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SCREENING OF PANICUM ANTIDOTALE GRASS SPECIES UNDER SPRING AND MONSOON SEASONS IN THE MESIC CLIMATE OF POTHOWAR PLATEAU (PAKISTAN)

M. Arshadullah, M. Rasheed* S. I. Hyder, and M. Anwar*

National Agricultural Research Centre, Park Road, Islamabad-Pakistan.
*University of Arid Agriculture, Rawalpindi-Pakistan.
Corresponding author e-mail:

ABSTRACT

A long term field study was conducted to evaluate the performance of different species of *Panicum antidotale* grass in the mesic climate at National Agricultural Research Centre, Islamabad during 2004-2007. The maximum fresh and dry weight was obtained by RMF-249 which was statistically at par with RMF-247 RMF-252 and RMF-253. RMF-248, RMF-250, and RMF-251 produced statistically same fresh and dry biomass. RMF-254 attained the lowest position in this regard. Forage yield of all species was higher in monsoon compared to spring season due to prolong growing season with more rainfall. Proximate composition showed that RMF-247 attained highest crude protein percentage and total digestible nutrients. The lowest crude protein percentage and total digestible nutrients were in RMF-249 grass species.

Key words: Biomass production, forage grass, sub-humid area, proximate composition, Islamabad.

INTRODUCTION

Pothowar plateau is located in the sub-tropical, semi arid to sub-humid ecological zone of Pakistan. Natural vegetation consists of scrub forest having mostly thorny trees, shrubs, and grasses. Total area of the plateau is approximately 30,362 km^2 out of which 15,340 km^2 is severely eroded and is currently used as range lands or woodlands (Nizami *et al*; 2004). Keeping in view the prevailing conditions of the rangelands it is the time of hour to promote forage grasses for increasing the productivity of degraded rangelands. Therefore the present study was conducted to evaluate the best species of *Panicum antidotale* tacking in to account both the biomass production and nutritive value.

Common names of *Panicum antidotale*, are Blue panic (Australia, United States) Giant Panic (Australia) and Bansi (India). This grass belongs of family graminae. It is Vigorous perennial having many branches with hairy stems up to 205m high and long blue green leaves. It grows in area with annual summer rainfall of 500-800mm. It grows on all types of soil but prefers sandy loam. It is resistant to drought, fire and heavy grazing. When cut or grazed, 25-30mm of stubble must be left. Stems rapidly become hard and woody and should be grazed or cut before flowering. At the late flowering stage it can acquire a bitter taste and accumulate large amounts of oxalic acid which may cause it is very unpalatable to livestock. Once established it produces a large bulk of feed. It is also used for erosion control and sown in areas which are too dry for *Panicum maximum* (Siegfried, 1990). It is highly nutritious grass before flowering and crude protein is more in dry matter than fresh material. Blue panic response in DM yield was also encouraging but being a tall and comparatively coarse grass It dose not have good palatability compared as that of other tested grasses (Javed *et al*., 2007).

MATERIALS AND METHODS

Germplasm of different species of this grass was obtained from different regions of the world through international organizations for evaluating their growth potential as well as forage quality under rainfed conditions.

The experiment was carried out at research area of National Agricultural Research Centre, Islamabad Pakistan. The climate is classified by very hot summers and cold winters. It is situated in the sub tropical, sub-humid continental Pothowar plateau. The mean annual rainfall may exceed 1000 mm which is received during the summer season. The hottest month June has the highest mean annual temperature and the coldest Month of January may received few frost events (Ullah *et al*; 2006). Climatic data of the study period was given in Tables-Ia, Ib and Ic. The soil is slightly alkaline with pH = 8.30 non-saline loamy in texture, low in organic matter (0.51%) and deficient in N (0.042%) and P (5.40 ppm)) except for available K=78.5 ppm. (Table-2). These stains were tested for their adaptability for four years at research area, NARC Islamabad. Eight strains of this grass were selected for further research. Tufts of these strains were planted at 50 cm row to row and plant to plant distance. Plot size was 3x4 m^2. The experiment was planned in a randomized complete block design (RCBD). The tufts were irrigated only at the time of planting.

