Journal of Advances and Scholarly Researches in Allied Education
Vol. 20, Issue No. 2, April-2023, ISSN 2230-7540

Effects of Cultivar Selection and Nitrogen Management on the Development and Productivity of Dual-Purposepearl Millet (*Pennisetum glaucum* L.)

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Abstract - The effects of cultivar selection and nitrogen management on the growth and production of dual-purpose pearl millet (Pennisetum glaucum L.) are investigated in this research. The study examines how various cultivars affect maturation length, forage quality, productivity potential, and resilience to pests and diseases. It also examines how nitrogen management affects pasture quality, yield improvement, water usage efficiency, weed competition, and environmental impact. The results emphasize the need of selecting appropriate cultivars and putting into practice efficient nitrogen management measures to maximize pearl millet yield. For farmers, agronomists, and academics engaged in the dual-purpose pearl millet production, the findings provide useful insights.

Keywords - Cultivar Selection, Nitrogen Management, Effects, Development and Productivity, Pennisetum glaucum L.

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INTRODUCTION

The grain known as pearl millet (*Pennisetum glaucum* L.) is cultivated widely and plays an important role in the diets of people in a number of African countries. Each year in the summer, a harvest is available that may be utilized for both human consumption and animal feed. Forage farmers in arid and semi-arid locations recognize this crop for its heat and drought endurance, vigorous growth, quick regrowth after grazing or cutting, high biomass production capacity, and absence of hydrocynide acid (Khairwal et al., 2007; Bramhaiah et al., 2018). Pearl millet's lush, tasty, and nutritious green leaves may be given to dairy calves. Due to the ongoing summertime shortage of green fodder, Egypt is now focusing on increasing production of many possible annual forage species. Only by using proper agronomic intervention can pearl millet's development and production be enhanced. It was shown that the forage cutting date significantly affects both the regrowth pattern and production of the forage crops. It has been shown that delaying harvesting leads to a higher yield (Bukhari et al., 2011, Raval et al., 2014, Manjanagouda, 2015). Andrews and Kumar (1992) state that pearl millet may be harvested at various stages of growth. Therefore, harvesting pearl millet when it is 15 centimeters tall in its stubble will provide the best digestible, appetizing yield, as well as the fastest regeneration. Harvesting the pearl millet cultivar Shandaweel 1 at 50 DAS results in the highest total fresh and dry fodder yields, according to study by Soliman (2000). Plants harvested at 90 DAS produced a higher dry yield than those harvested at 60 DAS, as reported by Wadi et al. (2004). The results revealed that the dry yield of pearl millet increased with later cutting dates.

The maximum leaf area was seen when pearl millet was cut at 75 DAS, as compared to 45 DAS and 60 DAS, as reported by Bukhari et al. (2011). Furthermore, the forage pearl millet cultivar Shandaweel 1 produced the tallest plants (127.15 cm) from the first cut, as reported by Shahin et al. (2013). Noor et al. (2016) found that when pearl millet was cut at 55, 65, and 75 DAS, the plants reached their maximum height (in centimeters) and leaf area per plant (in square centimeters). In addition, Chaudhari et al. (2018) found that the height of pearl millet plants did not significantly change until 60 DAS, at which point the plants became taller. To ensure rapid crop recovery after cutting or grazing and to obtain optimum forage yield, choosing the optimal pearl millet cutting date is crucial. Sometimes farmers and forage producers determine when to harvest forage crops depending on customer demand, rather than when the plants are at their optimal development and output. Increasing agricultural yield requires nitrogen, a vital nutrient for plant growth. Numerous research have shown that it improves the growth and yield of grass-based fodder crops (Usofzadeh et al., 2013, Midha et al., 2015, Nirmal et al., 2016, Joshi et al., 2018, and Thakor et al., 2018). Mansour et al. (2017) found that in Egyptian soil, nitrogen is the limiting factor for the growth of forage crops.

