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Effect of nitrogen and *Azospirillum* inoculation on growth and green forage yield of *Pennisetum* trispecific hybrid

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ABSTRACT

Inoculation of *Azospirillum* significantly influenced the leaf : stem ratio (LSR) of *Pennisetum* trispecifio hybrid (*P. typoides x P. purpureum x P. squmulatum*), but its effect on number of tillers was not consistent. Application of nitrogen did not significantly influence the number of tillers,LSR and green forage yield during the first year. Inoculation of *Azospirillum* strain ACD-20 recorded significantly higher green forage yield than ACD-15 and the control. The increase in green forage yield owing to inoculation of strain ACD-20 over ACD-15 was 18% and over the control was 25%. *Azospirilium* strain ACD-20 inoculation could give an equivalent green forage yield as given by application of 25 kg N/ha. The benefit : cost ratio was maximum (2.35) when *Azospirillum* strain ACD-20 inoculated to was *Pennisetum* trispecific hybrid, followed by application of 75 kg N/ha (2.09) and 25 Kg N/ha (2.07).

Key words : *Pennisetum* trispecific hybrid, Nitrogen, *Azospirillum* strains, Interaction effects, Rainfed conditions

Pennisetum trispecific hybrid, a cross between *Pennisetum typhoides* × *Pennisetum purpureum* × *Pennisetum squmulatum* (Burton and Powell, 1968; Rangaswamy *et al.*, 1971). It is perennial forage crop identified for rainfed conditions, as it is a tall growing, producing profuse tillers, true-to-type seeds and tussocky in nature (Ramamurthy and Vinod Shankar, 1997). Since it is a perennial and high tonnage producing (Choubey *et al.*, 1990; Ramamurthy and Vinod Shankar, 1998) forage crop, it removes nutrients continuously from the soil. A continuous replenishment is needed to sustain green fodder production.

In India, forage crops are generally considered as low-priority crops by most of the farming community, who prefers food or commercial crops. The forage crops are generally grown on marginal lands and often raised using sub-optimal fertilizer

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doses because of socio-economic constraints. In this situation nitrogen fixers like *Azospirillum* is very much promising to enhance the productivity of these soils. Biofertilizer can be effectively used in increasing forage production. Inoculation of *Azospirillum* as an inoculate was effective in supplementing N needed by forage crops and thus improves the yield of forages (Pahwa, 1994). Hence an experiment was carried out at Northern transitional tract of Karnataka on *Pennisetum* trispecific hybrid with different N levels and *Azospirillum* strains on growth and yield.

MATERIALS AND METHODS

A field experiment was initiated in the monsoon season of 1995 at Regional Research Station, Tegur Research Farm of Dharwad. The experimental site was sandy clay loam, with pH 5.5, 210 kg available N, 3.3 kg available P and 142 kg available K/ha. The region has a hot, sub-humid climate with a mean annual rainfall of 1,100 mm, received primarily through the south-west monsoon. The treatments comprised 4 levels of nitrogen (0, 25, 50 and 75 kg N/ha) with 3 *Azospirillum* inoculation (control, ACD-15 and ACD-20 strain) in randomized complete block design with 3 replications. *Azospirillum* strains were received from Department of Agricultural Microbiology, UAS, Dharwad. The root slips of *Pennisetum* trispecific hybrid was planted at 50 cm rows and 50 cm apart in the row. The basal dose of 30 kg P_2O_5 and K_2O each and 50% of N as per treatment was applied at the time of planting. Remaining 50% N was applied 30 days after planting or as basal dose application. The root slips of *Pennisetum* trispecific hybrid was applied with *Azospirillum* strain culture as per the treatments and planted.

First harvest was made 75 days after planting and subsequent cuts at an interval of 50–55 days. The observations on number of tillers and leaf : stem ratio were recorded at first and fourth cuts of first year and sixth cut of second year. The net plot green forage yield was considered to compute per ha productivity.

RESULTS AND DISCUSSION

Effect of nitrogen

Application of nitrogen to *Pennisetum* trispecific hybrid did not significantly influence the growth parameters like number of tillers/tussock and leaf : stem ratio in both the years except at sixth cut of second year (Table 1).

Total green forage yield of *Pennisetum* trispecific hybrid in the first year significantly influenced by N levels. Application of 25 or 75 kg N/ha recorded significantly higher green forage yield than the control (Table 1). There was no response to N application beyond 25 kg N/ha. The total green forage yield of *Pennisetum* trispecific hybrid in the second year was 56% more than first year in different treatments. This is because of increased number of tillers/tussock. Over the years, an application of 75 kg N recorded 11.1, 5.9% and 13.7% higher yield over the control, 25 kg N and 50 kg N/ha respectively (Table 2). This indicated that application of 25 kg N/ha was found to be optimum to rainfed *Pennisetum* trispecific hybrid, as the yield difference between 25 and 75 kg N was only 6% and cost of input was 3 times more

Table 1. Number of tillers/tussock, leaf : stem ratio, green forage yield and benefit : cost ratio of *Pennisetum* trispecific hybrid as influenced by N levels and *Azospirillum* inoculation

