

# Biomass Potential of Perennial Grass Species in Cholistan Desert (Pakistan)

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## ABSTRACT

The study was carried out at Cholistan farm (Chak no. 16/DRB) of Arid Zone Research Institute Bahawalpur during the years 2004 - 05. The grass species *Panicum antidotale*, *Panicum turgidum*, *Lasuirus scindicus* and six cultivars of *Cenchrus ciliaris* (Local, US Buffel, Nunbank, Gayndah, Biloela & cv. 267) were evaluated for their fresh biomass potential with two planting techniques (seeding & stump planting) using Randomized Complete Block Design. The highest fresh biomass yield were observed incase of *Panicum antodotale* (10.8 t ha<sup>-1</sup>) and *Cenchrus ciliaris* cv. Gayndah (10 t ha<sup>-1</sup>) through seeding method, where as incase of stump planting *Cenchrus ciliaris* cv. Gyandah and *Cenchrus ciliaris* cv. Nunbank gave good biomass potential (5.9 & 5.2 t ha<sup>-1</sup>), respectively. All other species showed intermediate performance under both planting techniques. Means were separated using Duncan's Multiple Range Test.

**Key Words:** Fresh biomass; Perennial grasses; Cholistan desert

## INTRODUCTION

Cholistan desert, covering an area of 2.6 million hectares situated in the south-eastern part of Punjab province with 69°52' and 73°05' east longitude and 27°42' and 27°45' N latitudes (Khan, 1987; Farid *et al.*, 1992; Arshad & Rao, 1994; Akbar *et al.*, 1996). The economy of the nomadic herders mainly depends upon the livestock including large and small ruminants. There is a tendency to increase the livestock population as it is the only livelihood of the pastoralists. This increase in the livestock population is at the expense of the fragile ecosystem.

The average annual rainfall of the Cholistan desert ranges from 100 to 200 mm (Arshad *et al.*, 1993; Akbar *et al.*, 1996), falling mostly in July and September. During summer, the temperature exceed up to 50°C with very low relative humidity. Low carrying capacity accompanied with overuse of depleted natural vegetation results in frequent movement of desert pastoralists through out the desert along with their animals towards the surrounding irrigated areas especially during drought periods (Arshad & Rao, 1994; Akbar *et al.*, 1996).

The Cholistan desert comprises of sand dunes with fine textured but lifeless hard plains called 'dahars' existing in between the sand dunes. Being very saline and impervious to rain water the 'dahars' remain predominately plant less.

Un-certain, un-predictable rainfall, low humidity and the extremes in temperatures are compounded with increasing livestock numbers and consequently decreasing the vegetation cover, which trigger the process of desertification.

Trees, shrubs and even roots of the plants are indiscriminately cut for fuel, feed, fencing and the construction of thatched huts called 'gopas' by the people of the cholistan. A variety of desert plants serve as a valuable source of food, medicine and some other domestic uses for the desert inhabitants. The over-exploitation of the natural vegetation to meet these requirements is adversely affecting the natural process of regeneration of these species thus crucially crippling the life pattern and reversing the natural succeeding trends, ultimately degrading the environment.

The present status of range vegetation in Cholistan giving "SOS" message for quick remedy measures to increase the productivity of deteriorated range ecosystem. The most important activity in range improvement is enhancement of ecologically suitable, high yielding and palatable range grass species and their strains through introduction (Springfield, 1957; Kaul & Thalen, 1971). In many tropical countries, improved selections and cultivars of perennial grasses have increased the forage yield over that of native and naturalized grasslands (Walmsley *et al.*, 1978). The increase in carrying capacity of highly depleted rangelands of Pakistan is possible through reseeding with promising grass species (Mohammad & Naqvi, 1987).

Realizing the problem of depletion of desert flora at an increasing rate, this study was conducted in Cholistan at Arid Zone Research Institute, Bahawalpur under the umbrella of Pakistan Agricultural Research Council, Islamabad. This study focused to different aspects of desert ecosystem by comparing two different modes of propagation for introduction of improved cultivars of suitable species of different perennial grasses hastening the process of recovery of desert vegetation.

## MATERIALS AND METHODS

This study was carried out at Cholistan farm of AZRI, Bahawalpur situated at "Chah Sullah Wala", 110 km towards south of Bahawalpur on the way to Fort Dirawar. The site was typical desert area comprising sand dunes and inter-dunal spaces (Locally called "Dahars") representing the specific Cholistan environment (Arshad & Rao, 1994; Akbar *et al.*, 1996).

Seeds of five grass species; *Panicum antidotale*, *Panicum turgidum*, *Lasuirus scindicus* and *Cenchrus ciliaris* (six genotypes, local & exotic) were arranged. The seeds of these grasses were broadcasted in the inter-dunal spaces and sub-dunal regions prior to the onset of monsoon rains during 2003. A seed rate of 250 seeds/m<sup>2</sup> was used (Vallentine, 1989). At the same time, root stumps of these grass species and cultivars were also planted in rows maintaining 0.5 m x 0.5 m spacing in the same areas (inter-dunal spaces & sub-dunal regions) in separate blocks using Randomized Complete Block Design with three replications. Both the treatments were maintained under natural conditions during the entire length of study.