In addition, Serba and Obour (2017) discovered that nitrogen fertilizer increased pearl millet's forage productivity, with a yield of 30 lb/acre being considered enough for high forage production. Summer pearl millet yield characteristics were shown to have better values at the higher level of 120 kg N/ha, as compared to 80 and 100 kg N/ha, in a study conducted by Thakor et al. (2018). Bramhaiah et al. (2018) found that when the maximum N level (150 kg N ha^{-1}) was applied to fodder pearl millet, the plants were much taller than when lower N levels were used.

Given the above, the research at hand set out to ascertain what factors contribute to high productivity and quality.

Cultivar Selection:

Yield potential: Different cultivars of pearl millet exhibit varying levels of yield potential. Selecting high-yielding cultivars can significantly enhance productivity.

Forage quality: Dual-purpose pearl millet is grown for both grain and forage production. Cultivar selection can influence the quality of forage produced, including attributes such as crude protein content, digestibility, and fiber composition.

Pest and disease resistance: Certain cultivars may possess resistance or tolerance to common pests and diseases affecting pearl millet. Choosing resistant cultivars can help minimize losses due to these factors.

Maturity duration: Cultivars vary in their maturity durations, with some being early maturing and others late maturing. The selection of cultivars that align with specific climatic conditions and cropping systems is important.

Nitrogen Management:

Yield enhancement: Nitrogen is a vital nutrient for plant growth and development. Proper nitrogen management, through adequate fertilization, can boost pearl millet yield by promoting vegetative growth, grain filling, and overall plant productivity.

Forage quality: Nitrogen availability influences the nutritional content of forage. Well-managed nitrogen fertilization can increase the crude protein content and overall nutritional value of dual-purpose pearl millet forage.

Water-use efficiency: Nitrogen management affects water-use efficiency in pearl millet. Optimal nitrogen levels can improve water-use efficiency, allowing the crop to better utilize available water resources.

Weed competition: Adequate nitrogen supply promotes vigorous growth in pearl millet, reducing the competitive ability of weeds and aiding in weed control.

Environmental impact: Proper nitrogen management helps minimize nitrogen losses to the environment, such as leaching or volatilization, which can contribute to water and air pollution.

The selection of appropriate cultivars and effective nitrogen management strategies can significantly impact the development and productivity of dual-purpose pearl millet. It is important to consider factors such as yield potential, forage quality, pest and disease resistance, maturity duration, as well as the effects of nitrogen on yield, forage quality, water-use efficiency, weed control, and environmental sustainability. Local agro-climatic conditions, available resources, and specific production goals should be taken into account when making cultivar and nitrogen management decisions.

MATERIAL AND METHODS

Green fodder production and quality of dual purpose pearl millet cultivars as influenced by cutting and nitrogen management were evaluated in a field experiment conducted at the Zonal Agricultural Research Station, Vishweswaraiah Canal Farm, Mandya (Karnataka) during the 2014 kharif season. The three factorial ideas were used to create the experiment in RCBD. There were three different types of plants tested (BAIF Bajra^{-1}, AVKB-19, and GFB^{-1}), as well as two different methods of cutting management (C1-Single cut at 45 days after planting for green fodder followed by harvest for grain purpose). Green fodder may be harvested twice (first at 45 days after sowing and again at 40 days after the first cut) before the grain can be harvested.include a range of 100 to 150 kg N/ha of nitrogen. Farm yard manure was applied at a rate of 10 t ha^{-1} and well blended into the soil three weeks before planting. Single super phosphate and muriate of potash furrows were dug at a spacing of 30 centimeters apart and 60 kilograms of P2O5 per hectare were applied. At 45 DAS and 85 DAS, urea is used as top dress to account for the remaining 50% of nitrogen. The crop was seeded the first week of August and harvested when 50 percent of the leaves were blooming. Five plants were selected at random from each net plot area to analyze for growth and yield characteristics. Each net plot's produce was collected separately in accordance with the treatment. The numbers were then represented as quintals per hectare. Before being dried in an electric oven at 600 C, the samples were air dried until they weighed the same. The green fodder dry matter yield (q/ha) was determined using the weight of these samples. Data on growth parameters are recorded just before to the cuttings, including plant height (cm), number of tillers per row, leaf area index, leaf-to-stem ratio, and green and dry fodder production (t ha-1). Gomez and Gomez (1984) were used for the statistical analysis of the data.

