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# NITROGEN AND CUTTING MANAGEMENT IN BAJRA NAPIER HYBRID - A REVIEW

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## SUMMARY

This study focuses on agronomic management techniques for Bajra Napier hybrid grass (*Pennisetum purpureum*), which is a well-known fodder grass among farmers because of its high yield potential and nutritional value. Hybrid Napier, which is a hybrid between Bajra and Napier grass, is a sterile, perennial grass that may live for up to two years in the field and grows to a height of 200-300 cm. In order to increase the quantity and quality of green forage, the study examines the significance of nitrogen management, cutting management, and fertiliser levels. According to the study, up to a certain point, rising nitrogen levels were associated with higher concentrations of crude protein and dry matter build-up. Also, as the cutting interval grew, the leaf-stem ratio of green fodders dropped. This decrease was mostly brought on by the fast expansion of the stem fraction with increasing plant maturity. The dairy sector, which has a lack of high-quality feed in many regions, may benefit from this study's unique insights on the management of Bajra Napier hybrid grass.

**Key words:** Bajra Napier hybrid, crude protein yield, nitrogen and cutting management

Agricultural is a backbone of Indian economics in which rearing of dairy animal with agriculture is a major farming system in India, it is important and prevalent subsidiary occupation along with agriculture. Feed expenses constitute approximately 70-75% of the total cost involved in livestock production, especially for milch animals. Therefore, adopting effective feeding strategies with an appropriate inclusion of green and nutritious fodder is essential to enhance the profitability of livestock or dairy farming (Roy *et al.,* 2019). To enhance the quantity and quality, the best alternative is to improve the plant and soil management (Khadda *et al*., 2016).

Green fodder plays an important role in fulfilling the nutritional requirements of animals and reduce a cost of milk production (Singh *et al*., 2019). Various fodder crops are available in the country, among the cultivated perennial grasses such as Bajra Napier hybrid grass, guinea grass, cenchrus, stylosanthus, desmanthus, desmodium, *Zea mays*, *Sorghum bicolor etc*. Among these Bajra Napier hybrid grass is inter specific hybrid between bajra (*Pennisetum glaucum*) and napier grass (*Pennisetum purpureum*). BNH is one of the high yielding green fodder crop. Farmers of dairy sector is preferring Bajra Napier hybrid more than other grass due to availability year-round green fodder and specially higher production multicut type of grass during *kharif* and summer season. It is important fast growing, photosensitive and flower in winter season due to these characteristics, vegetative stage found throughout year. It contains 8.7-10.2% crude protein, 28-30.5% crude fibre and 10-11.5% ash on dry matter basis.

Application and importance of nutrient to fodder crops is very less or negligible. The removal of nutrients through high yielding crops especially perennial crops causes nutrient imbalances over the time, with degradation of soil reserves of nutrients. Mineral nutrition, especially nitrogen contributes for growth and development as well to the structural organization of the leaf blade and thereby enhances the quantity and quality of leaves (vennila and Sankaran 2017). Nitrogen is fundamental sources of plant growth and its supply strongly effect growth and development. As per importance green fodder crop, nitrogen is an important agronomical inputs better growth and development of Bajra Napier hybrid. Application of nitrogen fertilizers improves growth and yield attributes as well as quality parameters of fodder crops, more over it is also associated with greenness of leave, photosynthesis activities *etc* (Pal and Jain, 2022).

Napier grass *(Pennisetum purpureum):* This is an inter-specific hybrid of Bajra (*Pennisetum purpureum*) and Napier grass (*Pennisetum typhoides*). Bajra-Napier hybrid, Napier Bajra hybrids, King Grass, Elephant millet, Cumbu-napier hybrid are common names for it. Bajra Napier hybrid is a perennial grass that may last for up to two years in the field. Bajra Napier hybrid develops bigger, softer leaves than Napier grass (*Nitrogen and Cutting Management of Hybrid Napier - Google Search*, n.d.). With the introduction of high yielding cultivars such as CO-3, CO-4, CO-5, BNH-10, BNH-11, BNH-12, BNH-13, BNH-14 and DNH etc., which provide 300-400 t/ha/year fresh fodder, Bajra Napier hybrid has become a popular fodder grass among farmers due to its high producing potential and nutritional qualities (Singh *et al.*, 2018). For fodder, the Bajra Napier hybrid is valued for its excellent herbage output, palatability, and superior herbage quality. On a dry matter basis, it comprises 8.7-10.2 percent CP, 28-30.5 percent crude fibre, and 10-11.5 percent ash. Some of the cultivars may have a high oxalate content (>3%) (*Package of Practices of Napiar | Agropedia*, n.d.).