At the end of monsoon season (2004 - 05), the data regarding the fresh biomass of these grass species and their respective cultivars were recorded using 1 m<sup>2</sup> quadrat. Random samples were clipped at ground level (leaving 3.5 cm stubbles). The data were analyzed statistically and means were separated using Duncan's Multiple Range Test (Steel & Torrie, 1980).

## RESULTS

In this study two different planting techniques (seeding & stump planting) were used. *Panicum antidotale* outperformed in terms of fresh biomass (10.8 t/ha) but it was at par with the fresh biomass of *Cenchrus ciliaris* (cv. Gayndah). Minimum fresh biomass was observed in case of *Lasuirus scindicus* (2.6 t/ha), whereas *Panicum turgidum*, *Cenchrus ciliaris* (cv. Nunbank), *C. ciliaris* (cv. bilola), *C. ciliaris* (cv. 267), *C. ciliaris* (cv. Local) and *Cenchrus ciliaris* (US Buffle) produced the intermediate yields of 9.0, 7.9, 7.8, 7.0, 5.4 and 4.5 t ha<sup>-1</sup>, respectively in seeding technique (Table I). The maximum fresh biomass potential was shown by *Cenchrus ciliaris* (cv. Gayndah) 5.9 t/ha and *Cenchrus ciliaris* (cv. Nunbank) 5.2 t/ha, respectively and the minimum fresh biomass was shown by *Cenchrus ciliaris* (cv. US Buffle) 1.8 t/ha, whereas the other gave intermediate performance in stump technique Table I.

While looking at the analysis of variance (Table II), grass species and the method of propagation also reflected highly significant values ( $p = 0.0000$  &  $p = 0.0042$  f, respectively) and their interaction was also significant ( $p = 0.0005$ ).

**Table I. Fresh biomass of grass species under two modes of propagation at Cholistan Farm 2004-2005 (tones ha<sup>-1</sup>)**

S. No	Species	Seeding	Stump Planting
1	<i>Panicum antidotale</i>	10.8a	4.6def
2	<i>C. ciliaris</i> (US Buffle)	4.5def	1.8f
3	<i>Panicum turgidum</i>	9.0abc	4.5def
4	<i>C. ciliaris</i> (Nunbank)	7.9ef	5.2cdef
5	<i>Lasuirus scindicus</i>	2.6ef	2.8ef
6	<i>C. ciliaris</i> (Local)	5.4cdef	4.5def
7	<i>C. ciliaris</i> (Gayndah)	10.0ab	5.9bcdef
8	<i>C. ciliaris</i> (Bilola)	7.8ef	4.3def
9	<i>C. ciliaris</i> CV. 267	7.0f	2.9ef

Mean in the same column with the same superscripts do not differ significantly ( $P < 0.05$ ).

**Table II. Analysis of variance for fresh matter yield of grass species under two propagation techniques in 2004-2005**

Source	Df	SS	MS	F	P
Replications	2	85.029	42.515	8.1310	0.0006
Year (Y)	1	1.501	1.501	0.2870	
Species (S)	9	493.644	54.849	10.4901	0.0000
Y x S	9	73.745	8.198	1.5671	0.1400
Methods (M)	1	45.412	45.412	8.6851	0.0042
Y x M	1	21.235	21.235	4.0613	0.0473
S x M	9	180.998	20.111	3.8463	0.0005
Y x S x M	9	83.211	9.246	1.7683	0.0878
Error	78	401.838	5.229		
Total	119	1392.614			

## DISCUSSION

Overgrazing, soil erosion, salinity and sodicity and removal of natural vegetation for various house-hold purposes are the long term critical issues of desertification especially in the developing world (Dregne, 1986). In cholistan desert, the explosion of human and livestock population during the last two decades and development of road networks, encroachment of desert areas by irrigated agriculture and farming settlements have contributed enormously to the degradation of natural vegetation in Cholistan. Therefore, the prolong drought spells reduce the reproductive capacity of natural vegetation on one hand and their seed bank in the desert soils on the other.

This study provides an opportunity to compare the efficiency of propagation through seeding and planting of root stumps of grasses. Results of this study very clearly signified the importance seeding method as compared to stumps planting (Table II). Field observations also revealed that plants emerging from seeding were morphologically more vigorous than those arising from root stumps. The results discussed above emphasize that in order to hasten the anti desertification measures on one hand and to conserve the vanishing plant wealth in cholistan desert on the other.

Therefore, the natural vegetation should be protected from misuse and introduction of suitable promising grass/shrub germplasm be carried out through careful screening evaluation.

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