RESULTS AND DISCUSSION

Growth parameters

Plant height

The tendency continued at 85 DAS. At 30 DAS, BAIF Bajra-1 among the varieties recorded considerably greater plant height (28.09 cm), which was comparable to GFB-1 (27.73 cm) and superior to AVKB-19 (24.36 cm). Bajra-1 had a much larger plant height (159.13 cm) than other types at 45 DAS BAIF. At harvest, a similar pattern was seen. According to Shekara and Lohithaswa (2009), Babalad et al. (1993), and Singh et al. (2004), the intrinsic nature of the distinct kinds may account for a significant amount of diversity.

The plant height at harvest (111.12 cm) was significantly greater for the single cut for green fodder followed by harvest for grain use. At 30, 45, and 85 DAS, however, significant changes were not seen. The availability of a longer growing season to promote greater growth was the cause of the rise in plant height in single cuts for green fodder and later leaves for grain purposes. The findings corroborate those of Joshi et al. (1997) and Bokde (1968).

When nitrogen 150 kg ha-1 was applied, plant height at 30, 45, 85 DAS, and harvest was considerably greater than when nitrogen 100 kg ha-1 was applied (28.91 cm, 148.56 cm, 94.27 cm, and 114.27 cm, respectively). The greater availability and absorption of nitrogen by plants, which promotes better plant development, is primarily responsible for the increased plant height at higher levels of nitrogen. Nitrogen is a crucial component of chlorophyll and is required for photosynthesis, which makes plants grow taller. These results concur with those of Agarwal et al. (2005), Tiwana and Puri (2005), and Naveen Kumar and Naleeni Ramawat (2006).

With nitrogen applied at 150 kg ha-1, a single cut for green fodder followed by harvest for grain resulted in noticeably increased plant height at harvest (122.38 cm). This could be because applying more nitrogen leads to increased availability and absorption, which in turn promotes greater vegetative growth and higher plant height (Table 1). The findings corroborate those of Arun Kumar and Het Ram Dudi (2010), Bokde (1968), and Chakraborty et al. (1999).

Table 1: Dual purpose pearl millet varieties Plant height as affected by cutting and nitrogen management

Plant height (cm)					Plant height (cm)				
Treatments	30 DAS	45 DAS	85 DAS	At harvest	Treatments	30 DAS	45 DAS	85 DAS	At harvest
Varieties (V)					Interaction (C×N)				
V1	28.09	159.13	92.67	118.23	C1×N1	24.02	140.75	82.71	99.87
V2	24.36	134.57	82.06	102.08	C1×N2	30.77	154.33	96.56	122.38
V3	27.73	140.68	90.72	100.09	C2×N1	25.06	141.31	82.69	98.79
S.Em.□□	0.99	3.04	2.06	2.02	C2×N2	27.06	142.77	91.98	106.17
CD @ 5%	2.90	8.90	6.03	5.93	S.Em.□□	1.14	3.51	2.37	2.33
Cutting management (C)					CD @ 5%	NS	NS	NS	6.84
C1	27.39	147.54		111.12		Interaction (V×C×N)			
C2	26.06	142.04	87.33	102.48	V1×C1×N1	23.65	156.87	87.67	109.93
S.Em.□□	0.81	2.48	1.68	1.65	V1×C1×N2	34.06	160.73	103.53	142.47
CD @ 5%	NS	NS	NS	4.84	V1×C2×N1	27.11	158.53	85.93	105.88
Nitrogen level (N)					V1×C2×N2	27.55	160.40	93.53	114.62
N1	24.54	141.03	82.70	99.33	V2×C1×N1	22.03	128.24	74.54	95.80
N2	28.91	148.56	94.27	114.27	V2×C1×N2	25.17	152.53	94.40	112.60
S.Em.□□	0.81	2.48	1.68	1.65	V2×C2×N1	23.82	128.27	78.20	96.85
CD @ 5%	2.37	6.84	4.92	4.84	V2×C2×N2	26.43	129.20	81.13	103.10
Interaction (V×C)					V3×C1×N1	26.40	137.13	85.93	93.87
V1×C1	28.85	158.80	95.60	126.20	V3×C1×N2	33.05	149.73	91.73	112.07
V1×C2	27.33	159.46	89.73	110.25	V3×C2×N1	24.24	137.13	83.93	93.64
V2×C1	23.60	140.40	84.47	104.20	V3×C2×N2	27.21	138.73	101.27	100.78
V2×C2	25.12	128.73	79.67	99.98	S.Em.□□	1.98	6.07	4.11	4.04
V3×C1	29.73	143.43	88.83	102.97	CD @ 5%	NS	NS	NS	NS
V3×C2	25.72	137.93	92.60	97.22	CV (%)	10.53	8.17	8.05	7.29
S.Em.□□	1.40	4.29	2.91	2.86					
CD @ 5%	NS	NS	NS	NS					
Interaction (V×N)	V1 : BAIF Bajra-1 V2 : AVKB-19 V3 : GFB-1				C1: Single cut at 45 days after sowing for green fodder followed by harvest for grain purpose.				
V1×N1	25.38	157.70	86.80	107.92					
V1×N2	30.80	160.56	98.53	128.55	C2: Two cuts (1st at 45 days after sowing and 2nd at 40 days after 1st cut) for green fodder followed by harvest for grain purpose.				
V2×N1	22.92	128.26	76.37	96.33					
V2×N2	25.80	140.86	87.77	107.85					
V3×N1	25.32	137.13	84.93	93.75	N1 : 100 kg Nitrogen ha-1				
V3×N2	30.13	144.23	96.50	106.42	N2 : 150 kg Nitrogen ha-1				
S.Em.□□	1.40	4.29	2.91	2.86					
CD @ 5%	NS	NS	NS	NS					