It may be found throughout Asia, Africa, southern Europe, and India's tropical and subtropical areas. It is a perennial grass that grows to be 200-300 cm tall, upright, strong, and well rooted. Because this hybrid is a triploid, it is sterile and does not generate seed (Kadam *et al.*, 2017). Because of its speedy sprouting and renewing abilities, Bajra Napier hybrid has become quite popular in the dairy business (Raj & Palled, 2014). The average milk output per cow per day is relatively low, and overall milk production does not satisfy the state's requirements. The major cause of low production is a shortage of high-quality feed (Ishrath *et al.*, 2018). The state's fodder demand is 232 m t, however the availability is just 94.5 m t, resulting in a A almost 60% shortage (137.5 million tonnes) (FIB, 2015). The Bajra Napier hybrid is a heavy feeder crop, and because of its capacity to be cut several times, it has very high nutritional needs. It also responds better to fertiliser levels that have been studied for it.

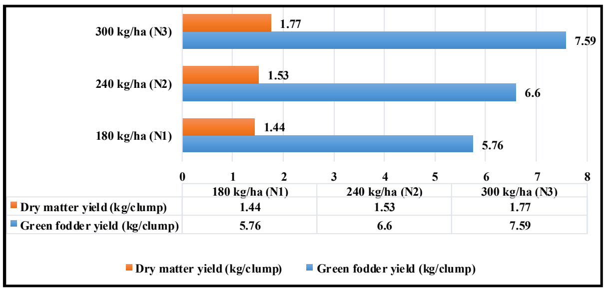
In order to increase the amount as well as quality of green forage, it was thought essential to research various agronomic management strategies *viz*., nitrogen and cutting management, and fertiliser levels (Pathan *et al.*, 2012).

## Nitrogen management

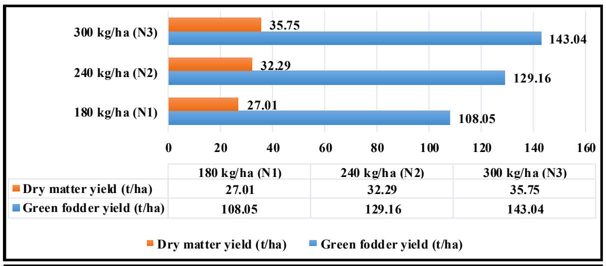
Nitrogen (N) is a key regulator of plant development, and its availability has a significant impact on plant growth. As a result, nitrogen fertilisers have become increasingly popular in agricultural areas across the world. According to some researchers, nitrogen fertiliser improved pasture quality while decreasing nitrogen usage efficiency. Increased nitrogen fertilisation boosted nitrogen absorption significantly, which contributed to increased photosynthetic activity and protein synthesis. Forages with high percentages of crude protein (CP) and dry matter are regarded high grade because providing high protein pasture reduces the requirement for supplemental protein. The protein composition improved as the availability of nitrogen as well as other nutrients increased (Goyal *et al.*, 2020).

## Effects of nitrogen level on hybrid Napier's yield and yield attributes

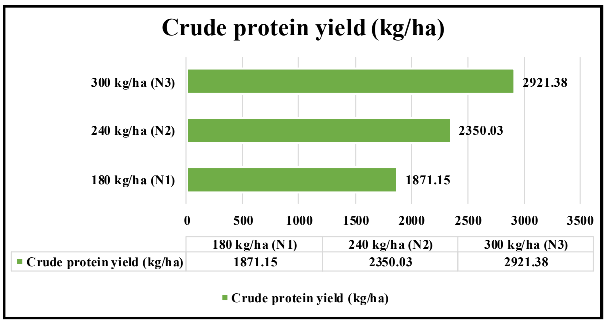
(I) Three amounts of nitrogen (180 kg, 240 kg, and 300 kg N/ha) were used in the treatments. In comparison to 180 kg and 240 kg nitrogen/ha, yields of dry matter (1.77 kg/clump) and green fodder (7.59 kg/clump) were significantly greater in 300 kg nitrogen/ha. In comparison to other levels, the yields of total green fodder (143.04 t/ha), dry matter (35.75 t/ha)




