

Original Research Article

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Effect of Varieties, Cutting and Nitrogen Management on Green Fodder Yield, Nutrient Uptake, Available Soil Nutrient Status and Economics of Dual Purpose Pearl Millet (*Pennisetum glaucum* L.)

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ABSTRACT

A field experiment was conducted during *kharif*2014 at Zonal Agricultural Research Station, VCFarm, Mandya to study the effect of varieties, cutting and nitrogen management on yield, nutrient uptake, available soil nutrient status and economics of dual purpose pearl millet (*Pennisetum glaucum* L.). The soil of the experimental site was red sandy loam with medium available nitrogen, phosphorus and potassium level. Experiment was laid out in randomized complete block design with factorial concept replicated thrice. There were 12 treatment combinations involving 3 varieties (BAIF Bajra-1, AVKB-19 and GFB-1), two cutting management practices (Single cut at 45 DAS for green fodder and later for grain purpose and two cuts for green fodder at 45 DAS and at 40 days after first cut and later for grain purpose) and two nitrogen levels (100 and 150 kg ha⁻¹). The results revealed that, BAIF Bajra-1 recorded significantly higher green fodder (365.21 q ha⁻¹), dry matter yield (92.47 q ha⁻¹), higher nitrogen, phosphorus and potassium uptake (174.26, 17.85, 142.75 kg ha⁻¹) and lower available soil nutrient status (NPK) after harvest (167.57, 22.75, 114.21 kg ha⁻¹). Two cuts for green fodder recorded significantly higher green fodder (334.31 q ha⁻¹), dry matter yield (76.33 q ha⁻¹), but single cut for green fodder later for grain purpose has recorded significantly higher nitrogen, phosphorus and potassium uptake (138.83, 14.45, 117.32 kg ha⁻¹) and lower available soil nutrient status after harvest (163.81, 21.85, 112.17 kg ha⁻¹) respectively. Nitrogen at 150 kg ha⁻¹ given significantly higher green fodder (316.91 q ha⁻¹), dry matter yield (74.95 q ha⁻¹) and higher nitrogen, phosphorus and potassium uptake (146.33, 15.51, 126.54 kg ha⁻¹) and higher available soil nutrient status after harvest of the crop (170.55, 23.09, 116.15 kg ha⁻¹). Higher gross returns (₹ 60102 ha⁻¹), net returns (₹ 42928 ha⁻¹) and B: C ratio (3.49) were recorded in BAIF Bajra-1 with single cut for green fodder followed by harvest for grain purpose along with application nitrogen 150 kg ha⁻¹.

Keywords

Varieties, Cutting, Nitrogen, Green fodder, Nutrient uptake, Economics.

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Introduction

Animal husbandry is an important component of farming in India. Farmers engage in rearing of animals, often as a subsidiary activity, for the supply of milk, meat, wool and manure, or

for using them as work animals. India supports nearly 20% of the world's livestock and 16.8% human population with only 2.3% of the world's geographical area. India is the

leader in cattle (16%) and buffalo (5.5%). The livestock sector contributes 32% of the agricultural output, which is 22% of the total GDP in India. Deficiency in feed and fodder has been identified as one of the major components in achieving the desired level of livestock production. The shortage in dry fodder is 21.8% compared with requirement of 560 million tons for the current livestock population (Anonymous, 2006). Although, India stands first in milk production (90 mt) in the world, but average milk yield is very low (5 litres/animal) compared to developed countries (24 litres/animal). Deficit supply of green fodder is one of the main reasons for low milk yield along with other factors like imbalanced nutrition, good quality fodder (Anonymous, 2009). In India, due to increased population pressure and competition from the food crops for natural resources like land, water, sunlight *etc.*, therefore it is not possible to increase the area under fodder crops further. The only way to bridge the large gap between demand and supply of fodder is through maximizing the fodder production per unit area and unit time and strategies to develop and adopt dual type grain-cum-fodder crop varieties to cater the demand of grain and fodder with available land resource. At this juncture, adopting dual type grain cum fodder varieties gaining importance to overcome green fodder shortage. Pearl millet (*Pennisetum glaucum* L.) is one of the important minor millets is being cultivated for high dietary fibre and nutrient source for human beings and also a good fodder crop for livestock. The dual purpose nature of pearl millet has been recently identified due to its profuse tillering, withstanding capacity for repeated harvesting, absence of anti-nutritional factor like prussic acid, better performance under marginal and low fertile soils (Reddy *et al.*, 2012). Pearl millet, popularly known as poor man's crop due to its fair productivity even under lower management and multicut nature ensures the

fodder supply year around and reduced cost of cultivation due to repeated cultivation like in single cut crops. In any crop, selection of good variety will increase the yield to tune of 15-24%. Nitrogen plays an important role in increasing all the growth and growth attributing characters which finally led to increased green fodder yield. In addition nitrogen increases the crude protein content in green fodder. In this regard, scientific study on cutting and nitrogen management on growth and green fodder yield of pearl millet is very meagre. Therefore, the present investigation was under taken on performance of dual purpose pearl millet (*Pennisetum glaucum* L.) varieties as influenced by cutting and nitrogen management.