Number of tillers m-1 row length

When compared to the varieties GFB-1 (26.0, 56.96, 52.50, and 55.08 at 30, 45, 85 DAS and at harvest respectively) and AVKB-19 (24.50, 51.45, 48.0, and

50.24 at 30, 45, 85 DAS and at harvest respectively), the number of tillers m^{-1} in BAIF $Bajra^{-1}$ was significantly higher (28.0, 61.32, 61.50, and 60.80). However, at 30 DAS, there was no discernible difference between the GFB^{-1} and AVKB-19 varieties.The growth and development of auxiliary buds into new shoots may have improved, which would explain the rise in the number of tillers. This backs up the conclusions reached by Shekara and Lohithashwa (2009).

In comparison to the two cuts for green fodder followed by harvest for grain purpose (53.68), the single cut for green fodder followed by harvest for grain purpose recorded a considerably greater number of tillers m^{-1} row length at harvest (57.06). The findings make it abundantly evident that harvesting for grain followed by two cuts for green fodder has no beneficial impact on tillering. These findings, along with those of Rohitashav et al. (1993), are supported by these results**.**

Table 2: Dual purpose pearl millet varieties as influenced by cutting and nitrogenmanagement in Number of tillers m^{-1} row length

Number of tillers m^{-1} row length					Number of tillers m^{-1} row length				
Treatment	30 DAS	45 DAS	85 DAS	At harvest	Treatment	30 DAS	45 DAS	85 DAS	At harvest
Varieties (V)					Interaction (C×N)				
V1	28.00	61.32	61.50	60.80	C1×N1	25.55	53.56	54.22	55.76
V2	24.50	51.45	48.00	50.24	C1×N2	30.00	58.74	57.56	58.36
V3	26.00	56.96	52.50	55.08	C2×N1	23.33	56.35	50.78	51.82
S.Em.□□	0.87	1.10	0.84	1.00	C2×N2	25.77	57.63	53.44	55.54
CD @ 5%	2.54	3.22	2.46	2.94	S.Em.□□	1.00	1.27	0.98	1.16
	Cutting management (C)				CD @ 5%	NS	NS	NS	NS
C1	27.78	56.16	55.88	57.06		Interaction (V×C×N)			
C2	26.89	56.99	52.12	53.68	V1×C1×N1	26.00	59.27	64.34	61.34
S.Em.□□	0.71	0.90	1.24	0.82	V1×C1×N2	34.00	62.44	67.66	64.86
CD @ 5%	NS	NS	NS	2.40	V1×C2×N1	24.00	61.07	57.00	57.80
Nitrogen level (N)					V1×C2×N2	28.00	62.20	57.00	59.20
N1	24.44	54.96	52.50	53.80	V2×C1×N1	24.67	49.33	44.34	48.40
N2	27.89	58.19	55.50	56.94	V2×C1×N2	28.00	56.67	50.34	52.66
S.Em.□□	0.71	0.90	0.68	0.82	V2×C2×N1	23.33	49.53	46.00	47.04
CD @ 5%	2.07	2.63	2.02	2.40	V2×C2×N2	22.00	50.27	51.34	52.84
Interaction (V×C)					V3×C1×N1	26.00	51.80	54.00	57.54
