

## EFFECT OF DEFOLIATION ON HARVESTED YIELD OF BUFFEL GRASS

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### ABSTRACT

The simulated grazing study on buffel grass (*Cenchrus ciliaris* L.) was carried out during summer growing seasons of 1986 and 1987 at the forage and pasture research block of National Agricultural Research Centre, Islamabad, Pakistan. Four cutting height and four cutting interval treatments were applied in all possible combinations. Individual plant yield and the yield per hectare showed similar response to clipping treatments. Harvested yield of buffel grass was influenced by the combined action of harvesting interval and cutting height indicating the importance of both factors in the management of buffel grass pastures. Maximum harvested yields were obtained by clipping the grass at very low clipping height (10 cm stubble height) after very short interval of cutting (3-week interval). This indicated resistance of this grass to frequent as well as intensive clipping.

### INTRODUCTION

Drought resistance and the colonizing ability of buffel grass (*Cenchrus ciliaris* L.) to non planted areas and quick recovery of severely defoliated plants made this grass most suitable for range improvement and reclamation purposes. Buffel grass was recommended for large scale rehabilitation programs in central Australia (Bosch 1983), Indian rangelands (Anonymous 1981) and desert rangelands of Pakistan (Mohammad and Naqvi 1987).

A variety of clipping studies have been performed on buffel grass to determine dry matter production under varying defoliation intensity and frequency regimes (Mutz and Drawe 1983; Clavero-Cepeda 1984). The main effect of cutting height on dry matter yield was less marked than cutting interval but variable yield responses were observed with height treatments. Chheda and Saleem (1973) and Fulkerson and Michell (1987) reported higher forage yield from clipping at low stubble height. Contrary to this, Shankarnarayan et al. (1977) showed an increase in dry matter yield with an increase in cutting height from 5 to 15 cm. An increase in dry matter yield of buffel grass by extending the harvesting interval was observed by several researchers (Asare 1970; Dabadghao et al. 1973; Shankarnarayan et al. 1977).

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The objectives of this study were to determine the effect of cutting frequency, cutting intensity and their interaction on harvested yield of buffel grass under sub-tropical conditions of Pakistan.

## MATERIAL AND METHODS

The average rainfall of the study area during the last 80 years is 940 mm, the major part of which is received during mid and late summer monsoon season. The soil of the study site is classified into ustochrept family (Anonymous 1976).

Buffel grass was established during the spring of 1983 in the forage and pasture research block through tuft splits keeping the distance between plants and rows 25 cm. Plot size was 1.5 x 3.0 m. Treatments consisted of four harvesting intervals and four cutting heights. Harvesting intervals were; clipping after 3, 6 and 9-week intervals and the control (clipping at the end of the growing season). The cutting heights were 10, 20 and 30 cm stubble heights and the control. The sixteen possible combinations of treatments were applied in three replications in a randomized complete block design with 4 x 4 factorial arrangement. Three plants in each plot were selected for recording data on fresh and dry forage yield per plant. The ratio between fresh and dry yields was used to calculate the correction factor for the determination of dry forage yield per plot. The experiment was repeated in 1987. The desired data were collected in the same manner as in the first year of study. The experiment was started earlier in 1987 so more cuttings were obtained during the second growing season. The final reading was taken on Oct. 25. Clipping dates and number of clippings in two years of study are shown in Table 1. The differences between the means of the main effects were separated using Bonferoni's test of comparison. Tukey's test of comparison was used to compare the interaction means (Steel and Torrie 1980). The control treatment of cutting height was not compared with other height treatment because total forage yield was not determined for the other height treatments. The term "significant" in the text refers to the 5 per cent level of significance.

## RESULTS AND DISCUSSION

### Harvested yield per plant

Interval between cuttings did not show and significant effect ( $P < 0.05$ ) on dry and fresh harvested yield of buffel grass at all cutting dates during two years of study except the October cutting of 1986. Significantly higher yield was obtained from 3 week clipping interval compared to 9 week clipping interval at the October cutting of 1986 (Table 2). At the end of second growing season when cutting treatments had fully expressed their effect, maximum dry harvested yield (49.36 g/plant) was obtained from 9 - week cutting interval (Table 3). Higher yield from longer harvesting interval have been reported by Asare (1970), Dabadghao et al. (1973) and Shankarnaryan et al. (1977).