Grass species were maintained without irrigation and fertilizer application. Weeding and hoeing was done manually whenever needed.

Data on fresh and dry matter yield were collected from the same plots in spring and monsoon season of 2004 to 2007. Data were collected during the last week of April (Spring season) and Monsoon during the first week of September. Three qudrats were harvested randomly for fresh and dry matter determinations (Khan, 1966). The fresh biomass was measured by using the formula.

$$\text{Fresh biomass } (t.ha^{-1}) = \frac{\text{Fresh biomass weight (Kg)} \times 10}{\text{Area in } m^2}$$

All the plots in one square meter were clipped close to the ground level and fresh biomass was weighed and the samples were oven dried to a constant temperature at 70 ^{o}C for 72 hours. The dried samples were weighed as dry matter yield. The moisture contents (%) were determined by using following formula.

$$\% \text{ Moisture} = \frac{\text{Fresh weight} - \text{dry weight}}{\text{Fresh weight}} \times 100$$

Forage Quality Analysis: For proximate composition the samples were again oven dried at 100 ^{o}C for 12 hours. The grass samples were manually harvested at panicle stage. The yield of DM, CP and total digestible nutrients (TDN) was calculated on the basis of chemical analysis.

The samples of grass were chopped in an electric chopper. The samples were dried at 55 ^{o}C and ground to particle of 2mm through a willey mill. These samples were analyzed for DM, CP by the methods of AOAC (1994). The total digestible nutrients (TDN) of each grass sample were calculated by using the equation of Wardeh (1981).

Nitrogen-Free Extract: Nitrogen-free extract was determined by difference after the analysis of all the other items in proximate analysis on dry matter percent basis.

% NFE = 100 – (% crude protein + %crude fiber + % ether extract + % Ash)

Agro-metrological Data

Total Digestible Nutrients: Total Digestible Nutrients were calculated by the equation of Wardeh (1981).

$$\% \text{ TDN} = -26.685 + 1.334(CF) + 6.598(EE) + 1.423(NFE) + 0.967(Pr) - 0.002(CF)^2 - 0.670(EE)^2 - 0.024(CF)(NFE) - 0.055(EE)(NFE) - 0.146(EE)(Pr) + 0.039(EE)^2(Pr)$$

The data were subjected to analysis of variance (ANOVA) and means were separated using least significant differences (Steel *et al*; 1997)

RESULTS AND DISCUSSION

RMF-249 grass species attained the highest fresh weight (20.05 t. ha^{-1}) in spring during 2004-2007. (Table-III). Data showed that RMF-247, 249, 252 and 253 were statistically at par with each other while RMF-250 and RMF-251 were also statistically similar in spring season as regarding fresh biomass. The highest dry matter yield was attained by RMF-247 (10.57 t. ha^{-1}) followed by RMF-249 (8.01 t. ha^{-1}) in spring season. During monsoon season RMF- 249 got the highest fresh biomass (27.70 t. ha-I) followed by RMF-254 (26.97 t. ha^{-1}) and RMF 253 (25.68 t. ha^{-1}). The dry matter yield showed statistically non-significant results, however, RMF-249 produced the highest dry matter yield (12.93 t. ha^{-1}) and lowest (8.62 t. ha^{-1}) was in RMF-254. Fresh biomass and dry matter yield were more in monsoon season as compared to spring season in almost all strains because of more rainfall on the yield of grass is quite visible as is evident from rainfall data and the yield data (Ullah *et al*., 2006). Difference (25-50%) was also marked between the yield of spring and monsoon with higher yield during monsoon as compared to spring season. This can also be attributed towards the rainfall nature of grass species under this study and higher rain fall during July-September as compared to spring rains (Table-Ia). In addition to higher yield, digestibility is one of the main qualities of forage.

