4, Ash-8.59 per cent, respectively.

Bhatti *et al*. (2005) studied nutritive value of Mott grass and Berseem fodder substituted with Saltbush. Fed on Nili-Ravi Buffalo heifers. The chemical composition of Mott grass and Berseem fodder substituted with Saltbush fed to Nili-Ravi buffalo heifers. DM-21.40±0.626, CP-11.50±0.23, Ash -11.75±0.07 per cent on DM basis.

Khan *et al*. (2005) studied the chemical composition of Oat grass (*Avena sativa*) ensiled with molasses for Nili-Ravi buffaloes. The chemical composition of Oat grass was reported as DM-28.2,CP- 10.0, NDF-70.1, ADF-38.5, ADL-4.30, Ash-11.3 per cent, and cane molasses was reported as DM-68.0, CP-4.70, Dextrose-1.2,Sucrose- 35.6, Ash-11.1 per cent on dry matter weight basis.

Grewal *et al.* (2003) evaluated the chemical composition of Pearl millet green fodder and 0.5 per cent urea treated, untreated cotton stem in buffaloes. The chemical composition was reported as, Pearl millet DM-23, OM-91.3, CP-7.65, CF-31.54, EE-2.44, Ash-8.70 NFE-49.66, Cellulose-42.90, NDF-72.10, ADL-47.84, Hemicellulllose-24.30 per cent. In 0.5 per cent urea treated cotton stem as DM-90, CP-6.10, CF-31.54, EE-1.16, Ash-4.18 NFE-31.28, Cellulose-39.71, NDF-78.42, ADF-63.12, ADL-4.84, Hemicellulose-15.30 per cent and in untreated cotton stem they were observed DM-40, CP-7.44, CF-58.20, EE-2.44, ADL-18.65, Hemicellulose-13.41per cent.

Kumar and Garg (1997) evaluated the chemical composition of Dhawalu *(Chrysopogaon fulvus.)* grass for murraha heifers. The chemical composition of Dhawalu grass reported as, DM-34.12 ±1.60, 0M-92.99 ±2.02, CP-7.86±0.41, CF-33.60±1.51, EE-1.51±0.14, NFE-49.55±2.12 per cent on dry matter basis.

Kumar and Garg (1997) studied the comparative evaluation of Signal (*Brachiara deiacumbens*) and Guinea (*Panicum maximum*) grasses in buffalo

heifers and reported the comparative chemical compositions of both grasses in table.

**Table 2.3 Chemical composition of Guinea grass and signal grass**

| Constituent (% DM Basis) | Guinea grass | Signal grass |
|---|---|---|
| **Organic Matter** | 92.45 ± 2.25 | 92.43 ± 2.21 |
| **Crude Protein** | 7.94 ± 0.48 | 8.34 ± 0.51 |
| **Ether Extract** | 2.75 ± 0.11 | 3.18 ± 0.19 |
| **Crude Fiber** | 29.80 ± 1.36 | 29.10 ± 0.42 |
| **ASH** | 7.55 ± 0.16 | 7.57 ± 0.18 |
| **Nitrogen Free Extract** | 51.96 ± 1.46 | 51.80 ± 1.54 |
| **DM intake(gm/kg)** | 96.03 ± 4.96 | 98.45 ± 5.21 |

Kumar and Garg (1996) reported the chemical composition of Baru (*Sorghum halpense)* grass fed to Murrah heifers as , DM- 32.60±1.60, OM - 94.13±4.70, CP-7.93±0.42, EE-2.48±0.14, CF-35.20±1.71 and NFE-48.52±2.61 per cent respectively.

Kumar and Garg (1996) reported the chemical composition of MP Chari *(Sorghum bicolor)* forage in Murrah heifers as, DM-32.43, OM-92.30, CP -7.56, CF-28.40, EE- 1.90 and NFE - 54.44 per cent, respectively.

Kumar and Garg (1994) reported the chemical composition of Guinea grass *(Panicum maximum)* in buffalo calves. As DM-37.60±1.60, OM-92.0±2.01, CP-7.56±0.42, EE-3.20±0.29, CF-34.90±1.48, NFE- 46.34±1.55, DCP-3.89±0.76, TDN- 56.22±2.78 per cent respectively.

Saha *et al*. (1991) reported the chemical composition of Para grass (*Brachiaria mutica*) in crossbred calves and reported chemical composition of Para grass as OM- 88.42, CP-15.70, and EE-2.77, CF-29.34 and NFE-40.61 per cent on DM basis.

Chauhan and Kakkar (1981) studied the nutritive evaluation of sugarcane tops of elite clones as fodder for buffalo calves and they reported the

chemical composition as DM-31.50, CP-4.87, EE-1.97, CF-27.80, NFE-59.47, and Ash-6.65 per cent respectively.

**2.2 Dry matter intake**

Jagdamba *et al* (2010) studied the nutritional evaluation of perennial fodder varieties suitable for low irrigation input areas in male buffalo calves, and reported the dry matter intake of of APBN-1-2.34±0.22, CO-3-2.30±0.24, Congo signal- 2.47±0.44, CO-63-2.29±0.17 per cent of body weight.

Khan *et al.* (2005) evaluated the nutritive value of Dinanath grass *(Pennisetum pedicellatum)* fed to Nil-Ravi buffaloes and observed the kg per day dry matter intake for five experimental as 13.0, 15.49, 16.45, 16.108, 15.68, respectively.

Bhatti *et al*. (2005) determined the nutritive value of Mott grass and Berseem fodder substituted with Saltbush fed to Nili-Ravi Buffalo heifers. A feeding experiment was conducted on fifteen buffalo heifers for twenty five weeks having five phases of five weeks each. The heifers were provided Mott + saltbush (50:50), Berssm + Saltbush (50:50), and Mott + Berseem + Saltbush (33.3:33.3:33.4) the diets designated as $T_1$, $T_2$, $T_3$, $T_4$, and $T_5$, respectively and observed DMI/day(kg) as 3.03 ± 0.12, 3.23 ± o.12, 2.65 ± 0.12 kg

Gwatumba *et al.* (2001) investigated the nutritive value of two Napier grass varieties fed as fresh green for Friesian cows. The average dry matter intake per cent body weight and g/ kg metabolic size remained 2.25g/kg and 2.26 g/kg, for Bana grass and French Cameroon varieties of Napier grass, respectively**.**

Singh *et al.* (2001) reported the voluntary DM intake per 100 kg body wt. of Buffalo calves in varieties of Naper bajara hybrid as PBN-233 higher (1.96±0.19) than PBN-83 (1.68±0.39) kg.

Kumar and Garg (1997) investigated the nutritive value of Dhawalu *(Chrysopogon fulvus)* grass in Murrah heifers. Conducting 7 days metabolic trial. The dry matter intake were observed 102.05Kcal/kgW0.75, body weight.

Kumar and Garg (1997) studied the comparative nutritive value of Signal (*Brachiaria decumbense)* and Guniea (*Pennisetum maximum*) grasses in Murraha heifers conducting 7 days metabolic trial. The dry matter intake was observed as 98.45± 5.21, 96.03 ±4.96g/$Kg^{W0.75}$, respectively.

Kumar and Garg (1996) determined the nutritive evaluation of Baru grass In Murraha heifers and reported the DM intake (kg/d) 5.64±0.28, DM intake for 100 kg body wt (2.39±0.12), DM intake / kg $W^o$ 75 94.27±4.7

Kumar and Garg (1996) determined the nutritive evaluation of MP Chari forage In Murraha heifers and reported the DM intake / kg $W^o$ 75 (g)-66.57.

Kumar and Garg (1994) studied the nutritive evaluation of Guinea grass in buffalo calves and reported the dry matter intake as 74.89 g/kg $W^{o75}$.

Saha *et al.* (1991) worked on nutritive value of Para grass (*Brachiaria mutica)* in crossbred calves. They reported DMI of Para grass in crossbred calves as 2.21±.0.08 kg/100 kg body weight.

Chauhan *et al.* (1980) determined nutritive value of five strains of Guinea grass *(Panicum maximum)* for buffalo calves by conducting seven days metabolic trial. The average DMI was given in following table

**Table 2.4 Average DMI of five strains of Guinea grass in buffalo calves.**

| Strains | Av. DMI (kg/day) | Av. DMI Per 100 kg BW per day |
|---|---|---|
| **No-59963** | 1.71 | 2.15 |
| **No-59917** | 1.98 | 2.32 |
| **No-59985** | 2.47 | 2.30 |
| **No-59996** | 1.87 | 1.99 |
| **No-Mixed red** | 1.87 | 2.13 |

**2.3 Digestibility coefficient**

Manzoor *et al.* (2013) evaluated the nutritive evaluation and *in-situ* digestibility of irrigated grass by fed on Buffaloes and reported DM and NDF digestibility of *Cencharis. cilaries* as grass 73.3, 62.67 per cent respectively.

Jagdamba *et al.* (2010) studied the nutritional evaluation of perennial fodder varieties suitable for low irrigation input areas in male buffalo calves and reported the digestible coefficient as shown in table.

**Table 2.5 Digestibility coefficient of different grasses (%)**

| Parameter | APBN-1 | CO-3 | Congo signal | CO-63 |
|---|---|---|---|---|
| **Dry Matter** | 57.84±5.64 | 59.81±4.78 | 56.37±4.45 | 57.40±4.48 |
| **Crude Protein** | 52.26±3.46 | 41.16±4.44 | 45.69±3.63 | 46.88±3.01 |
| **Ether Extract** | 50.04±4.53 | 51.94±4.21 | 55.27±2.27 | 53.76±5.42 |
| **Nitrogen Free Extract** | 65.56±3.34 | 62.00±3.76 | 64.84±2.85 | 57.92±4.56 |
| **Neutral Detergent Fiber** | 48.15±1.75 | 49.23±4.47 | 54.84±2.66 | 51.31±4.24 |

Tauqir *et al.* (2009) evaluated the nutritive value of Jumbo grass in lactating Nili-Ravi Buffaloes and reported the digestibility coefficient as DM-56.7, CP-71.3 per cent respectively.

Khan *et al.* (2006) studied nutritive value of Oat grass ensiled with molasses for Nili-Ravi buffaloes. They reported comparative digestibility coefficient of nutrients for Oat grass and Oat grass silage as, DM, NDF, 61.2, 58.6 per cent respectively for Oat grass and for oat grass silage DM, NDF 58.9, and 55.1 per cent respectively.

Gwatumba *et al*. (2001) evaluated nutritive values of two Napier grass varieties for Friesian cows. They reported digestibility coefficient of nutrients for Bana grass variety as DM- 57.5, CP-59.9, ADF-52.5, and NDF-54.5 per cent and for French Cameron variety as DM-57.6, CP-52.6, ADF-58.0, and NDF-59.4 per cent.

Kumar and Garg (1997) evaluated the nutritive value of Dhawalu grass *(Chrysopogon fulvus)* in Murra0ha heifers. They reported the digestibility coefficients as DM-63.26±3.17, OM-64.90±3.29, CP-52.28±2.18, CF-75.20±2.98, EE-54.20±2.19, and NFE-60.36±3.06 per cent, respectively.