| | Green fodder yield (kg/clump) | Dry matter yield (t/clump) |
|---|---|---|
| S. Em. ± | 0.03 | 0.01 |
| C.D. at 5 % | 0.09 | 0.03 |




| | Green fodder yield (t/ha) | Dry matter yield (t/ha) |
|---|---|---|
| S. Em. ± | 0.72 | 0.18 |
| C.D. at 5 % | 2.08 | 0.52 |




| | |
|---|---|
| S. Em. ± | 15.31 |
| C.D. at 5 % | 44.89 |

*Source*: (Raj and Palled, 2014).

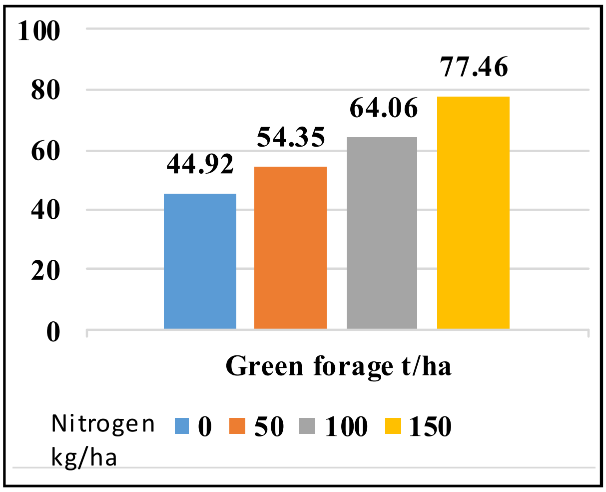
and crude protein (2921.38 kg/ha) were all considerably greater at 300 kg nitrogen/ha. Bajra Napier hybrid grasses reacted by producing less oxalate above 150 kg nitrogen/ha and up to 300 kg nitrogen (Rahman *et al*., 2008) (Raj and Palled, 2014).

(II) The results shown in the graphs below showed that, when data from both years were combined, green forage and dry matter yields both increased significantly when nitrogen levels increased up to 150 kg/ha.

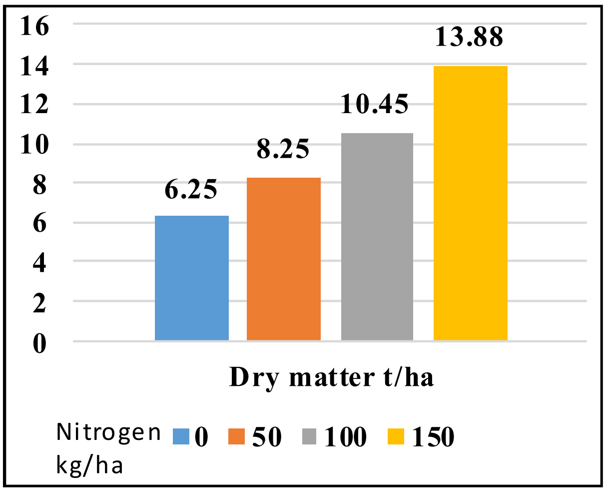
Increased photosynthetic activity in plants may have increased vegetative growth and the amount of dry matter in the soil, which in turn increased the yield of dry matter. This may explain why forage yield increased with increased nitrogen application.

**Effect of different nitrogen levels on quality of Bajra Napier Hybrid:**

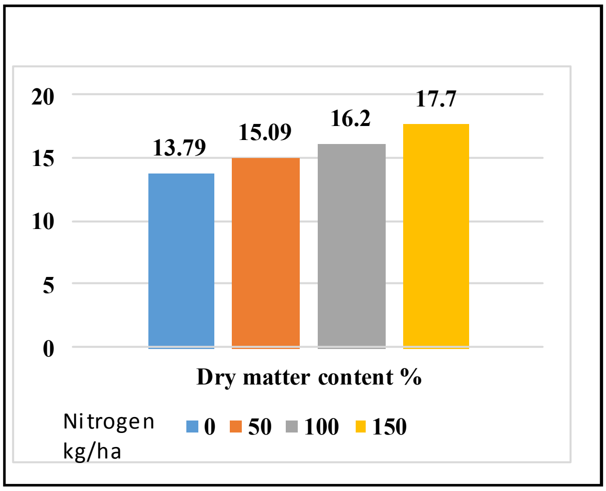
(I) Effect of different nitrogen levels on quality of Bajra Napier hybrid *cv*. Phule Jaywant-An experiment with nitrogen levels of 50, 75, 100, and 125 percent of the recommended dose of nitrogen was conducted (RDN). The maximum ($P<0.05$) DM