Materials and Methods

Field experiment was conducted during *kharif* season of 2014 at Zonal Agricultural Research Station, Vishweswaraiiah Canal Farm, Mandya (Karnataka) to assess the green fodder yield and quality of dual purpose pearl millet varieties as influenced by cutting and nitrogen management. The experiment was laid out in RCBD with factorial concept replicated thrice. The experiment consisted of 12 treatment combinations *viz.*, three varieties (BAIF Bajra-1, AVKB-19 and GFB-1), two cutting management practices (C₁-Single cut at 45 days after sowing for green fodder followed by harvest for grain purpose. 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 and two levels of nitrogen (100 and 150 kg N/ha). Equal quantity of farm yard manure at the rate of 10 t ha⁻¹ was applied to each plot and mixed well in soil three weeks prior to sowing. Furrows were opened at 30 cm apart, 60 kg P₂O₅ ha⁻¹ and 40 kg K₂O ha⁻¹ were applied through single super phosphate and muriate of potash respectively. Nitrogen as basal 50% and remaining as top dress applied

in two equal splits at 45 DAS and 85 DAS in the form of Urea. The crop was sown during 1st week of August and harvested when crop attained 50 % flowering. Five plants were randomly selected in each net plot area for taking observations on growth and yield attributing parameters. The crop in each net plot was harvested separately as per treatment and the values were converted into hectare basis and expressed in quintals. The samples were first dried under shade and then in electric oven at a temperature of 60⁰ C till attaining constant weight on the basis of weight of these samples, the green fodder yield was converted into dry matter yield (q/ha).

Nutrient uptake by crop

Digestion of plant samples

One gram plant samples were pre-digested with 5 ml nitric acid and digested with di-acid mixture of nitric acid and perchloric acid (9:4). The clean digested material was made up to 50 ml volume with 6 N HCl and was used for the analysis of all mineral elements.

Nitrogen uptake

Nitrogen content was estimated by modified micro-kjeldhal's method as outlined by Jackson (1967) and expressed in percentage. Nitrogen uptake (kg/ha) by crop was calculated for each treatment separately using the following formula.

Nitrogen uptake (kg ha⁻¹) = (Nitrogen concentration (%) / 100) X Dry matter (kg ha⁻¹)

Phosphorus uptake

Phosphorus content in the digested plant sample was estimated by vanadomolybdo phosphoric yellow colour method in nitric acid medium and the colour intensity was

measured at 460 nm wave length as outlined by Jackson (1973). It is calculated using the following formula.

Phosphorus uptake (kg ha⁻¹) = (Phosphorus concentration (%) / 100) X Dry matter (kg ha⁻¹).

Potassium uptake

Potassium in the plant samples digest were estimated by atomizing the diluted acid extract in a flame photometer as described by Jackson (1973). It is calculated using the following formula.

Potassium uptake (kg ha⁻¹) = (Potassium concentration (%) / 100) X Dry matter (kg ha⁻¹).

Chemical analysis of soil

Representative soil samples from the experimental plots were drawn from the top 45 cm depth before sowing of the crop. Similarly, the surface soil samples from 0 to 45 cm depth were also collected from each experimental plot after harvest of crop. Soil samples collected were air dried in shade, powdered with wooden mallet and passed through 2 mm sieve and chemically analyzed for organic carbon content (%), pH, EC (dsm⁻¹), available nitrogen, phosphorus and potassium content of the soil.

Available nitrogen (kg ha⁻¹)

Available nitrogen was determined by alkaline permanganate method as outlined by Subbiah and Asija (1956).

Available phosphorus (kg ha⁻¹)

Available phosphorus was determined by Olsen's method as outlined by Jackson (1967).

Available potassium (kg ha⁻¹)

Available potassium was determined by Neutral normal ammonium acetate solution using flame photometer as outlined by Jackson (1967).

Economics

To work out the economic information, market price of different fertilizer and labour units required for establishment of crops and harvesting was considered. Cost of labour was calculated by taking into account the prevailing labour wages at the time of investigation. Gross returns, net returns and benefit cost ratio were worked out by using the following formulae.

Gross returns = green fodder yield x market price

Net returns = Gross returns – Total cost of cultivation

Benefit: Cost ratio = $\frac{\text{Gross returns (} \text{ ha}^{-1}\text{)}}{\text{Total cost of cultivation (} \text{ ha}^{-1}\text{)}}$

Statistical analysis of data

The experimental data collected on growth and yield components of plant was subjected to Fisher's method of "Analysis of Variance" (ANOVA) as outlined by Panse and Sukhatme (1967). Wherever, F- test was significant, for comparison among the treatment means, an appropriate value of critical difference (C.D.) was worked out. If F-test found non-significant, against C.D. values NS (Non-Significant) was indicated. All the data were analyzed and the results were presented and discussed at a probability level of five per cent. Correlation matrix was worked out between growth, yield and quality parameters (Gomez and Gomez, 1984).