Kumar and Garg (1997) evaluated the comparative chemical composition and nutritive value of Signal *(Brachiaria decumbense*) and Guinea (*Panicum maximum*) grasses in Murraha heifers. The average comparative nutrient digestibility coefficient are shown in following table.

**Table 2.6 Digestibility coefficient of Signal and Guinea grass on per cent basis)**

| Constituents | Signal grass | Guinea grass |
|---|---|---|
| **Dry Matter** | 64.65 ± 3.28 | 62.05 ± 3.08 |
| **Organic Matter** | 67.26 ± 4.08 | 63.18 ± 3.78 |
| **Crude Protein** | 55.80 ± 2.91 | 52.10 ± 2.63 |
| **Ether Extract** | 61.34 ± 2.98 | 55.95 ± 2.45 |
| **Crude Fiber** | 74.10 ± 4.19 | 69.94 ± 3.98 |
| **Nitrogen Free Extract** | 65.90 ± 3.66 | 61.44 ± 3.45 |

Kumar and Garg (1996) evaluated the nutritive evaluation of Baru grass in Murraha heifers and reported the digestibility coefficients as DM-63.32±3.15, OM-65.44±3.28, CP-54.63±2.81, EE-53.32±2.81, CF-73.67±3.66, NFE -62.64±3.93 per cent, respectively.

Kumar and Garg (1996) evaluated the nutritive evaluation of MP Chari forage in Murrah heifers and reported the digestibility coefficients as DM-59.32, OM-59.01, CP-60.20, EE-58.32, CF-65.10 and NFE-58.3 per cent respectively.

Kumar and Garg (1994c) studied the nutritive evaluation of Guinea grass in Buffalo calves, and reported the digestibility coefficients as DM-56.71±3.26, OM-59.07±3.86, CP-51.40±2.40, EE-60.04±2.92, NFE-63.20±4.86 per cent, respectively.

Yokota *et al.* (1992) worked on chemical composition and nutritive value of wilted Napier grass ensiled with or without molasses. The digestibility coefficients (per cent) reported as shown in following table.

**Table 2.7 Digestibility coefficients of Napier grass ensiled with/ without molasses in ruminants.**

| Constituents | Without molases (%) | With molasses (%) |
|---|---|---|
| **Dry Matter** | 54.29±1.77 | 58.07±3.85 |
| **Crude Protein** | 66.0±1.69 | 65.92±3.53 |
| **Neutral Detergent Fiber** | 54.33±1.70 | 56.67±3.99 |
| **Acid Detergent Fiber** | 58.34±1.52 | 60.56±3.60 |
| **Acid Detergent Lignin** | 17.10±3.96 | 20.63±7.06 |
| **Hemicellulose** | 46.92±2.93 | 49.32±4.74 |
| **Cellulose** | 64.29±1.27 | 66.23±3.11 |
| **Gross energy** | 55.05±1.12 | 57.07±4.31 |

Chauhan *et al.* (1980) determined nutritive value of five strains of Guinea grass *(Panicum maximum)* for buffalo calves. The data of apparent digestibility coefficient of various proximate principles are presented in following table.

**Table 2.8 Apparent digestibility coefficients of nutrients of five strains of Guinea grass (%)**

| Strains | DM | CP | CF | EE | NFE |
|---|---|---|---|---|---|
| **NO-59963** | 57.01±1.50 | 48.40±3.14 | 70.54±1.47 | 40.92±2.04 | 46.22±1.46 |
| **NO-59917** | 55.48±1.30 | 47.48±2.67 | 70.75±0.85 | 49.70±2.24 | 44.72±0.93 |
| **NO-59985** | 52.23±1.40 | 45.12±1.57 | 70.42±0.57 | 41.77±2.50 | 47.94±1.94 |
| **NO-59996** | 51.66±0.51 | 48.03±1.42 | 66.88±0.68 | 36.75±2.30 | 45.23±1.95 |
| **Mixed Red** | 48.48±0.99 | 47.50±2.02 | 66.74±20.50 | 34.02±2.12 | 35.64±1.22 |

**2.4 Mineral balance**

Rahman *et al.* (2014) studied the Effect of di-calcium phosphate on calcium balance and body condition score of dairy cows fed Napier grass and reported total Ca- intake (g/d) as 56.82±6.86, Ca in faces (g/d) 43.10±4.46, Ca

in urine (g/d) 3.16±0.36, Ca in milk (g/d) 7.62±0.39, total Ca-excretion (g/d) 53.88±5.32, Ca- balance (g/ day) 2.94±0.2

Manzoor *et al.* (2013) evaluated the nutritive values and in-situ digestibility of irrigated grasses in Buffaloes and observed mineral composition of irrigated grasses (g/kg DM) which is shown in following table

**Table 2.9 Mineral composition of different grasses (g/kg DM)**

| Botanical names | Ca | P | Mg | Na | K | Ca:P |
|---|---|---|---|---|---|---|
| ***Cencharies cilaris*** | 1.6 | 0.14 | 0.26 | 10.0 | 12.7 | 10.67 |
| ***Leptochloa fusa*** | 3.6 | 0.22 | 0.84 | 10.5 | 11.6 | 10.36 |
| ***Chloris gayana*** | 4.0 | 0.59 | 0.72 | 5.0 | 17.7 | 6.78 |
| ***Cynodon dactylon*** | 1.6 | 0.22 | 0.34 | 7.5 | 16.6 | 7.27 |
| ***Panicum colunum*** | 2.0 | 0.44 | 0.43 | 5.0 | 27.2 | 4.55 |

Rahman *et al.* (2012) reported the balance of Calcium with respect to oxalic acid intake in Napier grass fed to crossbred bulls as Ca intake (g/d)-12.10, Ca excretion through faces and urine(g/d)-10.89 and Ca balance (g/d)-1.21.

Foroughbakhch *et al.* (2012) worked on nutrient content and *in vitro* digestability of *(Glyricidia sepium)* and *(Leucaena leucocephala)* fed to the cattle and observed mineral balance which is as shown in following tables.

**Table 2.10 Mineral balance of Glyricidia species in cattle**

| Items | *Leucaena leucocephala* | *Glyricidia sepium* |
|---|---|---|
| **Ca (DM basis %)** | 1.46 | 1.28 |
| **Mg (DM basis %)** | 0.35 | 0.52 |
| **P (DM basis %)** | 0.26 | 0.28 |
| **Cu (ppm)** | 5.89 | 4.62 |
| **Fe (ppm)** | 110.02 | 75.62 |
| **Co( ppm)** | 0.05 | 0.04 |
| **MN (ppm)** | 30.03 | 38.36 |
| **Al (ppm)** | 122.12 | 43.28 |
| **Na (ppm)** | 72.53 | 112.61 |
| **Cr (ppm)** | 1.97 | 1.89 |
| **Zn (ppm)** | 13.38 | 15.37 |

Anonymous (2010) studied the nutritive evaluation of buffalo grass *(Paspalum conjugatu)* in cattle and reported the mineral composition as Ca-(3.6) and Phosphrus-(3.0 g/kg)

Venkat krishnan (2010) studied the nutritive evaluation of Para grass *(Brachiaria mutica)* in cattle and reported the mineral composition as Ca-(3.4) and Phosphrus-(2.4 g/kg)

Kumar and Garg (1997) investigated the nutritive value of Dhawalu grass *(Chrysopogon fulvus*) in Murraha buffaloes, and observed average P-balance (g/day) such as P-intake 83.20, vioded in faeces-39.70, voided in urine-38.19 and P retained (%of intake)-6.38, (% of absorbed) 12.21.

Kumar and Garg (1996) studied the nutritive evaluation of Baru grass in Murraha heifers and they reported Nitrogen balance as 3.68 ± 0.15(g/d).

Yokota *et al.* (1992) evaluated chemical composition and nutritive value of wilted Napier grass ensiled with or without molasses the positive P- balance was reported as 5.31 g/day.

Chauhan *et al.* (1980) determined nutritive value of five strains of Guinea grass (NO-59963, NO-59917, NO-59985, NO-59996 and Mixed red) *(Panicum maximum)* by feeding to buffalo calves. All the strains of Guinea grass maintained the calves in positive nitrogen balance (4.03 to 7.6 g / day).

**2.5 Nutritive value**

Manzoor *et al*. (2013) evaluated the nutritive value of irrigated grasses by feeding to ruminants and observed *in- situ* digestibilities of grasses.

**Table 2.11 In situ digestibility of in situ grasses in ruminants**

| Grasses | DM Digestibility (%) | NDF Digestibility (%) |
|---|---|---|
| ***Cencharies cilaris*** | 73.3 | 62.67 |
| ***Leptochloa fusa*** | 32.8 | 27.37 |
| ***Chlois gayana*** | 48.5 | 44.47 |
| ***Cynodon dactylon*** | 53 | 50.70 |

Jagdamba *et al.* (2010) studied the nutritional evaluation of perennial fodder varieties suitable for low irrigation input areas in male Buffalo calves and reported the nutritive value as shown in fallowing table.

**Table 2.12 Digestibility (%) of grasses in male buffalo calves**

| Parameter | ABPN-1 | CO-3 | Congo signal | CO-63 |
|---|---|---|---|---|
| **DCP** | 4.65 | 3.94 | 2.06 | 1.92 |
| **TDN** | 51.83 | 49.86 | 48.14 | 49.55 |

Gupta *et al.* (2002) reported the variation in nutritive value of two varieties of berseem in buffalo calves. The DCP and TDN values of BL-42 and BL-10 reported as 17.85, 16.31 and 68.89, 63.06 per cent respectively.

Mahanta *et al* (2001) reported the nutritive value (%) of Guar forage varieties in buffalo calves as shown in following table.

**Table 2.13 Nutritive value of Guar forage varieties (%)**

| Varieties of Guar forage | DCP % | TDN % |
|---|---|---|
| **BG-1** | 11.14 | 60.26 |
| **BG-2** | 9.38 | 57.55 |
| **BG-3** | 12.56 | 58.08 |

Singh *et al.* (2001) reported the comparative nutritive value of PBN-233 Napier bajara hybrid with the standard variety PBN-83 grass in buffalo calves. The nutritional quality in terms of DCP and TDN of PBN -233(7.99±0.31 and 67.6±7.8) was similar to that of PBN-83 (7.96±0.09 and 66.2±7.6) per cent respectively.

Gwatumba *et al.* (2001) evaluated nutritive value of Bana and French Cameroon varieties of Napier grass by feeding to Friesian cows. The DCP and TDN values were found in Bana and French Cameron varieties of Napier grass were as DCP 59.9 and 52.6 per cent, respectively and TDN percentage 52.4 and 52.6, respectively.

Giri *et al.* (2000) studied nutritive value of grain less diets containing different nitrogen levels by feeding to crossbreed growing bulls. They observed that DCP was significantly higher (P<0.05). The gross energy (GE) and digestible energy (DE) intake were not affected. The urinary loss of energy (UE) was significantly lower (p<0.05) in urea fed animals.

