Proc. Indian natn. Sci. Acad. B 46 No. 4 pp. 495–505 (1980)

Grazing Behaviour of Dry Cows and Their Preference of Different Plant Species in a Protected Grassland at Early Fruiting Stage in Chakia Forest, Varanasi

A N PANDEY
Department of Botany, Banaras Hindu University, Varanasi 221005

(Received 21 June 1979; after revision 13 November 1979)

A controlled grazing experiment for dry cows was carried out in one year's protected grassland at early fruiting stage in Chandraprabha sanctuary, Varanasi forest division during October 26 to November 4, 1976. Cows are the top feeders and prefer tall species more than the small ones. Their bite is deeper on tall plants in comparison to that on small species. However, *H. contortus* was the most preferred species at the site. The amount of herbage suitable for cow grazing (herbivores) was only 26.5% at the plot I and 24.9% at the plot II of their respective total standing crop values. The quantity and quality of the diet constituents differ at different grazing days. Dry matter consumption/cow/day was 6.1 kg at the plot I and 6.0 kg at the plot II. For 100 kg body weight per day dry matter consumption was 2.4 kg at both the plots. Digestive efficiency of the cows was 60.4%.

Introduction

Grazing is the most economical form of livestock management and at global level it has become an integral part of ecosystem process. In nature animals are confronted with a variety of potential food sources wherefrom they select some and reject others. This ability to graze selectively has tremendous impact on the structure as well as on the function of the system. The conceptual model for the diet selection tactics has been viewed by Ellis et al. (1976) within the interaction of four major components viz., food availability, consumer food requirement, consumer preference and consumer selectivity. Moreover, these components are under the influence of several driving variables, some of which are characteristics of consumer and others of the food plants or of the abiotic environment. The present communication describes (i) the feeding behaviour, diet composition, food consumption and digestive efficiency of dry cows, and (ii) their preference for different plant species in a protected grassland in Chakia forest, Varanasi.

Study Site

The study site is located within Chandraprabha sanctuary (24°52' to 24°58' N Lat., 83°3' to 83°12' E Long.) of Varanasi Forest Division at a distance of 80 km from the Banaras Hindu University campus. The sanctuary is situated on the first escarpment of the Vindhyan highlands which range from 140 to 380 m above sea level. The terrain is undulating, and the experimental plot has a mild slope facing west. The soil derived from the sandstone rocks is red in colour and light in texture with water-holding capacity at 40–46%. The climate shows distinct seasonality with an average annual temperature of 25°C. The annual rainfall is about 1100 mm of which more than 80 percent occurs in the rainy season. Relative humidity, at 8 AM, varies from 63% to 91% throughout the year. The year is divisible into three seasons; wet summer i.e., rainy (July-September), dry winter (October-February) and dry hot summer (March-June).

Materials and Methods

An area of 150 m × 50 m was fenced during mid-June 1975 inside the sanctuary. The plot was divided into three equal subplots, numbered I, II and III. Analysis of the vegetation in plots I and II for numerical strength and distribution pattern of plants was made during the last week of October 1976 using 1 m^2 quadrats. Thereafter, the plants of dominant tall grasses were categorised in different height classes, viz., *Heteropogon contortus* (0–80, 81–100 and 101–115 cm), *Aristida adscenscionis* (0–50 and 51–72 cm) and *Bothriochloa pertusa* (0–50 and 51–65 cm), for the determination of standing crop. Species were in the early stage of fruiting and each tiller had attained its maximum height. Plants of *Cynodon dactylon* were categorised into fruiting and vegetative groups. An area of 50 cm × 50 cm was harvested at five random locations in the plots I and II before grazing. The samples were assorted by species and stratified height classes, oven-dried and weighed. The above-ground standing crop is calculated as kg ha^{-1}. The height fractions in each species were standardised against biomass. Five permanent quadrats, each of 50 cm × 200 cm were marked at random inside the plots I and II. Each of these quadrats had a patch of *H. contortus* growing adjacent to its either smaller arm. The number and height of plants for each species and height class were noted in each quadrat. Now five dry cows of almost similar age and body weight (248.4 kg/animal) were allowed to graze for 8 hr (8 AM to 4 PM) daily in the plot I from 26th to 30th October. On 31st October these animals were introduced in the plot II and were allowed to graze there up to 4th November for 8 hr daily. Plot III (middle one) served as ungrazed control. When the grazing was over on each date, the permanent quadrats were reinspected and the remaining height of the grazed plants of each species was measured. From this, the percentage ratio over the number of grazed plants was also established. The rare species were observed randomly at different spots inside the experimental plot. It was not difficult to spot out each day's grazed individuals because the grazed tip of the plants remained fresh at least for a day. After the grazing was finally over at a plot, an equivalent area of 50 cm × 50 cm was again harvested near each formerly sampled spot to determine the standing crop left ungrazed. Cow dung was systematically collected daily through faecal bags attached to each animal, oven dried and weighed.

