Research Article

Effect of Clipping Intensity and Frequency on Growth and Morphology of *Panicum antidotale*

Mazhar Habib[1], Aamir Saleem[1], Arshad Mahmood Malik[2*], Sarfraz Ahmed[3] and Sameera Arshad[4]

[1]Department of Forestry and Range Management, PMAS-Arid Agriculture University Rawalpindi, Pakistan; [2]Department of Economics, PMAS-Arid Agriculture University Rawalpindi, Pakistan; [3]Range Management Research Institute, NARC, Islamabad, Pakistan; [4]Quid-e-Azam University, Islamabad, Pakistan.

Abstract | A study on Blue panic grass *(Panicum antidotale* Retz.) was conducted during early 2012-13. Stubbles of the grass were grown on a site at NARC, Islamabad, Pakistan. Four clipping stages *i.e.* D1, D2, D3 and D4 (clipped after 20, 40, 60 and 80 days, respectively) were studied. The response variables were morphological characters (plant height, tiller density and herbage yield) of Blue panic grass. With the advance in maturity of clipping stages, plant height and no. of tillers in the grass increased (P<0.05). Herbage yield showed (fresh biomass yield, dry matter yield) significant differences (P<0.05) at each clipping stage. With advanced plant maturity species, its herbage yield increased (P<0.05). However, phonologically, proportion of its plants with vegetative stage declined. This decline of plants with vegetative stage can cause distraction to livestock depending on the species for grazing purposes. It is suggested that two month clipping stage should be applied on Blue panic grass to get sustained grass vigor and optimum herbage yield.

Received | April 25, 2019; **Accepted** | May 22, 2019; **Published** | October 26, 2019
***Correspondence** | Arshad Mahmood Malik Department of Economics PMAS-Arid Agriculture University Rawalpindi, Pakistan; **Email:** arshadmm@uaar.edu.pk
Citation | Habib, M., A. Saleem, A.M. Malik, S. Ahmed and S. Arshad. 2019. Effect of clipping intensity and frequency on growth and morphology of *Panicum antidotale. Pakistan Journal of Agricultural Research,* 32(4): 642-646.
DOI | http://dx.doi.org/10.17582/journal.pjar/2019/32.4.642.646
Keywords | Blue panic, Clipping stage, Maturity, Morphological characters, Herbage yield

Introduction

Pakistan is an agricultural country and about two third of its area is considered as rangelands. The rangelands in the country are important natural resources that heavily support livestock and wildlife population. Over-utilization and mismanagement of these rangeland resources have severely deteriorated potential for forage production. Currently these rangelands are overexploited constantly because of high human impact. The need of the time is to restore their forage potential by establishing high diversity of most productive forage species in the country's rangelands.

Blue panic grass *(Panicum antidotale* Retz.) is an important range grass in Pakistan. It belongs to Poaceae family and is locally called as "Malai" grass. It is resistant to drought and requires 500-800 mm precipitation annually and found at an elevation of up to 1000 m (Quraishi et al., 1993). Its rapid growth produced large quantities of palatable but rather coarse herbage in good growing conditions. This grass has a well-defined defensive system and can withstand heavy grazing. It grows on a variety of soils but fertile sandy loam soils are best suited. Reseeding of Blue panic increases the range productivity 12 times in northern areas of Pakistan (Quraishi et al., 1993). In Kohistan ranges, Blue panic yields the second largest amount

of forage after Buffel grass. This grass is quite suited for large scale seeding on Murree foothills, Pothowar Plateau and Kohistan ranges (Quraishi et al., 1993).

P. antidotale is a coarse, vigorous, leafy, much branched perennial grass spreading by short stout rhizomes or stolons. Leaves are linear and blue green and leaf blades are 25-50 cm long and 5-12 mm wide. Flowering stems are up to 2 m in height. It is now extensively grown from Arabia in the west to Australia in the east. The grass is propagated by seed, stem cuttings and root suckers and planted 50 cm apart. It is reseeded just before the onset of monsoon. Before sowing, seed preparation is necessary for reliable results. Its stem rapidly becomes hard and woody. Grazing is thus restricted to current year's growth only. Old stubbles and previous growth (plant capital) remains intact year after year. It should be grazed or cut for hay before flowering (Quraishi et al., 2006).