Results and Discussion

Green fodder and dry matter yield (q ha⁻¹)

Among the different varieties the BAIF Bajra-1 variety recorded significantly higher green fodder yield and dry matter yield (365.21 & 92.47 q ha⁻¹) over other varieties GFB-1 (295.21 & 64.90 q ha⁻¹) and AVKB-19 (249.78 & 43.0 q ha⁻¹) respectively (Table 1). The increase in green forage yield in the variety BAIF Bajra-1 was mainly due to significantly higher plant height, number of tillers m⁻¹ row length and leaf: stem ratio. Variety BAIF Bajra-1 accumulated significantly higher dry matter which might be due to increased higher plant height, number of tillers and leaf: stem ratio finally resulted in significantly higher green forage yield. The genetic potential of the variety could helped to excel better when compared to other varieties tried. The results are in conformity with the findings of Bali *et al.*, (1998) and Rana *et al.*, (2009). Significantly lower green forage and dry matter yield with variety AVKB-19 and GFB-1 was due to lower plant height and number of tillers m⁻¹ row growth due to genetic makeup of the varieties.

Two cuts for green fodder followed by harvest for grain purpose has recorded significantly higher green fodder (334.31 q ha⁻¹) and dry matter yield (76.33 q ha⁻¹) compared to the single cut for green fodder followed by harvest for grain purpose (272.49 q ha⁻¹ and 57.26 q ha⁻¹ respectively) (Table 1). It was due to two cut for green fodder followed by harvest for grain purpose facilitates the more biomass could harvest with two cuttings compared to single cut for fodder. These results are in conformity with the findings of Waseem and Badrul (1999).

The green fodder and dry matter yield was significantly higher with application nitrogen

at 150 N ha⁻¹ (316.91 q and 74.95 q ha⁻¹ respectively) as compared to nitrogen at 100 kg ha⁻¹ (289.89 q and 58.64 q ha⁻¹ respectively) (Table 1). This may be mainly because the nitrogen improved growth parameters *viz.*, plant height, number of tillers m⁻¹ row length, leaf: stem ratio. The nitrogen is directly involved in cell division, elongation, formation of nucleotides and co-enzymes which resulted in increased meristematic activity and nitrogen is integral part of chlorophyll which plays important role in photosynthetic activity of leaves finally helped to accumulate more biomass. These results are in conformity with the findings of Dudhat *et al.*, (2004), Sharma and Verma (2005), Sheoron and Rana (2006), Chotiya and Singh (2005), Singh *et al.*, (2013) and Chouhan *et al.*, (2015).

The interaction of varieties and cutting management were found significant in green fodder and dry matter yield. BAIF Bajra-1 with two cuts for green fodder followed by harvest for grain purpose recorded significantly higher green fodder and dry matter yield (393.62 q ha⁻¹ and 104.75 q ha⁻¹) (Table 1). This was mainly due to genetic potential of BAIF Bajra-1 made to absorb and assimilate more nitrogen which finally resulted in higher green fodder and dry matter yield. The results are in line with the findings of (Joon *et al.*, 1993), and (Leva *et al.*, 2004).

The interaction effect of variety BAIF Bajra-1 with application of nitrogen 150 kg ha⁻¹ found significant in dry matter yield (108.52 q ha⁻¹). The higher level of nitrogen increased the availability and uptake which resulted in higher plant height, number of tillers and leaf: stem ratio and led to higher photosynthesis which caused more dry matter production. Similar results were reported by Ramesh Babu *et al.*, (1995), Tiwana *et al.*, (2003), Sheoron *et al.*, (2008) and (Phatan *et al.*, 2007).

The interaction effect of two cuts for green fodder followed by harvest for grain purpose with application of nitrogen 150 kg ha⁻¹ recorded significantly higher dry matter yield (797.4 q ha⁻¹) compared to other combinations (Table 1). This was mainly due to more number of tiller and leaf: stem ratio contributed for higher dry matter yield.

Variety BAIF Bajra-1 with two cuts for green fodder followed by harvest for grain purpose along with application of nitrogen 150 kg ha⁻¹ (135.28 q ha⁻¹) resulted in significantly higher dry matter yield (Table 1). This is mainly due to genetic make-up of the variety BAIF Bajra⁻¹ has made to uptake and utilizes the nitrogen more efficiently in enhancing all growth parameters like plant height, number of tillers and leaf: stem ratio which leads to higher green fodder yield and in turn increases dry matter accumulation and yield.

Nutrient uptake by the crop (kg ha⁻¹)

BAIF Bajra-1 variety recorded significantly higher nitrogen, phosphorus and potassium uptake (174.26, 17.85, 142.75 kg ha⁻¹ respectively) as compared to variety GFB-1 (116.99, 12.51, 108.86 kg ha⁻¹ respectively) and AVKB-19 (88.18, 9.69, 84.39 kg ha⁻¹ respectively) (Table 2 and Fig. 1). Single cut for green fodder followed by harvest for grain purpose has recorded significantly higher nitrogen, phosphorus and potassium uptake (138.83, 14.45, 117.32 kg ha⁻¹ respectively) as compared to the two cuts for green fodder followed by harvest for grain purpose (114.12, 12.26, 106.63 kg ha⁻¹ respectively). Application of nitrogen 150 kg ha⁻¹ recorded significantly higher nitrogen, phosphorus and potassium uptake (146.33, 15.51, 126.54 kg ha⁻¹ respectively) compared to nitrogen 100 kg ha⁻¹ (106.62, 11.20, 97.41 kg ha⁻¹ respectively). The interaction of varieties and cutting management were found significant.