Kumar and Garg (1997) studied the nutritional evaluation of Dhawalu grass in Murraha heifers and reported the nutritive value as, DCP-4.11 ± 0.62 and TDN- 60.27 ± 2.41 per cent, respectively.

Kumar and Garg (1997) worked out comparative nutritive value of Signal *(Brachiaria decumbense)* and Guinea *(Panicum maximum)* grasses in Murraha heifers. The grasses contained DCP, TDN per cent and ME (Mcal per kg) shown in fallowing table.

**Table 2.14 Comparative digestibility (%) of grasses in Murraha heifers**

| Particular | Signal grass | Guinea grass |
|---|---|---|
| **DCP (%)** | 4.65 ± 0.92 | 4.14 ± 0.65 |
| **TDN (%)** | 64.80 ± 2.78 | 60.26 ± 2.62 |
| **ME (Mcal per kg)** | 2.33 ± 0.20 | 2.17 ± 0.16 |

Kumar and Garg (1996) studied the nutritive evaluation of Baru grass in Murraha heifers and reported nutritive value as DCP-4.33 ± 0.21 and TDN-63.49 ± 3.16 per cent respectively.

Kumar and Garg (1996) studied the nutritive evaluation of MP Chari forage in Murrah heifers and reported nutritive value as DCP-4.70 and TDN-56.20 per cent, respectively.

Kumar and Garg (1994) investigated the nutritional evaluation of Guinea grass in Buffalo calves and reported the nutritive value as DCP-3.89 ± 0.76 and TDN- 56.22 ± 2.78 per cent respectively.

Reddy *et al*. (1994) reported the DCP and TDN values in Colonial Guinea grass by feding to Murraha calves were 8.72 and 52.20 per cent, respectively.

Reddy and Reddy (1986) reported the values of DCP and TDN of NB-21 forage in Murraha buffalo heifers as 4.15, 54.84 per cent, respectively.

Chauhan *et al.* (1980) determined nutritive value of five strains of Guinea grass (NO-59963, NO-59917, NO-59985, NO-59996 and Mixed red) *(Panicum maximum)* by feeding to buffalo calves. The DCP and TDN values reported were as given below table.

**Table 2.15 Nutritive value of five strains of Guinea grass (%) in buffalo calves**

| Parameter | NO-59963 | NO-59917 | NO-59985 | NO-59996 | Mixed red |
|---|---|---|---|---|---|
| **DCP** | 5.68 | 5.29 | 4.00 | 5.31 | 5.57 |
| **TDN** | 49.40 | 48.26 | 49.67 | 48.14 | 43.99 |

**2.6 Body weight gain**

Alves *et al.* (2015) studied the growth curve of buffalo grazing on grass pasture and they observed body weight of two buffalo group grazing on tropical grass in different age, as given in following table.

**Table 2.16 Body weight gain of buffaloes grazing on grass pasture**

| Age (days) | Low body weight (kg) | High body weight (kg) |
|---|---|---|
| **Birth** | 45.8± 5.50 | 43.5±1.69 |
| **210** | 205.7±23.35 | 223.4±12.89 |
| **360** | 312.9± 17.41 | 340.5±10.86 |
| **540** | 380.4± 19.70 | 418.9±17.64 |
| **720** | 519.3±21.24 | 559.8±12.28 |

Bhatti *et al*. (2005) conduct study on nutritive value of Mott grass and Berseem fodder substituted with Saltbush feed in Nili-Ravi buffalo heifers and noted 0.43±0.01 daily weight gain (kg).

Muia *et al.* (2001) evaluated supplementation of Napier grass with sunflower meal or poultry litter-based concentrates to the Frisian cows. They noticed its observed effect on live weight change due to sunflower meal based

concentrates and poultry litter based concentrates as 435.4 and 438.2 kg respectively.

Gwatumba *et al.* (2001) carried out studies on the dry matter intake digestibility and milk yield by feding Bana grass and French Cameroon varieties of Napier grass to Friesian cows. They observed body weight change (Kg / day) 0.89 and 0.53 in Bana and French Cameroon varieties of Napier grass, respectively.

Giri *et al.* (2000) formulated grain less diets containing different nitrogen sources, barly 30 per cent in the concentrate mixture (Cm1) as source of grain, where as other concentrate mixture contained only wheat bran (Cm2),or wheat bran supplemented with urea 2.5%(Cm3), 21.5% groundnut oil cake(Cm4), 27% mustard oil cake (CM5) , feed for cross breed growing bulls and observed average daily live weight gains were 443, 344,370, 435, and 423 g in Cm1, Cm2, Cm3, Cm4, and Cm5 fed animals, respectively.

Abdulrazak *et al.* (1996) studied the effect of Napier grass supplementation with *Glyricidia sepium* or *Leucaena leucocephala* forage on intake and live-weight gains of *Bos taurus X Bos indicus*.They observed that live-weight gains were increased by supplementation from 306 to 478g/day.

Kumar and Garg (1996) studied the nutritive evaluation of Baru grass in Murrah heifers and reported the daily body wt. gain as 72.86 grams.

Kumar and Garg (1996) studied the nutritive evaluation of MP Chari forage in Murrah heifers and reported the daily body wt. gain as 49.05 grams.

Kumar and Garg (1994) studied the nutritive evaluation of Guinea grass in buffalo calves and reported the final body wt. as 113.50 ± 7.69 kg.

**2.7 Physiological responses**

Jacob *et al*.(2014) stated that feeding the grain to beef cattle and observed time post slaughter temperature (°C)after 1, 2, 3, 4, 5, and 20 hours as 39.78, 35.07, 30.25, 25.85, 22.48 and 7.93 (°C), respectively.

Singh *et al*. (2014) studied the effect of different season on feed efficiency, plasma hormones and milk production in lactating cows and observed the body temperature (°C) , respiration rate (per min.), pulse rate (per min.), rectal temperature (°F) in hot dry season 38.0, 68.4, 58.9,101 respectively and 30.2, 62.2,74.9,101, respectively in hot humid season.

Pearson and Smith (1994) conducted experiment on the effect of work on food intake and ingestive behavior of draught cattle and buffalo giving barely straw. They observed minimum and maximum temperature were 13.0°C and 19.8 °C respectively with average relative humidity 0.40 per cent. At these temperatures the animals showed minimal signs of heat stress during work and increased respiration rate.

Quartermain *et al.* (1960) observed some physiological effect of shading on dairy cattle as pulse rate 69-99 per minute, respiration rate 26-75 per minute, rectal temperature 101.3 to 102.35 °F, and body temperature 90.4 to 104.3 °F.

**2.8 Water intake**

Bhatti *et al. (*2005) studied the feed intake in Nili-Ravi buffalo heifers fed on Mott grass and observed higher daily intake of water in heifers as 6.85±0.26 liter/day.

Reddy and Reddy (1998) studied the utilization of expander v-extruder processed complete diet containing sunflower heads in male buffalo calves and they reported water intake as 2.79 liter/day.

Pearson and Smith (1994) studied the effect of forage type and level of feeding on the digestibility and gastrointestinal mean retention time of dry forages given to cattle and sheep and observed water intake 4.67, 3.12 (lit/kg DM) respectively.

**2.9 Feed Intake:**

Sath *et al.* (2012) studied the feed Intake, digestibility, and N retention in Cattle feed Rice Straw and Para grass combined with different levels of protein

derived from Cassava foliage. They formulated the feed with four treatments such as, $T_1$-Rice straw +Para grass, $T_2$- Rice straw + Para grass + Sun dried Cassava foliage (0.8 g CP/kg BW), $T_3$- Rice straw+ Para grass + Sun-dried Cassava foliage (1.6 g CP/kg BW BW), $T_4$- Rice straw+ Para grass + Sun-dried Cassava foliage (2.4 g CP/kg) and observed feed intake(g) of para grass for $T_1$, $T_2$, $T_3$, $T_4$, 1,304 ,1,280, 1,235 and 20.6, respectively , Rice straw, 2,173 1,962,1,971, respectively and Cassava foliage 0,460,875, 1.149, respectively.

Muia *et al.* (2001) studied the effect of supplementing Napier grass with poultry litter and sunflower meal based concentrates on feed intake and rumen fermentation in Friesian steers and observed optimal feed intake as 3.65 kg per day.

Kumar and Garg (1996) studied the nutritive evaluation of MP Chari forage in Murrah heifers and reported the intake of CP, DCP, TDN were 5.02, 3.12 and 37.37 gram, respectively.

# CHAPTER III

# MATERIAL AND METHODS

The present investigation was carried out to assess the nutritional evaluation of Sampoorna fodder (*Pennisetum glacum* × *Pennisetum purpureum*) in buffalo calves. The trial was conducted at Instructional Farm of the Department of Animal Husbandry and Dairy Science, College of Agriculture, Dapoli. This chapter deals with the information on material and methodology used to conduct the trial.

## 3.1 Climatological condition

Dapoli is situated on the west coast of Maharashtra at an altitude of 280 meters above mean sea level (MSL). It is located in the subtropical region at

170 45’ North latitude and 730 12’ East longitudes. The weather during summer day time is hot but pleasant during night. The maximum temperature reaches to about $37^0$C ($98.6^0$F) in summer and minimum temperature drops to about 80 $^0$C ($46.4^0$F) in winter. Thus, Dapoli has cold winter and hot summer. The average annual rainfall ranges from 3500-3900 mm, while relative humidity ranges from 55 to 96 per cent.

The data on climatic conditions during the period of experiment obtained from Meteorology Laboratory of the University on various parameters like maximum/minimum temperature, humidity and rainfall are presented in Appendix-II.

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### 3.3 Experimental period

Due to insufficient number of experimental animals with instructional farm during the experimental period, it was decided to carry out the experiment in two separate phases, i.e. from 14th February 2017 to 13th March, 2017 using 4 calves in first phase and from 29$^{th}$ March to 25$^{th}$ April 2017 using 2 calves from previous phase as second phase.

### 3.4 Management of experimental animals

#### 3.4.1 Experimental animals and their husbandry.

To maintain the health of the animals at optimum level, they were placed in a clean and well ventilated and hygienic byre. The house was disinfected with Korsolin (1%) before start of the trial; all the animals were dewormed with a broad spectrum dewormer 'Albomar'.

The experimental calves were secured individually with nylon rope and provided with individual feeder during the preliminary feeding period of 21 days. Total faeces and urine were collected and weighed every morning before feeding and faeces were subsampled to determine proximate composition.

#### 3.4.2 Watering of animals

Clean and fresh water was fed *ad. libitum* to each animal twice a day during the preliminary period of 21 days. The measured quantity of water was fed during the experimental period of seven days. The record of daily water offered, water intake and water leftover was maintained throughout the experimental period.

### 3.5 Feeding of experimental animals

#### 3.5.1 Procurement of fodder

Fresh Sampoorna fodder (*Pennisetum glaucum* × *Pennisetum purpureum*) was collected from "Fodder field" of Department of Animal Husbandry and Dairy Science, College of Agriculture, Dapoli.