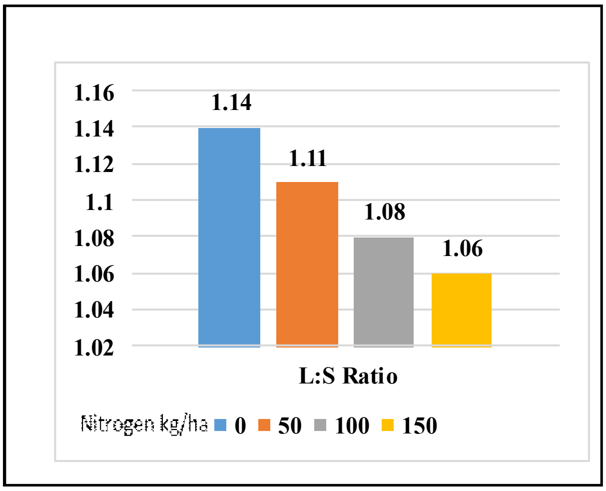

*CD at 5% -2.51




*CD at 5% -0.44




*CD at 5% -0.34




*CD at 5% -0.05

Source: (Singh *et al.*, 2000)

yield (153.90 q/ha) was obtained with 125 percent of RDN. The greatest crude protein concentration (8.53%) was found at 125 percent of RDN and that was at par to 100 percent RDN (8.35 percent).The crude protein content was measured at 100% of RDN and was at par to 75% of RDN (8.27%).

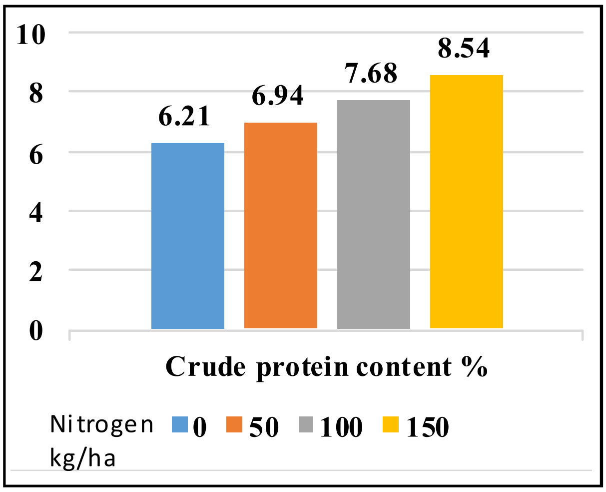
| Treatment | Parameter | | |
|---|---|---|---|
| | DM yield (q/ha) | CP yield (q/ha) | Digestible DM yield (q/ha) |
| N1-50% RDN | 113.12 | 9.06 | 75.46 |
| N2-75% RDN | 124.56 | 10.34 | 84.61 |
| N3-100% RDN | 136.77 | 11.46 | 94.07 |
| N4-125% RDN | 153.90 | 13.19 | 106.98 |
| N5-Control | 75.16 | 5.63 | 48.72 |
| SE± | 2.63 | 0.24 | 5.04 |
| CD at 5% | 7.50 | 0.7 | 15.12 |

*Source*: (Damame *et al.*, 2017).