Table.1 Green forage yield (GFY) and Dry matter yield (DMY) of dual purpose pearl millet varieties as influenced by cutting and nitrogen management

Treatments	GFY (q ha ⁻¹)	DMY (q ha ⁻¹)	Treatments	GFY (q ha ⁻¹)	DMY (q ha ⁻¹)
Varieties (V)			Interaction (C×N)		
V ₁	365.21	92.47	C ₁ ×N ₁	263.28	53.22
V ₂	249.78	43.00	C ₁ ×N ₂	281.70	61.30
V ₃	295.21	64.90	C ₂ ×N ₁	316.50	64.06
S.Em.±	6.70	2.41	C ₂ ×N ₂	352.12	88.60
CD @ 5%	19.65	7.07	S.Em.±	7.74	2.79
Cutting management (C)			CD @ 5%	NS	8.17
C ₁	272.49	57.26	Interaction (V×C×N)		
C ₂	334.31	76.33	V ₁ ×C ₁ ×N ₁	335.53	78.65
S.Em.±	5.47	1.97	V ₁ ×C ₁ ×N ₂	338.08	81.75
CD @ 5%	16.05	5.78	V ₁ ×C ₂ ×N ₁	360.00	74.21
Nitrogen level (N)			V ₁ ×C ₂ ×N ₂	427.25	135.28
N ₁	289.89	58.64	V ₂ ×C ₁ ×N ₁	227.10	36.28
N ₂	316.91	74.95	V ₂ ×C ₁ ×N ₂	245.28	43.39
S.Em.±	5.47	1.97	V ₂ ×C ₂ ×N ₁	253.70	43.48
CD @ 5%	16.05	5.78	V ₂ ×C ₂ ×N ₂	273.03	48.86
Interaction (V×C)			V ₃ ×C ₁ ×N ₁	227.20	44.72
V ₁ ×C ₁	336.80	80.20	V ₃ ×C ₁ ×N ₂	261.74	58.76
V ₁ ×C ₂	393.62	104.75	V ₃ ×C ₂ ×N ₁	335.81	74.48
V ₂ ×C ₁	236.18	39.83	V ₃ ×C ₂ ×N ₂	356.09	81.65
V ₂ ×C ₂	263.37	46.17	S.Em.±	13.40	4.82
V ₃ ×C ₁	244.47	51.73	CD @ 5%	NS	14.15
V ₃ ×C ₂	345.95	78.07	CV (%)	9.16	9.72
S.Em.±	9.48	3.41	V ₁ : BAIF Bajra-1 V ₂ : AVKB-19 V ₃ : GFB-1 C ₁ : Single cut at 45 days after sowing for green fodder followed by harvest for grain purpose. C ₂ : Two cuts (1 st at 45 days after sowing and 2 nd at 40 days after 1 st cut) for green fodder followed by harvest for grain purpose. N ₁ : 100 kg Nitrogen ha ⁻¹ N ₂ : 150 kg Nitrogen ha ⁻¹		
CD @ 5%	27.79	10.00			
Interaction (V×N)					
V ₁ ×N ₁	347.77	76.43			
V ₁ ×N ₂	382.67	108.52			
V ₂ ×N ₁	240.40	39.88			
V ₂ ×N ₂	259.15	46.13			
V ₃ ×N ₁	281.50	59.60			
V ₃ ×N ₂	308.92	70.20			
S.Em.±	9.48	3.41			
CD @ 5%	NS	10.00			

Table.2 Nutrient uptake (Nitrogen, Phosphorus and potassium) of dual purpose pearl millet varieties as influenced by cutting and nitrogen management

