

**EFFECT OF CUTTING INTERVAL AND CUTTING HEIGHT  
ON PRODUCTIVITY AND NUTRITIONAL COMPOSITION OF  
NAPIER GRASS (*Pennisetum purpureum*) GROWN IN  
COASTAL SOIL**

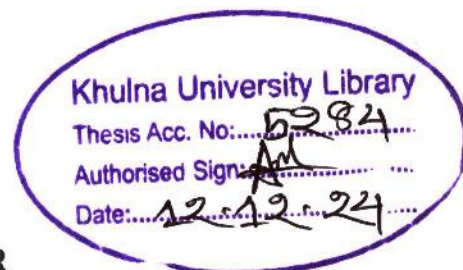
**A THESIS**

**BY**

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**STUDENT ID: MS-210821**

**A Thesis (Course No. AN-6104) Submitted to Agrotechnology  
Discipline in Partial Fulfilment of the Requirement for the Degree of  
Master of Science in Animal Nutrition**



**AGROTECHNOLOGY DISCIPLINE**

**KHULNA UNIVERSITY**

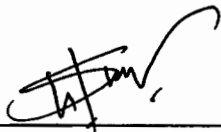
**KHULNA-9208**

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DEDICATED  
TO  
MY  
BELOVED PARENTS

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## ABSTRACT

A key problem in Bangladesh is the lack of feeds and forage for animal production. Fodder production is increasing in Bangladesh but still facing shortage about 45%. In the coastal region of Bangladesh, the situation is particularly serious and complicated. We investigated the interaction effects of cutting height and cutting interval on the agronomic growth parameters and nutrient composition of BLRI Napier-4 forage genotype. The experimental was laid out in a factorial randomized complete block design (RCBD) with two factors having factor A cutting height e.g., T<sub>1</sub> (0 cm), T<sub>2</sub> (5 cm), T<sub>3</sub> (10 cm), T<sub>4</sub> (15) and factor B cutting interval e.g., C<sub>1</sub> (60 day), C<sub>2</sub> (75 day) and C<sub>3</sub> (90 day) with 3 replications. The interaction effects of cutting height and cutting interval has significant effects ( $p < 0.05$ ) on plant height and leaf length. The results was highly significant ( $p < 0.005$ ) among all the interaction on biomass, leaf number and leaf width. But no significant effect between the interactions of cutting height and cutting interval on tiller number and stem diameter. Among all the interactions, highest biomass was found in T<sub>3</sub>C<sub>3</sub> (109.36 t ha<sup>-1</sup>) and the lowest was found in T<sub>1</sub>C<sub>1</sub> (14.68 t ha<sup>-1</sup>). Highest tiller number and plant height was found in T<sub>3</sub>C<sub>1</sub> (10.58) and T<sub>3</sub>C<sub>3</sub> (235.49 cm), respectively and lowest value was found in T<sub>1</sub>C<sub>1</sub> (6.73) and T<sub>4</sub>C<sub>1</sub> (100 cm), respectively. Highest leaf number (13.33) was also found in T<sub>3</sub>C<sub>3</sub>. There was no significant effect of the interactions on nutrition content. Highest DM (20.72%) and CF (33.88%) content was found in T<sub>4</sub>C<sub>3</sub>. Highest CP (9.84%), ash (13.64%) and moisture (81.17%) content was found in T<sub>3</sub>C<sub>1</sub> and T<sub>3</sub>C<sub>3</sub>, respectively. It may be concluded that 10 cm cutting height with 90 days of cutting interval (T<sub>3</sub>C<sub>3</sub>) was found best interaction in respect of all agronomic growth parameters. The experiment's results will undoubtedly be helpful to the farmers in Bangladesh's coastal region.

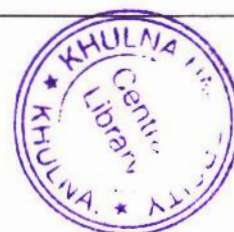
**Keywords:** BLRI Napier-4, Cutting Height, Cutting Interval

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## Elaboration

|      |                                                        |     |                                       |
|------|--------------------------------------------------------|-----|---------------------------------------|
| ADF  | Acid Detergent Fiber                                   | NDF | Neutral detergent fibre               |
| CABI | Centre for Agriculture and<br>Bioscience International | CP  | Crude Protein                         |
| CF   | Crude fibre                                            | DM  | Dry mater                             |
| DLS  | Department of Livestock Service                        | DAT | Day after treatment                   |
| DMRT | Duncan's multiple range test                           | FAO | Food and Agricultural<br>organization |
| GDP  | Gross Domestic Product                                 | GLM | General Linier Model                  |
| SRDI | Soil Resource Development<br>Institute                 |     |                                       |

# CHAPTER I

## INTRODUCTION

In Bangladesh's integrated and subsistence farming system, livestock is a crucial element and a quickly expanding sector (Rahman *et al.*, 2014). However, a major factor restricting livestock production in Bangladesh is the lack of feeds and fodder, which leads to low productivity, subpar growth, and poor animal reproduction. Animal health, welfare, productivity, product safety, quality, and land use are all guaranteed by an effective animal feeding program. The livestock industry is viewed as a key sector for eradicating poverty, generating income, and addressing nutrient deficiencies (Uddin and Akter, 2019). Livestock is one of the important sub-sectors of Agriculture. It contributes in the GDP is about 1.60% and growth rate of GDP is about 3.32% and about 20% population in the country are directly and 50% peoples' are indirectly depends on livestock for their livelihoods (DLS 2021). The density of livestock per acre of arable land is 7.37, and there is a yearly demand for 70 million metric tons of green grass for cow feed, but only 24 million metric tons are produced (Prothom Alo, 2008). Although fodder crop production is increasing in Bangladesh (Sarker *et al.*, 2021), a shortage of fodder of about 45% remains (Huque and Sarker, 2014). In south-west Bangladesh, where land scarcity caused by salinity and water logging is the main barrier to crop production (Mia *et al.*, 2020). Livestock rearing is becoming a viable option in south-west region of Bangladesh. Bangladesh, a deltaic plain covers more than 30% of the cultivable land is in the coastal area (Mia *et al.*, 2020). Out of about 1.689 million hectares of coastal land 1.056 million hectares are affected by various degrees of soil salinity (Mia *et al.*, 2020). Due to salinity in the soil, a lack of high-quality irrigation water, and a condition known as late draining, the majority of the land is left fallow during the dry season and about 50% of the coastal lands face different degrees of inundation, thus limiting their effective use. (January to May) (Karim *et al.*, 1990, SRDI, 2001 and SRDI, 2010).

The availability of high-quality feed and forage resources is crucial for sustainable livestock production. A key problem in Bangladesh is the lack of feeds and forage for animal production (Uddin and Akter, 2019). In the coastal region of Bangladesh, the situation is particularly serious and complicated. These conditions are unfavourable for crop cultivation as well as fodder that depend on supplemental watering throughout the

winter months of December to May because soil and water salinity inhibits plant growth and development (FAO, 2015).

The amount of dry matter consumed, the chemical composition, and the coefficient of digestibility of the dry matter all affect the nutritional value of grass for cattle. It has been demonstrated that the chemical composition changes depending on the climate, soil quality, and maturity stage. Young plants have a high protein content, a low lignin and cellulose content, and a high digestibility (Wijitphan *et al.*, 2009). The perennial forage crop Napier grass (*Pennisetum purpureum*) has a high growth rate, high productivity, and good nutritional value (Wadi *et al.*, 2004). The various studies with Napier grass found that the defoliation intensity is the main factor affecting sward growth, yield, and persistence, as well as the choice of cutting interval and height of cutting (Werner *et al.*, 1966; Santana *et al.*, 1989).

Grasses like Napier grass offer a best-fit alternative to other feed options because they are high yielding forages that require a minimal amount of inputs and acreage, which is advantageous given that the majority of smallholder livestock producers own small and fragmented pieces of land (Negawo *et al.*, 2017). The characteristics of Napier grass include high biomass yield (Morais *et al.*, 2009; Wangchuk *et al.*, 2015), rapid re-growth potential, and ease of propagation (Lee *et al.* 2016), as well as characteristics that aid in the management of soil erosion (Magcale-Macandog *et al.*, 1998). Here, roadside grass and crop residue are primarily used as animal feed. Animal feed and nutrient shortages in Bangladesh have been clearly demonstrated by numerous studies in the past (Akbar and Khaleduzzaman, 2009). Here, we chose BLRI Napier-4 cultivar, which will help farmers in the south-west coastal region to increase forage and livestock production.

However, forage crop performances are positively correlated with the cutting height and cutting interval as well as with area, location, and season (Wadi *et al.*, 2004; Caro-coster and Vincente-Chandler, 1961; Wijitphan *et al.*, 2009). Investigating the Napier biomass yield and quality, which vary according to cutting height and interval under coastal regions in Bangladesh, is therefore necessary (Tessema *et al.*, 2010; Pandey and Roy, 2011). This study will look into how Napier grass's chemical makeup and productivity are affected by cutting height and frequency.

## CHAPTER II

### LITERATURE REVIEW



#### 2.1 Napier Grass

##### Origin

English name: Napier Grass

Scientific name: *Pennisetum purpureum* Schumach

Elephant grass is native to tropical sub-Saharan Africa (Clayton *et al.*, 2013). Most of the tropical and subtropical regions around the world, it has been introduced as forage. It was introduced to the USA in 1913, Central and South America, the West Indies, and Australia in the 1950s and 1960s, respectively. It frequently naturalizes and occasionally becomes invasive (CABI, 2014). The elephant grass ranges in distribution from 10 °N to 20 °S. In crops, along roadsides, waterways, wetlands, floodplains, swamps, forest edges, disturbed areas, and wastelands, it is frequently viewed as a weed (CABI, 2014; Francis, 2004). It is a pioneer species in dry areas like the Galapagos Islands and can withstand drought conditions (CABI, 2014).

One of the most significant tropical forage crops is Napier grass, also known as elephant grass or Uganda grass. According to Lukuyu *et al.* (2012), Kabirizi *et al.*, (2015), and Farrell *et al.* (2002), it is extensively used in cut and carry feeding systems and is becoming more significant in other agricultural systems. Napier grass is a preferred forage due to its many desirable characteristics, including its high yield per unit area, tolerance to intermittent drought, and high water use efficiency (Kabirizi *et al.*, 2015). It can withstand repeated cutting and quickly regenerate, giving rise to palatable leafy shoots (Lowe *et al.*, 2003). Therefore, improving knowledge-based use and conservation of the available Napier grass resources promises to have a significant positive impact on livestock value chains.

##### Morphological characteristics

Elephant grass is a strong, rhizomatous, tufted perennial grass. It has a vigorous root system, sprouting from the nodes of its creeping stolon. The culms are coarse, perennial, and may reach up to 4-7 m in height, branching above. Elephant grass creates dense thick

clumps, up to 1 m across. The leaves are flat, linear, and hairy at the base, up to 100-120 cm long and 1-5 cm wide, with a bluish-green tint. The leaf border is coarsely serrated and the leaf blade has a pronounced midrib. The inflorescence is a stiff terminal bristly spike, up to 15-20 cm in length, yellow-brown to purplish in hue. Spikelets are grouped around a hairy axis, and fall upon maturity. Spikelets are 4-6 mm long and encircled by 2 cm long plumose bristles. There is little or no seed formation. When seeds are present they are quite small (3 million seeds/kg) (CABI, 2014; Francis, 2004; Mannetje, 1992; Duke, 1983). Elephant grass is quite similar in appearance to sugarcane (*Saccharum officinarum*) but its leaves are thinner and its stems are longer (DAFF, 2014).

### **Physiological characteristics**

Elephant grass is a summer-growing grass that can be found everywhere from sea level to an elevation of 2000 m. (Francis, 2004). It thrives in regions with annual rainfall of around 1500 mm and temperatures between 25 and 40 °C (FAO, 2015). It is sensitive to frost and stops growing below 15°C, but if the soil is not frozen, it can reappear from the stolon stage (Duke, 1983). Elephant grass can withstand dryness and will thrive in regions with 200–4000 mm of annual rainfall. Elephant grass likes well-drained soils and is not tolerant of flooding. It grows well in raised beds when there is inadequate drainage (Göhl, 1982). It thrives in rich, deep soils like friable loams, but it may also grow in sandy or clayey soils that have been overly drained and have a pH range of 4.5 to 8.2. (FAO, 2015; Cook *et al.*, 2005 and Duke, 1983). Under a dense tree canopy, elephant grass, a species that prefers full sunshine, cannot endure complete shade but can still produce under partial shade (Francis, 2004).