Inadequate information is available on variation in its morphological characters and forage yield with respect to clipping stages. It is, therefore, necessary to clarify the effects of defoliation on this species. The objectives of this study were to determine the effect of clipping stage on its morphological characters and herbage yield.

Materials and Methods

A study site at the research area of Range land Research Institute, NARC, Islamabad was selected. Plot size was 17 × 14 m. This main plot was subdivided into 12 blocks. Each block was further divided into 3 replications and each replication contained 12 plants. Four clipping intensities *i.e.* clipping at 0 cm (maximum possible depth at which clipping was possible) above ground level (T1) 05 cm (T2), 10 cm (T3) and 15 cm (T4) were studied. Similarly clipping frequencies were 20, 40, 60 and 80 days, respectively. Mean daily minimum temperature ranged from 15 °C min. to 31 °C max., while corresponding maximum temperature was 32 to 48 °C. Total precipitation recorded was 300 mm. More than 75 % of the precipitation was recorded during the monsoon season (Loo, Billa and Singh, 2015; Nandargi and K Barman, 2018).

For calculation of no. of tillers, 3 plants from each replication were selected and then their no. of tillers were calculated and for remaining one's average of these three was considered. Plant height (cm) was measured from ground to the end of the tallest leaf. Plant morphology (MSC) (Table 3) was also recorded at each sampling date in which percentage of plants in vegetative, flowering, seeding stages were calculated.

Data was analyzed by using Statistics 8.1 software and their means were compared. Two factor factorial designs under completely randomized block design were used. The data collected for different parameters were statistically analyzed using analysis of variance and comparison of means was done by Duncan's Multiple Range test (Palaniswamy and Palaniswamy, 2006).

Results and Discussion

Plant height

Mean plant heights of *P. antidotale* before monsoon were 91.444, 68.500, 84.139 cm at 20 days interval, 40 days interval, 60 days interval respectively (Table 1). While after monsoon, heights were 101.06, 71.86, 93.64, and 105.78 cm at 20 day's interval, 40 days interval, 60 days interval and 80 days interval respectively (Table 2). Although, the plant height increased throughout the experimental period, the rate of increase was maximum during after monsoon. Plant height of the grass expanded ($P<0.05$) with expanding plant development. Increase in plant height with progressing development might be recognized to longer vegetative development time of this grass with expanded phase of defoliation. Comparative results were accounted for by Butt et al. (1992), Mislevy et al. (1989) and Garcia and Rodriguez (1980) . Plants of Buffel grass defoliated at the end of developing season delivered taller plants than those cut at 3, 6 and 9 weeks in the wake of planting (Butt et al., 1992). These taller plants were attributed to longer vegetative development period. Additionally, normal plant height of elephant grass increased from 1.2 to 4.9 m with expanding cutting stage (Mislevy et al., 1989). Garcia and Rodriguez (1980) reported that plant tallness of Buffel grass expanded with progressing age and the most astonishing normal height (96.7 cm) was recorded when it was cut after 84 days while the least normal height (51.3 cm) was recorded when it was cut after 42 days.

No of tillers per plant

Before monsoon average number of tillers per plant of Blue panic grass at 20 days interval, 40 days interval,

and 60 day's intervals were 123.36, 56.61 and 52.83, respectively (Table 1). The tiller density was highest (123.36) at 20 days and it declined gradually to the minimum (52.83) at 60 days. Maximum tillers per plant of this grass at 20 days were due to more vegetative growth (Figure 1). The tillers density decreased (P<0.05) with advancing plant maturity of the grass (Figure 2). Decreased tillers per plant of this grass with advancing growth can be attributed to its morphological character and due to hot weather. After monsoon, the no. of tillers with 20 days interval were 116.0, at 40 days interval were 81.44, at 60 days interval were 53.33 and at 80 day's intervals were 59.63.