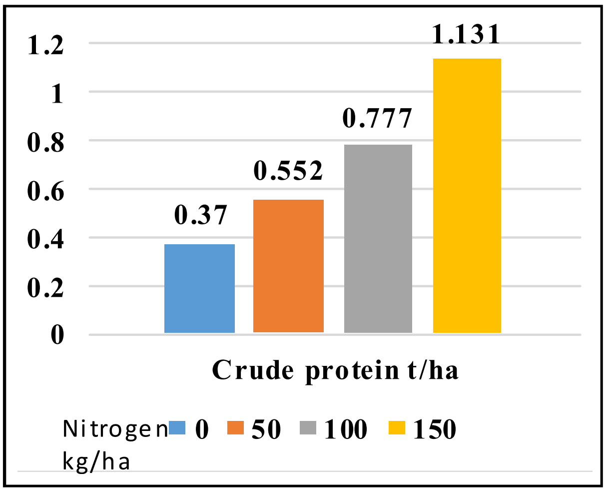
(II) The combined data from the two years are shown in the following graphs, which reveal that the digestibility (%) increased significantly with an increase in nitrogen level up to 150 kg/ha. The graphs also show that an increase in nitrogen level significantly increased crude protein content in both of the years. The quick transformation of carbohydrates into amino acids may cause a rise in crude protein content with an increase in nitrogen (Srivastava and Chatterjee, 1970).

**Cutting management**

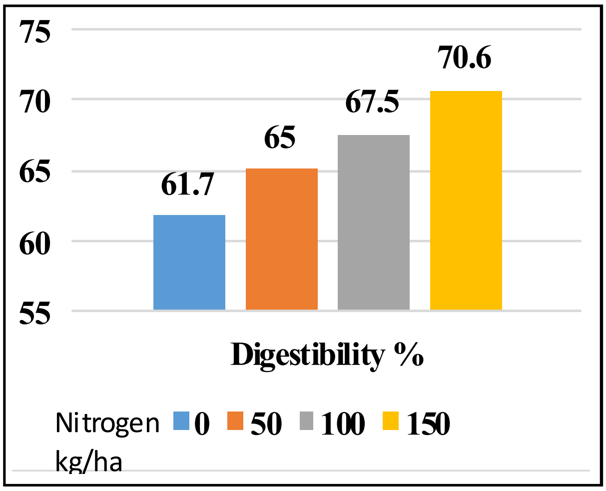
Napier hybrid as a perennial forage grass, cutting it at the proper stage is critical to obtaining improved quality and production (WANGCHUK *et al.*, 2015). Found that total dry matter/plant was greater after 80 days compared to 40 days, while crude protein content was the opposite. Furthermore, cutting interval has a substantial impact on plant height, total dry matter, leaves, number of tillers, and crude protein



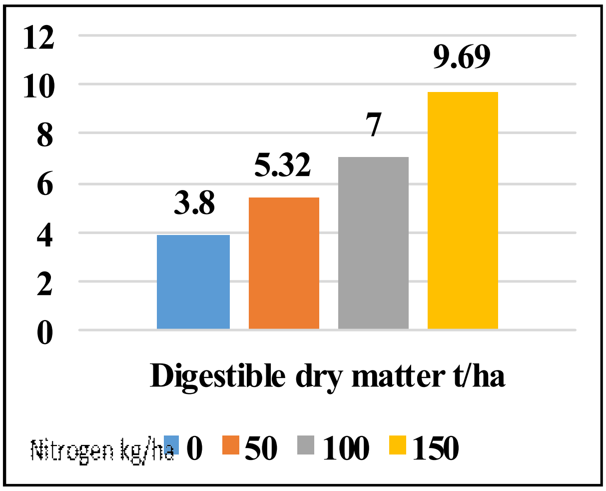

*CD at 5% -0.31




*CD at 5% -0.048




*CD at 5% -0.2




*CD at 5% -0.30

Source:(Singh *et al.*, 2000)

content plant-1 (Kadam *et al*., 2017). Farmers lack enough knowledge on Pennisetum cutting management. This information is essential to improve herbage yields, nutritional value, and also the percentage of water soluble carbohydrates (WSC) in Pennisetum during ensiling. Farmers' lack of expertise has resulted in silages with low feeding value (Manyawu *et al*., 2003).

With proper care, Napier grass might provide a continuous supply of green feed throughout the year, making it suitable for small-scale, intensive farming. There is a deficiency in effective use and management procedures. Harvesting at optimum cutting (stubble) heights above ground level is one of the primary agronomic procedures necessary for good production and quality of Napier grass. The significance of optimum cutting intervals and their various result on production and quality High cutting frequency stunts growth and development, but extended intervals between harvests result in fibre build up and quality degradation (Tessema *et al*., 2010).