Table 1. Treatment schedule for buffel grass during 1986 and 87

		Clipping dates					
1986		Aug. 25	Sept. 17	Oct. 09	Oct. 30	Nov. 20	
1987	Jun. 16 Jul: 09	Jul. 29 (Jul. cut)	Aug. 19 (Aug. cu )	Sept. 10 (Sept. cut)	Oct. 04 (Oct. cut)	Oct. 25 (Fl. eut)	
<i>Treatment</i>							
Control	b	a				ab	
3 week	b b	ab	ab	ab	ab	ab	
6 week	b	ab		ab		ab	
9 week	b	a	b		a	ab	

a-clipping dates in 1986, b-clipping dates in 1987, Fl-final cut

Table 2. Least square means and their standard error for cumulative dry and fresh harvested yields (g/plant) of buffel grass during 1986.

Cutting Treatments	Sept. cutting		Oct. cutting		Final cutting	
	Dry yield	Fresh yield	Dry yield	Fresh yield	Dry yield	Fresh yield
<i>Interval (week)</i>						
Control	x	x	x	x	22.44	56.18
3	17.73	55.04	18.77 <sup>a</sup>	57.54 <sup>a</sup>	22.60	66.39
6	17.57	53.69	x	x	23.11	65.54
9	x	x	14.48 <sup>b</sup>	43.31 <sup>b</sup>	18.33	51.06
S E	2.39	7.01	1.26	3.95	2.31	6.14
<i>Height (cm)</i>						
Control	x	x	x	x	30.67	48.68
10	19.23	58.73	21.93 <sup>a</sup>	65.14 <sup>a</sup>	4.67	70.30 <sup>a</sup>
20	20.36	61.97	16.83 <sup>ab</sup>	50.62 <sup>ab</sup>	21.92	59.82 <sup>ab</sup>
30	13.37	42.41	11.11 <sup>b</sup>	35.52 <sup>b</sup>	18.27	49.26 <sup>b</sup>
S E*	2.93	8.58	1.55	4.84	2.00	5.32

\* S E standard error of the means, x-no harvesting on that date, Means bearing different letters are significantly different at P < 0.05.

Significant effect of clipping height was observed on the harvested yield of October and final cutting of 1986. Harvested yield decreased with an increase in clipping interval but the differences in dry and fresh harvested yields between low and medium and high clipping heights were not significant (Table 2). The nonsignificant difference between the consecutive treatments may be due to the limited height differences in clipping treatments. The general trend of height harvested yield from low clipping height is in agreement with Chheda and Saleem (1973) and Fulkerson and Michell (1987).

During 1987 fresh and dry harvested yields decreased by increasing the cutting height (Table 3). The two early cuttings in the growing season showed a significant effect of clipping height on dry and fresh harvested yield. The yields increased

Table 3. Least square means and their standard error for cumulative dry and fresh harvested yields (g/plant) of buffel grass during 1987.

Cutting Treatment	July cutting		Aug cutting		Sept. cutting		Final cutting	
	Dry yield	Fresh yield	Dry yield	Fresh yield	Dry yield	Fresh yield	Dry yield	Fresh yield
<i>Interval (week)</i>								
Control	x	x	x	x	x	x	46.31	99.67
3	15.49	38.37	24.15	66.20	39.62	127.93	43.87	139.05
6	18.68	44.17	x	x	41.74	131.63	45.18	140.77
9	x	x	28.09	73.23	x	x	49.36	121.09
S E	1.64	6.14	2.28	5.87	4.55	14.54	5.40	13.99
<i>Height (cm)</i>								
Control	x	x	x	x	x	x	64.06	116.49
10	25.67 <sup>a</sup>	63.93 <sup>a</sup>	33.15 <sup>a</sup>	91.66 <sup>a</sup>	46.94	145.65	49.46	133.64
20	15.58 <sup>ab</sup>	38.19 <sup>ab</sup>	26.81 <sup>ab</sup>	70.46 <sup>ab</sup>	30.72	93.49	46.18	118.39
30	10.01 <sup>b</sup>	21.68 <sup>b</sup>	18.39 <sup>b</sup>	47.04 <sup>b</sup>	44.38	150.19	42.91	123.40
S E*	3.09	7.52	2.79	7.19	5.57	17.81	4.68	12.11

\* S E standard error of the means. x-no harvesting on that date. Means bearing different letters are significantly different at  $P < 0.05$ .

enormously by decreasing the clipping height from high and low. Nonsignificant differences between low and medium or medium and high stubble heights were possibly due to inadequate difference in treatments. The two latter cuttings did not show significant effect of clipping height on cumulative harvested yields revealing reduction in favourable effect of intensive clipping on harvested yield for a longer period of time.