### 3.5.2 Feeding

The basal feeds were offered into two equal parts at 8.30 A.M. and 15.00 P.M. hour. Feed intake and body weight changes were recorded daily and weekly interval, respectively. Leftover of feed was recorded daily at 8.00 A.M.

### 3.6 Physiological response

### 3.6.1 Respiration rate (per minute)

Respiration rate was recorded at weekly interval by counting the breath of animals per minute (Shinde *et al.,* 2016).

### 3.6.2 Body temperature ($^0$C)

The body temperature was taken at weekly interval by Infrared thermometer (HTC-MT-4). The infrared thermometer was kept in hand, then shut animals back, chest and head by non-contact infrared thermometer and after recorded observations were divided by three.

### 3.6.3 Rectal temperature ($^0$C)

The body temperature was taken at weekly interval by inserting the mercury thermometer (Meet digital thermometer) into the anus. The thermometer was kept in place until the temperature stabilized and then reading was taken.

### 3.7 Metabolic trial

The metabolic trial was conducted on six buffalo calves with pre-experimental period of 21 days, followed by seven days collection period. During the collection period animals feeding and watering was done in buyer. Record of individual feed offered, left over, faeces and urine voided was kept on 24 hours basis. The faeces and urine were collected weighed and measured, daily at the morning.

### 3.7.1 Sampling of feed

During the collection period of seven days the representative samples of feed offered were collected daily for dry matter estimation and proximate analysis.

### 3.7.2 Collection of faeces

While conducting metabolic trial, the collection of faeces by avoiding urine contamination is important. For this purpose throughout day and night watch was kept with the help of specially trained attendants, to ensure complete collection of faeces and urine voided out in 24 hours. As soon as the dung was passed out, it was immediately collected into labelled tins covered with lids, kept separately behind each animal.

### 3.7.3 Sampling of faeces

Every day at 7.30 a.m., the dung excreted during 24 hours was weighed accurately. After mixing of faeces, homogenous sample of faeces was stored in glass stoppered bottles allotted to each animal. In the laboratory 100g aliquot of total faeces of each animal was weighed in shallow trays and kept in hot air oven at 100°C for dry-matter and moisture estimation. The next day residue were weighed and quantitatively transferred in polythene bags marked for the respective animal. The process of collection, weighing and drying was continued for all the seven days. All the dry faeces were ground to make powder for further analysis.

Due to appreciable loss of nitrogen during the process of drying, the estimation of nitrogen from dry faeces may not be accurate (Kleiber *et al*., 1936). Thus to overcome this difficulty, an aliquot sample was taken (30-40g) and was added with 10 ml of 25 per cent $H_2SO_4$ and transferred to previously labeled bottles and stoppered. In this way the samples for all the seven days period of collection were preserved. At the end the preserved faeces in the bottle was mixed well and aliquot from this bottle was used for nitrogen estimation. (Banerjee, 1978).

### 3.7.4 Collection of urine

The urine was collected by means of specially designed bags fitted to each calf. The opening of urine collection bag was connected to a rubber tube which conveyed urine into empty bottle, kept inside the pit behind each animal. Every day at 7.30 a.m. the actual volume of urine voided out during 24 hours by the animals was measured separately and empty bottles were replaced.

### 3.7.5 Sampling of urine

Every day the urine was collected and measured. The aliquot sample from the measured volume of urine was taken which was added with 10ml of 25 per cent $H_2S0_4$ and poured in labelled bottles. This procedure continued for the seven days and aliquot was transferred to previously weighed and labelled bottles. Similarly, 30ml of urine was collected every day in bottles containing 1-2 drops of toluene for seven days for estimation of calcium and phosphorous.

## 3.8 Chemical analysis

The sample of Sampoorna fodder (*Pennisetum glacum* × *Pennisetum purpureum*) was analyzed for the proximate principles *viz.*, dry matter, crude protein, crude fiber, ether extract, nitrogen free extract, total ash (AOAC,1995). Similarly, collected samples of faeces were analyzed for proximate principles and urine samples for nitrogen, calcium and phosphorus contents (AOAC, 1995).

### 3.8.1 Dry matter

The moisture from sample is lost by the evaporation caused due to heat. The amount of material left after the evaporation of moisture was the dry matter.

$$\text{DM (\%)} = \frac{\text{Weight of sample after drying}}{\text{Weight of sample before drying}} \times 100$$

### 3.8.2 Crude protein

The crude protein was estimated by micro *Kjeldahl* method. Nitrogen of protein was converted into ammonium sulphate with sulphuric acid digestion. The acid digest was made strongly basic with sodium hydroxide and ammonia released was distilled into a boric acid solution and titrated with standard sulphuric acid solution.

$$\text{Crude protein (\%)} = \frac{V \times 0.0014 \times D \times 100}{W \times A} \times 6.25$$

Where,

V = Volume of 0.01 N $H_2SO_4$ used for titration (ml)

D = Dilution factor [volume made in volumetric flask (ml)]

W = Weight of sample (g)

A = Aliquot taken (ml)

### 3.8.3 Ether extract

Ether was continuously volatilized, condensed and allowed to pass through the sample in thimble extracting ether soluble material. When the process was completed the loss in the weight of sample was taken as the ether extract.

$$\text{Ether extract (\%)} = \frac{(\text{Wt. of thimble} + \text{Sample (g)} - (\text{Wt. of thimble} + \text{sample after extraction})}{(\text{Wt. of thimble} + \text{Sample(g)} - (\text{Wt. of thimble (g)}}$$

### 3.8.4 Crude fiber

A moisture and fat free samples were digested successively with dilute acid and alkali. The organic residues were collected in sintered crucible. The loss of weight after ignition was called crude fiber.

$$\text{Crude fiber (\%)} = \frac{\text{Loss of weight after ignition}}{\text{Original weight of sample}} \times 100$$

### 3.8.5 Nitrogen free extract

NFE of the feed was determined by subtracting cumulative proportion of Ash, Crude protein, Ether extract and Crude fiber from hundred.

$$\text{NFE (\%)} = 100 - (\%\ \text{Ash} + \%\ \text{CF} + \%\ \text{CP} + \%\ \text{EE})$$

### 3.8.6 Total ash

The sample was ignited at 600 $^0$C to burn all the organic matter. The inorganic matter that does not burn at this temperature was called ash.

$$\text{Ash (\%)} = \frac{\text{Weight of ash}}{\text{Weight of sample}} \times 100$$

### 3.8.7 Acid insoluble ash

The ash was digested with dilute HCl (1:1) to dissolve inorganic salt.

### 3.8.8 Calcium

Calcium was precipitated as oxalate and was titrated with standard potassium permanganate.

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### 3.8.9 Phosphorus

The organic matter of sample was digested by acid and treated with calcium oxide to form calcium phosphate. This was dissolved by alkali (N/10 NaOH) in titration for determining the phosphorus.

$$\text{P}\ \frac{\text{g}}{100\text{g}} = \frac{\text{Concentration} \times \text{Volume of extract made} \times 10 \times 1}{\text{Aliquot} \times \text{Weight of sample taken for extract} \times 1000}$$

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## 3.9. Statistical analysis

The University statistician was consulted for finalization of the statistical method for the planning of research work and data analysis, however, it was suggested that no statistical design was necessary for the metabolic trial.

# CHAPTER IV

# RESULTS AND DISCUSSION

Amongst the domesticated animal, buffalo has positively established its identity, especially in rural sector, as an animal offering secured income with least risk. Perennial grasses have more importance today, but there is bridge gap between demand and supply of feed and fodder. It is imperative to use the available sources like industrial byproduct, non-conventional feeds and available grasses etc.

Unfortunately, inadequate availability of feed and forages due to reduction in area and deterioration of grazing lands poses a serious threat to animal production because of high livestock density. The fodder are considered as staple food for small and large ruminants. Grasses are useful as protein supplements to straws and low protein feeds. The evaluation of nutritive value of fodder grasses and it's feeding for large ruminants has received great importance in recent times.

Keeping this in view, nutritional evaluation of Sampoorna (*Pennisetum glacum x Pennisetum purpureum*) fodder was carried out in buffalo calves. The results of the study are presented and discussed in this chapter under following heads:

4.1 Climatic conditions
4.2 Chemical composition
4.3 Dry matter intake
4.4 Water intake
4.5 Nutrient intake / outgo
4.6 Nutrient digested
4.7 Digestibility coefficient
4.8 Mineral balance
4.9 Nutritive value
4.10 Feed conversion efficiency
4.11 Body weight changes
4.12 Physiological responses

## 4.1 Climatic conditions

The details of climatic conditions in respect of temperature and humidity during the period of experiment are appended in Appendix- II.

## 4.2 Chemical composition

Common nutrients are taken into consideration for chemical analysis. Grasses are composed of water, organic and mineral matter. Organic matter consists of protein, fats, crude fiber and soluble carbohydrates. These constituents play an important role in the nutrition of animals. These nutrients present in the grass indicate the quality of the grass. The Sampoorna fodder was analyzed for chemical composition and the results obtained are presented in Table 4.1

### 4.2.1 Proximate principles:

#### 4.2.1.1 Dry matter:

Estimation of dry matter of feed is obvious for comparing and drawing the valid conclusions about the chemical composition studies. The dry matter content of Sampoorna fodder was 23.50 per cent.

The lower value of DM was reported by Khan *et al*. (2005) in oat grass 21.4 and 2 per cent.

**Table 4.1 Chemical composition of Sampoorna *(Pennisetum galaucum x Pennisetum purpureum*) fodder on (dry matter basis).**

| Sr. No. | Proximate composition | (%) |
|---|---|---|
| 1. | Organic matter | 32.39 |
| 2. | Dry matter | 23.50 |
| 3. | Crude protein | 9.93 |
| 4. | Ether extract | 5.90 |
| 5. | Crude fiber | 23.93 |
| 6. | Nitrogen free extract | 51.35 |
| 7. | Total ash | 8.89 |
| **Minerals** | | |
| 1. | Calcium | 0.13 |
| 2. | Phosphorus | 0.23 |

However, higher value of DM was reported by Kumar and Garg (1994, 1997) in Guinea and Dhawlu grass *i.e.* 37.70 ± 1.60 and 34.12 ± 1.60 per cent, respectively.

**4.2.1.2 Crude protein (CP)**

Crude protein in feeding stuffs includes the true protein containing a number of amino acids and non-protein nitrogenous compound such as the amides. The CP content of Sampoorna grass observed in the present study was 9.93 per cent. This value was comparable with earlier reports of Manzoor *et al.*(2013) They reported higher value of CP in *Cenhrus cilaries* and *Panicum dactylon* as 11.13 and 10.53 per cent, Tauqir *et al*. (2009) and Saha *et al.*(1991) also reported the higher value in Jumboo and Para grass as 11 and 15.70 per cent, respectively. However lower value reported by Manzoor *et al.(*2013) in *Chloris gayana* and *Panicum colunum* as 9.34 and 7.90 per cent respectively, Khan *et al.* (2005), Kumar and Garg (1997, 1994) also reported the lower value of CP in Oat, Dhawalu, Guinea grass than the present investigation as 4.70, 7.86 and 7.56 per cent ,respectively.

