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GREEN FODDER YIELD AND QUALITY OF DUAL PURPOSE PEARL MILLET (*PENNISETUM GLAUCUM* L.) VARIETIES AS INFLUENCED BY CUTTING AND NITROGEN MANAGEMENT

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ABSTRACT

The study was conducted during *kharif* 2014 at ZARS, V. C. Farm, Mandya. The soil was red sandy loam with medium available NPK. Experiment was laid out in RCBD with factorial concept replicated thrice. There were 12 treatment combinations involving 3 varieties (BAIF Bajra-1, AVKB-19 and GFB-1), two cuttings (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 (92.47 q ha^{-1}), crude protein (7.07 q ha^{-1}) and crude fibre yield (31.17 q ha^{-1}). Two cuts for green fodder recorded significantly higher green fodder (334.31 q ha^{-1}), dry matter (76.33 q ha^{-1}) and crude protein and crude fibre yield. Nitrogen at 150 kg ha^{-1} given significantly higher green fodder (316.91 q ha^{-1}), dry matter (74.95 q ha^{-1}), crude protein (5.74 q ha^{-1}), crude fibre yield (23.69 q ha^{-1}).

INTRODUCTION

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 mans 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 was undertaken.

MATERIALS AND METHODS

Field experiment was conducted during *kharif* season of 2014 at Zonal Agricultural Research Station,Vishweswaraiah Canal Farm, Mandya (Karnataka) toassess 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 (**C_1**-Single cut at 45 days after sowing for green fodder followed by harvest for grain purpose. **C_2**-Two cuts (1st at 45 days after sowing and 2nd at40 days after 1st cut) for green fodder followed by harvest for grain purpose.and two levels ofnitrogen (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 cmapart60 kg P_2O_5 ha^{-1} and 40 kg K_2O 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 1stweek 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 60ºC till attaining constant weight on the basis of weight of these samples, the green fodder yield was converted into dry matter yield (q/ha). Data of growth attributes that is plant height (cm), number of tillers m^{-1} row length, leaf area index, leaf:stem ratio and forage yield as green and dry (t ha^{-1}) just before the cuts. Data obtained were statically analyzed as mentioned by (Gomez and Gomez, 1984).The crude protein content of forage was worked out by multiplying the nitrogen percentage with factor 6.25 (Doubetz and Wells, 1968).The crude protein yield was calculated by multiplying crude protein percentage with dry matter yield and expressed in quintals ha^{-1}.Crude fibre (CF) content in whole plant was estimated by acid-alkali digestion method (Mahadevan, 1965) and was expressed in percentage. The crude fibre yield (CFY) was worked out by multiplying crude fibre percentage with dry matter yield and expressed in quintals ha^{-1}.