### **Production Characteristics**

Napier grass is palatable and can be fed fresh, as silage, or as field grazing (Martin *et al.* 1976). There have been yields of 85.4 t ha<sup>-1</sup> without fertilizer application and 130 t ha<sup>-1</sup> a record high yield with fertilizer application of 1320 kg ha<sup>-1</sup> of nitrogen (Woodard *et al.*, 1991). While fresh and green, Napier grass is a high-quality fodder that is incredibly tasty (Boonman 1993 and Tessema *et al.*, 2002). One of the tropical grasses with the highest yield is Napier grass. It is a very versatile species that can be grown in a wide range of environments and agricultural systems, including dry or wet climates, smallholder or industrial agriculture. It is an excellent feed that is widely used in the tropics, especially in cut-and-carry systems (Mannetje, 1992; FAO, 2015).

## Utilization

A range of grass species are used as fodder crops by farmers in Africa, Asia and other tropical/subtropical regions of the world. Napier grass is one of the most important fodder crops, particularly in Eastern and Central African smallholder farming communities (Lukuyu *et al.*, 2012; Kabirizi *et al.*, 2015). It is mainly used to feed livestock in cut and carry feeding systems (Farrell *et al.*, 2002; Ishii *et al.*, 1995). It is a multipurpose forage crop that can be grazed directly, or made into silage or hay (Orodho, 2006) and there have also been reports of using Napier grass as fish food, for example for feeding grass carp and tilapia in Nepal (Pandit *et al.*, 2004; Shrestha 1998) and Bangladesh (Shaha, 2015).

A recent report from Nigeria also indicated that young shoots of Napier grass were used as a cooked vegetable (Akah *et al.*, 2014). These varied uses provide an indication of the diversity of roles that Napier grass could contribute to the reduction of poverty and nutritional insecurity.

Elephant grass was recommended to be fed to dairy cows in Kenya when it reached a height of 55-60 cm (7-8 weeks) and 130-140 cm (9-10 weeks) in locations with medium and high rainfall, respectively (Muia *et al.*, 1999). However, due to its low DM and high fiber content, as well as the crop's morphological characteristics, the use of newly harvested elephant grass is reduced (Moran, 2011). Only milk production of 7 to 8 litters per cow per day may be supported by elephant grass when used as the primary diet or when supplemented with leucaena alone (Muia *et al.*, 2000). For 14 weeks starting in week 3 of lactation, cows were fed *ad libitum*. Grass height (1 m vs. 1.5 m, or 4 to 6 weeks vs. more than 6 weeks) significantly affected daily, DM intake (9.3 and 6.8 kg), total daily DM intake (10.5 and 7.9 kg), daily live-weight losses (165 and 490 g), and daily milk yield (8.6 and 6.9 kg/d, respectively) (Muinga *et al.*, 1992).

## Harvesting time

The ideal harvest regime depends on the cultivar, weather conditions, soil fertility, management practices and livestock needs. In Kenya, the recommendation is to harvest elephant grass for the first time when it attains a height of 1-1.2 m, usually 3-4 months after planting. Thereafter the grass should be harvested at intervals of 6 to 8 weeks, at the same height. Well-managed elephant grass can be harvested every month in hot and wet environments, or every 2 months in drier areas. Harvesting at longer intervals produces higher DM yields but lower quality forage as protein and ash content, digestibility and

leaf-to-stem ratios decline. Leaving 10-15 cm high stubble provides sufficient carbohydrate reserves for subsequent regrowth (Orodho, 2006).

### **Feeding system**

Elephant grass is often fed fresh in cut-and-carry systems. It can be manually or mechanically chopped prior to feeding to reduce the selection of leaves and stems by the animal. Chopping and then wilting in the sun for several hours reduces moisture, stimulates appetite, facilitates rumination and thus improves forage utilisation (Moran, 2011)

## **2.2 Agronomic growth parameters of Napier grass**

### **Cutting Height**

A study was conducted by Lounglawan *et al.* (2014) and they found that increasing cutting height had no effect on dry matter yield and yields of nutrients, but in terms of nutrient content, it decreased crude fiber content. By comparison, cutting King Napier grass to different heights at harvest has no significant effect on DM yield and on nutrient composition (Lounglawan *et al.*, 2014).

According to Sumran *et al.* (2009), the forage DM yield and nutritional qualities of King Napier grass can be influenced by the cutting height.

In an experiment to determine Pakchong's need for nitrogen fertilizer, Phakamas and Yampracha (2018) discovered that plant height was significantly influenced by fertilizer treatments at the first cutting but not at the second or third cutting periods.

### **Cutting Interval**

Lounglawan *et al.* (2014) said that cutting interval has a marked effect on the dry matter yield and nutrient composition of King Napier grass. They also said that Cutting every 45 to 60 days will achieve a much higher dry matter yield than cutting every 30 days and also result in higher yields of CP, ash, EE, NDF, ADF and ADL in spite of a significant decrease in the percentage of these components in the plant as cutting interval is increased.

### **Biomass**

According to Hasan *et al.* (2010) with increasing level of nitrogen fertilizer, green matter yield of forage was increased. The application of increased level of nitrogen fertilizer



### **2.3 Nutritional parameters of Napier grass**

#### **Crude Protein (CP)**

Haryani *et al.* (2018) conducted an experiment to evaluate the yield and nutritive values of six Napier cultivars at different cutting stages. The nutrient content of harvested plant material was measured, pre-dried in air, and dried in an oven before grinding, and it was discovered that as yield and quality of fodder and concluded that nitrogen application has the cutting interval increased, crude protein and metabolised energy % declined significantly.

Eltelib *et al.* (2006) studied on the effect of nitrogen and phosphorus application on growth, forage effect on the growth of plant and protein also influenced by nitrogen.

Delevatti *et al.* (2019) evaluated the effect of nitrogen fertilizer on the nutrient composition of Marandu grass at field salinity level and found that crude protein content increased rather than fiber content by adequate application of nitrogen fertilizer in the grass.

#### **Crude Fiber (CF)**

To determine the effects of three cutting intervals (60, 75 and 90 days) and three cutting heights (5, 10 and 15 cm above ground level) on the yield and nutrient composition of King Napier grass (*Pennisetum purpureum x Pennisetum americanum*), Lounglawan *et al.* (2014) conducted research and found that crude fiber increased with the maturation of the plant and decreased with the increasing cutting height.

Eltelib *et al.* (2006) studied the effect of nitrogen and phosphorus application on growth, forage yield, and quality of fodder and found that nitrogen and phosphorus had no effect on crude fiber.

Kidder (1945) experimented on the composition and digestible nutrients of Napier grass leaves and found that at ages 6, 8, 10, 12, and 14 weeks, CF% was gradually increasing and CF contents were respectively 28.8, 30.7, 32.0, 32.6, and 33.9.

Liangco *et al.* (2019) experimented on the chemical composition of super Napier grass silage treated with *Lactobacillus buchneri* and *Lactobacillus plantarum* and found that infectant-treated Super Napier Grass (SNG) silage had higher levels of crude fiber and nutrient detergent fiber compared to untreated, treated Super Napier Grass.

Haryani *et al.* (2018) conducted an experiment to evaluate the yield and nutritive composition of six Napier cultivars at different cutting stages. Before grinding, harvested plant material was weighed, pre-dried in the air, and dried in the oven, and it was

discovered that increasing the cutting interval considerably increased dry matter and crude fiber.

#### **Dry Matter (DM), Ether Extract (EE) and ash content**

Lounglawan *et al.* (2014) conducted an experiment to determine the effects of three cutting intervals (60, 75 and 90 days) and three cutting heights (5, 10 and 15 cm above ground level) on the yield and nutrient composition of King Napier grass (*Pennisetum purpureum* x *Pennisetum americanum*) and found that with the advancing of age, dry matter increased significantly, however the cutting height had no effect on dry matter. Also found that EE content was unaffected by cutting height and ash content was reduced with increasing cutting period.

Wadi *et al.* (2004) reported that the annual herbage dry matter yield (HDMY) of King Napier grass was higher in the plants at a 90-day interval and 0 cm height than at a 60-day interval and 30 cm cutting height.

A scientific study was conducted by Tessema *et al.* (2003) on Napier grass (*Pennisetum purpureum* (L.) Schumach.) using a 5 x 3 factorial experiment. The treatments were five fertilizer applications (0 kg ha<sup>-1</sup> N, 46 kg ha<sup>-1</sup> N, and 92 kg ha<sup>-1</sup> N; 1 t ha<sup>-1</sup> and 2 t ha<sup>-1</sup> cattle manure); and three plant heights at cutting (0.5 m, 1 m, and 1.5 m). The average dry matter (DM) yield per cut was 8.21 t ha<sup>-1</sup>; however, the dry matter increased as the plant height at cutting and the quantity of nitrogen fertilization increased, and it was also found that total ash was affected by both plant heights at cutting and fertilizer level.

To compare the potentiality between BLRI Napier-3 (BN-3) and Pakchong (PK) fodders, research was conducted by Sarker *et al.* (2019) and found that dry matter (DM) (24.71%) and total ash (8.35%) in PK silage were significantly higher.

An experiment was conducted by Ahmed *et al.* (2021) to compare Bangladesh Livestock Research Institute-developed Napier hybrid-3 (BN-3) and Pakchong-1, where the cultivars were harvested at three cutting periods (40, 50, and 60 days), and based on DM yield, BN-3 performed better at 50 days after the first plantation, but Pakchong-1 performed better at 60 days after the first plantation.

Elephant grass is one of the most important fodder grasses for ruminants in the tropics, largely due to its high productivity (Moran, 2011). It is grazed, used for cut-and-carry, dried, or ensiled. The high variability among cultivars may result in many differences regarding intake and animal performance (Islam *et al.*, 2003). There is a trade-off between

Werner *et al.* (1966) who reported no significant difference in DM and CP yields between different cutting intervals. Present study proves that there was a highly significant effect of cutting interval on DM and CP content. Dry matter yield generally increases with increasing fertilizer rate and cutting interval (Carvalho *et al.*, 2000).

# CHAPTER III

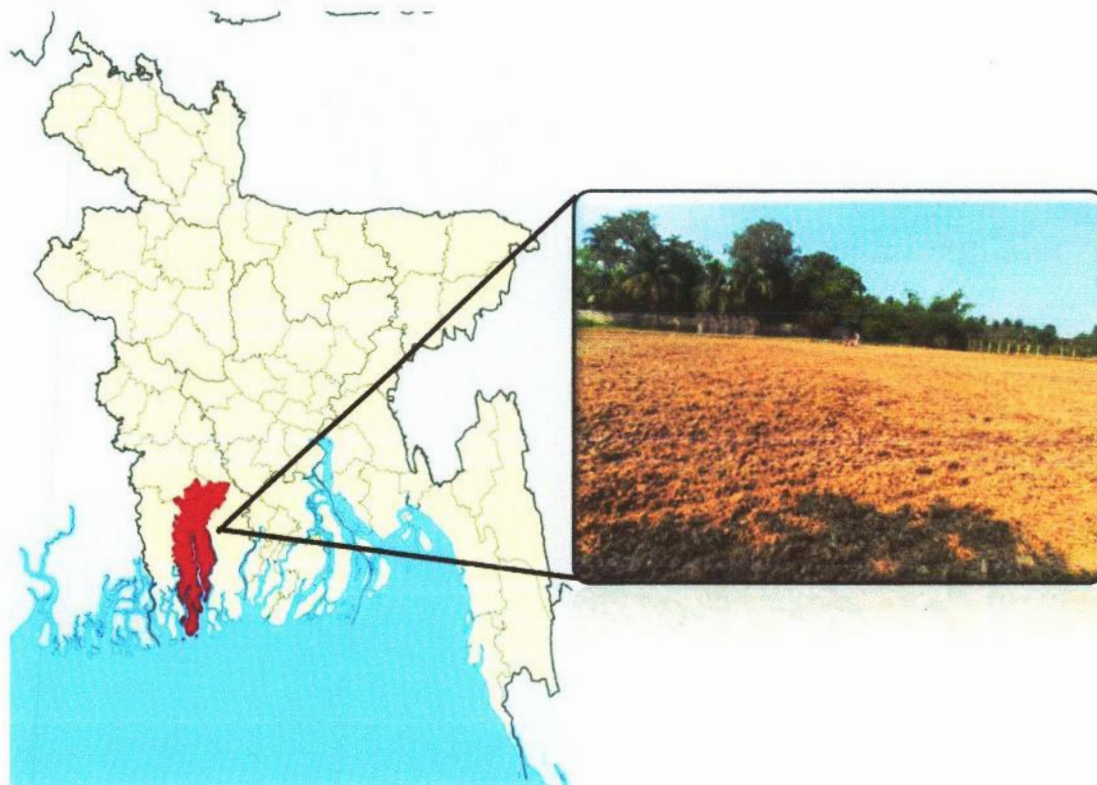
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## METHODOLOGY

### 3.1 Site of the experiment

The experiment was conducted at Professor Dr. Purnendu Gain Field Laboratory of Agrotechnology Discipline, Khulna University, Khulna.