Treatments	Nitrogen (kg ha ⁻¹)	P ₂ O ₅ (kg ha ⁻¹)	K ₂ O (kg ha ⁻¹)	Treatments	Nitrogen (kg ha ⁻¹)	P ₂ O ₅ (kg ha ⁻¹)	K ₂ O (kg ha ⁻¹)
Varieties (V)				Interaction (C×N)			
V ₁	174.26	17.85	142.75	C ₁ ×N ₁	117.37	11.85	103.16
V ₂	88.18	9.69	84.31	C ₁ ×N ₂	160.28	17.03	131.46
V ₃	116.99	12.51	108.86	C ₂ ×N ₁	95.86	10.53	91.64
S.Em.±	2.87	0.38	3.33	C ₂ ×N ₂	132.37	13.97	121.60
CD @ 5%	8.40	1.11	9.78	S.Em.±	3.31	0.44	3.85
Cutting management (C)				CD @ 5%	NS	NS	NS
C ₁	138.83	14.45	117.32	Interaction (V×C×N)			
C ₂	114.12	12.26	106.63	V ₁ ×C ₁ ×N ₁	164.54	14.96	130.14
S.Em.±	2.34	0.31	2.72	V ₁ ×C ₁ ×N ₂	230.93	25.02	167.43
CD @ 5%	6.86	0.90	7.98	V ₁ ×C ₂ ×N ₁	109.02	11.98	104.23
Nitrogen level (N)				V ₁ ×C ₂ ×N ₂	192.54	19.45	169.20
N ₁	106.62	11.20	97.41	V ₂ ×C ₁ ×N ₁	81.19	8.92	77.62
N ₂	146.33	15.51	126.54	V ₂ ×C ₁ ×N ₂	110.95	12.19	106.07
S.Em.±	2.34	0.31	2.72	V ₂ ×C ₂ ×N ₁	73.42	8.07	70.19
CD @ 5%	6.86	0.90	7.98	V ₂ ×C ₂ ×N ₂	87.17	9.58	83.34
Interaction (V×C)				V ₃ ×C ₁ ×N ₁	106.41	11.69	101.73
V ₁ ×C ₁	197.73	19.98	148.78	V ₃ ×C ₁ ×N ₂	138.97	13.90	120.90
V ₁ ×C ₂	150.78	15.71	136.71	V ₃ ×C ₂ ×N ₁	105.15	11.55	100.53
V ₂ ×C ₁	96.06	10.55	91.85	V ₃ ×C ₂ ×N ₂	117.43	12.91	112.27
V ₂ ×C ₂	80.30	8.81	76.76	S.Em.±	5.73	0.75	6.67
V ₃ ×C ₁	122.68	12.8	111.31	CD @ 5%	NS	NS	NS
V ₃ ×C ₂	111.28	12.23	106.40	CV (%)	6.99	7.14	7.37
S.Em.±	4.05	0.53	4.71	V ₁ : BAIF Bajra-1 V ₂ : AVKB-19 V ₃ : GFB-1 C ₁ : Single cut at 45 days after sowing for green fodder followed by harvest for grain purpose. C ₂ : Two cuts (1 st at 45 days after sowing and 2 nd at 40 days after 1 st cut) for green fodder followed by harvest for grain purpose. N ₁ : 100 kg Nitrogen ha ⁻¹ N ₂ : 150 kg Nitrogen ha ⁻¹			
CD @ 5%	11.88	1.57	NS				
Interaction (V×N)							
V ₁ ×N ₁	136.78	13.46	117.18				
V ₁ ×N ₂	211.73	22.23	168.31				
V ₂ ×N ₁	77.30	8.50	73.90				
V ₂ ×N ₂	99.06	10.88	94.70				
V ₃ ×N ₁	105.78	11.61	101.13				
V ₃ ×N ₂	128.2	13.40	116.58				
S.Em.±	4.05	0.53	4.71				
CD @ 5%	11.88	1.57	13.83				

Table.3 Available Nitrogen, Phosphorus and Potassium content in soil (kg ha⁻¹) after harvest of crop as influenced by cutting and nitrogen management

Treatments	Avail. N (kg ha ⁻¹)	Avail. P ₂ O ₅ (kg ha ⁻¹)	Avail. K ₂ O (kg ha ⁻¹)	Treatments	Avail. N (kg ha ⁻¹)	Avail. P ₂ O ₅ (kg ha ⁻¹)	Avail. K ₂ O (kg ha ⁻¹)
Varieties (V)				Interaction (C×N)			
V ₁	167.57	22.75	114.21	C ₁ ×N ₁	162.70	21.54	113.44
V ₂	169.23	23.51	118.46	C ₁ ×N ₂	164.93	22.16	110.90
V ₃	172.08	22.88	116.47	C ₂ ×N ₁	174.71	24.63	119.78
S.Em.±	0.75	0.26	1.20	C ₂ ×N ₂	176.17	23.86	121.40
CD @ 5%	2.21	NS	NS	S.Em.±	0.87	0.30	1.39
Cutting management (C)				CD @ 5%			
C ₁	163.81	21.85	112.17	NS	NS	0.88	NS
C ₂	175.44	24.25	120.59	Interaction (V×C×N)			
S.Em.±	0.61	0.21	0.98	V ₁ ×C ₁ ×N ₁	162.30	21.95	111.13
CD @ 5%	1.81	0.63	2.88	V ₁ ×C ₁ ×N ₂	163.56	21.56	106.05
Nitrogen level (N)				V ₁ ×C ₂ ×N ₁	170.66	24.33	118.74
N ₁	168.70	23.01	116.61	V ₁ ×C ₂ ×N ₂	173.75	23.61	120.90
N ₂	170.55	23.09	116.15	V ₂ ×C ₁ ×N ₁	160.33	21.37	117.22
S.Em.±	0.61	0.21	0.98	V ₂ ×C ₁ ×N ₂	163.05	23.01	111.62
CD @ 5%	1.81	NS	NS	V ₂ ×C ₂ ×N ₁	175.01	25.36	122.30
Interaction (V×C)				V ₂ ×C ₂ ×N ₂	178.54	24.31	122.72
V ₁ ×C ₁	162.93	21.76	108.59	V ₃ ×C ₁ ×N ₁	165.46	21.31	111.98
V ₁ ×C ₂	172.20	23.74	119.82	V ₃ ×C ₁ ×N ₂	168.18	21.91	115.04
V ₂ ×C ₁	163.68	22.19	114.42	V ₃ ×C ₂ ×N ₁	178.45	24.21	118.30
V ₂ ×C ₂	176.78	24.84	122.51	V ₃ ×C ₂ ×N ₂	176.22	24.10	120.57
V ₃ ×C ₁	166.82	21.61	113.51	S.Em.±	1.50	0.52	2.40
V ₃ ×C ₂	177.33	24.16	119.44	CD @ 5%	NS	NS	NS
S.Em.±	1.06	0.36	1.70	CV (%)	6.08	8.93	7.68
CD @ 5%	3.13	NS	NS	V ₁ : BAIF Bajra-1 V ₂ : AVKB-19 V ₃ : GFB-1			
Interaction (V×N)				C ₁ : Single cut at 45 days after sowing for green fodder followed by harvest for grain purpose. C ₂ : Two cuts (1 st at 45 days after sowing and 2 nd at 40 days after 1 st cut) for green fodder followed by harvest for grain purpose.			
V ₁ ×N ₁	166.48	23.14	114.94	N ₁ : 100 kg Nitrogen ha ⁻¹ N ₂ : 150 kg Nitrogen ha ⁻¹			
V ₁ ×N ₂	168.65	22.36	113.48				
V ₂ ×N ₁	167.67	23.37	119.76				
V ₂ ×N ₂	170.80	23.66	117.17				
V ₃ ×N ₁	171.95	22.76	115.14				
V ₃ ×N ₂	172.20	23.01	117.80				
S.Em.±	1.06	0.36	1.70				
CD @ 5%	NS	NS	NS				