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

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 Varieties (V)	GFY (q ha^{-1})	DMY (q ha^{-1})	Treatments Interaction (C×N)	GFY (q ha^{-1})	DMY (q ha^{-1})
V_1	365.21	92.47	$C_1 \times N_1$	263.28	53.22
V_2	249.78	43	$C_1 \times N_2$	281.7	61.3
V_3	295.21	64.9	$C_2 \times N_1$	316.5	64.06
S.Em.±	6.7	2.41	$C_2 \times N_2$	352.12	88.6
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	$V_1 \times C_1 \times N_1$	335.53	78.65
S.Em.±	5.47	1.97	$V_1 \times C_1 \times N_2$	338.08	81.75
CD @ 5%	16.05	5.78	$V_1 \times C_2 \times N_1$	360	74.21
Nitrogen level (N)			$V_1 \times C_2 \times N_2$	427.25	135.28
N_1	289.89	58.64	$V_2 \times C_1 \times N_1$	227.1	36.28
N_2	316.91	74.95	$V_2 \times C_1 \times N_2$	245.28	43.39
S.Em.±	5.47	1.97	$V_2 \times C_2 \times N_1$	253.7	43.48
CD @ 5%	16.05	5.78	$V_2 \times C_2 \times N_2$	273.03	48.86
Interaction (V×C)			$V_3 \times C_1 \times N_1$	227.2	44.72
$V_1 \times C_1$	336.8	80.2	$V_3 \times C_1 \times N_2$	261.74	58.76
$V_1 \times C_2$	393.62	104.75	$V_3 \times C_2 \times N_1$	335.81	74.48
$V_2 \times C_1$	236.18	39.83	$V_3 \times C_2 \times N_2$	356.09	81.65
$V_2 \times C_2$	263.37	46.17	S.Em.±	13.4	4.82
$V_3 \times C_1$	244.47	51.73	CD @ 5%	NS	14.15
$V_3 \times C_2$	345.95	78.07	CV (%)	9.16	9.72
S.Em.±	9.48	3.41	V_1 : BAIF Bajra-1		
CD @ 5%	27.79	10	V_2 : AVKB-19		
Interaction (V×N)			V_3 : GFB-1		
$V_1 \times N_1$	347.77	76.43			
$V_1 \times N_2$	382.67	108.52	C_1: Single cut at 45 days after sowing for green fodder followed by harvest for grain purpose.		
$V_2 \times N_1$	240.4	39.88	C_2: 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.		
$V_2 \times N_2$	259.15	46.13			
$V_3 \times N_1$	281.5	59.6	N_1 : 100 kg Nitrogen ha^{-1}		
$V_3 \times N_2$	308.92	70.2	N_2 : 150 kg Nitrogen ha^{-1}		
S.Em.±	9.48	3.41			
CD @ 5%	NS	10			

Table 2: Crude protein yield and Crude fibre yield of dual purpose pearl millet varieties as influenced by cutting and nitrogen management.

Treatments	Crude protein yield (q ha^{-1})	Crude fibre yield (q ha^{-1})	Treatments	Crude protein yield (q ha^{-1})	Crude fibre yield (q ha^{-1})
Varieties (V)			Interaction (C×N)		
V_1	7.07	31.17	$C_1 \times N_1$	4.12	18.09
V_2	2.97	13.2	$C_1 \times N_2$	5.11	18.68
V_3	4.7	21.43	$C_2 \times N_1$	4.06	22.27
S.Em.±	0.21	0.76	$C_2 \times N_2$	6.37	28.7
CD @ 5%	0.61	2.23	S.Em.±	0.24	0.88
Cutting management (C)			CD @ 5%	0.7	2.57
C_1	4.62	18.38	Interaction (V×C×N)		
C_2	5.21	25.48	$V_1 \times C_1 \times N_1$	6.39	26.98
S.Em.±	0.17	0.62	$V_1 \times C_1 \times N_2$	6.91	24.79
CD @ 5%	0.49	1.82	$V_1 \times C_2 \times N_1$	4.76	27.94
Nitrogen level (N)			$V_1 \times C_2 \times N_2$	10.24	44.98
N_1	4.09	20.18	$V_2 \times C_1 \times N_1$	2.59	11.83
N_2	5.74	23.69	$V_2 \times C_1 \times N_2$	3.48	13.59
S.Em.±	0.17	0.62	$V_2 \times C_2 \times N_1$	2.57	13.04
CD @ 5%	0.49	1.82	$V_2 \times C_2 \times N_2$	3.24	14.33
Interaction (V×C)			$V_3 \times C_1 \times N_1$	3.39	15.44
$V_1 \times C_1$	6.65	25.88	$V_3 \times C_1 \times N_2$	4.96	17.67
$V_1 \times C_2$	7.5	36.47	$V_3 \times C_2 \times N_1$	4.82	25.83
$V_2 \times C_1$	3.03	12.72	$V_3 \times C_2 \times N_2$	5.63	26.78
$V_2 \times C_2$	2.9	13.68	S.Em.±	0.41	1.52
$V_3 \times C_1$	4.18	16.55	CD @ 5%	1.21	4.46
$V_3 \times C_2$	5.22	26.3	CV (%)	7.03	8.83
S.Em.±	0.29	1.08	V_1 : BAIF Bajra-1		
CD @ 5%	NS	3.15	V_2 : AVKB-19		
Interaction (V×N)			V_3 : GFB-1		
$V_1 \times N_1$	5.57	27.45	C_1: Single cut at 45 days after sowing for green fodder followed by harvest for grain purpose.		
$V_1 \times N_2$	8.58	34.88	C_2: 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.		
$V_2 \times N_1$	2.58	12.43	N_1 : 100 kg Nitrogen ha^{-1}		
$V_2 \times N_2$	3.37	13.97	N_2 : 150 kg Nitrogen ha^{-1}		
$V_3 \times N_1$	4.1	20.63			
$V_3 \times N_2$	5.3	22.22			
S.Em.±	0.29	1.08			
CD @ 5%	0.86	3.15			