Food consumption was calculated as difference between the initial and left over standing crop values. For the fractionation of daily dry matter consumption, defoliation depth of the plant from the top, percentage of the grazed plants, and stratified standing crop of the species were taken into account.

Table 1 *Floristic composition of the experimental plots I and II*

Species	Frequency (%)		Density/m²	
	Plot I	Plot II	Plot I	Plot II
GRASSES				
Heteropogon contortus (Linn) Roem. et. Schult	26	18	44	48
Aristida adscenscionis L.	70	70	247	255
Bothriochloa pertusa (L.) A. Camus	36	42	88	92
Chloris barbata (L.) Sw.	4	—	0.1	—
Chrysopogon montanus Trin.	2	4	2.3	0.3
Cynodon dactylon Pers.	66	52	50	37
Dactyloctenium aegypticum (L.) P. Beauv.	22	18	3	1
Digitaria bifasciculata (Trin.) Henrard.	48	90	44	53
Echinochloa coloum Link.	16	10	6	5
Eragrostis tenella R. and S.	48	66	54	112
Eragrostiella bifaria (Vahl.) Bor in India	5	6	1.5	1.3
Paspalidium sp.	58	46	39	23
Paspalidium flavidum A. Camus	2	—	1.5	—
Setaria glauca (L.) P. Beauv.	8	6	0.5	0.4
FORBS AND LEGUMES				
Achyranthes aspera Linn.	6	2	0.08	0.04
Alysicarpus monilifer Dc.	8	8	0.7	0.4
Aneilema nudifolorum R. Br.	10	2	1.0	0.04
Boerhaavia diffusa Linn.	2	—	0.04	—
Bonnaya brachiata Link. and Otto.	4	8	0.2	0.5
Borreria hispida (L.) Schum.	2	10	0.1	0.4
Cassia tora Linn.	60	60	2.0	2.0
Cassia pumila Lamk.	8	20	0.1	2.0
Convolvulus pluricaulis Choisy	10	16	0.5	0.4
Corchorus acutangulus Lamk.	6	—	0.4	—
Cyperus sp.	38	36	7.9	16
Desmodium triflorum (L.) Dc.	6	2	0.3	0.01
Euphcrbia hirta Linn.	4	2	0.04	0.04
Euphorbia thymifolia Linn.	2	4	0.02	0.1
Evolvulus alisinoides Linn.	40	38	6.8	4.0
Ipomoea pestigridis var.	4	—	0.01	—
Kyllinga triceps Rottb.	10	12	0.8	0.4
Leucas aspera (Willd.) Spreng.	—	8	—	0.2
Peristrophe bicalyculata Nees	6	4	0.9	0.1
Phyllanthus niruri auct.	2	—	0.02	—
Sida acuta Burm. *f.*	8	6	0.5	0.4
Tephrosia purpurea (L.) Pers.	2	6	0.02	0.04
Triumfetta neglecta W and A	2	8	0.1	0.2
Vandellia crustacea Benth	4	16	0.5	13
Zornia diphylla Auct—pur	—	10	—	0.2
Total			605.5	680.3