Table.4 Economics of dual purpose pearl millet varieties as influenced by cutting and nitrogen management

Treatments	Total cost of cultivation (₹ ha ⁻¹)	Gross returns (₹ ha ⁻¹)	Net returns (₹ ha ⁻¹)	B:C ratio
V ₁ ×C ₁ ×N ₁	16523	50404	33881	3.05
V ₁ ×C ₁ ×N ₂	17174	60102	42928	3.49
V ₁ ×C ₂ ×N ₁	19523	46830	27307	2.39
V ₁ ×C ₂ ×N ₂	20174	56785	36611	2.81
V ₂ ×C ₁ ×N ₁	16523	35286	18763	2.13
V ₂ ×C ₁ ×N ₂	17174	43187	26013	2.51
V ₂ ×C ₂ ×N ₁	19523	34205	14682	1.75
V ₂ ×C ₂ ×N ₂	20174	38454	18280	1.90
V ₃ ×C ₁ ×N ₁	16523	39875	23352	2.41
V ₃ ×C ₁ ×N ₂	17174	45229	28055	2.63
V ₃ ×C ₂ ×N ₁	19523	43330	23807	2.21
V ₃ ×C ₂ ×N ₂	20174	46859	26685	2.32

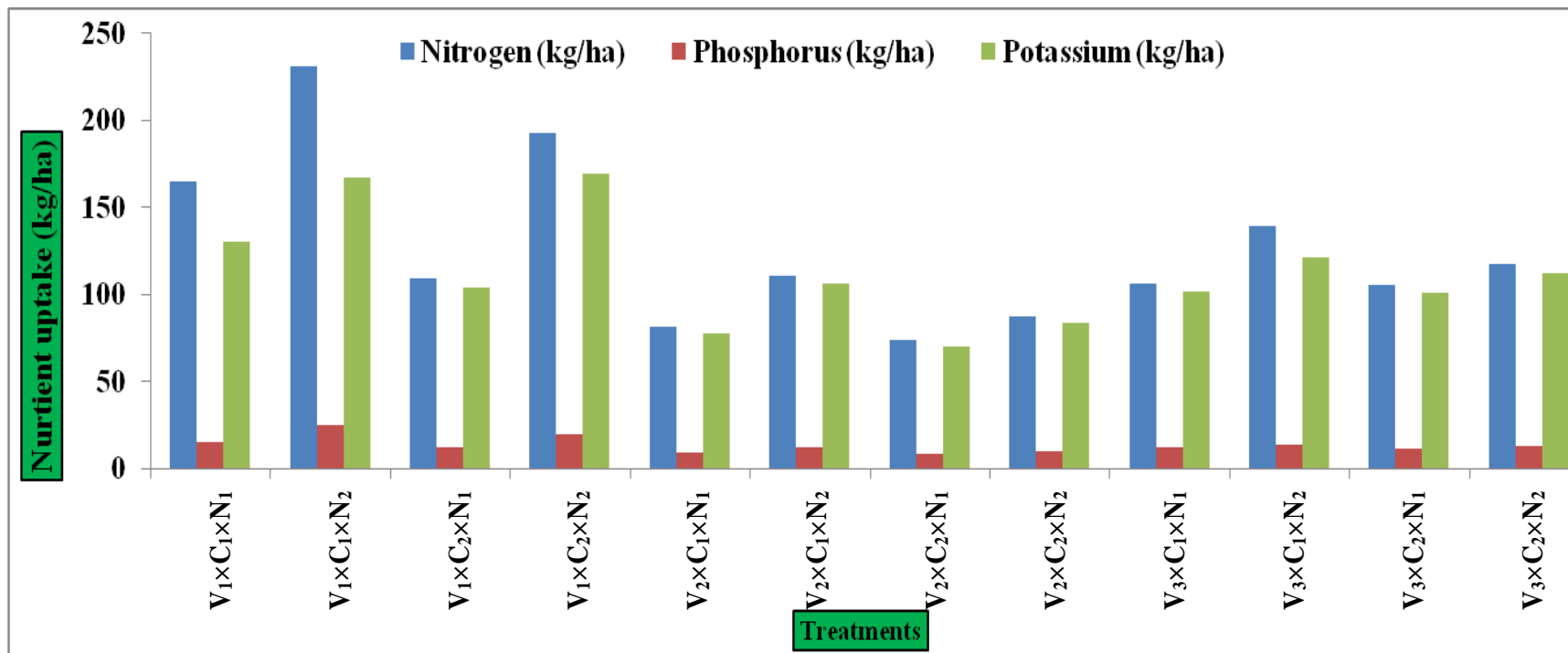


Fig. 1: Nutrient uptake (kg ha⁻¹) of dual purpose pearl millet varieties as influenced by cutting and nitrogen management