V1×C1	30.00	61.00	66.00	63.10	V3×C1×N2	28.00	57.13	54.66	57.54
V1×C2	26.00	61.63	57.00	59.10	V3×C2×N1	22.67	58.47	49.34	50.64
V2×C1	26.33	53.00	47.34	50.54	V3×C2×N2	27.73	60.43	52.00	54.58
V2×C2	22.66	49.90	48.66	49.94	S.Em.□□	1.73	2.20	1.68	2.00
V3×C1	27.00	54.46	54.34	57.54	CD @ 5%	NS	NS	NS	NS
V3×C2	25.00	59.45	50.66	52.60	CV (%)	11.46	9.38	7.66	8.81
S.Em.□□	1.22	1.55	1.58	1.41	V1 : BAIF Bajra-1				

Interaction (V×N)					V3 : GFB-1
V1×N1	25.00	60.31	60.66	59.56	C1: Single cut at 45 days after sowing for green fodder followed by harvest for grain purpose.
V1×N2	31.00	62.31	62.34	62.04	
V2×N1	24.00	49.43	45.16	47.74	C2: Two cuts (1st at 45 days after sowing and 2nd at 40 days purpose.
V2×N2	25.00	53.46	50.84	52.76	
V3×N1	24.33	55.13	51.66	54.10	
V3×N2	27.66	58.78	53.34	56.06	N1 : 100 kg Nitrogen ha^{-1}
S.Em.□□	1.22	1.55	1.18	1.42	N2 : 150 kg Nitrogen ha^{-1}
CD @ 5%	NS	NS	NS	NS	

Leaf: stem ratio

A considerably greater leaf:stem ratio was seen in the BAIF $Bajra^{-1}$ variety (1.66, 0.51, 0.32 at 30, 45, and 85 DAS, respectively) in compared to the varieties GFB^{-1} (1.46, 0.29, 0.22 at 30, 45, and 85 DAS, respectively) and AVKB-19 (1.37, 0.26, 0.21 at 30, 45, and 85 DAS, respectively). But there was no obvious distinction between the AVKB-19 and GFB^{-1} kinds.The BAIF $Bajra^{-1}$ plant is taller and has more tillers per row than GFB-1 and AVKB-19, leading to a larger leaf:stem ratio. The findings confirm the conclusions made by Shekara and Lohitaswa (2009) and Dilip Singh et al. (2012).At all phases of growth, it was shown that the leaf to stem ratio among the different cutting management approaches was not significant.

Nitrogen applied at a rate of 150 kg ha^{-1} resulted in noticeably greater leaf: stem ratios (1.59, 0.38, and 0.28 at 30, 45, and 85 DAS, respectively) than nitrogen applied at a rate of 100 kg ha^{-1}.The accumulation of photosynthates increased as a result of the quick development of dark green leaves that could absorb and utilise incoming solar energy. This in turn enhanced meristematic activity and the leaf:stem ratio as nitrogen levels rose. This could be as a consequence of nitrogen's effects on cell growth and division, which may have led to more active leaves over a longer period of time. These conclusions concur with those of Singh and Gill (1976), Gardner Franklin et al. (1988), and Shekara and Lohithaswa (2009). None of the interaction effects were found to be significant.