Food consumption minus faecal loss yielded the value for the amount of food digested. Digestive efficiency was calculated as:

$$Digestive\ efficiency = \frac{food\ digested}{Consumption} \times 100$$

Results and Discussions

Food composition, characteristics and availability

Table 1 shows that *H. contortus*, *A. adscenscionis*, *B. pertusa* and *Eragrostis tenella* are the dominant tall grass species. The spatial distribution of *H. contortus* was relatively poor because of its gregarious growth habit due to close tillering. The ground layer is dominated by *Cynodon dactylon*, *Digitaria bifasciculata* and *Paspalidium sp.* and they collectively form a thick cover. The number of species totalled to 38 and 31 in plots I and II, respectively, about 40% and 45% of them being grasses. Almost all the species were in the early stage of fruiting. In *C. dactylon* only 5% plants were in fruiting in each plot.

Total standing crop of vegetation is 2378.8 kg ha^{-1} in plot I and 2438.8 kg ha^{-1} in plot II (table 2). Graminoids constitute the major amount of total available food. Forbs and legumes contribute only 2% in plot I and 3% in plot II. Among the graminoids, maximum standing crop, 528 kg ha^{-1} in plot I and 640.0 kg ha^{-1} in plot II, is obtained for *H. contortus* followed, in decreasing order, by *A. adscenscionis*, *B. pertusa*, *C. dactylon*, *E. tenella*, *D. bifasciculata* and *Paspalidium sp.* The coefficients of variation show a small range. The pre-grazing coefficients averaged at 16.1% and 15.9%, whereas the mean residue coefficients averaged at 19.7% and 16.6% of respectively for plots I and II. Ivins (1959) considers that higher post-grazing coefficients are the result of low dry matter yields as such, rather than the increased variability of the grazed stands.

Grazing behaviour of cows and their preference of plant species

Cows are top feeders of grass. It is evident from column 2 of tables 3 and 4 that they make measured bites according to the height of the plants, i.e., there is only a little variation in the length of defoliated plant parts among the species of similar height. The size of the bite varies little also on different days of grazing. In general, the bites are deeper on the tall plants than those on the short ones. The tall plants, thus are more accessible to grazing. However, within a species the height is also a reflection of ageing and this results in some further selectivity. Thus, date wise analysis of grazed species reveals that *H. contortus* is the most preferred species; the tillers of 0–80 cm height class are grazed four times during the experimental period in both the plots. The next height class (81–100 cm) also shows regrazing but the tillers of the top height class (101–115 cm) are not grazed at all. It appears that with ageing and maturity this species becomes unpalatable. Pandey (1978) has reported a higher concentration of crude fibres in older grass tillers and it may be a reasonable explanation for the deterioration of the food quality in overmature plants. *B. pertusa* and *A. adscenscionis* also show that the plants for 0–50 cm height class are liked and both are thrice grazed during five-day experiment. *D. bifasciculata* and *C. dactylon* are grazed right from the beginning to the last date of the experiment. Despite the liking for *C. dactylon*, its fruiting tillers remained ungrazed. *E. tenella* is grazed from the second day onwards. *Dactyloctenium aegypticum*, *Digitaria sanguinalis* (only vegetative tillers) and *Echinochloa colonum* (only somewhat green plants) are grazed on the second or third day or still later. Among the forbs and herbs, *Corchorus acutangulus*, *Boerhaavia diffusa*,

Table 2 *Standing crop of different plant species (pre-entry cuts and residue cuts) along with coefficient of variation, and dry matter consumption in the plots I and II during the grazing trial*