The interaction between harvesting interval and cutting height was significant only on fresh plant yield of buffel grass at the August cutting of 1987. At this growth stage clipping at low stubble height (10 cm) after 3 week interval produced higher cumulative dry and fresh harvested yields (36.54 and 104.66 g/plant, respectively) compared to other treatments (Table 4). Although nonsignificant differences between harvested yields were observed at the final cutting of 1987 but maximum dry harvested yield (61.90 g/plant) was obtained by clipping the grass after 9 week interval at medium stubble height (20 cm).

#### Yield per hectare

Dry harvested yield of buffel grass at the end of 1987 growing season was significantly affected ( $P < 0.05$ ) by the harvesting interval and cutting height interaction. Maximum yield (8.20t/ha) was obtained when the grass was harvested at a low stubble height (10 cm) only once at the end of the growing season (Table 5). This was probably due to greater lignification on unclipped grass. Higher dry matter yields (6.83, 6.11, and 6.88 t/ha) obtained from clipping to short stubble height after

Table 4. Least square interaction means and their standard error for cumulative dry and fresh harvested yields (g/plant) of buffel grass during 1987.

Treatments		July cutting		Aug. cutting		Sept. cutting		Final cutting	
Cutting interval	Cutting height	Dry yield	Fresh yield	Dry yield	Fresh yield	Dry yield	Fresh yield	Dry yield	Fresh yield
Control	Control	x	x	x	x	x	x	72.89	130.68
Control	10	x	x	x	x	x	x	46.60	99.13
Control	20	x	x	x	x	x	x	51.61	112.37
Control	30	x	x	x	x	x	x	40.73	87.52
3	10	25.71	64.99	36.54	104.66	49.16	160.34	53.20	169.80
3	20	11.51	29.14	19.91	54.54	27.47	84.64	32.70	98.99
3	30	9.23	20.97	16.00	39.40	42.22	138.81	45.71	148.36
6	10	25.62	62.88	x	x	44.73	130.96	47.33	138.26
6	20	19.64	47.24	x	x	33.97	102.34	38.50	113.20
6	30	10.78	22.39	x	x	46.53	161.58	49.71	170.86
9	10	x	x	29.76	78.66	x	x	50.69	127.38
9	20	x	x	33.71	86.37	x	x	61.99	149.02
9	30	x	x	20.79	54.68	x	x	35.49	86.88
S E*		4.36	10.63	3.94	10-16	7.88	25.18	9.36	24.23

\* S E- standard error of the means, x- no harvesting on that date. Means bearing different letters are significantly different at P<0.05

Table 5. Least square interaction means and their standard error for cumulative dry and fresh harvested yields (t/ha) of buffel grass at the end of the growing seasons of 1986 and 1987.

Treatments		1986		1987	
Cutting interval (week)	Cutting height (cm)	Dry yield (t/ha)	Fresh yield (t/ha)	Dry yield (t/ha)	Fresh yield (t/ha)
Control	Control	7.19	11.52	9.96	17.85
Control	10	5.16	14.57	8.20	17.40
Control	20	2.52	6.45	5.38	11.74
Control	30	2.71	6.96	4.53	9.78
3	10	4.84	13.61	6.83	22.28
3	20	4.05	11.81	6.29	19.38
3	30	1.92	6.20	4.63	14.38
6	10	3.00	9.44	5.99	18.78
6	20	3.00	8.70	4.89	15.82
6	30	2.28	6.59	6.11	18.89
9	10	3.47	10.61	4.85	11.91
9	20	4.01	11.13	6.88	15.93
9	30	2.12	6.50	5.70	12.97
S E*		0.90	2.56	0.81	2.10

\* S E- standard error of the means  
 Means bearing different letters are significantly different at P<0.05

3-week intervals, to high stubble height after 6-week intervals and to medium stubble height after 9-week intervals, respectively indicated that both cutting intervals and cutting height should be considered in the management of buffel grass rangeland.

It may be concluded from this study that harvested yield of buffel grass was affected by the combined action of harvesting interval and cutting height indicating the importance of both factors in the management of buffel grass pasture. Maximum harvested yield was obtained by clipping the grass most frequently (3-week interval) at low stubble height (10 cm) indicated resistance of buffel grass to frequent and intensive clipping.

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