**4.2.1.3 Ether extract**

The ether extract comprises of fat, oil, pigments and fatty acids. The energy produced by fat is 2.25 times more as compared to protein. The ether extract content of Sampoorna grass was observed 5.90 per cent. The present value of EE was agreement with Jagdamba *et al*. (2010), who recorded 0.66 per cent EE in CO-3 grass, and 1.19 per cent in African Napier grass which lower as compared present investigation Kumar and Garg (1996, 1996) also reported the lower value of EE in Baru and MP Chari grass as 2.48, 1.90 per cent, respectively. Whereas the value reported by Kumar and Garg (1994), 3.2± 0.29 per cent in Guinea grass, which is nearly about same to the present investigating values.

#### 4.2.1.4 Crude fiber

The crude fiber consists of cellulose, variable proportion of hemicellulose and highly variable proportion of lignin along with some minerals. The crude fiber content of Sampoorna fodder was observed to be 23.93 per cent. Comparable results were also reported by Kumar and Garg. (1994,1996), in Guinea, Baru grass i.e. 34.90 ± 1.48 , 35.20 ± 1.71 per cent respectively Thomas and Antony (2014) reported the per cent value of CF in grasses as CO-2 (34.75), CO-3(28.62), KKM-1(33.67), IGFRI-3(31.48), IGFRI-7 (36.22). Those values are higher than present results of the Sampoorna fodder.

#### 4.2.1.5 Nitrogen free extracts (NFE)

The nitrogen free extract (NFE) is the fraction of the total carbohydrate and comprises of soluble sugar, starch, hemicelluloses and is the major source of energy for animals. In the present investigation Sampoorna fodder have 51.35 per cent the values of NFE reported by Chauhan and Kakkar for sugarcane top (1981) 59.47 per cent which is higher than the present result. Kumar and Garg (1997) stated the lower value in Dhawalu grass. ie.49.55 ± 2.12 and they were also observed the nearly same value for signal and Guinea grass i.e. 51.80±1.45 and 51.96 ± 1.46, respectively.

#### 4.2.1.6 Total ash

The value of total ash in Sampoorna fodder was found to be 8.89 per cent. Kumar and Garg (1997) reported total ash content in Signal grass and Guinea grass as 7.57 ± 0.18 per cent and 7.55 ± 0.16 per cent, respectively. Thomas and Antony (2014) reported the lower value of total ash in grasses like KKM-1 (7.40), Suguna (7.87), IGFRI-3 (6.03) and IGFRI-7 (6.13) per cent respectively, which compares favorably with present findings. Higher value of total ash was reported by Khan *et al.* (2006) 11.3 per cent.

### 4.2.3 Minerals

The minerals are equally important in the diet of adult as well as young ones. They play an important role in repair and formation of bones, digestive juices, blood etc. These are essential for the body development in growing animals.

#### 4.2.3.1 Calcium

Calcium is present in the body in large amount. Ninety-nine per cent of body calcium occurs in skeleton and teeth. Calcium content of Sampoorna fodder estimated during present investigation was 0.13 per cent, which was comparable to the values reported earlier by Manzoor *et al.* (2013) as 1.6, 3.6, 4.0, 1.6, 2.0 per cent in *Cenhrus cilari, Leptochloa fusca, Chloris gayana, Cynadon dactylon, Panicum colunum* grasses, respectively and these values are significantly higher than the values of present investigation.

#### 4.2.3.2 Phosphorous

Phosphorous is found in every cell of body, but most part of it is combined with calcium, particularly in the bones. The Sampoorna fodder contained 0.23 per cent of phosphorous which was comparable with value of Phosphorous reported by Manzoor *et al*. (2013) they observed highest values of phosphorus in *(Chloris gayana and Panicum colunum)* grasses i.e. 0.59 and 0.44 per cent, respectively lower value than present results in *(Cenhrus cilaris)* grass .i.e. 0.14 per cent and nearly same value in *(Cynadon dactylon)* grass i.e. 0.22 per cent.

### 4.3 Dry matter intake

The dry matter intake is good indicator of feed quality, its palatability and acceptability to the animals. The dry matter consumption by Buffalo calves through fodder varies widely depending upon species, breed and weight of animal, feed and physiological status involved.

In present investigation, the daily feed consumption of Sampoorna on dry matter basis and gram per kg dry matter basis, DM intake per 100 kg body weight and intake per metabolic body weight are presented in Table 4.2.

**Table 4.2: Average dry matter intake by experimental buffalo calves (per day per animal)**

| Animal No. | Body weight (kg) | Daily feed consumption | DM intake kg/ 100kg body wt. (kg) | DM intake (g/kg $W^{0.75}$) |
|---|---|---|---|---|
| | | On dry matter basis (g/day) | | |
| $C_1$ | 109.30 | 3102.00 | 2.84 | 91.78 |
| $C_2$ | 104.10 | 3008.00 | 2.89 | 92.30 |
| $C_3$ | 99.50 | 2667.20 | 2.68 | 84.68 |
| $C_4$ | 129.50 | 3445.10 | 2.66 | 89.74 |
| C5 | 106.40 | 3100.50 | 2.91 | 93.59 |
| C6 | 124.80 | 3352.30 | 2.69 | 89.77 |
| **Mean** | **112.27** | **3112.52** | **2.78** | **90.31** |
| **±SE** | **4.49** | **102.41** | **0.04** | **1.17** |
| **CV (%)** | **9.81** | **8.06** | **3.75** | **3.17** |

The average daily dry matter intake per 100 kg body weight was 2.78 ± 0.04 kg per day in buffalo calves fed on Sampoorna fodder. Higher values were reported by Bhatti *et al*. (2005) as 3.03 and 3.23kg DMI /100 kg body weight in Mott and Berseem fodder, respectively and Tauqir *et al*. (2009) as 2.86kg DMI /100 kg body weight in Jumbo grass for lactating buffalos, Saha *et al*. (1991) reported as 2.98 kg DMI / 100 kg body weight. The lower values were reported by Kumar and Garg (1996a) in baru grass as 2.39 ± 0.12kg/ day Chauhan *et al*. (1980) also reported the lower values in strains of Guinea grass as NO-59963 (1.71), NO-5971(1.98), NO-5996 (1.87) and NO-Mixed red (1.87) kg DMI/ 100 kg body weight, respectively.

The daily dry matter intake per kg of metabolic body weight ($W^{0.75}$) was in the range of 84.68 to 93.59 g/day with a mean value of 90.31 ± 1.17g/day. In comparison with the present findings higher values were reported by Kumar and Garg (1997) in Signal and Dhawalu grass as 98.45±5.21 and 96.03±4.96 g/

day respectively. Kumar and Garg (1996a) also reported the higher value in Baru grass as 94.27 ± 4.7. The lower values were reported by Kumar and Garg (1997) as 74.89 in Guinea grass. Kumar and Garg (1996b) stated the lower value in MP Chari forage as 66.57 g/Kg ($W^{0.75}$) / day. The present findings in respect to the consumption of Sampoorna fodder by buffalo calves indicated higher dry matter intake which may be due to the succulent nature of Sampoorna fodder in the initial stage and which clearly indicates higher palatability of Sampoorna fodder to buffalo calves.

### 4.4 Water intake

From the present investigation average weekly water intake by buffalo calves during metabolic trial was reported as average 14.83 ± 0.46 liter. And having average daily water intake during metabolic trial was 2.11 lit/ day. The present results comprised with Bhatti *et al.* (2005) who reported and higher daily intake of water in Mott and Berseem Grass fed to buffalo as 6.85±0.26 and 6.71 ± 0.26 lit daily, respectively. Reddy and Reddy(1998) reported the lower value of daily water intake in sunflower head fed to male calves as 2.79 lit/ day.

**Table 4.3 Average weekly water intake by buffalo calves during metabolic trial period (Lit.)**

| Animal no. | Water consumption (Lit./ Day/ Week) | Urine (Lit. / Day / Week) |
|---|---|---|
| **C1** | 15.10 | 4.60 |
| **C2** | 14.25 | 3.67 |
| **C3** | 12.72 | 4.34 |
| **C4** | 15.67 | 5.34 |
| **C5** | 15.00 | 4.99 |
| **C6** | 16.25 | 5.15 |
| **Mean** | **14.83** | **4.68** |
| **SE** | **0.46** | **0.56** |
| **CV (%)** | **7.59** | **12.00** |

### 4.5 Nutrient intake/ outgo

The average intake and outgo of nutrient per animal per day through Sampoorna grass in buffalo calves on per cent DM basis was calculated and are presented in Table 4.4 and 4.5. It was observed from the Table 4.4 that the average nutrient intake in buffalo calves in terms of OM, DM, CP, EE, CF, NFE, ASH, Ca and P. were 3389.22± 111.52, 3112.52± 102.41, 309.07 ± 10.17, 183.64± 6.04, 744.83± 24.51, 1598.28 ± 52.59,276.70± 9.11, 4.05±0.13 7.16± 0.24 g/day, respectively. However, it was seen from the Table 4.6 that the amount of average nutrient outgo through faeces found to be as OM-446.23± 21.16, DM-382.45± 20.77, CP-31.55± 1.71, EE-39.01± 2.12, CF-86.55± 4.49, NFE-171.34± 9.30 ASH- 63.79± 4.47,Ca-0.35± 0.02 and P- 0.58± 0.03 g/day.

### 4.6 Nutrient digested

The average nutrients digested by the animals during the experimental period were calculated and are tabulated in Table 4.6. It was observed from Table 4.7 that the average dry matter digested was 2730.07g.The corresponding values of retention in the body for OM, DM, CP, EE, CF, NFE, ASH, Ca, P were 2942.99± 129.40, 2730.07± 119.56, 277.52 ± 11.58, 144.63 ± 7.83, 658.28± 28.09, 1426.94 ± 60.24, 212.91± 10.86, 3.70±0.14, 6.59± 0.26 g/day. The nutrients like OM, DM, CP, and NFE were observed to be highly digested in $C_4$ with the values 3371.56, 3112.66, 314.67and 1620.13 g/day, respectively.

However, variation observed in the experimental animals for nutrient digestion may be because of the individual's ability to digest nutrients with the help of microbial fauna present in rumen of the respective animal.