Varieties:

V₁: BAIF Bajra-1
 V₂: AVKB-19
 V₃: GFB-1

Cutting management:

C₁: Single cut at 45 days after sowing for green fodder followed by harvest for grain purpose.
 C₂: Two cuts (1st 45 days after sowing and 2nd at 40 days after 1st cut) for green fodder followed by harvest for grain purpose.

Nitrogen levels:

N₁: 100 kg Nitrogen /ha
 N₂: 150 kg Nitrogen /ha

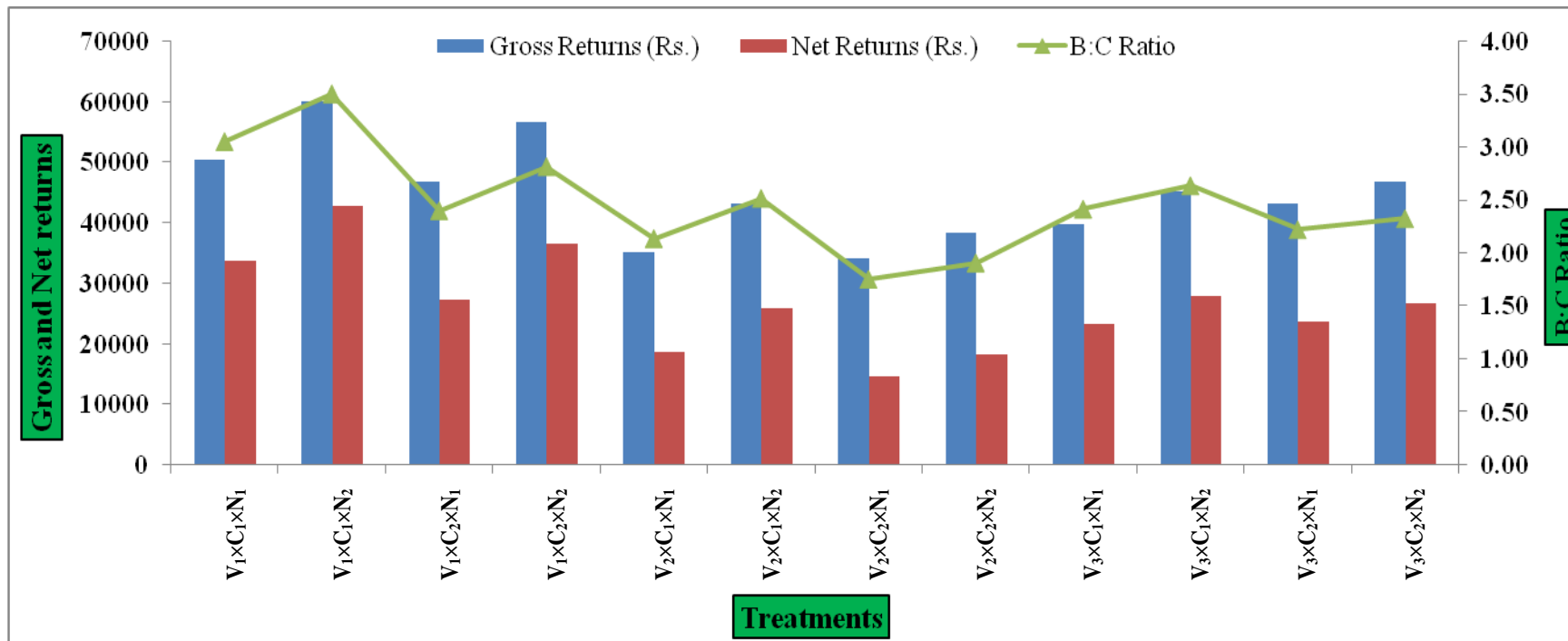


Fig. 2 : Economics of dual purpose pearl millet varieties as influenced by cutting and nitrogen management

Varieties:

- V₁: BAIF Bajra-1
- V₂: AVKB-19
- V₃: GFB-1

Cutting management:

- C₁: Single cut at 45 days after sowing for green fodder followed by harvest for grain purpose.
- C₂: Two cuts (1st 45 days after sowing and 2nd at 40 days after 1st cut) for green fodder followed by harvest for grain purpose.