Species	Shoot biomass kg ha^{-1} Plot I					Plot II					Dry matter consumption kg/cow/day	
	Initial dry matter	C.V. (%)	Dry matter left after grazing	C.V. (%)	Total dry matter consumption	Initial dry matter	C.V. (%)	Dry matter left after grazing	C.V. (%)	Total dry consumption	Plot I	Plot II
Heteropogon contortus	528.0	18.3	270.4	23.9	257.6	640.0	19.7	368.0	25.2	272.0	2.5	2.7
Bothriochloa pertusa	483.3	16.8	332.8	17.0	150.4	400.0	15.0	268.0	18.0	132.0	1.5	1.3
Aristida adscenscionis	470.4	14.1	400.0	12.6	70.4	473.6	15.0	392.0	13.2	81.6	0.7	0.8
Cynodon dactylon	448.0	14.7	338.4	15.9	109.6	320.0	18.3	256.0	18.1	64.0	1.0	0.6
Digitaria bifasciculata	137.6	11.9	108.0	14.9	29.6	144.0	13.3	113.6	11.2	30.4	0.29	0.3
Eragrostis tenella	226.8	14.6	220.0	16.0	6.8	361.6	13.8	336.0	15.8	25.6	0.07	0.2
Dactyloctenium aegypticum	8.0	20.0	4.8	33.3	3.2	8.0	15.0	6.8	23.5	1.0	0.03	0.01
Echinochloa colonum	12.0	20.0	10.8	25.0	1.2	10.8	18.6	10.0	20.0	1.0	0.01	0.01
Rest of the species	64.8	14.8	62.8	19.1	2.0	80.8	14.8	80.0	15.0	1.0	0.02	0.01
	mean	16.1		19.7			15.9		16.6			
Total	2378.8		1748.0		630.8	2438.8		1830.4		608.6	6.1	6.0

C.V.=Coefficient of variation
Initial dry matter=Pre-entry cuts' yield
Dry matter left=Residues cuts' yield.

Table 3 *Daily dry matter consumption of the more important plant species in plot I*

Date	Percentage plants grazed	Plant part defoliated (cm)	Height class (cm)	Dry matter consumption (g/m^2/day)	Total dry matter consumption	
					(kg/ha/day)	(kg/animal/day)
1	2	3	4	5	6	7
Heteropogon contortus						
26.10.76	93	15.6	0–80	7.18	7.18	3.59
	7	15.6	0–80	0.60	6.0	
27.10.76	100	14	81–100	3.62	36.2	2.50
	16	12	0–80 (regrazed)	0.78	7.8	
					50.0	
28.10.76	64	12	0–80 (regrazed)	3.12	31.2	2.44
	55	12	81–100 (regrazed)	1.76	17.6	
					48.8	
29.10.76	71	12	0–80 (thrice grazed)	4.35	43.5	2.17
30.10.76	60	12	0–80 (fourth time grazed)	4.60	46.0	2.30
Bothriochloa pertusa						
26.10.76	50	14	0–50	2.46	24.6	1.23
27.10.76	50	14	0–50	2.46	24.6	1.23
28.10.76	42	13	0–50 (regrazed)	2.15	21.5	1.07
29.10.56	56	13	0–50 (regrazed)	2.86	28.6	1.43
30.10.76	38	12	0–50 (thrice grazed)	5.53	55.3	2.76
Aristida adscensionis						
26.10.76	23	14	0–50	0.86	8.6	0.43
27.10.76	22	14	0–50	0.86	8.6	0.43
28.10.76	37	14	0–50	1.44	14.4	0.72
29.10.76	62	12	0–50 (regrazed)	2.45	24.5	1.22
30.10.76	25	12	0–50 (thrice grazed)	2.34	23.4	1.17
Cynodon dactylon						
26.10.76	7	4	Vegetative plants	0.64	6.4	0.32
27.10.76	21	4	-do-	1.92	19.2	0.96
28.10.76	31	4	-do-	3.20	32.0	1.60
29.10.76	26	4	-do-	2.56	25.6	1.28
30.10.76	15	4	-do-	1.28	12.8	0.64