Table 1: *LSD all-pair wise comparisons test of height for days (before monsoon).*

Days	Means
20	91.444a
40	68.500b
60	84.139a

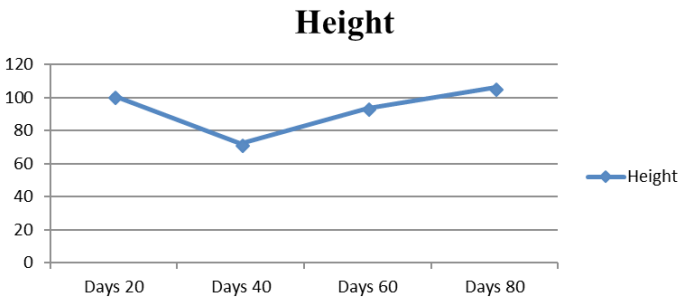

Figure 1: *Comparison Test of Height for Days (After monsoon).*

Table 2: *LSD all-pair wise comparisons test of tillers for days (before monsoon).*

Days	Means
20	123.36a
40	56.61b
60	52.83b

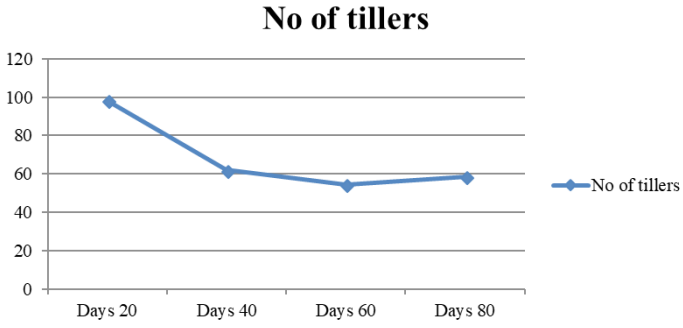

Figure 2: *Comparison test of tillers for days (after monsoon).*

Table 3: *Comparison between the morphological characteristics of Panicum antidotale.*

Sr. No.	Morphlogical Characteristic			Panicum Antidotale
1	Ligule			Membranous
	Membranous	Hairy	Absent	
2	Auricles			Short stubby
	Long Claw like	Short Stubby	Absent	
3	Collar			C
	Continuous	Divided	Broad/Narrow	
4	Leaf Bud			R
	Rolled		Folded	
5	Leaf Blade			P
	Present		Absent	
6	Mid Rib			Parallel
	Parallel		Scattered	
7	Leaf Sheath			P
	Present		Absent	
8	Node			Prominent
	Prominent		Not Prominent	
9	Internodes			P
	Present		Absent	
10	Culm			P
	Present		Absent	
11	Rhizome			A
	Present		Absent	
12	Stolon			A
	Present		Absent	
13	New Tillers			A
	Present		Absent	
	Inflorisence			P
	Present		Absent	
14	Inflorescence length (cm)			30

P. antidotaie had characteristic of branching through which it enhanced its foliage (Gohl, 1981). After clipping, the tillers emerged adequately and subsequent expansion of plant was through branching. These findings differed with those of Madakadze et al. (1999) who reported that tiller density increased with increasing plant age and caused increased dry matter yields. Similarly, Butt et al. (1992) also reported that tiller density increased in Buffel grass with advancing grass age. The results of this study are however consistent with those of Mislevy et al. (1997) who determined the influence of plant height of *Erianthus arundinaceum* on number of tillers and reported that percentage of total and live

tillers declined, while that of dead tillers enhanced quadratically as plant height increased from 0.6 to 4.3 m. Decreased number of tillers per plant may also be due to self-shade effect of mature plants. High light intensities enhanced tillering and as plant grew larger and denser, it became increasingly self-shaded and resulted in reduced number of tillers (Homes, 1989).

Response of clipping intensity on dry and fresh weight of Panicum antidotale

Clipping intensity at greater interval has positive effects on plant yield. When clipping intensity was after 20 days interval, the harvest in terms of both dry weight and fresh weight was lower as compared to 80 days (Figure 3). The wide variation was observed in first sixty days clipping (220gms) and eighty days clipping (675gms) in fresh weight of *Panicum antidotale*. This indicated that the fresh weight harvest is more efficient after sixty days.