Table 3: Dual purpose pearl millet varieties Leaf to stem ratio as influenced by cutting and nitrogen management

Leaf to stem ratio				Leaf to stem ratio			
Treatment	30 DAS	45 DAS	85 DAS	Treatment	30 DAS	45 DAS	85 DAS
Varieties (V)				Interaction (C×N)			
V1	1.66	0.51	0.32	C1×N1	1.43	0.33	0.22
V2	1.37	0.26	0.21	C1×N2	1.51	0.38	0.27
V3	1.46	0.29	0.22	C2×N1	1.37	0.33	0.22
S.Em.□□	0.05	0.02	0.01	C2×N2	1.66	0.36	0.29
CD @ 5%	0.16	0.04	0.02	S.Em.□□	0.06	0.02	0.01

	Cutting management	(C)		CD @ 5%	NS	NS	NS
C1	1.47	0.36	0.24		Interaction	(V×C×N)	
C2	1.52	0.35	0.26	V1×C1×N1	1.57	0.53	0.27
S.Em.□□	0.04	0.01	0.01	V1×C1×N2	1.70	0.58	0.36
CD @ 5%	NS	NS	NS	V1×C2×N1	1.40	0.46	0.26
	Nitrogen level (N)			V1×C2×N2	1.95	0.46	0.40
N1	1.40	0.33	0.22	V2×C1×N1	1.11	0.21	0.20
N2	1.59	0.38	0.28	V2×C1×N2	1.43	0.27	0.21
S.Em.□□	0.04	0.01	0.01	V2×C2×N1	1.39	0.22	0.21
CD @ 5%	0.13	0.04	0.02	V2×C2×N2	1.54	0.34	0.23
	Interaction (V×C)			V3×C1×N1	1.62	0.25	0.19
V1×C1	1.60	0.56	0.32	V3×C1×N2	1.39	0.30	0.23
V1×C2	1.68	0.46	0.33	V3×C2×N1	1.34	0.30	0.21
V2×C1	1.26	0.23	0.20	V3×C2×N2	1.50	0.31	0.24
V2×C2	1.46	0.28	0.22	S.Em.□□	0.11	0.03	0.01
V3×C1	1.50	0.28	0.22	CD @ 5%	NS	NS	NS
V3×C2	1.41	0.30	0.23	CV (%)	11.97	11.03	10.34
S.Em.□□	0.08	0.06	0.01				

	Interaction (V×N)		
V1×N1	1.48	0.50	0.27
V1×N2	1.83	0.51	0.38 C1: Single cut at 45 days after sowing for green fodder
V2×N1	1.25	0.21	0.20 followed by harvest for grain purpose.
V2×N2	1.48	0.30	0.22 after 1st cut) for green fodder followed by harvest for grain
V3×N1	1.48	0.28	0.20 purpose.
V3×N2	1.45	0.30	0.23
S.Em.□	0.08	0.02	N1 : 100 kg Nitrogen ha^{-1} 0.06 N2 : 150 kg Nitrogen ha^{-1}
CD @ 5%	NS	NS	NS

Green fodder and dry matter yield (q ha^{-1})

The BAIF Bajra^{-1} variety outperformed the other two kinds, GFB^{-1} (295.21 & 64.90 q ha^{-1}) and AVKB-19 (249.78 & 43.0 q ha^{-1}) in terms of dry matter yield and green fodder production, respectively (365.21 & 92.47 q ha^{-1}). The variety BAIF Bajra-1's increased green forage output was mostly attributed to considerably greater plant height, tiller count, row length, and leaf: stem ratio. Because of its larger plant height, greater number of tillers, and higher leaf: stem ratio, the variety BAIF Bajra^{-1} gathered much more dry matter, which ultimately led to a significantly higher yield of green fodder. When compared to other types tested, the variety's genetic potential may have helped it perform better. The results are consistent with what Bali et al. (1998) and Ranaet al. (2009) found. Due to the genetic make-up of the varieties, their lower plant height and number of tillers per m^{-1} row development resulted in significantly lower yields of green forage and dry matter with AVKB-19 and GFB^{-1}.