Table 3—*Contd.*

1	2	3	4	5	6	7
Eragrostis tenella						
27.10.76	20	15	—	0.33	3.3	0.17
28.10.76	10	15	—	0.15	1.5	0.07
29.10.76	5	15	—	0.09	.9	0.04
30.10.76	2.5	15	—	0.03	.3	0.01
Digitaria bifasciculata						
26.10.76	44	3.5	—	1.43	14.3	0.71
27.10.76	33	3.5	—	1.07	10.7	0.53
28.10.76	11	3.5	—	0.35	3.5	0.17
29.10.76	7	3.5	—	0.25	2.5	0.12
30.10.76	5	3.5	—	0.17	1.7	0.08
Dactyloctenium acgypticum						
27.10.76	60	18	—	0.50	5.0	0.25
28.10.76	40	18	—	0.25	2.5	0.12
Echinochloa colonum						
28.10.76	25	8	—	0.13	1.3	0.06
29.10.76	25	8	—	0.13	1.3	0.06
Corchorus acutangulus+Sida acuta+Triumfetta neglecta						
26.10.76	100	5	—	0.15	1.5	0.07
Borreria hispida						
27.10.76	30	15	—	0.009	0.09	0.004
28.10.76	30	15	—	0.009	0.09	0.004

Table 4 *Daily dry matter consumption of the more important plant species in plot II*

Date	Percentage plants grazed	Plant part defoliated (cm)	Height class (cm)	Dry matter consumption ($g/m^2/day$)	Total dry matter consumption	
					(kg/ha/day)	(kg/animal/day)
1	2	3	4	5	6	7
Heterapogon contortus						
31.10.76	95	15.6	0–80	7.92	79.2	3.96
	5	15.6	0–80	0.60	6.0	
1.11.76	100	14	81–100	3.62	36.2	2.70
	18	12	0–80 (regrazed)	1.17	11.7	
					53.9	
2.11.76	62	12	0–80 (regrazed)	4.29	42.9	2.58

Table 4—*Contd.*

1	2	3	4	5	6	7
	50	12	81–100 (regrazed)	0.88	8.8 —— 51.7	
3.11.76	70	12	0–80 (thrice grazed)	4.83	48.3	2.41
4.11.76	59	12	0–80 (fourth time grazed)	4.60	46.0	2.30
Bothriochloa pertusa						
31.10.76	45	14	0–50	1.86	18.6	0.93
1.11.76	55	14	0–50	2.13	21.3	1.06
2.11.76	42	13	0–50 (regrazed)	1.86	18.6	0.93
3.11.76	56	13	0–50 (regrazed)	2.43	24.3	1.21
4.11.76	37	12	0–50 (thrice grazed)	4.36	43.6	2.18
Aristids adscensionis						
31.10.76	24	14	0–50	0.95	9.5	0.47
1.11.76	22	14	0–50	0.90	9.0	0.45
2.11.76	38	14	0–50	1.50	15.0	0.75
3.11.76	65	12	0–50 (regrazed)	2.87	28.7	1.43
4.11.76	27	12	0–50 (thrice grazed)	2.69	26.9	1.34
Cynodon dactylon						
31.10.76	10	4	Vegetative plants	0·64	6.4	0.32
1.11.76	20	4	-do-	1.28	12.8	0.64
2.11.76	27	4	-do-	1.92	19.2	0.96
3.11.76	27	4	-do-	1.92	19.2	0.96
4.11.76	16	4	-do-	1.28	12.8	0.64
Digitaria bifasciculata						
31.10.76	42	3.5	—	1.20	12.0	0.60
1.11.76	32	3.5	—	0.96	9.6	0.48
2.11.76	11	3.5	—	0.24	2.4	0.12
3.11.76	9	3.5	—	0.21	2.1	0.10
4.11.76	6	3.5	—	0·14	1.4	0.07
Eragrostis tenella						
1.11.76	16	15	—	1.20	12.0	0.60
2.11.76	14	15	—	1.12	11.2	0.56
3.11.76	11	15	—	0.86	8.6	0.43
4.11.76	5	15	—	0.43	4.3	0.21
Borreria hispida						
1.11.76	15	15	—	0.01	0.16	0.009
2.11.76	15	15	—	0.01	0.16	0.009
3.11.76	15	15	—	0.01	0.16	0.009