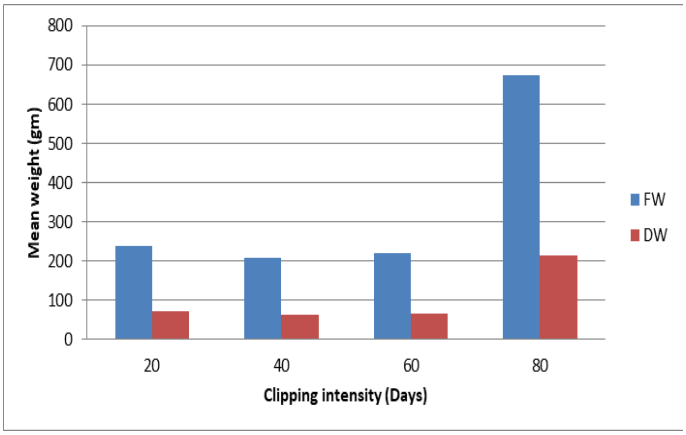

Figure 3: *Comparison of fresh and dry weight of Panicum antidotale at various clipping intensities*

In economic terms, the 20 days clipping produces more fresh and dry weight as compared to 80 days due to four times greater number of clippings in *Panicum antidotale* but it involves more labour and wages. This indicated that harvesting intensity depends upon demand of *Panicum antidotale* and availability of labour and its opportunity cost.

Conclusions and Recommendations

It can be concluded from the above discussion that morphological characters of *P. antidotale* like its plant height and no. of tillers increased with advancing plant maturity if there occurs proper soil moisture and rainfall. While, if there occurs a drought then very minute increase in growth of species occur. Although the grass had highest herbage biomass production at the 4th clipping stage but in this growth the proportion of plants with vegetative stage was lower than the height at the first 20 days of clipping stage of the species.

Author's Contribution

Mazhar Habib: Conceived the idea, Wrote abstract, Methodology, Did SPSS analysis, Conclusion, Data collection, Data entry in SPSS and analysis, Result and discussion, introduction, References.
Aamir Saleem: Technical input at every step, Overall management of the article, Data collection, Data entry in SPSS and analysis, Result and discussion, introduction, References.
Arshad Mahmood Malik: Technical input at every step, Overall management of the article, Conclusion, Did SPSS analysis.
Safraz Ahmad and Sameera Arshad: Techincal input at every step, Overall management of the article.

References

Baron, V.S., A.C. Dick and J.R. King. 2000. Leaf and stem mass characteristics of cool-season grasses grown in the Canadian Parkland. Agro. J. 92: 54- 63. https://doi.org/10.2134/agronj2000.92154x

Beaty, E.R. and J.D. Powell. 1976. Response of switchgrass (*Panicum virgatum* L.) to clipping frequency. J. Range Manage. 29: 132-135. https://doi.org/10.2307/3897409

Berg, C.C., A.R. McElroy and H.T. Kunelius. 1996. Timothy. Cool season forage grasses. Agron. Monogr. pp-643. Moser *et al*. (ed.) 34. ASA, CSSA, and SSSA, Madison, WI.

Borreani, G., P.P. Roggero, L. Sulas and M.E. Valente. 2003. Quantifying morphological stage to predict the nutritive value in Sulla (*Hedysarum coronarium*L.) Agron. J. 95: 1608-1617.https://doi.org/10.2134/agronj2003.1608

Butt, N.M., G.B. Donart, M.G. Southward, R.D. Pieper and N. Mohammad. 1992. Effect of defoliation on plant growth of Buffel (*Cenchrus ciliaris* L.). Ann. Arid Zone. 31: 19-24.

Butt, N.M. and M. Ahmad. 1994. Production and management of Buffel grass pasture. Prog. Farm. 14: 30-33.

Crowder, L.V. and H.R. Chheda. 1982. Tropical grassland husbandry. Longman, London and New Yark. pp. 562.