**Effects of cutting interval on hybrid Napier's Growth attributes**

In 2013, Bajra Napier hybrid plants were allowed to develop well, and field measurements were taken in 2014. On March 20, 2014, all treatments' plants were consistently clipped to a standard height of 5 cm. there are 3 cutting interval-40 days, 60 days and 80 days. Cutting interval showed a significant influence on plant height and basal circumference, with height growing progressively as cutting interval increased and basal circumference during 60 and 80 day cutting has a same result which lower at 40 day cutting.

| Cutting interval | Plant height (cm) | Basal circumference (cm) |
|---|---|---|
| 40 days | 151 ± 4.5 c | 119.0 ± 2.7 b |
| 60 days | 218 ± 5.4 b | 137.0 ± 3.2 a |
| 80 days | 256 ± 6.4 a | 137.0 ± 3.8 a |

Source: (WANGCHUK *et al.,* 2015).

**Effect of cutting interval on yield attributes**

(I) It was found that the yield decreased by 21.08% when the cutting interval was lowered from T3 (75 days) to T2 (60 days) and by 41.35% when the interval was lowered to 45 days. This may be because the crop's dry matter content has increased along with its growth period. Similar to green fodder yield, cutting interval increases significantly increased dry fodder yield/cut. In addition, (McDonald *et al*., 2002) noted an increase in dry matter at higher cutting intervals as a result of the late-season increase in fibrous tissues and carbohydrates.

| Treatments | Green fodder yield/cut (t/ha) | Green fodder yield/year (t/ha) | Dry fodder yield/cut (t/ha) | Dry fodder yield/year (t/ha) |
|---|---|---|---|---|
| **Cutting intervals (T)** | | | | |
| $T_1$-45 days | 34.28 | 274.29 | 9.76 | 78.11 |
| $T_2$-60 days | 45.83 | 275.03 | 15.36 | 92.19 |
| $T_3$-75 days | 57.85 | 289.25 | 21.63 | 108.19 |
| S. Em± | 2.04 | 16.61 | 0.71 | 4.08 |
| C. D. (P=0.05) | 6.307 | NS | 2.198 | 12.592 |

*Source*: (Ishrath *et al.,* 2018).

(II) No of tiller per plant is also increase with the cutting interval while leaves per plant is decrease with cutting interval increase. (WANGCHUK *et al*., 2015).

**Effect of cutting interval on Leaf-stem ratio**

The ratio of leaves to stems is a crucial factor in determining the quality of fodder plants (Mganga *et al*., 2021). The plant's capacity for growth is determined by the leaf to stem ratio. Additionally, we are aware that stems have just a 30–40% digestion rate whereas leaves have a 60–70% digestive rate. This means that if your cattle eat more leaves, they will be better nourished (*How to Measure Leaf to Stem Ratio*, n.d.).

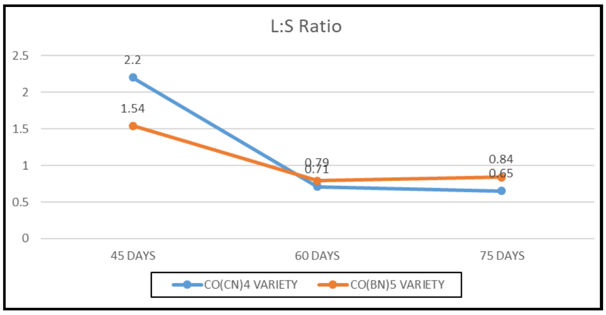
(I) The first cutting was made at 45 days after planting and subsequently at 60 and 75 days. Leaf-stem ratio was significantly (P<0.01) higher in CO (CN) 4 (2.20:1) at 45$^{th}$ day of cutting. The leaf-stem ratio of green fodders decreased as the cutting interval increased which described in below graph. The decrease in leaf-stem ratio with increasing stage of cutting was mainly due to rapid expanding of stem fraction with advancing plant maturity.

**Effect of cutting interval on Quality of BN hybrid (crude protein crude fibre and Ether extract content)**

(I) According to the study, the cutting interval

| Cutting interval | Tillers/plant (no.) | Leaves/tiller (no.) | Leaves/plant (no.) |
|---|---|---|---|
| 40 days | 63.0 ± 2.6 a | 6.0 ± 0.4 a | 378 ± 2.4 a |
| 60 days | 57.0 ± 3.1 b | 7.0 ± 0.5 a | 399 ± 3.5 a |
| 80 days | 43.0 ± 3.7 c | 6.0 ± 0.6 a | 258 ± 3.6 b |

Source : (WANGCHUK *et al.,* 2015).




had a significant impact on the nutritional composition of green feed. From 45 to 60 days of cutting, the crude protein percentage increased; however, by 75 days of cutting, it had significantly decreased from 60 days. As a result, the 60 day of cuttings have higher quality, which is evident in their higher content of crude protein.