Treatment	Tillers/tussock			Leaf : stem ratio			Green forage yield (tonnes/ha)										Benefit : cost ratio
							I year					II year				Mean of 2 years	
	II cut of first year	IV cut of first year	VI cut of second year	I cut of first year	IV cut of first year	VI cut of second year	I cut	II cut	III cut	IV cut	Total	I cut	II cut	III cut	IV cut	Total	
N (kg/ha)																	
0	7.7	31.8	35.0	1.32	1.87	1.47	4.4	8.5	12.9	7.1	32.9	58.8	16.7	2.1	4.0	81.9	57.4	1.97
25	8.4	32.6	34.6	1.51	2.12	1.38	4.5	11.3	13.1	8.1	37.5	57.8	17.3	3.1	5.1	83.3	60.2	2.00
50	7.7	32.0	31.4	1.92	2.04	1.79	4.7	10.1	12.2	8.4	35.4	52.7	15.4	3.1	5.1	76.8	56.1	1.70
75	9.7	35.7	35.5	2.19	2.09	1.83	5.1	11.6	14.1	8.7	39.4	60.5	19.7	2.5	5.3	88.1	63.8	1.97
CD (P=0.05)	NS	NS	NS	NS	NS	0.25	NS	NS	NS	NS	4.5	NS	NS	NS	NS	NS	NS	
Azospirillum																		
Control	7.4	29.8	33.6	1.44	1.46	1.32	4.6	9.5	11.0	7.1	32.5	54.3	15.9	1.9	3.4	75.5	53.8	1.78
ACD-15	8.2	30.8	32.6	1.82	2.21	1.59	4.8	9.3	13.1	8.3	35.5	53.8	16.2	2.9	5.3	78.4	57.0	1.92
ACD-20	9.4	30.4	36.1	1.95	2.42	1.39	4.6	12.3	15.1	8.8	40.9	64.2	19.7	3.3	6.0	93.7	67.3	2.45
CD (P = 0.05)	NS	NS	2.7	NS	0.44	0.22	NS	NS	1.7	1.4	3.9	8.3	NS	1.0	1.4	9.5	5.3	
Interaction							NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	*	

than 25 kg N/ha. Ramamurthy and Vinod Shankar (1998) reported a linear response up to 50 kg N/ha in *Pennisetum* trispecific hybrid under rainfed conditions of Jhansi.

Effect of Azospirillum *inoculation*

Azospirillum inoculation significantly influenced the number of tillers/tussock at sixth cut of second year and leaf : stem ratio at fourth cut of first year and sixth cut of second year (Table 1). Inoculation of ACD-20 strain recorded significantly higher number of tillers/tussock at the sixth cut of second year (36.1) and leaf: stem ratio year (2.42) and sixth cut of second year (1.93).

Green forage yield of *Pennisetum* trispecific hybrid was significantly improved at third, fourth cut of first year, total forage yield of first year and second year and also poled data (Table 1). Pahwa (1994) also recorded increased forage yield of *Cenchrus ciliaris, C. setigerus* and *Dicanthium annulatum* grasses due to *Azospirillum* inoculation. Inoculation of ACD-20 strain recorded significantly higher green forage yield than ACD-15 and the control. The increase in green forage yield due to inoculation of ACD-20 strain over the control was 25% and 18% over inoculation of ACD-15 strain. Over the years, data indicate that the yield recorded under inoculation of ACD-20 strain was more than the yield recorded due to application of 75 kg N/ha. This showed that ACD-20 strain was more effective and suitable strain for inoculation to *Pennisetum* trispecific hybrid.

Table 2. Green forage yield of *Pennisetum* trispecific hybrid as influenced by interaction effects of N levels and *Azospirillum* inoculation

N (kg/ha)	Green forage yield (tonnes/ha)			
	Control	ACD-15	ACD-20	Mean
0	44.8	60.2	67.2	57.4
25	54.9	55.2	70.5	60.2
50	54.0	56.9	57.4	56.1
75	61.5	55.7	74.1	63.8
Mean	53.8	57.0	67.3	
CD (P=0.05)		10.6		

*Mean of 2 years

Interaction effects of nitrogen x Azospirillum

An interaction effect of N levels and *Azospirillum* was significant in pooled analysis (Table 2). It was observed that without application of N fertilizer, just by inoculation of ACD-20 strain itself could result in significantly higher green forage yield, which was on par with application of 25 or 75 kg N/ha.

Economics

Inoculation of *Azospirillum* strain ACD-20 recorded the highest benefit : cost ratio of 2.45 compared with chemical nitrogen application. Among the nitrogen levels, application of 25 kg N/ha recorded highest benefit : cost ratio of 2.00, followed by 75 kg N/ha and control (1.97).

Inoculation of *Azospirillum* strain ACD-20 or application of 25 kg N/ha found most economical way to *Pennisetum* trispecific hybrid under rainfed conditions of northern transitional tract of Karnataka.

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