Table-1. Rainfall and Wind Speed.

	Rainfall (mm)				Wind Speed km/ day			
Year	**2004**	**2005**	**2006**	**2007**	**2004**	**2005**	**2006**	**2007**
Month								
January	87	59	54	0	33	40	23	27
February	35	184	23	94	27	60	29	37
March	0	75	52	179	37	35	35	52
April	93	14	21	3	72	64	48	51
May	7	20	41	58	93	98	44	80
June	132	73	62	141	91	108	61	84
July	190	183	493	335	85	75	95	57
August	258	270	312	456	71	61	87	47
September	24	73	13	133.13	63	52	69	42.81
October	83	68	35	0	68	45	49	33.97
November	23	4	15	13.35	45	46	36	17.31
December	30	9	124	0	41	36	36	21.01

Table-1 b. Pan Evaporation and Sunshine Hours.

	Pan Evaporation mm/day				Sunshine hours			
Year	**2004**	**2005**	**2006**	**2007**	**2004**	**2005**	**2006**	**2007**
Month								
January	1	1.1	1.1	1.6	5	5.2	5.4	7.5
February	2.2	1.5	1.9	1.6	8.2	4.7	5.6	5.8
March	3.8	2.4	3.3	3.2	8.6	7.2	7.0	8.3
April	5.2	4.2	3.4	5.2	6.4	8	8.2	9.0
May	7.7	7.2	4.2	7.1	10.2	10.1	9.99	10.1
June	8	9	5.1	8	9.7	9.8	8.7	9.3
July	6.9	4.6	8.1	5.3	9	7.1	10.6	8.4
August	4.9	5.2	8	4.1	8.4	8.6	8.8	8.1
September	4.8	4.3	6.1	3.61	8.4	8	7.3	9.4
October	3.3	3.4	2.9	3.50	7	9	8.5	8.8
November	2.3	2.4	2.4	1.78	6.5	6.7	8.3	7.1
December	1.2	1.6	1.4	1.34	4.5	7.6	5.4	7.8

Table-1 c. Average Temperature and Relative Humidity.

	Monthly Average Temperature (°C)								Relative Humidity (%)							
Year	**2004**		**2005**		**2006**		**2007**		**2004**		**2005**		**2006**		**2007**	
Month	**Max.**	**Min.**	**Max.**	**Min.**	**Max.**	**Min.**	**Max.**	**Min.**	**Max.**	**Min.**	**Max.**	**Min.**	**Max.**	**Min.**	**Max.**	**Min.**
January	16	5	15	3	17	3	19	2	96	63	92	46	96	63	92	46
February	21	5	16	5	24	8	19	7	94	51	95	67	94	51	95	67
March	29	10	22	10	24	9	23	9	87	45	92	58	87	45	92	58
April	32	16	30	12	32	13	33	15	84	51	71	37	84	51	71	37
May	36	18	33	17	38	21	34	19	90	74	58	33	90	74	58	33
June	35	22	39	20	37	22	38	23	90	69	65	43	90	69	65	43
July	36	23	33	23	33	24	34	23	57	33	88	65	57	33	88	65
August	33	22	33	22	32	23	33	23	51	28	91	70	51	28	91	70
September	34	20	33	21	33	20	32	20	58	26	90	62	58	26	90	62
October	26	13	30	14	30	16	31	11	90	52	81	29	90	52	81	29
November	25	8	24	7	24	9	25	7	89	55	89	43	89	55	89	43
December	18	5	21	1	18	5	19	3	92	63	90	49	92	63	90	49

Agricultural Meteorological field station at Water Resources Research Institute, NARC, Islamabad Altitude 518m Latitude 33 42 Longitude 73 08

Apart from other factors, it also depends upon the succulence of the forages. During spring RMF-252 had the highest moisture contents (65%) while monsoon RMF-254 got the top position having 68%. This showed that moisture contents percentage was higher in monsoon as compared to spring due to more rainfall in monsoon. This finding resulted that succulence was more in monsoon season than spring season (Rushland *et al.,* 1993).