Table 4—*Contd.*

1	2	3	4	5	6	7
Dactyloctenium aegypticum						
2.11.76	40	18	—	0.25	2.5	0.12
Echinochloa colonum						
3.11.76	60	18	—	0.26	2.6	0.13
Triumfetta neglecta						
31.10.76	100	5	—	0.14	1.4	0.07

Ipomoea pestigridis, *Sida acuta* and *Triumfetta neglecta* are grazed on the first day. *Borreria hispida* is grazed after one day. Rest of the species of forbs and legumes are not liked by cows. In addition, there are 6 ungrazed graminoid species, viz., *Paspalidium* sp. *Paspalidium flavidum*, *Eragrostiella bifaria*, *setaria glauca*, *Chrysopogon montanus* and *Chloris barbata*.

The above findings also indicate that the palatable species are grazed simultaneously. Animals do not finish the species of their best liking first and then take up the species next in preference. However, taste seems to become a guiding factor for cows when they feel satiated since according to observations, during the last part of the feeding period of the day they search for *H. contortus*. Ivlev (1961) summarized his experiments on food selection in fish as follows: "While the animal is hungry it eats up all the food objects it finds. As it becomes satiated, especially in the case where taste is the animal's guiding sense, it becomes more discriminating, and finally, when the degree of satiation reaches an almost maximum value, it only eats the items it likes best". According to dry matter consumption, the order of preference to species is: *H. contortus*>*B. pertusa*>*A.*
\>
adscenscionis=*C. dactylon*>*D. bifasciculata*
<
\>*E. tenella*.

Diet composition, food consumption and utilization

The diet composition differs on different dates as shown in tables 5 and 6. *H. contortus* is consumed most on each day. *B. pertusa*, *C. dactylon* and *A. adscenscionis* come next to *H. contortus* in successive order. Among the small plant species, consumption of *D. bifasciculata* is more than that of *C. dactylon* on the first two days. Later on as the standing crop of the succulent fraction of *H. controtus* among the tall species, and of *D. bifasciculata* among the small species, decreases, other species like *B. pertusa*, *A. adscenscionis* and *C. dactylon* are grazed more to compensate for the food requirement. The dry matter consumption during the grazing periods is 48.4%, 31.1% 14.9%, 24.4%, 21.5%, 3.0%, 40.0%, 10.4% and 3.0% of the total standing crop of *H. contortus*, *B. pertusa*, *A. adscenscionis*, *C. dactylon*, *D. bifasciculata*, *E. tenella*, *D. aegypticum*, *E. colonum* and the rest of the species, respectively in plot I. Similarly dry matter consumption is respectively 42.5%, 33%, 17.2%, 20.0% 21.1%, 7.0%, 12.5%, 9.0% and 1.2% for the above cited species in plot II. On the whole 26.5% and 24.9% herbage is removed from the plots I and II respectively. The amount of herbage left ungrazed is 73.4% in plot I and 75.0% in plot II Dry matter consumption/cow/day obtained through the fractionation (table 5 and 6) ranges from 6.0 kg to 6.9 kg for

Table 5 *Diet composition and dry matter consumption kg/animal/day at the grazed plot I during 26th to 30th October 1976 (derived through fractionation)*

Species	26/10/76	27/10/76	28/10/76	29/10/76	30/10/76	Total dry matter consumption of different species (kg/animal in five days)
Heteropogon contortus	3.590	2.508	2.443	2.176	2.304	13.021
Bothriochloa pertusa	1.232	1.232	1.075	1.433	2.769	7.741
Aristida adscensionis	0.433	0.433	0.724	1.228	1.172	3.990
Cynodon dactylon	0.320	0.960	1.600	1.280	0.640	4.800
Digitaria bifasciculata	0.716	0.537	0.179	0.125	0.089	1.646
Eragrostis tenella	—	0.171	0.075	0.045	0.015	0.306
Dactyloctenium aegypticum	—	0.250	0.125	—	—	0.375
Echinochloa colonum	—	—	0.066	0.066	—	0.132
Borreria hispida	—	0.004	0.004	—	—	0.008
Corchorus acutangulus + Sida acuta + Triumfetta neglecta	0.079	—	—	—	—	0.079
Total dry matter consumption kg/animal/day	6.370	6.095	6.291	6.353	6.989	32.098