Figure 3.1 Meteorological location

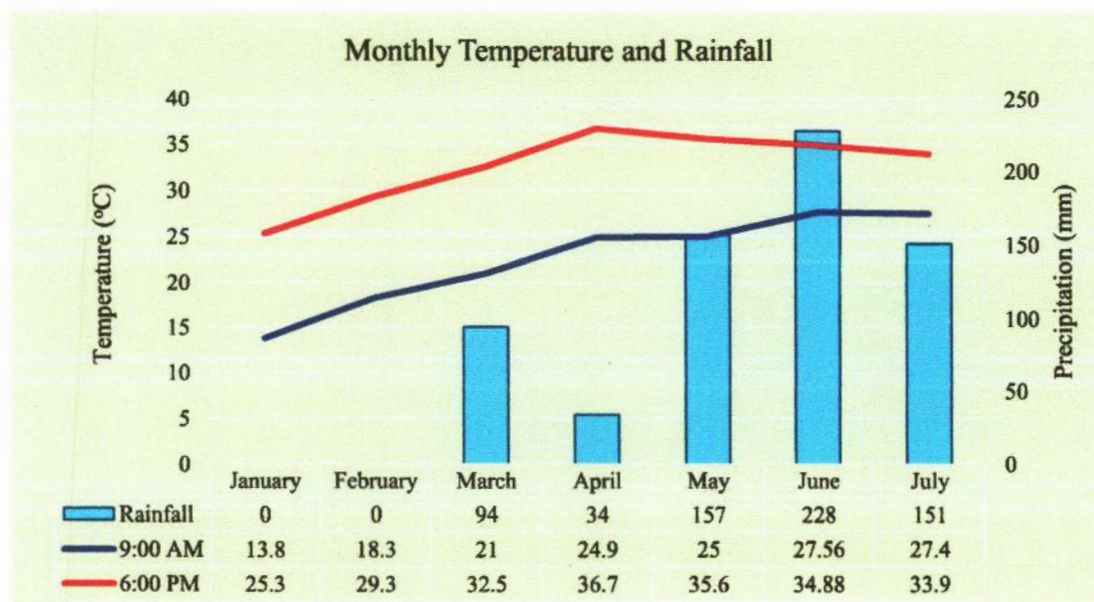


### Climatic condition

Monthly maximum temperature during January to July in 2022 were recorded by Bangladesh meteorological Department, Khulna. It is shown monthly temperature and rainfall in figure 3.2. Average highest temperature ( $36.7^{\circ}\text{C}$ ) was recorded in April month during summer and there was very low precipitation (34 mm) during this time. Meteorological department declared this time as drought. There was no precipitation during January and February and average temperature was  $13.8^{\circ}\text{C}$  in the morning and  $25.3^{\circ}\text{C}$  in the evening in January and average  $29.3^{\circ}\text{C}$  temperature was in February during

evening. Precipitation rate is increased during May, June and July. Average temperature is decreased during this time period. Wijitphan *et al.* (2009) said that monthly temperatures appeared to have some effects on productivity of Napier grass.

Figure 3.2 Monthly temperature and rainfall



Source: Bangladesh meteorological station, Khulna

### 3.2 Preparation of plot

Thirty six (36) plots having the same dimension of  $2\text{m} \times 3\text{m} = 6\text{m}^2$  spaces for each plot was arranged for this experiment.

### 3.3 Design of experiment

The experimental was laid out in a factorial randomized complete block design (RCBD) with two factors having factor A cutting height e.g.,  $T_1$  (0 cm),  $T_2$  (5 cm),  $T_3$  (10 cm),  $T_4$  (15) and factor B cutting interval e.g.,  $C_1$  (60 day),  $C_2$  (75 day) and  $C_3$  (90 day) with 3 replications

### 3.4 Layout of the experiment

| Treatment            |                    | Replication                                  |                                              |                                              |
|----------------------|--------------------|----------------------------------------------|----------------------------------------------|----------------------------------------------|
| Cutting Interval (C) | Cutting Height (H) | R <sub>1</sub>                               | R <sub>2</sub>                               | R <sub>3</sub>                               |
| C <sub>1</sub>       | H <sub>1</sub>     | C <sub>1</sub> H <sub>1</sub> R <sub>1</sub> | C <sub>1</sub> H <sub>1</sub> R <sub>2</sub> | C <sub>1</sub> H <sub>1</sub> R <sub>3</sub> |
| C <sub>2</sub>       | H <sub>2</sub>     | C <sub>2</sub> H <sub>1</sub> R <sub>1</sub> | C <sub>2</sub> H <sub>1</sub> R <sub>2</sub> | C <sub>2</sub> H <sub>1</sub> R <sub>3</sub> |
| C <sub>3</sub>       | H <sub>3</sub>     | C <sub>3</sub> H <sub>1</sub> R <sub>1</sub> | C <sub>3</sub> H <sub>1</sub> R <sub>2</sub> | C <sub>3</sub> H <sub>1</sub> R <sub>3</sub> |
|                      | H <sub>4</sub>     | C <sub>1</sub> H <sub>2</sub> R <sub>1</sub> | C <sub>1</sub> H <sub>2</sub> R <sub>2</sub> | C <sub>1</sub> H <sub>2</sub> R <sub>3</sub> |
|                      |                    | C <sub>2</sub> H <sub>2</sub> R <sub>1</sub> | C <sub>2</sub> H <sub>2</sub> R <sub>2</sub> | C <sub>2</sub> H <sub>2</sub> R <sub>3</sub> |
|                      |                    | C <sub>3</sub> H <sub>2</sub> R <sub>1</sub> | C <sub>3</sub> H <sub>2</sub> R <sub>2</sub> | C <sub>3</sub> H <sub>2</sub> R <sub>3</sub> |
|                      |                    | C <sub>1</sub> H <sub>3</sub> R <sub>1</sub> | C <sub>1</sub> H <sub>3</sub> R <sub>2</sub> | C <sub>1</sub> H <sub>3</sub> R <sub>3</sub> |
|                      |                    | C <sub>2</sub> H <sub>3</sub> R <sub>1</sub> | C <sub>2</sub> H <sub>3</sub> R <sub>2</sub> | C <sub>2</sub> H <sub>3</sub> R <sub>3</sub> |
|                      |                    | C <sub>3</sub> H <sub>3</sub> R <sub>1</sub> | C <sub>3</sub> H <sub>3</sub> R <sub>2</sub> | C <sub>3</sub> H <sub>3</sub> R <sub>3</sub> |
|                      |                    | C <sub>1</sub> H <sub>4</sub> R <sub>1</sub> | C <sub>1</sub> H <sub>4</sub> R <sub>2</sub> | C <sub>1</sub> H <sub>4</sub> R <sub>3</sub> |
|                      |                    | C <sub>2</sub> H <sub>4</sub> R <sub>1</sub> | C <sub>2</sub> H <sub>4</sub> R <sub>2</sub> | C <sub>2</sub> H <sub>4</sub> R <sub>3</sub> |
|                      |                    | C <sub>3</sub> H <sub>4</sub> R <sub>1</sub> | C <sub>3</sub> H <sub>4</sub> R <sub>2</sub> | C <sub>3</sub> H <sub>4</sub> R <sub>3</sub> |

*C<sub>1</sub>= 60 days; C<sub>2</sub>= 75 days; C<sub>3</sub>= 90 days and H<sub>1</sub>= 0 cm; H<sub>2</sub>= 5 cm; H<sub>3</sub>= 10 cm; H<sub>4</sub>= 15 cm*

### 3.5 Collection of cutting

Cutting of BLRI Napier-4 forage genotype was collected from the BLRI Sub station, Faridpur, Bangladesh.

### 3.6 Planting of cuttings

Cuttings were planted on 4<sup>th</sup> January, 2023. The spacing was 60 x 30 cm and each plot contains 20 cuttings.

### 3.7 Irrigation and fertilizer application

Half of measured fertilizers (Urea, TSP and sheep manure) were applied after cutting and rest of fertilizers were applied 15 days after cutting. Irrigation was applied according to the requirement.

### **3.8 General management**

All plots were received a basal dressing of a compound NPK fertilizer and compost fertilizer before ploughing. Napier grass cutting had 2 nodes a piece and placed at 45° angle with 2 pieces in a hole with plant spacing of 60 x 30 cm in each plot. All plot were watered once per week to ensure adequate soil moisture for plant growth. The weeds were cleared using local weeding equipment.

### **3.9 Data Collection**

After 70 days, 16 March, 2023 first cutting was done by applying different cutting height treatment (0, 5, 10 and 15 cm) from ground level without any sampling. The residual plants were allowed to re-grow and was cut again after further 60, 75 and 90 days. 60 days data were collected on 25 May, 75 days data were collected on 11 June and 90 days data were collected on 25 June 2023. The sample was weighed and processed for chemical analysis.

#### **3.9.1 Agronomic data collection**

##### **Plant height**

Five plants/plot were selected randomly for determination of plant height. The height of each plant was measured from the ground to the top of the upper most leaf of the plant and mean value of plant height was recorded.

##### **Leaf number, leaf width and leaf length**

Leaf number were counted manually. Leaf length and leaf width were measured in cm using measurement scale.

##### **Tiller number**

Tiller number and leaf number were counted manually and mean tiller number of five plants from each plot was recorded.

##### **Biomass**

Randomly five plants were harvested from each plot and their mean shoot weight was recorded.



### **3.10 Proximate Analysis**

#### **3.10.1 Crude Protein Analysis:**

##### **Test Procedures:**

##### **Digestion**

Digestion was completed by using DK 8 Heating Digester VELP SCIENTIFICA. 1 g of sample was weighted with an accuracy of  $\pm 0.1$  mg. For each sample 2 catalyst and 12 ml  $H_2SO_4$  (98%) were added and then placed into digestion block. The temperature of the digestion block was maintained at  $420^\circ C$  and sample was heated for 60 minutes until the fumes stopped. Then the sample was taken to cool at  $50-60^\circ C$ .

##### **Distillation**

Distillation process was conducted by using UDK 129 Distillation Unit VELP SCIENTIFICA. After cooling the sample, it was mixed with 50 ml distilled water. 50 ml NaOH was added with the solution. The digestion flask was then given into the distillation chamber. 30 ml Boric acid solution was taken in a conical flask and 3 drops of indicator were added into it. The water flow was previously adjusted. The distillation process was done until the colour of indicator mixture solution did not turn into green colour.

##### **Titration**

The sample of the flask was then taken for titration. Then 0.1%  $H_2SO_4$  was taken in burette pipe and added drop wise. The procedure was continued until the colour of the solution of the conical flask turn from green to blue. When the solution colour had changed the titration procedure ended. The strength of titrate was then recorded.