The feeding value of the grass species may be divided into different aspects. A high percentage of protein is required in the diet of ruminants because production of milk, meat, and reproduction mainly depends on the protein ingredient of the animal diet (Javed *et al*., 2007). Among grass species the crude protein percentage is statistically non-significant, however RMF-247 (7.17%) had the highest crude protein (Table-IV). The amount of crude protein lower than 6-7% in animal diet may depress microbial activity due to non-availability of nitrogen in the rumen (Bose and Balakrishnan, 2001).

Table 2. Physical and Chemical Analysis

			Units
ECe	=	0.53	dsm^{-1}
pH	=	8.3	
Total N	=	0.042	%
Phosphorus	=	5.40	ppm
Ext. K	=	78.50	ppm
Organic matter	=	0.51	%
Sand	=	34.2	%
Silt	=	28.6	%
Clay	=	37.2	%
Texture	=	Loam	

Table-IV showed that total digestibe nutrients among grass species was the highest in RMF-247 (59.80) and lowest (52.07) in RMF-248. Another factor for the evaluation of feeding value is digestibility by which animal converts forage to human foods. Digestibility is mainly concerned on the availability of total digestible nutrients (TDN). So depending on the availability of crude protein and TDN, RMF-247 is the best to grow followed by RMF-249. (Afzal and Ullah; 2007).

Table-3. Fresh, dry biomass (t.ha^{-1}) and moisture contents (%) of *Panicum antidotale* grass (Average of four years with three repeats i.e. 2004-2007)

	Spring			Monsoon		
Grass Species	Fresh	Dry	Moisture Contents	Fresh	Dry NS	Moisture contents
RMF-247	18.93a	10.57a	44c	22.68ab	10.98	52cd
RMF-248	16.15ab	6.11b	62a	20.92b	9.45	55bc
RMF-249	20.05a	8.01ab	60a	27.70a	12.93	55bc
RMF-250	16.26ab	6.51b	60a	21.77b	10.23	53c
RMF-251	16.51ab	6.28b	62a	22.17b	10.49	54bc
RMF-252	17.97a	6.35b	65a	22.40b	8.99	60b
RMF-253	18.60a	7.89ab	62a	25.68a	9.80	62a
RMF-254	15.24b	6.47b	58b	26.97a	8.62	68a

Values followed by same letter (s) are statistically similar at P=0.05 level of significance

Table-4. Proximate composition of *Panicum antidotale* Grass species at 50% flowering on percent dry matter basis (Average of 4 years i.e. 2004-2007 with three repeats)

Grass Species	Dry matter	Crude protein	Crude fiber	Ash	Ether Extract	Nitrogen free Extract	Total digestible Nutrients
RMF-247	35.67a	7.17NS	37.92b	5.20NS	2.00b	47.71a	59.80a
RMF-248	35.76a	6.70	43.65a	7.48	4.22a	37.95c	52.07b
RMF-249	31.82b	5.67	41.07a	7.36	1.76b	44.14a	56.39a
RMF-250	34.41a	6.51	41.87a	6.68	2.68ab	42.26ab	56.26a
RMF-251	33.99a	6.29	41.86a	7.17	2.88ab	41.80b	54.90ab
RMF-252	33.31a	6.16	41.27a	7.07	2.43b	43.07a	55.85a
RMF-253	33.90a	6.03	41.88a	6.80	2.65b	42.64ab	55.67a
RMF-254	33.73a	6.17	41.48a	7.19	2.68ab	42.48ab	55.47a

Values followed by same letter (s) are statistically similar at P=0.05 level of significance

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