**Table 4.4: Average intake of nutrients through Sampoorna (*Pennisetum glaucum x Pennisetum purpureum*) Fodder in buffalo calves (g/day)**

| Animal No | OM | DM | CP | EE | CF | NFE | Ash | Ca | P |
|---|---|---|---|---|---|---|---|---|---|
| **$C_1$** | 3377.77 | 3102.00 | 308.03 | 183.02 | 742.31 | 1592.88 | 275.77 | 4.03 | 7.14 |
| **$C_2$** | 3275.41 | 3008.00 | 298.69 | 177.47 | 719.81 | 1544.61 | 267.41 | 3.91 | 6.92 |
| **$C_3$** | 2904.30 | 2667.20 | 264.85 | 157.37 | 638.26 | 1369.61 | 237.10 | 3.47 | 6.14 |
| **$C_4$** | 3751.37 | 3445.10 | 342.10 | 203.26 | 824.41 | 1769.06 | 306.27 | 4.48 | 7.92 |
| **C5** | 3376.14 | 3100.50 | 307.88 | 182.93 | 741.95 | 1592.11 | 275.64 | 4.03 | 7.13 |
| **C6** | 3650.32 | 3352.30 | 332.88 | 197.79 | 802.21 | 1721.41 | 298.02 | 4.36 | 7.71 |
| **Mean** | **3389.22** | **3112.52** | **309.07** | **183.64** | **744.83** | **1598.28** | **276.70** | **4.05** | **7.16** |
| **±SE** | **111.52** | **102.41** | **10.17** | **6.04** | **24.51** | **52.59** | **9.11** | **0.13** | **0.24** |
| **CV (%)** | **8.06** | **8.06** | **8.06** | **8.06** | **8.06** | **8.06** | **8.06** | **8.05** | **8.02** |



**Table 4.5: Average outgo of nutrients through faeces (g/day) in buffalo calves**

| Animal No | OM | DM | CP | EE | CF | NFE | Ash | Ca | P |
|---|---|---|---|---|---|---|---|---|---|

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **$C_1$** | 491.29 | 430.01 | 35.48 | 43.86 | 96.75 | 192.65 | 61.28 | 0.39 | 0.65 |
| **$C_2$** | 491.88 | 430.53 | 35.52 | 43.91 | 96.87 | 192.88 | 61.35 | 0.39 | 0.65 |
| **$C_3$** | 486.68 | 425.98 | 35.14 | 43.45 | 95.85 | 190.84 | 60.7 | 0.38 | 0.64 |
| **$C_4$** | 379.81 | 332.44 | 27.43 | 33.91 | 77.8 | 148.93 | 47.37 | 0.3 | 0.5 |
| **C5** | 457.83 | 373.74 | 30.83 | 38.12 | 84.09 | 167.44 | 84.09 | 0.34 | 0.56 |
| **C6** | 369.91 | 301.97 | 24.91 | 30.8 | 67.94 | 135.28 | 67.94 | 0.27 | 0.45 |
| **Mean** | **446.23** | **382.45** | **31.55** | **39.01** | **86.55** | **171.34** | **63.79** | **0.35** | **0.58** |
| **±SE** | **21.16** | **20.77** | **1.71** | **2.12** | **4.49** | **9.30** | **4.47** | **0.02** | **0.03** |
| **CV (%)** | **11.62** | **13.30** | **13.30** | **13.30** | **12.71** | **13.30** | **17.18** | **13.47** | **13.65** |

**Table 4.6: Average nutrients digested in buffalo calves (g/day)**

| Animal No | OM | DM | CP | EE | CF | NFE | Ash | Ca | P |
|---|---|---|---|---|---|---|---|---|---|
| **$C_1$** | 2886.48 | 2671.99 | 272.55 | 139.16 | 645.56 | 1400.23 | 214.49 | 3.64 | 6.49 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **$C_2$** | 2783.53 | 2577.47 | 263.17 | 133.56 | 622.94 | 1351.73 | 206.06 | 3.52 | 6.27 |
| **$C_3$** | 2417.62 | 2241.22 | 229.71 | 113.92 | 542.41 | 1178.77 | 176.4 | 3.09 | 5.5 |
| **$C_4$** | 3371.56 | 3112.66 | 314.67 | 169.35 | 746.61 | 1620.13 | 258.9 | 4.18 | 7.42 |
| **C5** | 2918.31 | 2726.76 | 277.05 | 144.81 | 657.86 | 1424.67 | 191.55 | 3.69 | 6.57 |
| **C6** | 3280.41 | 3050.33 | 307.97 | 166.99 | 734.27 | 1586.13 | 230.08 | 4.09 | 7.26 |
| **Mean** | **2942.99** | **2730.07** | **277.52** | **144.63** | **658.28** | **1426.94** | **212.91** | **3.70** | **6.59** |
| **±SE** | **129.40** | **119.56** | **11.58** | **7.83** | **28.09** | **60.24** | **10.86** | **0.14** | **0.26** |
| **CV (%)** | **10.77** | **10.73** | **10.22** | **13.26** | **10.45** | **10.34** | **12.50** | **9.81** | **9.68** |

**Table 4.7: Average digestibility coefficients for nutrients in buffalo calves (% DM basis)**

| Animal no. | OM | DM | CP | EE | CF | NFE | Ash | Ca | P |
|---|---|---|---|---|---|---|---|---|---|
| **$C_1$** | 85.46 | 86.14 | 88.48 | 76.04 | 86.97 | 87.91 | 77.78 | 90.32 | 90.90 |
| **$C_2$** | 84.98 | 85.69 | 88.11 | 75.26 | 86.54 | 87.51 | 77.06 | 90.03 | 90.61 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **$C_3$** | 83.24 | 84.03 | 86.73 | 72.39 | 84.98 | 86.07 | 74.40 | 89.05 | 89.58 |
| **$C_4$** | 89.88 | 90.35 | 91.98 | 83.32 | 90.56 | 91.58 | 84.53 | 93.30 | 93.69 |
| **C5** | 86.44 | 87.95 | 89.99 | 79.16 | 88.67 | 89.48 | 69.49 | 91.56 | 92.15 |
| **C6** | 89.87 | 90.99 | 92.52 | 84.43 | 91.53 | 92.14 | 77.20 | 93.81 | 94.16 |
| **Mean** | **86.64** | **87.52** | **89.64** | **78.43** | **88.21** | **89.12** | **76.74** | **91.35** | **91.85** |
| **±SE** | **1.01** | **1.02** | **0.85** | **1.77** | **0.94** | **0.89** | **1.83** | **0.71** | **0.68** |
| **CV (%)** | **2.85** | **2.86** | **2.33** | **5.53** | **2.60** | **2.45** | **5.83** | **1.90** | **1.80** |

## 4.7 Digestibility coefficients

It is the proportion of a nutrient taken in to the digestive tract that is actually digested – compare biological value. The average digestibility coefficients for different proximate principles in Sampoorna fodder for buffalo calves were calculated and are tabulated in Table 4.7.

### 4.7.1 Organic matter

The average digestibility coefficient of OM in experimental buffalo calves was found to be 86.64± 1.01 per cent. This value is higher than the values reported by Kumar and Garg (1997) in Signal 67.26±4.08 and Guinea grass 63.18±3.78 per cent, Kumar and Garg (1997) 64.90±3.29 per cent in Dhawalu grass, Kumar and Garg (1994) 59.07±3.86 per cent in Guinea grass, Kumar and Garg (1996a) 65.44±3.28 per cent in Baru grass and Kumar and Garg (1996b) 59.01 per cent in MP Chari forage.

### 4.7.2 Dry matter

The average dry matter digestibility coefficient in experimental buffalo calves fed on Sampoorna fodder is observed to be 87.52 ± 1.02 per cent. The lower DM digestibility coefficients were reported by Tquqir *et al*. (2009) in Jumbo grass as 56.07 per cent in buffalo., Manzoor *et al.* (2013) reported the dry matter digestibility coefficient in (*Cenhrus cilaries*), (*Leptochlo fusca*), (*Chloris gayana*), (*Cynadon dactylon*),( *Panicum colunum*) grasses as 73.3, 32.8, 48.5, 53,66.2 per cent respectively, fed to male buffalo bulls. Chauhan *et al*. (1980) reported the digestibility coefficient of five strains Guinea grass as No-59963 (57.01±1.50), NO-59917 (55.48±1.30), NO-59985 (52.31±1.40), NO-59996 (51.66±0.51) and Mixed Red (48.48±0.99 ) per cent Kumar and Garg (1994) observed dry matter digestibility coefficient of Guinea grass in buffalo calves as 56.71 ± 3.2 per cent. Kumar and Garg (1997) reported the digestibility coefficient of Signal and Guinea grass in Murrah heifers as 64.65 ± 3.28 and 62.05 ± 3.08 per cent respectively. Kumar and Garg (1994a) reported the digestibility coefficient of Dhawalu grass in Murraha heifers as 63.26 ± 3.17 per cent. Kumar and Garg (1996a) found the digestibility coefficient of DM of Baru grass in Murraha heifers as 63.22 ± 3.15 per

cent. Kumar and Garg (1996b) stated the digestibility coefficient of MP Chari forage in Murraha heifers as 59.32 per cent.

### 4.7.3 Crude protein

The average digestibility coefficient of crude protein in experimental buffalo calves was 89.64 ± 0.85 per cent. However, significantly lower digestibility for CP was reported by Tauqir *et al.* (2003), in Jumboo grass fed Buffalo as 71.3 per cent. Kumar and Garg (1994c) also reported the lower value of Guinea grass fed to buffalo calves as 51.40 ± 2.40. Kumar and Garg (1997) reported the value of Signal ,Guinea grass and Dhawlu grass fed to buffalo heifers as 55.80 ± 2.91, 52.10 ± 3.78 and 64.90 ± 3.29 per cent respectively. Kumar and Garg (1996a) stated the value of Baru grass fed to buffalo heifers as 54.63 ± 2.81 per cent. Kumar and Garg (1996b) found the value of MP Chari forage fed Murraha heifers as 60.20 per cent. Jagdamba *et al*. (2010) observed the digestible coefficient of Crude protein in varieties of grasses fed to and buffalo calves as APBN-1-(57.84 ± 5.64), Co-3 (59.81 ± 4.78), Congo signal-(56.37 ± 4.45 ) and Co-63 (57.40 ± 4.48) per cent.

### 4.7.4 Ether extract

The digestibility coefficient for ether extract in buffalo calves feeding on Sampoorna fodder was observed to be 78.43 ± 1.77 per cent. Present values are comparable with earlier report given by Chauhan *et al*. (1980) of five strains of Guinea grass in buffalo calves as No-59963 (40.92 ± 2.04), No-59917 (49.70 ± 2.24), No-59985 (41.77 ± 2.50), No-59996 (36.75 ± 2.30) and Mixed Red- (34.02 ± 2.12) per cent Jagdamba *et al.* (2010) reported the value of ether extract digestibility coefficient in varieties of grasses fed to the buffalo calves as APBN-1 (52.26 ± 3.46), Co-3 (41.16 ± 4.44), Congo signal-(45.69 ± 3.63 ) and Co-63 (46.88 ± 3.01) per cent. Kumar and Garg (1994) reported the value of ether extract coefficient Guinea grass fed to buffalo calves as 60.04 ± 2.92 per cent. Kumar and Garg (1997 a, b) found the values of ether extract digestibility coefficient in Dhawalu grass, Signal grass and Guinea grass by fed to buffalo heifers as 54.20 ± 2.19, 61.34 ± 2.89 and 55.95 ± 2.45 per cent respectively. Kumar and Garg (1996a)

reported the values of ether extract digestibility coefficient in Baru grass fed to buffalo heifers as 53.32 ± 2.81 per cent. Kumar and Garg (1996b) narrated the value of ether extract digestibility coefficient of MP Chari forage in Murraha heifers as 58.32 per cent.