##### **Calculation**

$$CP = \frac{(\text{ml } H_2SO_4 \text{ sample} - \text{ml } H_2SO_4 \text{ blank}) \times \text{conc. } H_2SO_4 \times 14.007 \times 100}{\text{Wight of sample} \times 1000}$$

#### **3.10.2 Crude Fibre Analysis:**

##### **Test Procedures:**

Crude fiber analysis was conducted by using VELP SCIENTIFICA FIWE Raw Fiber Extractor. 1 g sample was taken in crucibles were fixed with the channels. 150 ml 1.25%  $H_2SO_4$  was taken in the flask of the analyzer adding 3-5 drops n-octanol as anti-foam agent. The switch of the fibre analyzer was turned on. Boil exactly for 30 minutes. After 30 minutes, filter the remaining agent. Washing should be done three times with 30 ml

(crucible filled to the top) of hot deionized water, connecting each time to compressed air for stirring the content of crucible. After draining last wash, 150 ml 1.25% KOH and 3-5 drops of anti-foam agent were added. Again, after boiling for 30 minutes then washing 3 times, a last washing was done with cold deionized water to cool the crucible and then wash three times the crucible content with 25 ml of acetone and stirring by compressed air. The crucible content with 25 ml of acetone was washed. After that crucible were dried at 105° C for one hour in oven and then cooled down in a desiccator to take the dry weight (F<sub>1</sub>). The crucibles were placed into a muffle and heated up to 550° C for three hours to reweight after cooling in a desiccator (F<sub>2</sub>).

**Calculation:**

$$\text{Crude Fibre (\%)} = \frac{F_1 - F_2}{F_0} \times 100$$

Where,

F<sub>0</sub> = Weight of sample in gram

F<sub>1</sub> = Weight of oven dried sample in gram

F<sub>2</sub> = Weight of ash containing crucible in gram

**3.10.3 Ether Extract Analysis**

**Test method procedure:**

Ether extract analysis was conducted by using VELP SCIENTIFICASER 148 Solvent Extractor.

Sample: 3 g of grounded and homogenized material was weighed in an extraction thimble with 1 mg approximation. Total weight- thimble weight = wet sample weight.

Chemicals: petroleum ether 40-60° C with an evaporation of residue not higher than 10 mg/l.

Sample drying dried the thimble one hour in a 125° C oven.

Immersion: sample containing thimble or the glass crucible containing dry hydrolysed sample were introduced into the extraction equipment. After weighing extract collecting vessel, 40 ml of petroleum ether was added. Thimble with sample, assembled with thimble connector to extraction unit. After closing the extraction unit, the cooling water flow started and the heating. When the solvent started boiling, the thimble or glass crucibles were placed into "Immersion" position for 30 minutes.

**Washing:** after 30 minutes extracted, thimble or glass crucible were placed into "Washing" position for 60 minutes.

**Recovery:** after washing, the stopcock located under the water, was closed and cooled in condenser and evaporated completely the solvent from the extraction vessel.

**Weighing:** the extract containing cups were dried in oven at 125°C for 30 minutes and weighed it after cooling a desiccator.

**Calculation:**

$$\text{Ether Extract (\%)} = \frac{W_3 - W_2}{W_1} \times 100$$

Where,

$W_1$  = Weight of sample in gram

$W_2$  = Weight of empty vessel in gram

$W_3$  = Weight of vessel and ether extract in gram

### **3.10.4 Dry matter**

**Test procedure**

At first envelopes were weighted ( $W_1$ ). After harvesting, fresh shoot weight ( $W_2$ ) of forage was taken and the envelope was filled with sample and dried in oven for 24 hours at 105°C. Thereafter the dried sample containing envelope ( $W_3$ ) is weighted.

**Calculation:**

$$\text{Dry Matter (\%)} = \frac{W_3 - W_1}{W_2} \times 100$$

Where,

$W_1$  = Weight of envelope in gram

$W_2$  = Weight of fresh sample in gram

$W_3$  = Weight of envelope and dried sample in gram

### **3.10.5 Ash Analysis**

**Test Procedure**

Crucibles were placed in muffle furnace, allowing 30 minutes to reach 600°C. Weight of crucible was recorded ( $W_1$ ). About 3 g sample was weighted into a crucible which had been tarred. Weight of sample was recorded ( $W_2$ ). Crucibles were placed into muffle furnace at 600°C for 6 hours. Crucibles were allowed to cool in furnace to less than 20°C



and crucibles were placed in desiccator with a vented top. Crucibles were cooled in desiccator to room temperature and were weighed immediately and the weight was recorded ( $W_3$ ). Ash% was calculated and reported to one decimal place.

#### **Calculation**

$$\text{Ash (\%)} = \frac{W_3 - W_1}{W_2} \times 100$$

Where,

$W_1$  = Weight of crucible in gram

$W_2$  = Weight of sample in gram

$W_3$  = Weight of crucible and ash in gram

#### **3.11 Statistical method and analysis:**

Data were analysed using the General Linear Model (GLM) procedure of SAS version 9.1, 1994 (SAS Institute, Inc.). DMRT was used to compare the treatment means with significance consider at  $p < 0.05$ .

## CHAPTER IV

### RESULTS AND DISCUSSION

#### 4.1 Agronomic Growth Parameter of Napier grass

##### 4.1.1 Effect of Cutting height on agronomic growth parameter

Table 4.1.1 showed that highest tiller was found in T<sub>3</sub> (10.28) and lowest one was in T<sub>1</sub> (7.96). Highest Plant height was found in T<sub>4</sub> (180.29 cm) and lowest was in T<sub>1</sub> (174.57 cm). All the treatment had highly significant effect ( $p<0.003$ ) on tiller number but there was no significant ( $p>0.05$ ) effect on plant height. Highest stem diameter (2.05 cm) was found in T<sub>1</sub> and lowest was found in T<sub>2</sub>. Highest leaf number (11.39), leaf length (92.27 cm), leaf width (3.80 cm) was found in T<sub>1</sub>, T<sub>3</sub> and T<sub>2</sub> respectively. There was no significant ( $p>0.05$ ) effect among the treatments on leaf number, leaf length and leaf width. Height biomass (70.85 t ha<sup>-1</sup>) was found in T<sub>4</sub> and lowest value (60.53 t ha<sup>-1</sup>) was found in T<sub>1</sub>. T<sub>4</sub> was similar to that of T<sub>3</sub> and T<sub>2</sub>. All the treatments had highly significant effect ( $p<0.0001$ ) on biomass production.

This study verified earlier results that Napier grass can be superior with higher cutting height (Wadi *et al.*, 2004, Wijitphan *et al.*, 2009), but it differs from the results of Lounglawan *et al.* (2014) who showed that cutting height at 5, 10 and 15 cm had no significant effect on Napier grass yield. But present study found that there was statistical effect on biomass production.

Table 4.1.1. Effect of cutting height on agronomic parameter of Napier grass

| Treatment      | Tiller Number      | Plant Height (cm) | Stem Diameter (cm) | Leaf Width (cm) | Leaf Length (cm) | Leaf Number | Biomass (t ha <sup>-1</sup> ) |
|----------------|--------------------|-------------------|--------------------|-----------------|------------------|-------------|-------------------------------|
| T <sub>1</sub> | 7.96 <sup>b</sup>  | 174.57            | 2.053 <sup>a</sup> | 3.68            | 90.06            | 11.39       | 60.53 <sup>b</sup>            |
| T <sub>2</sub> | 9.40 <sup>a</sup>  | 176.16            | 1.846 <sup>b</sup> | 3.80            | 89.45            | 11.14       | 67.83 <sup>a</sup>            |
| T <sub>3</sub> | 10.28 <sup>a</sup> | 175.85            | 1.884 <sup>b</sup> | 3.71            | 92.27            | 10.88       | 70.49 <sup>a</sup>            |
| T <sub>4</sub> | 9.74 <sup>a</sup>  | 180.29            | 1.848 <sup>b</sup> | 3.79            | 90.45            | 10.99       | 70.85 <sup>a</sup>            |
| SEM            | 0.39               | 1.97              | 0.15               | 0.04            | 0.74             | 0.15        | 0.97                          |
| <i>p</i>       | 0.003              | 0.22              | 0.0001             | 0.129           | 0.071            | 0.158       | 0.0001                        |

SEM = Standard error mean; DAT indicates day after treatments; T<sub>1</sub> = 0 cm; T<sub>2</sub> = 5 cm; T<sub>3</sub> = 10 cm; T<sub>4</sub> = 15 cm; NS=non-significant, \*\*\*= $p<0.001$ , \*\*= $p<0.01$ , \*= $p<0.05$

#### 4.1.2 Effect of cutting intervals on agronomic parameters

Table 4.1.2 showed the effect of cutting interval on agronomic parameters. Highest tiller number was found in C<sub>3</sub> and there was no significance differences between the treatments. Conversely, there was a highly significant difference ( $p<0.0001$ ) observed in the plant height. Highest plant height (233.42 cm) was found in C<sub>3</sub> and lowest value was found in C<sub>1</sub>. Highest stem diameter was found in C<sub>1</sub> but stem diameter had no significant effect. Highest leaf number (13.07), leaf length (105.30 cm) and leaf wide (4.45 cm) was found in C<sub>3</sub> and all cutting intervals had highly significant effect ( $p<0.0001$ ) on these parameters. Height biomass (103.36 t ha<sup>-1</sup>) was found in C<sub>3</sub> and lowest value (24.94 t ha<sup>-1</sup>) was found in C<sub>1</sub>. All the treatments had highly significant effect ( $p<0.0001$ ) on biomass.

Lounglawan *et al.* (2014) said that there is a positive relationship between cutting interval and biomass production. This study aligns with the statement.

Table 4.1.2. Effects of cutting interval on agronomic parameters of Napier grass

| Treatment      | Tiller Number     | Plant Height (cm)   | Stem Diameter (cm) | Leaf Width (cm)   | Leaf Length (cm)    | Leaf Number        | Biomass (t ha <sup>-1</sup> ) |
|----------------|-------------------|---------------------|--------------------|-------------------|---------------------|--------------------|-------------------------------|
| C <sub>1</sub> | 9.21 <sup>a</sup> | 99.94 <sup>c</sup>  | 1.92               | 2.88 <sup>c</sup> | 71.48 <sup>c</sup>  | 9.27 <sup>c</sup>  | 24.94 <sup>c</sup>            |
| C <sub>2</sub> | 9.27 <sup>a</sup> | 196.79 <sup>b</sup> | 1.89               | 3.90 <sup>b</sup> | 94.90 <sup>b</sup>  | 10.95 <sup>b</sup> | 73.97 <sup>b</sup>            |
| C <sub>3</sub> | 9.57 <sup>a</sup> | 233.42 <sup>a</sup> | 1.90               | 4.45 <sup>a</sup> | 105.30 <sup>a</sup> | 13.07 <sup>a</sup> | 103.36 <sup>a</sup>           |
| SEM            | 0.34              | 1.71                | 0.13               | 0.03              | 0.64                | 0.13               | 0.84                          |
| <i>p</i>       | 0.73              | 0.0001              | 0.189              | 0.0001            | 0.0001              | 0.0001             | 0.0001                        |

SEM = Standard error mean; DAT indicates day after treatments; C<sub>1</sub> = 60 DAT; C<sub>2</sub> = 75 DAT; C<sub>3</sub> = 90 DAT; NS=non-significant, \*\*\*= $p<0.001$ , \*\*= $p<0.01$ , \*= $p<0.05$

#### 4.1.3 Effects of cutting height and cutting interval on agronomy of Napier grass

In Table 4.1.3, highest tiller number was found in the interaction effect of T<sub>3</sub>C<sub>1</sub> (10.58) and lowest was in T<sub>1</sub>C<sub>1</sub> (6.73). The interaction effects has no significant effect on tiller number. In T<sub>3</sub>C<sub>3</sub>, highest plant height was found (235.49 cm) and lowest plant height was found in T<sub>4</sub>C<sub>1</sub> (100 cm). The interaction effects of cutting height and cutting interval has significant effects ( $p<0.05$ ) on plant height. Highest leaf width and leaf length was found in the interaction of T<sub>4</sub>C<sub>3</sub> (4.63 cm) and T<sub>1</sub>C<sub>3</sub> (105.75 cm) respectively and the both lowest was found in the interaction effect of T<sub>1</sub>C<sub>1</sub>. The result was highly significant ( $p<0.005$ ) among all the interaction on leaf width and leaf length. It was found in the Table 4.1.3 that

highest leaf number was in T<sub>3</sub>C<sub>3</sub> interaction and lowest was in T<sub>1</sub>C<sub>3</sub>. All the interaction effects has highly significant effect ( $p < 0.005$ ). Among all the interactions, highest biomass was found in T<sub>3</sub>C<sub>3</sub> (109.36 t ha<sup>-1</sup>) and the lowest was found in T<sub>1</sub>C<sub>1</sub> (14.68 t ha<sup>-1</sup>). The results was highly significant ( $p < 0.005$ ) among all the interaction on biomass.