(II) The table below showed that the percentage of crude protein decreased as the cutting interval increased. It was already known that crude protein levels decreased as fodder grew more mature. Furthermore, the percentage of crude fibre in Bajra Napier hybrid increases along with an increase in the cutting interval from 45 to 75 days. According to (Van Soest, 1994), Napier grass will immediately start to

| Constituent | Hybrid Bajra Napier variety | | | |
|---|---|---|---|---|
| | CO(CN)4 | | CO(BN)5 | |
| | Wet | Dry | Wet | Dry |
| **45th day of cutting** | | | | |
| Crude protein | 1.95 | 16.88 | 1.52 | 14.03 |
| Crude fibre | 3.05 | 26.40 | 3.02 | 26.59 |
| Ether extract | 0.38 | 3.29 | 0.29 | 2.68 |
| Total ash | 1.25 | 10.82 | 1.42 | 13.11 |
| Gross energy | 465.00 | 4025.97 | 417.00 | 3850.41 |
| **60th day of cutting** | | | | |
| Crude protein | 2.52 | 17.08 | 2.48 | 14.10 |
| Crude fibre | 4.72 | 32.00 | 5.13 | 29.18 |
| Ether extract | 0.34 | 2.30 | 0.49 | 2.78 |
| Total ash | 1.83 | 12.40 | 1.98 | 11.26 |
| Gross energy | 577.00 | 3911.86 | 692.00 | 3936.29 |
| **75th day of cutting** | | | | |
| Crude protein | 2.15 | 13.35 | 1.69 | 9.27 |
| Crude fibre | 5.31 | 32.98 | 6.54 | 35.89 |
| Ether extract | 0.43 | 2.67 | 0.38 | 2.08 |
| Total ash | 1.60 | 9.94 | 1.27 | 6.97 |
| Gross energy | 639.00 | 3968.94 | 727.00 | 3990.12 |

Source: (Ramya *et al.,* 2017).

accumulate more carbohydrates as it matures, which decrease the concentration of crude protein and digestibility.

| Treatments | Crude protein (%) | Crude fiber (%) |
|---|---|---|
| **Cutting intervals (T)** | | |
| $T_1$-45 days | 10.56 | 26.81 |
| $T_2$-60 days | 9.16 | 35.28 |
| $T_3$-75 days | 7.61 | 40.56 |
| S. Em± | 0.48 | 0.73 |
| C. D. (P=0.05) | 1.036 | 1.594 |

*Source*: (Ishrath *et al.,* 2018).

## CONCLUSION

According to recent studies, the amount of nitrogen applied greatly affects the crude protein (CP) content of the fodder crop. The crop's CP content altered as different amounts of nitrogen were administered. Also, when the cutting interval lengthened, the leaf-to-stem ratio of green feeds reduced. This suggests that for livestock producers who wish to provide the highest possible feed quality for their cattle, the percentage of leaves in the fodder is a crucial issue to take into account.

Also, it was discovered that raising the nitrogen level up to a particular point caused an increase in the amount of dry matter accumulated as well as crude protein concentration. This implies that careful nitrogen application management might result in increased yields of high-quality feed for cattle.

The fact that the gross energy of the fodder crop rose with longer cutting intervals was another significant discovery. This suggests that a key factor in the livestock's ability to get energy from the feed is the percentage of leaves present. Hence, farmers should expect to observe an improvement in their cattle's general health and production if they can feed them more leaves.

The fast growth of the stem fraction with increasing plant maturity was the primary cause of the decline in the leaf-stem ratio with increasing cutting stage. The quantity of leaves reduces and the stems get bigger as the plants get older. This emphasises how crucial it is to time crop harvesting to provide the cattle with the best possible nutrition.

In conclusion, controlling nitrogen levels and timing of cutting can significantly affect the quality of feed that is available for animals. Farmers may make sure their cattle are receiving the finest nutrition possible by monitoring the percentage of leaves in the fodder crop, which can eventually result in higher health and production.

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