### 4.7.5 Crude fiber

The average crude fiber digestibility during present investigation was found to be 88.21 ± 0.94 per cent. The present value was superior as compared to the CF digestibility reported by Kumar and Garg (1994) in Guinea grass fed to buffalo calves as 60.40 ± 3.12 per cent. Kumar and Garg (1997a, b) found the value of crude fiber digestibility coefficient in Dhawalu, signal, and Guinea grass fed to the buffalo heifers, as 54.02 ± 2.19, 61.34 ± 2.98, and 69.94 ± 3.98 per cent respectively. Kumar and Garg (1996a) reported the value of Crude fiber digestibility coefficient in Baru grass fed to Buffalo heifersas 73.67 ± 3.66 per cent. Kumar and Garg (1996b) found the value of Crude fiber digestibility coefficient of MP Chari forage in Murraha heifers as 65.20 per cent. Chauhan *et al.* (1980) observed the value of crude fiber digestibility coefficient in five strains of Guinea grass in buffalo calves as NO-59963 (70.54 ± 1.47), NO-59917(70.75 ± 0.85), NO-59996 (66.88 ± 0.68) and Mixed Red (66.74 ± 20.50) per cent. Jagdamba *et al.* (2010) mentioned the value of crude fiber digestibility coefficient in varieties of grasses fed to buffalo calves as APBN-1 (50.04 ± 4.53),Co-3 (51.94 ± 4.21), Congo signal (55.27 ± 2.27 ) and co-63 (53.76 ± 5.42) per cent.

### 4.7.6 Nitrogen free extract

In the present investigation the average digestibility coefficient for NFE in Sampoorna fodder was worked out to be 89.12 ±0.89 per cent. Value reported by Kumar and Garg (1994) in Guinea grass fed to the buffalo calves was 63.20 ± 4.86 per cent. Kumar and Garg (1996a) mentioned the value of NFE digestibility coefficient in Baru grass fed to the buffalo heifers as 62.64 ± 3.93 per cent. Kumar and Garg (1997) reported the value of Dhawalu, Signal and Guinea grass fed to the buffalo heifers observed as 60.36 ± 3.06, 51.80 ± 1.54 and 51.96 ± 1.46 per cent, respectively. Kumar and Garg (1996b) observed the NFE digestibility coefficient of

Mp Chari forage in Murraha heifers as 58.3 per cent. Jagdamba *et al.* (2010) reported the values for variety of grasses fed to the buffalo calves such as ABPN-1(65.56 ± 3.34), Co-3(62.00 ± 3.76), and Co-63 (57.92 ± 4.24) per cent.

### 4.8 Mineral balance

#### 4.8.1 Nitrogen balance

The data for intake, excretion and retention of nitrogen is tabulated in Table 4.8. The average daily intake N in the experimental animal through Sampoorna fodder was 55.44 ± 1.62 g/day. However, N excretion through faeces 5.05 ± 0.27 (g/d). N excretion through urine 26.38 ± 0.72 (g/d), total excretion of N through faeces and urine was observed to be 32.88 ± 0.97 g/day.

The gross retention of nitrogen in experimental buffalo calves was found to be 22.56 ± 2.47 g/day. Whereas, the retention per kg metabolic body weight ($W^{0.75}$) was 0.64 ± 0.05 g/kg. The per cent retention of N to total intake was worked out to be 40.12 ± 3.33 in experimental buffalo calves.

Kumar and Garg (1997) they reported as 3.68 ± 0.15 positive N balance of nitrogen intake in Baru grass fed to four Murrah heifers for its nutritional evaluation. They reported positive (3.68 ± 0.15) N Balance.

Yokota *et al.* (1992) reported intake of nitrogen 5.31, faecal nitrogen 1.81 ± 0.09, and urinary nitrogen 3.96 ± 0.014, retained nitrogen 0.45 ± 0.13 g/day, respectively.

#### 4.8.2 Calcium balance

The data for intake, excretion and retention of calcium is tabulated in Table 4.8. The average daily intake of Ca in the experimental animal through Sampoorna fodder was 4.05 ± 0.13 g/day. However, Ca excretion through faeces 0.35 ± 0.02 (g/d), Ca excretion through urine- 0.28 ± 0.01 (g/d), total excretion of Ca through faeces and urine was observed to be 0.63 ± 0.01 g/day.

The gross retention of Calcium in experimental buffalo calves was found to be 3.42 ± 0.14 g/day. Whereas, the retention per kg metabolic body weight ($W^{0.75}$)

was 0.09 ± 0.002 g/day. The per cent retention of Ca to total intake was worked out to be 84.39 ± 0.70 in experimental buffalo calves.

Rahman *et al*. (2012) reported the balance of Calcium with respect to oxalic acid intake in Napier grass fed by male buffaloes as calcium intake 12.10 g/day excretion through feces and urine 10.89 g/day and Ca balance of 1.21g/day. Rahman *et al.* (2014) observed the effect of di- calcium phosphate on calcium balance of dairy cows fed Napier grass and reported higher values than the present investigation. The total Ca intake was 56.82 ± 6.86 g/d, Ca execrated in feces 43.10 ± 4.46 g/d, Ca execrated in urine 3.16 ± 0.36 g/d. Therefore, the total excretion of calcium was found 46.26 ± 4.82 g/day.

### 4.8.3 Phosphorus balance

The average intake, excretion and balances of phosphorus per day in the experimental buffalo calves fed on Sampoorna fodder is presented in Table 4.9. The average intake of phosphorus in experimental buffalo calves 7.16 ± 0.24 g/day. However, total excretion of phosphorus through faeces and urine was observed to be 0.94 ± 0.02 g/day. The average gross retention of phosphorus in buffalo calves was 6.22 ± 0.25 g/day. The retention per kg metabolic body weight ($W^{0.75}$) was observed to be 0.18 ± 0.003 g/day. The retention of phosphorus to total intake was calculated as 86.6 ± 0.66 per cent.

Kumar and Garg (1997) found the phosphrus balance in Dhawalu grass fed to the murrrah heifers as, P intake 83.20 g/day, Voided in feces 39.70 g/ day, voided in urine 38.19g/day,P- balance+5.31 , P retained (%of intake 6.38), (%of absorbed 12.21). Yokota *et al.* (1992) reported the P- balance as 5.31g/d in Napier grass.

## Table 4.8: Average intake, excretion and balance of Nitrogen, Calcium and Phosphorus (g/day) in buffalo calves

| Parameters | Balance of nutrients (g/day) | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Nitrogen | | | | | | | | | Calcium | | | | | | | | | Phosphorus | | | | | | | |
| | $C_1$ | $C_2$ | $C_3$ | $C_4$ | $C_5$ | $C_6$ | Mean | +SE | CV% | $C_1$ | $C_2$ | $C_3$ | $C_4$ | $C_5$ | $C_6$ | Mean | +SE | CV% | $C_1$ | $C_2$ | $C_3$ | $C_4$ | $C_5$ | $C_6$ | Mean | +SE | CV% |
| **Intake** | 55.23 | 53.79 | 48.38 | 60.74 | 55.26 | 59.26 | 55.44 | 1.62 | 7.18 | 4.03 | 3.91 | 3.47 | 4.48 | 4.03 | 4.36 | 4.05 | 0.13 | 1.55 | 7.14 | 6.92 | 6.14 | 7.92 | 7.13 | 7.71 | 7.16 | 0.24 | 8.02 |
| **Excretion through** | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **(I)Faecs** | 5.68 | 5.68 | 5.62 | 4.39 | 3.99 | 3.99 | 5.05 | 0.27 | 13.27 | 0.39 | 0.39 | 0.38 | 0.3 | 0.34 | 0.27 | 0.35 | 0.02 | 13.45 | 0.65 | 0.65 | 0.64 | 0.5 | 0.56 | 0.45 | 0.58 | 0.03 | 13.65 |
| **(II) Urine** | 28 | 30 | 29 | 26 | 29 | 25 | 26.38 | 0.72 | 6.37 | 0.28 | 0.22 | 0.26 | 0.32 | 0.3 | 0.31 | 0.28 | 0.01 | 12.03 | 0.34 | 0.29 | 0.35 | 0.42 | 0.4 | 0.41 | 0.368 | 0.02 | 12.48 |
| **Total Excretion** | 33.68 | 35.68 | 34.62 | 30.39 | 33.93 | 28.99 | 32.88 | 0.97 | 7.23 | 0.67 | 0.61 | 0.64 | 0.62 | 0.64 | 0.58 | 0.63 | 0.01 | 4.48 | 0.99 | 0.94 | 0.99 | 0.92 | 0.96 | 0.86 | 0.94 | 0.02 | 4.77 |
| **Retention** | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Gross retention** | 21.55 | 18.11 | 13.76 | 30.35 | 21.33 | 30.27 | 22.56 | 2.47 | 26.83 | 3.36 | 3.3 | 2.83 | 3.86 | 3.39 | 3.78 | 3.42 | 0.14 | 9.92 | 6.15 | 5.98 | 5.15 | 7 | 6.17 | 6.85 | 6.22 | 0.25 | 9.77 |
| **Retention G/Kg** | 0.64 | 0.55 | 0.43 | 0.79 | 0.64 | 0.81 | 0.64 | 0.05 | 20.42 | 0.1 | 0.1 | 0.09 | 0.1 | 0.1 | 0.1 | 0.09 | 0.002 | 3.79 | 0.18 | 0.18 | 0.16 | 0.18 | 0.18 | 0.18 | 0.18 | 0.003 | 4.22 |
| **Retention of total intake (%)** | 39.0 | 33.66 | 28.44 | 49.96 | 38.59 | 51.07 | 40.12 | 3.33 | 20.31 | 83.37 | 84.40 | 81.56 | 86.16 | 84.12 | 86.70 | 84.39 | 0.70 | 2.03 | 86.13 | 86.42 | 83.88 | 88.38 | 86.54 | 88.85 | 86.69 | 0.66 | 1.87 |

**4.9 Nutritive value**

Quality of any green fodder is primarily judged on the basis of palatability, digestible crude protein (DCP), available energy i.e. Total digestible nutrient (TDN) and other nutrients like minerals and vitamins available from the feed. The DCP and TDN values of Sampoorna fodder were calculated on per cent DM basis and are presented in Table 4.9.

The nutritive value of Sampoorna fodder was calculated from the average digestibility coefficients of various nutrients. The average DCP and TDN values of Sampoorna were 8.90 ± 0.09 per cent and 86.18 ± 1.00 per cent, respectively.