Alves *et al.*, (2020) recorded that the total forage biomass, leaf blade and stem biomass, dry matter, neutral and acid detergent fiber contents, mass and higher heating value increased with cutting interval. It was also found that dry matter yield generally increases with increasing fertilizer rate and cutting interval (Carvalho *et al.*, 2000). Present study agreed with this statement.

Table 4.1.3. Effects of cutting height and cutting interval on agronomy of Napier grass

| Treatments     |                | Tiller Number | Plant Height (cm)    | Stem Diameter (cm) | Leaf Width (cm)    | Leaf Length (cm)    | Leaf Number         | Biomass (t ha <sup>-1</sup> ) |
|----------------|----------------|---------------|----------------------|--------------------|--------------------|---------------------|---------------------|-------------------------------|
| T <sub>1</sub> | C <sub>1</sub> | 6.73          | 102.78 <sup>d</sup>  | 2.111              | 2.74 <sup>f</sup>  | 68.46 <sup>d</sup>  | 10.2 <sup>cde</sup> | 14.68 <sup>f</sup>            |
|                | C <sub>2</sub> | 7.88          | 188.93 <sup>c</sup>  | 2.023              | 3.99 <sup>cd</sup> | 95.93 <sup>b</sup>  | 11.41 <sup>bc</sup> | 65.33 <sup>d</sup>            |
|                | C <sub>3</sub> | 9.27          | 232.01 <sup>a</sup>  | 2.025              | 4.31 <sup>bc</sup> | 105.78 <sup>a</sup> | 12.55 <sup>ab</sup> | 101.59 <sup>ab</sup>          |
| T <sub>2</sub> | C <sub>1</sub> | 9.97          | 103.54 <sup>d</sup>  | 1.858              | 3.09 <sup>ef</sup> | 69.55 <sup>d</sup>  | 9.5 <sup>d</sup>    | 30.05 <sup>e</sup>            |
|                | C <sub>2</sub> | 9.91          | 192.72 <sup>b</sup>  | 1.824              | 3.92 <sup>d</sup>  | 93.79 <sup>b</sup>  | 10.66 <sup>cd</sup> | 73.58 <sup>d</sup>            |
|                | C <sub>3</sub> | 8.33          | 232.23 <sup>a</sup>  | 1.857              | 4.41 <sup>ab</sup> | 105.03 <sup>a</sup> | 13.27 <sup>a</sup>  | 99.85 <sup>b</sup>            |
| T <sub>3</sub> | C <sub>1</sub> | 10.58         | 93.47 <sup>d</sup>   | 1.87               | 2.91 <sup>ef</sup> | 76.13 <sup>c</sup>  | 8.5 <sup>f</sup>    | 29.58 <sup>e</sup>            |
|                | C <sub>2</sub> | 9.89          | 198.61 <sup>bc</sup> | 1.87               | 3.73 <sup>d</sup>  | 95.44 <sup>b</sup>  | 10.83 <sup>cd</sup> | 72.52 <sup>d</sup>            |
|                | C <sub>3</sub> | 10.39         | 235.49 <sup>a</sup>  | 1.912              | 4.48 <sup>ab</sup> | 105.25 <sup>a</sup> | 13.33 <sup>a</sup>  | 109.36 <sup>a</sup>           |
| T <sub>4</sub> | C <sub>1</sub> | 9.55          | 100 <sup>d</sup>     | 1.865              | 2.79 <sup>ef</sup> | 71.77 <sup>cd</sup> | 8.91 <sup>ef</sup>  | 25.44 <sup>e</sup>            |
|                | C <sub>2</sub> | 9.39          | 206.92 <sup>b</sup>  | 1.845              | 3.95 <sup>d</sup>  | 94.44 <sup>b</sup>  | 10.91 <sup>cd</sup> | 84.46 <sup>c</sup>            |
|                | C <sub>3</sub> | 10.28         | 233.95 <sup>a</sup>  | 1.834              | 4.63 <sup>a</sup>  | 105.13 <sup>a</sup> | 13.14 <sup>a</sup>  | 102.66 <sup>ab</sup>          |
| SEM            |                | 0.68          | 3.42                 | 0.26               | 0.07               | 1.29                | 0.27                | 1.68                          |
| <i>p</i>       |                | 0.12          | 0.03                 | 0.34               | 0.006              | 0.05                | 0.005               | 0.0001                        |
|                |                | NS            | *                    | NS                 | ***                | *                   | ***                 | ***                           |

SEM = Standard error mean; DAT indicates day after treatments; T<sub>1</sub> = 0 cm; T<sub>2</sub> = 5 cm; T<sub>3</sub> = 10 cm; T<sub>4</sub> = 15 cm; NS=non-significant, \*\*\*= $p < 0.001$ , \*\*= $p < 0.01$ , \*= $p < 0.05$

#### 4.1.4 Marginal mean of biomass

Figure 4.1.1 showed the mean of biomass production according to the cutting height and cutting interval. In this figure, three production line are shown as per treatment. In 60 DAT production line highest biomass production was  $30.05 \text{ t ha}^{-1}$  in  $T_2$ . In second line (75 DAT) biomass was higher in  $T_4$  than the other treatment. In 90 DAT production line highest biomass production was  $109.39 \text{ t ha}^{-1}$  in  $T_3$ .

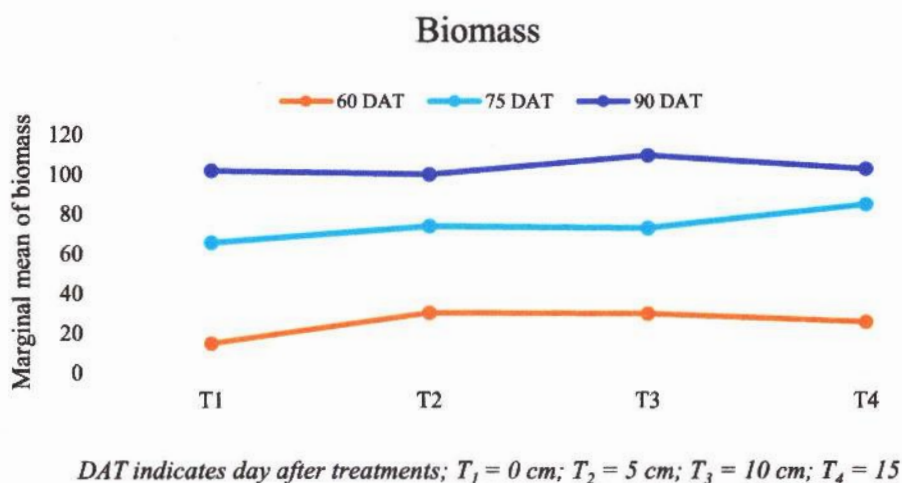


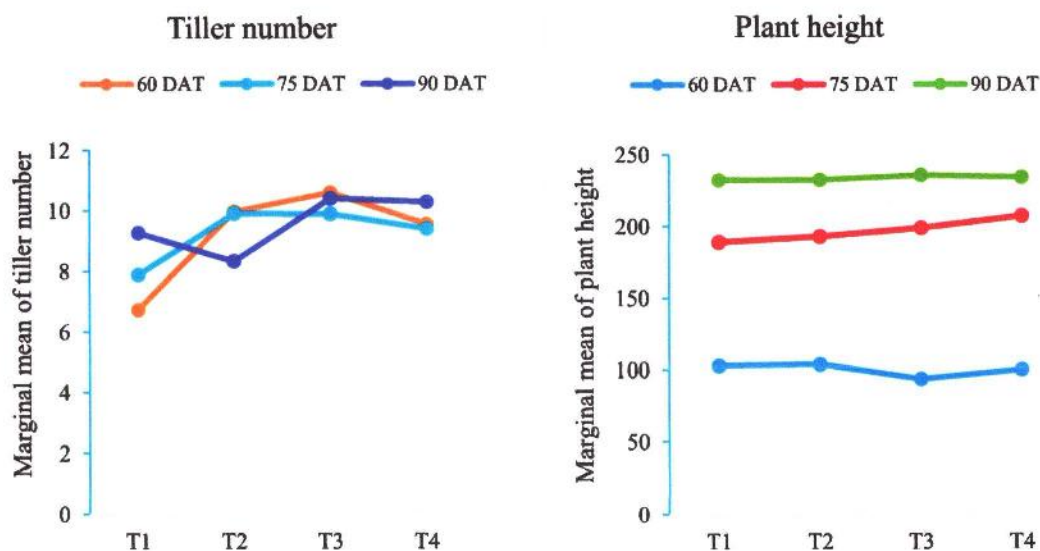
Figure 4.1.1 Marginal mean of biomass

#### 4.1.5 Marginal mean of tiller number and plant height

Figure 4.1.2 showed the mean of tiller number and plant height according to the cutting height and cutting interval. In this figure, three production line are shown as per treatment. In 60 DAT line, highest tiller number was 10.53 in  $T_3$ . In second line (75 DAT), tiller number was higher in  $T_2$  than the other treatment. In 90 DAT production line highest tiller number was 10.39 in  $T_2$ .

In this figure, three line indicates the marginal plant height are shown as per treatment. In 60 DAT line, highest plant height was 103.54 cm in  $T_2$ . In second line (75 DAT), plant height was higher in  $T_4$  than the other treatment. In 90 DAT production line highest tiller number was 235.49 cm in  $T_3$ .

Geren *et al.* (2016) conducted an experiment where highest plant height (92.1 cm) was found in 15 cm cutting height. Wadi *et al.* (2004) found 167 cm plant height in 60 day and 252 cm plant height in 90 day at 0 cm cutting height in case of King Napier grass.



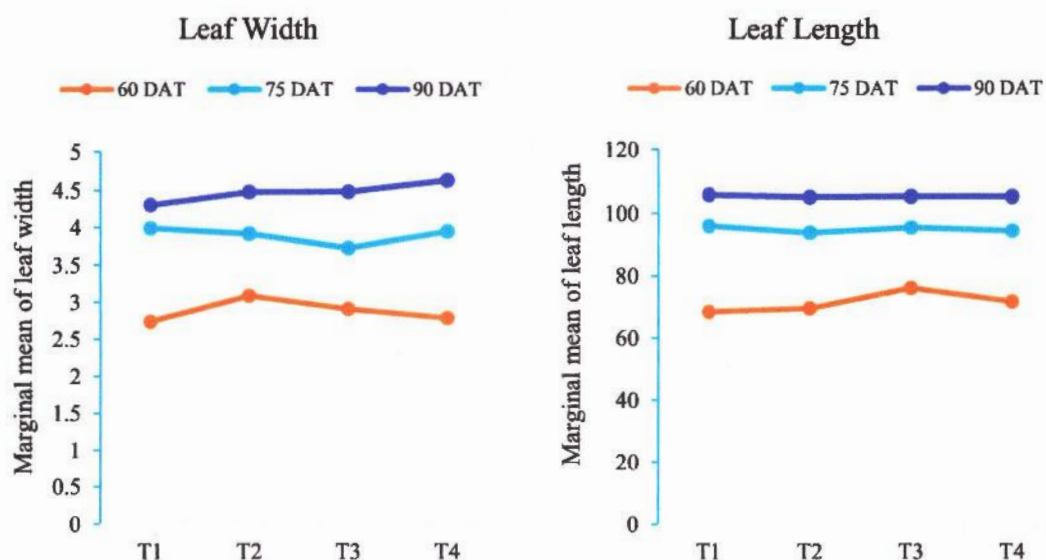
DAT indicates day after treatments; T<sub>1</sub> = 0 cm; T<sub>2</sub> = 5 cm; T<sub>3</sub> = 10 cm; T<sub>4</sub> = 15 cm

Figure 4.1.2 Marginal mean of tiller number and plant height



#### 4.1.6 Marginal mean of leaf width and leaf length

Figure 4.1.3 showed the mean of leaf width and leaf length according to the cutting height and cutting interval. In this figure, three production line are shown as per treatment. In 60 DAT line, highest leaf width and leaf length was 3.09 cm and 76.13 cm in T<sub>2</sub> and T<sub>3</sub> respectively. In second line (75 DAT), both leaf width and leaf length was higher in T<sub>1</sub> than the other treatment. In 90 DAT production line, T<sub>2</sub> and T<sub>3</sub> showed highest leaf length together that was 4.48 cm. on the other hand height leaf length (105.78 cm) was found in T<sub>1</sub>. There was no significance difference between the treatments.