Nitrogen levels:

- N₁: 100 kg Nitrogen /ha
- N₂: 150 kg Nitrogen /ha

BAIF Bajra-1 with single cut for green fodder followed by harvest for grain purpose recorded significantly higher nitrogen and phosphorus uptake (197.73, 19.98 kg ha⁻¹ respectively). BAIF Bajra-1 variety with application of nitrogen 150 kg ha⁻¹ found significant in NPK uptake (211.73, 22.23, 168.31 kg ha⁻¹ respectively) (Table 2 and Fig. 1). The interaction of single cut for green fodder later leave it for grain purpose with nitrogen 150 kg ha⁻¹ found non-significant. The interaction of variety, cutting and nitrogen management were found non-significant. The higher nitrogen, phosphorus and potassium uptake (230.93, 25.02, 167.43 kg ha⁻¹) was noticed in the variety BAIF Bajra-1 with single cut for green fodder followed by harvest for grain purpose along with application of nitrogen 150 kg ha⁻¹. The higher nutrient uptake was mainly due to the higher green fodder yield, dry matter yield, grain yield and stover yield. The results were conformity with the findings of Singh *et al.*, (1983), Amrutkar *et al.*, (1985), Yadav, (1988), Agarwal *et al.*, (1992).

Available soil nutrients (kg ha⁻¹)

The available nutrient status in the soil differed significantly. The lower available NPK was observed in variety BAIF Bajra-1 (167.57, 22.75, 114.21 kg ha⁻¹ respectively) as compared to the variety GFB-1 (172.08, 22.28, 116.47 kg ha⁻¹ respectively) and AVKB-19 (169.23, 23.51, 118.46 kg ha⁻¹ respectively). There was no significant difference between GFB-1 and AVKB-19 varieties. The single cut for green fodder followed by harvest for grain purpose has recorded significantly higher available nitrogen content (163.81 kg ha⁻¹), lower phosphorus and potassium content (21.85, 112.7 kg ha⁻¹) as compared to the two cuts for green fodder followed by harvest for grain purpose (175.44, 24.25, 120.59 kg ha⁻¹ respectively). Application of 150 kg nitrogen

ha⁻¹ recorded significantly higher available nitrogen and phosphorus content (170.55, 23.09 kg ha⁻¹) as compared to 100 kg nitrogen ha⁻¹ (168.70, 23.01 kg ha⁻¹). The interaction of variety and cutting management were found significant with respect to nitrogen. BAIF Bajra-1 with single cut for green fodder followed by harvest for grain purpose recorded significantly lower available nitrogen content (162.93 kg ha⁻¹). The other interaction effects were found to be non-significant (Table 3).

Economics

Higher gross returns (₹ 60102 ha⁻¹), net returns (₹ 42928 ha⁻¹) and B:C ratio (3.49) were recorded in BAIF Bajra-1 with single cut for green fodder followed by harvest for grain purpose along with application nitrogen 150 kg ha⁻¹. Lower gross returns (₹ 34205 ha⁻¹), net returns (₹ 14682 ha⁻¹) and B:C ratio (1.75) were obtained in AVKB-19 with two cuts for green fodder followed by harvest for grain purpose along with application of nitrogen 100 kg ha⁻¹ (Table 4 and Fig. 2). The higher B: C ratio in above interactions was mainly due to the higher grain and stover yield along with the green fodder increased gross returns.

The interaction of varieties and cutting management were found significant in green fodder and dry matter yield. BAIF Bajra-1 with two cuts for green fodder followed by harvest for grain purpose recorded significantly higher green fodder and dry matter yield (393.62 q ha⁻¹ and 104.75 q ha⁻¹). The higher nitrogen, phosphorus and potassium uptake was noticed in the variety BAIF Bajra-1 with single cut for green fodder followed by harvest for grain purpose along with application of nitrogen 150 kg ha⁻¹. Higher B: C ratio was recorded with BAIF Bajra-1 with single cut for fodder followed by harvest for grain purpose along with

application of nitrogen 150 kg ha⁻¹ (3.49). The next best combination was BAIF Bajra-1 with single cut for fodder purpose followed by harvest for grain purpose along with application of 100 kg of nitrogen ha⁻¹ (3.05). The higher B: C ratio in above interactions was mainly due to the higher grain and stover yield along with the green fodder increased gross returns.

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