It was noticed that the calculated DCP of Sampoorna fodder was comparable with DCP value reported by Kumar and Garg (1997), in Signal grass (4.65 ± 0.92 %), Guinea grass (4.148 ± 0.65%) and Kumar and Garg (1997) Dhawalu grass (4.11 ± 0.62%). Kumar and Garg (1996) reported the DCP value of MP Chari forage as 4.70 per cent. Singh *et al*. (2001) reported the nearly same values of Napier Bajara hybrid verities fed to the buffalo calves as PBN-233 (7.99 ± 0.31) per cent and PBN-83 (7.96 ± 0.09) per cent. Mahanta *et al*. (2001) fed varieties of Guar forage BG-1, BG-2, BG-3 to the buffalo calves and observed the higher values than present investigation of Sampoorna fodder as 11.4, 9.38 and 12.56 per cent, respectively. Significantly lower value of TDN was reported by Jagdamba *et al*. (2010) in varieties of grasses fed to the buffalo calves as APBN-1 (51.83),Co-3 (48.86), Congo signal (48.14) and Co-63 (49.55) per cent. Singh *et al*. (2001) stated the nutritional quality of PBN-233 and PBN-83 in buffalo calves as 67.6±7.8 and 66.2 ± 7.6 per cent, respectively. Mahanta *et al.* (2001) mentioned the TDN values of Guar forage varieties as BG-1 (60.26), BG-2 (57.55), and BG-3 (58.08) per cent. Reddy and Reddy reported the value of TDN of NB-21 forage in Murrah buffalo heifers as 52.20 per cent. Gupta *et al* (2002) noticed the TDN value of two varieties of Berseem in buffalo calves as BL-(4268.89 ) and BL-10 (63.06) per cent .Kumar and Garg (1997) found the TDN value of signal grass, Guinea grass and Dhawalu grass in Murraha heifers as 64.80 ± 2.78, 60.26 ± 2.62 and 60.27 ± 2.41 per cent, respectively. Kumar and Garg (1994) reported the TDN

value of Guinea grass in Buffalo calves as 56.22 ± 2.78 per cent. Kumar and Garg (1996a) narrated the TDN value of Baru grass in buffalo heifers as 63.49 ± 3.16 per cent. Kumar and Garg (1996) reported the TDN value of MP Chari forage in heifers as 56.20 per cent.

**Table 4.9: Nutritive value of experimental feed (%) on DM basis**

| Animal No | Nutritive value | | Intake g/day | |
|---|---|---|---|---|
| | DCP | TDN | DCP | TDN |
| $C_1$ | 8.79 | 84.83 | 30.59 | 1050.47 |
| $C_2$ | 8.75 | 84.39 | 29.66 | 1018.63 |
| $C_3$ | 8.61 | 82.75 | 26.29 | 903.22 |
| $C_4$ | 9.13 | 88.89 | 33.97 | 1166.64 |
| C5 | 8.94 | 86.62 | 30.57 | 1049.95 |
| C6 | 9.19 | 89.61 | 33.06 | 1135.23 |
| **Mean** | **8.90** | **86.18** | **30.69** | **1054.02** |
| **±SE** | **0.09** | **1.00** | **1.01** | **34.68** |
| **CV (%)** | **2.33** | **2.85** | **8.07** | **8.06** |

## 4.10 Feed conversion efficiency

The feed conversion efficiency showed by buffalo calves fed on Sampoorna fodder was 1: 6.92 and was classified as medium nutritive ratio. This indicates that the growing animals are in healthy status and the digestibility and conversion efficiency of feed is very high may be due to the active microbial protein synthesis in the rumen of the animals

## 4.11 Body weight changes

The observation regarding body weight changes of animals on feeding Sampoorna fodder during experimental period are presented in Table 4.10.

**Table: 4.10 Body weight changes in buffalo calves with feeding of Sampoorna fodder**

| Animal No. | Body weight (kg) | | Difference (kg) | Gain/day (g) |
|---|---|---|---|---|
| | Initial | Final | | |
| $C_1$ | 98.1 | 109.3 | 11.2 | 400.00 |
| $C_2$ | 94.3 | 104.1 | 9.8 | 350.00 |
| $C_3$ | 89.53 | 99.5 | 9.97 | 356.10 |
| $C_4$ | 114.1 | 129.5 | 15.4 | 550.00 |
| C5 | 93.66 | 106.4 | 12.74 | 455.00 |
| C6 | 108.39 | 124.8 | 16.41 | 586.10 |
| **Mean** | **99.68** | **112.27** | **12.59** | **449.53** |
| **SE** | **3.55** | **4.49** | **1.04** | **37.22** |
| **CV (%)** | **8.73** | **9.81** | **20.28** | **20.28** |

The average body weight of experimental group at the start of the experiment was 99.68 ± 3.55 kg whereas at the end of experiment, it was 112.27 ± 4.49kg. The average weight gain during the course of this study was 12.59 ± 1.04 kg. The average daily gain in weight was observed to be 449.53 ± 37.22 g.

Less gain in weight were reported by Bhati *et al*. (2009) of Mott grass and Berseem fodder substituted with saltbush by fedding to the Nili - Ravi buffalo heifers as 0.43 ± 0.01 kg daily weight gain. Kumar and Garg (1996a) reported the daily weight gain in Murraha heifers fed Baru grass as 72.86 (g/d), Kumar and Garg (1996b) reported the daily weight gain in MP Chari forage fed Murraha heifers as 49.05 g/d. Abdulrazak *et al. (*1996) observed the higher weight gain of Napier grass supplementation with *Glyricidia sepium or Leucaena leucocephala*in of *Bos taurus* x *Bos indicus* as 306-478g/day. The gain in body weight of animals in the present study indicated that the nutrient availability of Sampoorna fodder is sufficient to meet the maintenance and growth requirement of the buffalo calves.

## 4.12 Physiological Responses:

The physiological responses with respect to respiration rate, rectal temperature and heart beat/ min is presented in table No 4.11.

From the present investigation average weekly physiological responses of buffalo calves was reported as respiration rate/minute 21.84 ± 1.15, Rectal temperature (°C) 37.84±0.10, heart beat/minute 56.40 ± 0.34. Jacob *et al* (2014) offered grain to the cattle and reported the lower temperature than the present investigation as 30.25 (°C).

**Table 4.11. Average weekly physiological response of buffalo calves**

| Animal no. | Respiration rate/minute | Rectal temperature (°C ) | Heart beat/ min |
|---|---|---|---|
| **C1** | 18.20 | 38.07 | 56.12 |
| **C2** | 22.17 | 37.97 | 57.17 |
| **C3** | 18.00 | 38.04 | 56.77 |
| **C4** | 23.17 | 37.49 | 57.56 |
| **C5** | 24.00 | 37.97 | 55.30 |
| **C6** | 25.50 | 37.50 | 55.50 |
| **Mean** | **21.84** | **37.84** | **56.40** |
| **SE** | **1.15** | **0.10** | **0.34** |
| **CV (%)** | **12.94** | **0.65** | **1.48** |

# RESULTS AND DISCUSSION

# MATERIAL AND METHODS

# REVIEW OF LITERATURE

# *INTRODUCTION*

# SUMMARY AND CONCLUSION

# LITERATURE CITED

# APPENDICES

# CHAPTER V

# SUMMARY AND CONCLUSION

## SUMMARY

Livestock industry in our country is experiencing large deficit of green and dry fodder. Animal rearing under traditional grazing system in small numbers has danger of disturbing ecological balance through uncontrolled grazing similarly; the small group of animals do not make an economic unit to provide gainful employment. Considering these drawbacks of traditional grazing system, rearing of animals under semi-intensive system is being propagated to provide gainful employment, conserve ecological balance and also to achieve greater productivity. By improving the feeding and management practices of available breeds, while adopting semi-intensive system of management, production can be increased.

The availability of green fodder is depleted due to the continued shrinkage of fast growing fodder grass species and introduction of high yielding dwarf crop varieties and cash crops. To overcome the curt of roughages, it is necessary to explore the nutritive value of perennial grasses, which have nutritional potential. Use of fodder grasses in the ration of ruminants becomes paramount importance.

Keeping this in view present study was undertaken to explore the possibility of using the Sampoorna fodder in the diet of growing buffalo calves.

The experiment was conducted at the Dairy Unit, College of Agriculture, Dapoli. Six Mehsana male buffalo calves were selected and fed with Sampoorna fodder. The calves were fed for 28 days with preliminary period of 21 days, followed by seven days as a collection period. The calves were maintained under uniform management and housing condition.

The Sampoorna fodder was analyzed for their chemical composition. To find out the nutrient digestibility and mineral balances, metabolic trial was conducted. The gain in weight during the trial period was worked out as a difference between the weight at the start of the experiment and at the end of the experiment. The results obtained during the study are summarized here.

### 5.1 Chemical composition

The chemical analysis of Sampoorna fodder revealed that contained, DM-23.5, OM-32.39, CP-9.93, EE-5.9 Ash-8.89, CF-23.93, NFE-51.35, Ca-0.13, P-0.23, per cent.

### 5.2 Dry matter intake

The average DM intake per 100 kg body weight was observed to be 2.78 ± 0.04 kg. The DM intake per kg metabolic body weight ($W^{0.75}$) was 90.31 ± 1.17 g per day. This higher DMI indicated that the Sampoorna fodder was found palatable to calves and relished by calves.

### 5.3 Digestibility coefficient

The average digestibility coefficients for various nutrients were as OM-86.64 ± 1.01, DM-87.52 ± 1.02 CP-89.64 ± 0.85, EE-78.43 ± 1.77, CF-88.21 ± 0.94, NFE-89.12 ± 0.89, Ash- 76.74± 1.83 Ca- 91.35± 0.71, P- 91.85 ± 0.68

### 5.4 Mineral balance

All the experimental calves showed positive balances for Ca and P with average retention of 0.09 ± 0.002 ,0.18 ± 0.003 g/day, respectively.

### 5.5 Nutritive value

Nutritive values of Sampoorna fodder in calves were 8.90 ± 0.09 per cent DCP and 86.18 ± 1.00 per cent TDN.

### 5.6 Nutritive ratio

Nutritive ratio showed by calves fed on Sampoorna fodder was 1:6.92 and was classified as narrow nutritive ratio. This is normally shown by healthy growing animals.

### 5.7 Body weight change

All the experimental calves showed gain in body weight. The average gain was 12.59 ± 1.04 kg during the experimental period of 28 days. However, the average gain in body weight per day per calves was 449.53 ± 37.22g.

### 5.8 Water intake

Average weekly water intake by calves during metabolic trial was 14.83±0.46 liter. Average daily water intake during metabolic trial was 2.11 liter / day.

### 5.9 Physiological responses

Average weekly physiological responses of calves were reported as Respiraton rate / minute - 21.84±1.15, Rectal temperature ($^{o}$C) 37.84± 0.10, Heart beat / minute- 56.40± 0.34

## CONCLUSION

From the overall results of the present investigation , it can be concluded that Sampoorna fodder is good source for the maintenance as well as growth in calves. Production of Sampoorna fodder in Konkan region is quite easy which creates scope for better option of fodder for buffalo calves. It provides all nutrients and also data revealed that it has good chemical composition, dry matter intake, digestibility coefficient, nutritive value, nutritive ratio, body weight gain and positive mineral balances. There is also scope for further research in future and its multipurpose use.

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**Plate II. Buffalo calves during Sampoorna consumption**

Sampoorna field

Chopped Sampoorna fodder

**Plate I Sampoorna field and Chopped Sampoorna fodder**