DAT indicates day after treatments;  $T_1 = 0$  cm;  $T_2 = 5$  cm;  $T_3 = 10$  cm;  $T_4 = 15$  cm

Figure 4.1.3 Marginal mean of leaf width and leaf length

#### 4.1.7 Pearson's correlation matrix of Growth parameters of Napier grass at different cutting interval

The results of Pearson's correlation coefficients analysis among the agronomic growth parameters of Napier-4 forage genotype are presented in Table 4.1.4. Highly positive significant ( $p < 0.001$ ) association was found between plant height and biomass ( $r = 0.98$ ), leaf width and biomass ( $r = 0.98$ ), plant height and leaf length ( $r = 0.98$ ), plant height and leaf width ( $r = 0.97$ ), plant height and leaf number ( $r = 0.91$ ), leaf width and leaf length ( $r = 0.97$ ), leaf width and leaf number ( $r = 0.92$ ), leaf width and biomass ( $r = 0.98$ ), leaf length and leaf number ( $r = 0.89$ ), leaf length and biomass ( $r = 0.97$ ), leaf number and biomass ( $r = 0.90$ ).

Table 4.1.4 Correlation matrix of agronomic parameters of Napier grass

|               | <i>Tiller<br/>Number</i> | <i>Plant<br/>Height</i> | <i>Stem<br/>Diameter</i> | <i>Leaf<br/>Width</i> | <i>Leaf<br/>Length</i> | <i>Leaf<br/>Number</i> | <i>Biomass</i> |
|---------------|--------------------------|-------------------------|--------------------------|-----------------------|------------------------|------------------------|----------------|
| Tiller Number | 1                        |                         |                          |                       |                        |                        |                |
| Plant Height  | 0.12                     | 1                       |                          |                       |                        |                        |                |
| Stem Diameter | -0.74                    | -0.13                   | 1                        |                       |                        |                        |                |
| Leaf Width    | 0.18                     | 0.97**                  | -0.18                    | 1                     |                        |                        |                |
| Leaf Length   | 0.17                     | 0.98**                  | -0.14                    | 0.97**                | 1                      |                        |                |
| Leaf Number   | -0.05                    | 0.91**                  | 0.05                     | 0.92**                | 0.89**                 | 1                      |                |
| Biomass       | 0.25                     | 0.98**                  | 0.22                     | 0.98**                | 0.97**                 | 0.90**                 | 1              |

DAT indicates day after treatments, \*\*= $p < 0.01$ , \*= $p < 0.05$

## 4.2 Nutritional parameter of Napier grass

### 4.2.1 Effect of cutting height on nutritional composition of Napier grass

In Table 4.2.1, nutritional compositions of Napier grass are showed according to cutting height. Highest DM (19.79%) and CP (8.96%) was found in T<sub>1</sub> and lowest DM (19.71%) was found in T<sub>2</sub> and lowest CP (8.74%) was found in T<sub>4</sub>. There is no significance difference among the treatments in case of DM. but had a significant effect ( $p < 0.002$ ) among the treatments in case of CP. Highest ash (13.01%) and moisture (80.29%) was found in T<sub>2</sub> and T<sub>3</sub>, respectively. Cutting height has no significant effect on ash and moisture content. Highest CF content (33.02%) was obtained from T<sub>4</sub> and highest fat content (2.04%) was in T<sub>4</sub>. In case of CF and fat content there was no significant effect among the treatments.

Lounglawan *et al.* (2014) conducted experiment where the cutting height at harvest, was 5, 10 or 15 cm above the ground level had no effect on dry matter or nutrient yields of King Napier grass. Present study agreed with Lounglawan *et al.* (2014). In contrast, however, the different cutting heights imposed on the rows of King Napier grass had no significant effect on DM production or nutrient yields measured (Carvalho *et al.*, 2000). Reports also indicated that the content of CP was statistically different among cutting heights (Tessema *et al.*, 2010; Lounglawan *et al.*, 2014). This present study also found there was no statistical effect on DM% and CP% has highly statistical effect for different cutting height.

Table 4.2.1 Nutritional composition of Napier grass according to cutting height

| <i>Treatment</i>      | DM%   | CP%                | Ash%  | Moisture% | CF%   | Fat%  |
|-----------------------|-------|--------------------|-------|-----------|-------|-------|
| <i>T</i> <sub>1</sub> | 19.79 | 8.96 <sup>a</sup>  | 12.98 | 80.20     | 32.41 | 2.017 |
| <i>T</i> <sub>2</sub> | 19.71 | 8.86 <sup>ab</sup> | 13.01 | 80.28     | 32.55 | 2.041 |
| <i>T</i> <sub>3</sub> | 19.71 | 8.84 <sup>b</sup>  | 13.00 | 80.29     | 32.74 | 2.042 |
| <i>T</i> <sub>4</sub> | 19.79 | 8.74 <sup>c</sup>  | 12.99 | 80.20     | 33.02 | 2.047 |
| <i>SEM</i>            | 0.044 | 0.034              | 0.011 | 0.044     | 0.20  | 0.019 |
| <i>p</i>              | 0.376 | 0.002              | 0.202 | 0.376     | 0.184 | 0.685 |

*SEM* = Standard error mean; *T*<sub>1</sub> = 0 cm; *T*<sub>2</sub> = 5 cm; *T*<sub>3</sub> = 10 cm; *T*<sub>4</sub> = 15 cm; NS=non-significant, \*\*\*=*p*<0.001, \*\*=*p*<0.01, \*=*p*<0.05; DM= Dry matter, CP= Crude protein, CF= crude fiber.

#### 4.2.2 Effects of cutting interval on nutritional composition of Napier grass

Table 4.2.2 showed the nutritional composition of Napier grass according to cutting interval. Highest DM content (20.69%) and CP (9.83%) was found in *C*<sub>3</sub> and *C*<sub>1</sub>, respectively. Cutting interval has highly significant effect (*p*<0.0001) on DM and CP. Highest ash (13.63%) and moisture content (81.11%) was obtained from *C*<sub>3</sub> and *C*<sub>1</sub>, respectively. The result was highly significant (*p*<0.0001) among the treatments. Highest CF content (33.38%) and fat content (2.10%) was found in *C*<sub>3</sub>. Cutting interval had highly significant effect (*p*<0.0001) on CF and fat content both.

This differs from the finding of Werner *et al.* (1966) who reported no significant difference in DM and CP yields between different cutting intervals. In the present study, it was found that there was a highly significant effect of cutting interval on DM and CP content. Dry matter yield generally increases with increasing fertilizer rate and cutting interval (Carvalho *et al.*, 2000). Present study was consistent with the Carvalho *et al.* (2000).

Table 4.2.2 Nutritional composition of Napier grass according to cutting interval

| <i>Treatment</i>      | DM%                | CP%               | Ash%               | Moisture%          | CF%                | Fat%              |
|-----------------------|--------------------|-------------------|--------------------|--------------------|--------------------|-------------------|
| <i>C</i> <sub>1</sub> | 18.88 <sup>c</sup> | 9.83 <sup>a</sup> | 12.46 <sup>c</sup> | 81.11 <sup>a</sup> | 31.11 <sup>c</sup> | 1.94 <sup>c</sup> |
| <i>C</i> <sub>2</sub> | 19.69 <sup>b</sup> | 8.93 <sup>b</sup> | 12.90 <sup>b</sup> | 80.30 <sup>b</sup> | 33.10 <sup>b</sup> | 2.06 <sup>b</sup> |
| <i>C</i> <sub>3</sub> | 20.69 <sup>a</sup> | 7.79 <sup>c</sup> | 13.63 <sup>a</sup> | 79.30 <sup>c</sup> | 33.83 <sup>a</sup> | 2.10 <sup>a</sup> |
| <i>SEM</i>            | 0.038              | 0.029             | 0.009              | 0.38               | 0.17               | 0.016             |
| <i>p</i>              | 0.0001             | 0.0001            | 0.0001             | 0.0001             | 0.0001             | 0.0001            |

*SEM* = Standard error mean; DAT indicates day after treatments; *C*<sub>1</sub> = 60 DAT; *C*<sub>2</sub> = 75 DAT; *C*<sub>3</sub> = 90 DAT; NS=non-significant, \*\*\*=*p*<0.001, \*\*=*p*<0.01, \*=*p*<0.05; DM= Dry matter, CP= Crude protein, CF= crude fiber.

#### 4.2.3 Effect of cutting height and cutting interval on nutritional composition of Napier grass

In table 4.2.3, height DM content (20.72%) was found in the interaction effect of T<sub>4</sub>C<sub>3</sub> and lowest was found in T<sub>3</sub>C<sub>1</sub> (18.33%). The interaction effects has no interaction effects has no significant effect on DM content. Highest CP (9.84%) and moisture content (81.17%) was found in T<sub>3</sub>C<sub>1</sub> and the lowest value of CP and moisture was found in T<sub>4</sub>C<sub>3</sub> and T<sub>1</sub>C<sub>3</sub>, respectively. The interaction effect has no significant effect on CP and moisture content. Highest ash content (13.64%) was found in T<sub>3</sub>C<sub>3</sub> and lowest value (12.48%) was found in T<sub>4</sub>C<sub>1</sub>. Highest CF content (33.88%) was found in T<sub>4</sub>C<sub>3</sub> and lowest value (30.72%) was found in T<sub>2</sub>C<sub>1</sub>. All the interaction effects has significant effect ( $p < 0.05$ ) on ash, but no significant on CF content. Highest fat content was found in T<sub>2</sub>C<sub>3</sub> and lowest (1.90%) was found in T<sub>2</sub>C<sub>1</sub>. All the interaction effect has no significant effect ( $p > 0.05$ ) on fat content.

Lounglawan *et al.* (2014) conducted experiment where the cutting height at harvest, whether 5, 10 or 15 cm above ground level had no effect on dry matter or nutrient yields of King Napier grass. Present study agreed with this findings. Figueira *et al.* (2016) reported increased CP content from 12.5 to 15.04% with increased cutting heights from 30 to 60 cm whereas the highest protein content was obtained at a cutting height of 20 cm (Wijitphan *et al.*, 2009; Geren *et al.*, 2016) and 10 cm. The report on the effect of cutting height on ash content was not consistent while Tessema *et al.* (2010) reported statistical effect at a cutting height of 5 and 25 cm. It was also found in present study that there was statistical effect on ash content. Different studies have revealed a strong association between cutting interval and increased dry matter and a decline in nutritive value because crude protein levels, cell content, digestibility and proportion of leaf declined with age while fibre level increased (Ova and Chheda, 1985; Okwori, 1989). Oyenuga (1966) showed that the older the forage materials, the lower the crude protein contents, the higher the fibre content, the lower the digestibility and the poorer nutritive quality and intake Akinola (1981). Forages when harvested at early stages of their development have relatively higher crude protein content, other extract and ash content, but crude fiber, acid detergent lignin, hemicelluloses and cellulose increase with later harvesting resulting in decreased dry digestibility (Mirza *et al.*, 2002). In Kenya, the average dry matter yields vary between 10 and 40 t DM ha<sup>-1</sup> yr<sup>-1</sup> depending on soil fertility, climate, and management (Schreuder *et al.*, 1993). Napier grass on average contains 20% DM, 7 to 10% CP, 70% NDF, 45% ADF (Gwayumba *et al.*, 2002; Islam *et al.*, 2003).