(365.21 and 92.47 q ha^{-1}) over other varieties GFB-1 (295.21 and 64.90 q ha^{-1}) and AVKB-19 (249.78 and 43.0 q ha^{-1}) respectively. 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 was 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). It is 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). 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}). 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. 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. 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.

Crude protein and Crude fibre yield (q ha^{-1})

BAIF Bajra-1 variety recorded significantly higher crude protein and crude fibre yield (7.07 and 31.17 q ha^{-1}) as compared to the variety GFB-1 (4.70 and 21.43 q ha^{-1}) and AVKB-19 (2.97 and 13.20 q ha^{-1}). The increase may be due to increased nutrient uptake, assimilation and translocation to the biomass. Similar resulted have been reported by Rana *et al.* (2009)

The higher crude protein and crude fibre yield is due to higher dry matter yield of variety BAIF Bajra-1 as compared to other varieties. The findings are in agreement with (Vinayraj, 2013).

Two cuts for green fodder followed by harvest for grain purpose has recorded significantly higher crude protein and crude fibre yield (5.21 and 25.48 q ha^{-1}) as compared to the single cut for green fodder followed by harvest for grain purpose (4.62 and 18.38 q ha^{-1}). This was attributed to the higher crude protein and fibre per cent and higher dry matter yield finally resulted in higher crude protein and fibre yield.

Application of nitrogen 150 kg ha^{-1} recorded significantly higher crude protein and crude fibre yield (5.74 and 23.69 q ha^{-1}) compared to nitrogen 100 kg ha^{-1} (4.09 and 20.18 q ha^{-1}). The interaction of varieties and cutting management were found significant. BAIF Bajra-1 with two cuts for green fodder followed by harvest for grain purpose recorded significantly higher crude fibre yield (36.47 q ha^{-1}). This was attributed due to the higher crude protein content and dry matter yield with higher levels of nitrogen. This was in line with findings of Gupta *et al.* (2008).

The interaction between BAIF Bajra-1 variety with nitrogen 150 kg ha^{-1} found significant in crude protein and crude fibre yield (8.58 and 34.88 q ha^{-1}). The variety BAIF Bajra-1 was highly responsive to the nitrogen application. Increase in crude protein with each increment in nitrogen dose was due to increased uptake and assimilation of nitrogen. Since nitrogen is main constituent of amino acids, it ultimately increased crude protein content of plants. Similar results were obtained by Sheoron *et al.* (2008).

The interaction between two cuts for green and fodder followed by harvest for grain purpose with application of nitrogen 150 kg ha^{-1} recorded significantly higher crude protein and crude fibre yield (6.37 and 28.70 q ha^{-1}). The results were conformity with the findings of (Afzal *et al.*, 2013) and (Singh *et al.*, 1983).

The interaction between the variety BAIF Bajra-1 with two cuts for green fodder followed by harvest for grain purpose along with application nitrogen of 150 kg ha^{-1} recorded significantly higher crude protein and crude fibre yield (10.24 and 44.98 q ha^{-1}).

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