With nitrogen applied at 150 N ha-1 (316.91 q and 74.95 q ha^{-1}, respectively) as opposed to 100 kg ha^{-1} (289.89 q and 58.64 q ha^{-1}, respectively), the production of green fodder and dry matter was much greater. This could be mostly as a result of nitrogen improving plant height, tiller density per m^{1}, row length, and leaf-to-stem ratio growth characteristics. Increased meristematic activity was caused by the nitrogen's direct involvement in cell division, elongation, the production of nucleotides and co-enzymes, and its essential role in chlorophyll, which is crucial for the photosynthetic activity of leaves and ultimately contributes to the accumulation of more biomass.

Table 4: Dual purpose pearl millet varieties as influenced bycutting and nitrogen management Green forage yield (GFY) and Dry matter yield (DMY)

Treatments	GFY (q ha^{-1})	DMY (q ha^{-1})	Treatments	GFY (q ha^{-1})	DMY (q ha^{-1})
	Varieties (V)			Interaction (C×N)	
V1	365.21	92.47	C1×N1	263.28	53.22
V2	249.78	43.00	C1×N2	281.70	61.30
V3	295.21	64.90	C2×N1	316.50	64.06
S.Em.□□	6.70	2.41	C2×N2	352.12	88.60
CD @ 5%	19.65	7.07	S.Em.□□	7.74	2.79
	Cutting management (C)		CD @ 5%	NS	8.17
C1	272.49	57.26		Interaction (V×C×N)	
C2	334.31	76.33	V1×C1×N1	335.53	78.65
S.Em.□□	5.47	1.97	V1×C1×N2	338.08	81.75
CD @ 5%	16.05	5.78	V1×C2×N1	360.00	74.21
	Nitrogen level (N)		V1×C2×N2	427.25	135.28
N1	289.89	58.64	V2×C1×N1	227.10	36.28
N2	316.91	74.95	V2×C1×N2	245.28	43.39
S.Em.□□	5.47	1.97	V2×C2×N1	253.70	43.48
CD @ 5%	16.05	5.78	V2×C2×N2	273.03	48.86
	Interaction (V×C)		V3×C1×N1	227.20	44.72
V1×C1	336.80	80.20	V3×C1×N2	261.74	58.76
V1×C2	393.62	104.75	V3×C2×N1	335.81	74.48
V2×C1	236.18	39.83	V3×C2×N2	356.09	81.65
V2×C2	263.37	46.17	S.Em.□	13.40	4.82
V3×C1	244.47	51.73	CD @ 5%	NS	14.15
V3×C2	345.95	78.07	CV (%)	9.16	9.72
S.Em.v	9.48	3.41			

CD @ 5%	27.79 **Interaction (V×N)**	10.00	V1 : BAIF Bajra-1V2 : AVKB-19
V1×N1	347.77	76.43	V3 : GFB-1
V1×N2	382.67	108.52	C1: Single cut at 45 days after sowing for green fodder followed
V2×N1	240.40	39.88	by harvest for grain purpose.
V2×N2	259.15	46.13	C2: Two cuts (1st at 45 days after sowing and 2nd at 40 days after
V3×N1	281.50	59.60	
V3×N2	308.92	70.20	N1 : 100 kg Nitrogen ha^{-1}
S.Em.□□	9.48	3.41	N2 : 150 kg Nitrogen ha^{-1}
CD @ 5%	NS	10.00	

CONCLUSION

In conclusion, the growth and production of dual-purpose pearl millet are significantly influenced by cultivar choice and nitrogen control. The selection of cultivars with a high potential yield, superior forage quality, and pest and disease resistance might increase production overall. The productivity, forage quality, water-use efficiency, weed control, and environmental sustainability are all enhanced by effective nitrogen management via the employment of the best fertilizer techniques. The results highlight the need of specialized cultivar selection and nitrogen management techniques based on regional agro-climatic variables and production objectives. By putting these methods into reality, one may increase the output of pearl millet while also promoting sustainable agriculture and food security.

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