Table 4.2.3 Effect of cutting height and cutting interval on nutritional composition of Napier grass

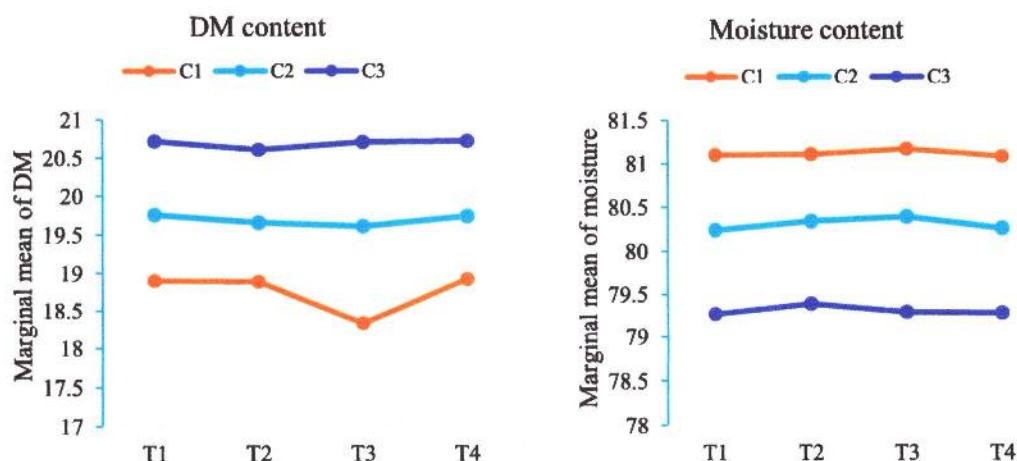
| Treatments     | DM%   | CP%  | Ash%               | Moisture% | CF%   | Fat% |
|----------------|-------|------|--------------------|-----------|-------|------|
| T <sub>1</sub> |       |      |                    |           |       |      |
| C <sub>1</sub> | 18.90 | 9.92 | 12.41 <sup>c</sup> | 81.10     | 30.93 | 1.92 |
| C <sub>2</sub> | 19.76 | 9.07 | 12.90 <sup>b</sup> | 80.24     | 32.57 | 2.04 |
| C <sub>3</sub> | 20.72 | 7.89 | 13.64 <sup>a</sup> | 79.27     | 33.73 | 2.08 |
| T <sub>2</sub> |       |      |                    |           |       |      |
| C <sub>1</sub> | 18.89 | 9.82 | 12.50 <sup>c</sup> | 81.11     | 30.72 | 1.90 |
| C <sub>2</sub> | 19.66 | 8.93 | 12.91 <sup>b</sup> | 80.34     | 33.05 | 2.07 |
| C <sub>3</sub> | 20.61 | 7.84 | 13.64 <sup>a</sup> | 79.39     | 33.87 | 2.13 |
| T <sub>3</sub> |       |      |                    |           |       |      |
| C <sub>1</sub> | 18.33 | 9.84 | 12.46 <sup>c</sup> | 81.17     | 30.94 | 1.96 |
| C <sub>2</sub> | 19.61 | 8.84 | 12.91 <sup>b</sup> | 80.39     | 33.45 | 2.07 |
| C <sub>3</sub> | 20.71 | 7.84 | 13.64 <sup>a</sup> | 79.29     | 33.83 | 2.09 |
| T <sub>4</sub> |       |      |                    |           |       |      |
| C <sub>1</sub> | 18.92 | 9.75 | 12.48 <sup>c</sup> | 81.08     | 31.85 | 1.97 |
| C <sub>2</sub> | 19.74 | 8.87 | 12.90 <sup>b</sup> | 80.26     | 33.32 | 2.05 |
| C <sub>3</sub> | 20.72 | 7.60 | 13.59 <sup>a</sup> | 79.28     | 33.88 | 2.11 |
| SEM            | 0.06  | 0.04 | 0.01               | 0.06      | 0.21  | 0.02 |
| <i>p</i>       | 0.93  | 0.32 | 0.05               | 0.93      | 0.54  | 0.72 |
|                | NS    | NS   | *                  | NS        | NS    | NS   |

SEM = Standard error mean; DAT indicates day after treatments; C<sub>1</sub> = 60 DAT; C<sub>2</sub> = 75 DAT; C<sub>3</sub> = 90 DAT; T<sub>1</sub> = 0 cm; T<sub>2</sub> = 5 cm; T<sub>3</sub> = 10 cm; T<sub>4</sub> = 15 cm; NS=non-significant, \*\*\*=p<0.001, \*\*=p<0.01, \*=p<0.05; DM= Dry matter, CP= Crude protein, CF= crude fiber.

#### 4.2.4 Marginal mean of DM and moisture content

Figure 4.2.1 showed the marginal mean of DM and moisture content according to the cutting height and cutting interval. In this figure, three line are shown as per treatment. In C<sub>1</sub> line, highest DM and moisture content was 18.92% and 81.17% in T<sub>4</sub> and T<sub>3</sub> respectively. In C<sub>3</sub> line, highest DM and moisture content was 20.72% and 79.39% in T<sub>4</sub> and T<sub>2</sub>, respectively.

Lounglawan *et al.* (2014) found highest DM content (13.37% in 30 day and 17.16% in 45 day) at 5 cm cutting height and 18.93% DM content in 60 day at 10 cm cutting height.



DAT indicates day after treatments; C<sub>1</sub>= 60 DAT, C<sub>2</sub>= 75 DAT, C<sub>3</sub>= 90 DAT; T<sub>1</sub> = 0 cm; T<sub>2</sub> = 5 cm; T<sub>3</sub> = 10 cm; T<sub>4</sub> = 15 cm

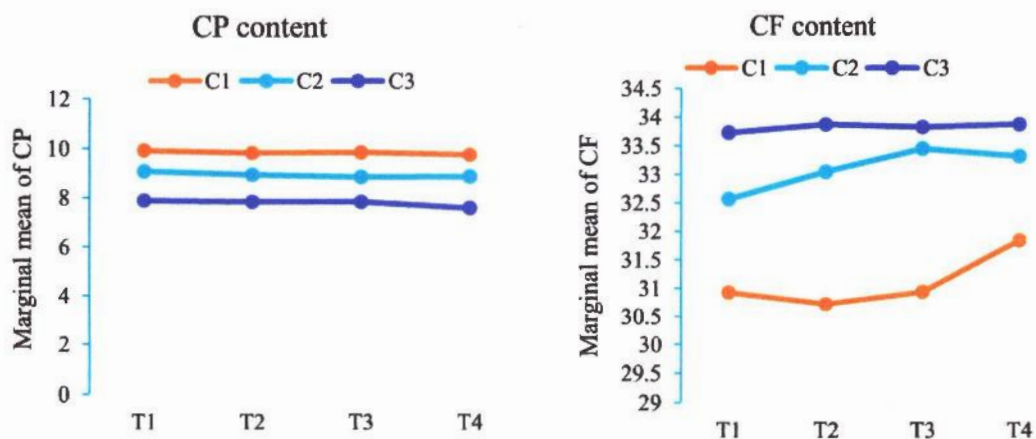
Figure 4.2.1 Marginal mean of DM and moisture content

#### 4.2.5 Marginal mean of CP and CF content

Figure 4.2.2 depicted the marginal averages of CP and CF content based on cutting height and cutting interval. Within the C<sub>1</sub> line, the highest CP and CF content, reaching 9.92% and 30.94%, was observed in T<sub>1</sub> and T<sub>3</sub>, respectively. Meanwhile, for the C<sub>3</sub> line, the CP and CF content at a cutting height of T<sub>1</sub> and T<sub>4</sub> were 7.89% and 33.88%, respectively. These findings suggest a negative correlation between CP and CF.

Lounglawan *et al.* (2014) conducted an experiment where they found highest CP content (12.64%) at 10 cm cutting height in 30 day and found 8.87% CP content at 15 cm cutting

height in 60 day cutting interval. They also found highest CF content (43.75%) in 5 cm cutting height in 60 day cutting interval.



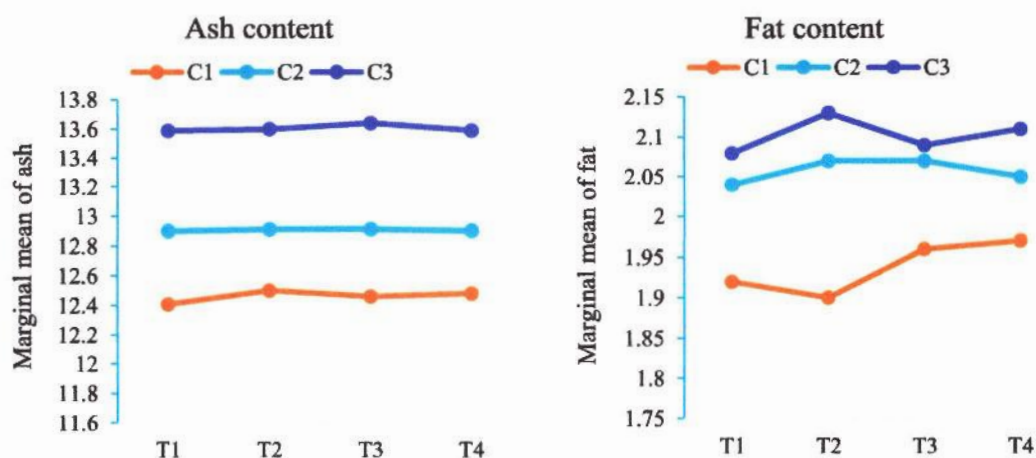
DAT indicates day after treatments; C<sub>1</sub>= 60 DAT, C<sub>2</sub>= 75 DAT, C<sub>3</sub>= 90 DAT; T<sub>1</sub> = 0 cm; T<sub>2</sub> = 5 cm; T<sub>3</sub> = 10 cm; T<sub>4</sub> = 15 cm

Figure 4.2.2 Marginal mean of CP and CF content

#### 4.2.6 Marginal mean of ash and fat content

Figure 4.2.3 illustrated the marginal averages of DM and moisture content with respect to cutting height and cutting interval. In the C<sub>1</sub> line, the highest ash and fat content, reaching 12.48% and 1.97%, respectively, was observed in T<sub>4</sub>. Conversely, in the C<sub>3</sub> line, the peak levels of ash and fat content were 13.64% and 2.13%, found in T<sub>3</sub> and T<sub>2</sub>, respectively.

Lounglawan *et al.* (2014) found highest ash content (14.11%) and highest EE content (2.08%) in 30 day at 10 cm and 15 cm cutting height, respectively.



DAT indicates day after treatments; C<sub>1</sub>= 60 DAT, C<sub>2</sub>= 75 DAT, C<sub>3</sub>= 90 DAT; T<sub>1</sub> = 0 cm; T<sub>2</sub> = 5 cm; T<sub>3</sub> = 10 cm; T<sub>4</sub> = 15 cm

Figure 4.2.3 Marginal mean of ash and fat content

#### 4.3 Pearson's correlation matrix of Napier grass

The result of Pearson's correlation coefficients analysis among the growth parameters and nutritional composition of Napier-4 forage genotype are presented in Table 4.3. There was highly positive significance association between ash and DM content ( $r= 0.975$ ), moisture and CP content ( $r= 0.991$ ), leaf number and DM content ( $r= 0.973$ ), fat and CF content ( $r= 0.972$ ), plant height and CF content ( $r= 0.968$ ), plant height and leaf width ( $r= 0.976$ ), plant height and leaf length ( $r= 0.982$ ), plant height and biomass ( $r= 0.982$ ), leaf width and leaf length ( $r= 0.974$ ), leaf width and biomass ( $r= 0.980$ ), leaf length and biomass ( $r= 0.979$ ).

Asmare *et al.* (2017) found the positive association of DM and DMY with morphological parameters (plant height and leaf length per plant). A similar correlation was observed in another study (Hunter, 1980).