Dabo, S.M., C.M. Taliaferro, S.W. Coleman, F.P. Horn and P.L. Claypool. 1987. Yield and

digestibility of Old World Bluestem grasses as affected by cultivar, plant part and maturity. J. Range Manage. 40: 10-15. https://doi.org/10.2307/3899352

Dabo, S.M., C.M. Taliaferro, S.W. Coleman, F.P. Horn and P.L. Claypool. 1988. Chemical composition of old world bluestem grasses as affected by cultivar and maturity. J. Range Manage. 41: 10- 15. https://doi.org/10.2307/3898788

Garcia, R., Silva, U, 1980. Nutritive value, productivity and morphological characteristics of buffelgrass (*Cenchrus ciliaris*, L.) cv. Gayndah. Society for Range Management, 33rd Annual Meeting, San Diego, California, February 11-14, 1980, Abstracts and Position Statements: p. 7

Gohl, B. (1981) *Tropical Feeds*. FAO, Rome

Griffin, J.L. and G.A. Jung. 1983. Yield and forage quality of *Panicum virgatum.* In: proc. Of XIV Int. Cong. Lexington, Kentucky, USA Boulder, Colorde Western Press, pp. 491.

Homes, W. 1989. Grass-Its production and utilization. The British grassland society, blackwell scientific publications, Oxford London, pp. 300.

Khan, C.M.A. 1970. Effects of clipping intensities on forage yield of *Cenchrus ciliaris* (Linn.) in Thal. Pak. J. For. 20: 75-87.

Loo, Y.Y., L. Billa and A. Singh. 2015. Effect of climate change on seasonal monsoon in Asia and its impact on the variability of monsoon rainfall in Southeast Asia. Geosci. Front. 6(6), 817-823. https://doi.org/10.1016/j.gsf.2014.02.009

Madakadze, I.C., K. Stewart, P.R. Peterson, B.E. Coulman and D.L. Smith. 1999. Switchgrass biomass and chemical composition for biofuel in Eastern Canada. Agron. J. 91: 696-701. https://doi.org/10.2134/agronj1999.914696x

Mislevy, O., F.G. Martin and M.B. Adjei. 1989. Changes in elephant grass plant components with maturity: II. Crude protein and digestibility. P. 841. In R. Desroches (ed.) Proc. Int. Grassl. Congr., 16th, Nice, France. 4-11 Oct. 1989. French Grassland Soc. Versailles.

Mislevy, P., F.G. Martin, M.B. Adjei and J.D. Miller. 1997. Harvest management effects on quantity and quality of Erianthus plant morphological components. Biomass and Bioenergy 13: 51-58. https://doi.org/10.1016/S0961-9534(97)00023-8

Nandargi and K. Barman. 2018. Evaluation of climate change impact on rainfall variation in west bengal, acta scientific agriculture (ISSN: 2581-365X) Volume 2 Issue 7 May 2018.

O'Reagain, P.J. and R.N. Owen-Smith. 1996. Effect of species composition and sward structure on dietary quality in cattle and sheep grazing South African Sourveld. J. Agric. Sci. Cambodia. 127: 261-270. https://doi.org/10.1017/S0021859600078035

Palaniswamy, U.R. and K.M. Palaniswamy. 2006. Handbook of statistics for teaching and research. Salasar Imaging Sys. Dehli, pp. 624. https://doi.org/10.1201/9781482277814

Qurasishi, M. A. A., M. A. Zia and M. S. Qurasihi, 2006. Pakistan Agriculture Management and Development. A One Publication, Lahore, Pakistan.

Quraishi, M.A.A., G.S. Khan and S. Yaqoon. 1993. Range management in Pakistan. Kazi Publications, Lahore, pp. 229.

Shehu, Y., W.S. Alhassan, U.R. Pal and C.J.C. Phillips. 2001. The effects of sowing date on the growth and nutritive value of *Lablab purpureus.* J. Agron. Crop Sci. 186: 21-29. https://doi.org/10.1046/j.1439-037x.2001.00454.x

Vogel, K.P., J.J. Brejda, D.T. Walters and D.R. Buxton. 2002. Switchgrass biomass production in the Midwest USA: Harvest and nitrogen management. Agron., J., 94: 413-420. https://doi.org/10.2134/agronj2002.0413