Table 4.3 Pearson's correlation matrix of Growth parameters of Napier grass at different cutting interval

|               | DM       | CP       | Ash     | Moisture | CF      | Fat     | Tiller Number | Plant Height | Stem Diameter | Leaf Width | Leaf Length | Leaf Number | Biomass |
|---------------|----------|----------|---------|----------|---------|---------|---------------|--------------|---------------|------------|-------------|-------------|---------|
| DM            | 1        |          |         |          |         |         |               |              |               |            |             |             |         |
| CP            | -0.975** | 1        |         |          |         |         |               |              |               |            |             |             |         |
| Ash           | 0.975**  | -0.991** | 1       |          |         |         |               |              |               |            |             |             |         |
| Moisture      | -0.987   | 0.991**  | -0.994  | 1        |         |         |               |              |               |            |             |             |         |
| CF            | 0.914    | -0.924   | 0.891   | -0.909   | 1       |         |               |              |               |            |             |             |         |
| Fat           | 0.878    | -0.915   | 0.884   | -0.896   | 0.972** | 1       |               |              |               |            |             |             |         |
| Tiller Number | 0.055    | -0.197   | 0.171   | -0.122   | 0.183   | 0.177   | 1             |              |               |            |             |             |         |
| Plant Height  | 0.949**  | -0.944   | 0.923*  | -0.946   | 0.968** | 0.946** | 0.117         | 1            |               |            |             |             |         |
| Stem Diameter | -0.027   | 0.154    | -0.097  | 0.052    | -0.229  | -0.264  | -0.749        | -0.131       | 1             |            |             |             |         |
| Leaf Width    | 0.951**  | -0.957   | 0.943** | -0.96    | 0.922*  | 0.922*  | 0.183         | 0.976**      | -0.181        | 1          |             |             |         |
| Leaf Length   | 0.928*   | -0.947   | 0.932*  | -0.949   | 0.956** | 0.964** | 0.174         | 0.982**      | -0.140        | 0.974**    | 1           |             |         |
| Leaf Number   | 0.973**  | -0.947   | 0.955** | -0.964   | 0.850   | 0.834   | -0.058        | 0.91*        | 0.059         | 0.92*      | 0.892       | 1           |         |
| Biomass       | 0.947**  | -0.965   | 0.952** | -0.962   | 0.954** | 0.936*  | 0.254         | 0.982**      | -0.220        | 0.980**    | 0.979**     | 0.903       | 1       |

DAT indicates day after treatments; , \*\*\*= $p < 0.001$ , \*\*= $p < 0.01$ , \*= $p < 0.05$ ; DM= Dry matter, CP= Crude protein, CF= crude fiber

However, Wadi *et al.* (2004) discovered that Napier grass exhibited superior growth when cut at a height of 30 cm compared to cutting it at ground level (0 cm) when the interval between cuts was 90 days. The annual dry matter yield of herbage was greater when the grass was cut at ground level (0 cm) at a 90-day interval, compared to a 60-day interval and a 30 cm cutting height. Nakamanee *et al.* (1996) reported that cutting Napier grass at heights of 0 cm, 7.5 cm, and 15 cm had no significant effect on crude protein (CP) content and acid detergent fibre (ADF) but did show significant differences in neutral detergent fibre (NDF). Werner *et al.* (1966) achieved very high protein levels (19.97% and 18.17%) when cutting close to the ground and at a height of 15-20 cm, respectively. However, Werner *et al.* (1966) recommended 5 cm cutting height as the optimal choice, while the current experiment revealed no significant differences in the effects of cutting height between 10 cm and 15 cm. Lounglawan *et al.* (2014) conducted a research where cutting every 45 to 60 days will achieve a much higher dry matter yield than cutting every 30 days and also result in higher yields of CP, ash, EE, NDF, ADF and ADL in spite of a significant decrease in the percentage of these components in the plant as cutting interval is increased. The present study matched with these findings. Asmare *et al.* (2017) found the positive association of DM and DMY with morphological parameters (plant height and leaf length per plant). A similar correlation was observed in another study (Hunter, 1980). The direct relationship between leaf-to-stem ratio and CP content, and the inverse association of leaf-to-stem ratio and fiber content were also previously observed by Tessema *et al.* (2002) for Napier grass.

## CHAPTER V

### SUMMARY AND CONCLUSION

#### 5.1 Summary

Forages play a pivotal role as they provide the essential fiber needed to optimize digestive function for cattle. Napier stands out as a highly sought-after forage variety in both tropical and sub-tropical regions, including Bangladesh, thanks to its remarkable yield, nutritional qualities, and adaptability. This has piqued the strong interest of farmers, who are eager to cultivate Napier. Notably, when it comes to cultivating Napier, it is proved that there was huge variation due to cutting interval and cutting height for both agronomic parameter and nutritional composition. With these considerations in mind, the researcher embarked on a study titled "Effect of Cutting Interval and Cutting Height on Productivity and Nutritional Composition of Napier Grass (*Pennisetum purpureum*) Grown in Coastal Soil". The findings of the study revealed that highest plant height, leaf width, leaf number and biomass were 235.49 cm, 4.63 cm, 13.33 cm and 109.36 t ha<sup>-1</sup>, respectively obtained with the interaction effect of T<sub>3</sub>C<sub>3</sub>. All of this parameters had highly significant effect ( $p < 0.001$ ). Highest tiller number, stem diameter and leaf length was found in T<sub>3</sub>C<sub>1</sub>, T<sub>1</sub>C<sub>1</sub> and T<sub>1</sub>C<sub>3</sub>, respectively (Table 4.1.3).

Highest DM (20.72%) and CF (33.88%) content was found in T<sub>4</sub>C<sub>3</sub>. Highest CP (9.84%) and moisture (81.17%) content was found in T<sub>3</sub>C<sub>1</sub>. Highest ash content (13.64%) was found in T<sub>3</sub>C<sub>3</sub> (Table 4.2.3).

#### 5.2 Conclusion

The interaction effects of cutting height and cutting interval has significant effects ( $p < 0.05$ ) on plant height and leaf length. The results was highly significant ( $p < 0.001$ ) among all the interaction on biomass, leaf number and leaf width. Among all the interactions, highest biomass was found in T<sub>3</sub>C<sub>3</sub> (109.36 t ha<sup>-1</sup>). Highest tiller number and plant height was found in T<sub>3</sub>C<sub>1</sub> (10.58) and T<sub>3</sub>C<sub>3</sub> (235.49 cm), respectively. Highest leaf number (13.33) was also found in T<sub>3</sub>C<sub>3</sub>. Highest DM (20.72%) and CF (33.88%) content was found in T<sub>4</sub>C<sub>3</sub>. Highest CP (9.84%), ash (13.64%) and moisture (81.17%) content

was found in  $T_3C_1$  and  $T_3C_3$ , respectively. It may be concluded that 10 cm cutting height with 90 days of cutting interval ( $T_3C_3$ ) was found best interaction.



## CHAPTER VI

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## APPENDIX



**Land Preparation**



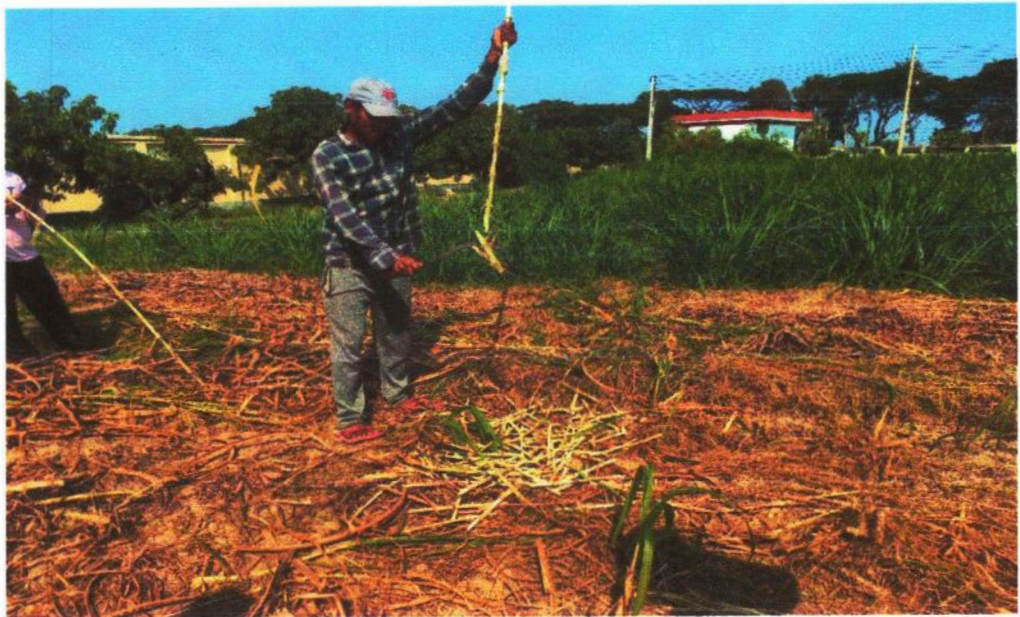
**Land preparation**



**Meeting with BLRI scientific officer**



**Fodder germplasm centre of BLRI**



**Cutting collection**



**Plantation of cutting**



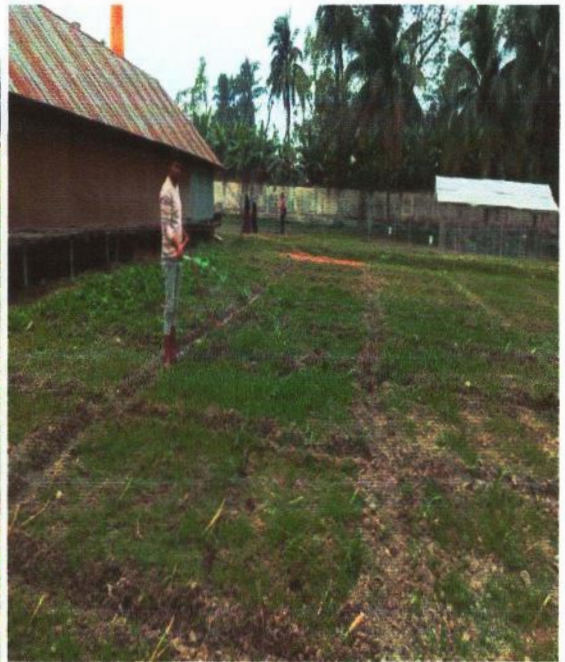
**Plantation of cutting**



**Plant started to grow**



**First weeding**



**Watering**



**Fertilizer applied**



**Tagging the plot**



**Tagging the plot**



**It was applying treatment**



**Applying treatment**



**Napier grass was growing**



**2<sup>nd</sup> weeding**



**3<sup>rd</sup> weeding**



**Napier grass was growing**



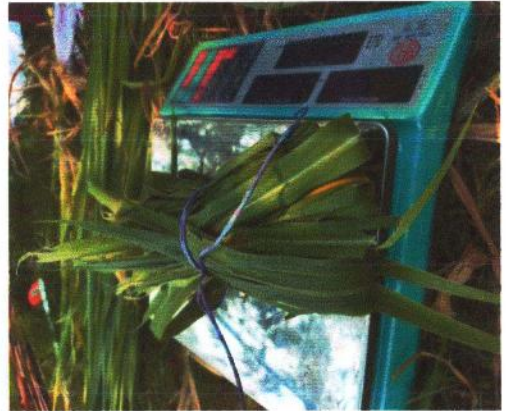
**Napier grass at 60 day**



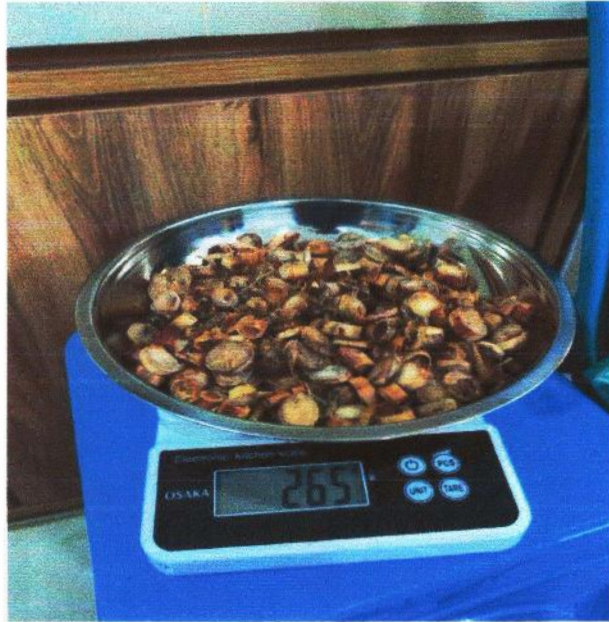
**Napier grass at 75 day**



**Napier grass**



**Data collection**



**Sampling**



**Determination of CP**