Average dry matter consumption/animal/day = 6.419kg

Table 6 *Diet composition and dry matter consumption kg/animal/day at the grazed plot II during 31st October to 4th November 1976 (derived through fractionation)*

Species	31/10/76	1/11/76	2/11/76	3/11/76	4/11/76	Total dry matter consumption of different species (kg/animal in five days)
Heteropogon contortus	3.960	2.703	2.588	2.419	2.304	13.974
Bothriochloa pertusa	0.933	1.067	0.932	1.219	2.180	6.331
Aristida adscensionis	0.479	0.451	0.752	1.435	1.347	4.464
Cynodon dactylon	0.320	0.640	0.960	0.960	0.640	3.520
Digitaria bifasciculata	0.600	0.480	0.120	0.108	0.072	1.380
Eragrostis tenella	—	0.604	0.561	0.432	0.216	1.813
Dactyloctenium aegypticum	—	—	0.125	—	—	0.125
Echinochloa colonum	—	—	—	0.132	—	0.132
Borreria hispida	—	0.009	0.009	0.009	—	0.027
Triumfetta neglecta	0.070	—	—	—	—	0.070
Total dry matter consumption kg/animal/day	6.360	5.954	6.047	6.714	6.759	31.836

Average dry matter consumption/animal day—6.367 kg plot I and from 5.9 to 6.7 kg for plot II. The difference between the total initial standing crop minus standing crop left ungrazed yields the average consumption of 6.1 kg/cow/day in plot I and 6.0 kg/cow/day in plot II. Hence, dry matter consumption/100 kg body weight of the cow is 2.4 kg in both the plots. Average digestive efficiency of the cows is 60.4% (Singh, J. 1976, personal communication) during the grazing period. About 40% dry matter goes in faecal loss. In a metabolic study on similar dry cows, the dry matter intake was found to be 2.1 kg/100 kg body weight and the digestibility was 56.7% (Singh J, Personal Comm.). The feed provided in the above study consisted of forest grasses. Thus, animals liberty of food choice, dry matter intake and digestive efficiency have been found higher in field grazing than those in stall feeding trial. Therefore the above findings stand to conclude grazing as a more suited feeding process for cattle.

However, present study has certain limitations because it was not feasible to protect a larger area for grazing trials at different phenological stages of grasses and also to have another group of acclimatized animals to allow for simultaneous grazing in plots I and II. Animal's preference might vary if experiment is conducted at different phenological stages of the grasses. Bhimaya et al. (1960) studied the relative palatability of *Dichanthium annulatum*, *Cenchrus ciliaris*, *Cenchrus setigerus*, *Lasiurus hirsutus*, *Panicum turgidum* and *Panicum antidotale* at their various growth stages at Jodhpur in Western Rajasthan. They found that *Cenchrus ciliaris* and *C. setigerus* were highly palatable grasses followed by *Lasiurus hirsutus*, while *Panicum antidotale* and *P. turgidum* were the least palatable species when fully ripe. However, during early vegetative growth stage *Panicum turgidum* and *P. antidotale* were better than *Cenchrus setigerus* and *Lasiurus hirsutus*. According to Heady (1964), presumably, chemical composition is the most important palatability factor. Other factors such as proportion of leaves, stems and fruits, plant growth stages, past grazing use, climate, topography, soil moisture, and fertility have been related to palatability mainly through their influence on chemical components.

Acknowledgement

I feel pleasure to place my heartfelt gratitude to Professor R Misra, Principal Investigator MAB Project I, Deptt. of Botany, Banaras Hindu University for his invaluable suggestions and constant inspiration. This work was funded by the national MAB Project I granted by the Department of Science and Technology, Government of India.

References

Bhimaya C P., Dabadghao P M and Prakash M 1960 Personal Communication (Quoted by Whyte 1964)

Ellis J E, Wiens J A, Rodell C F and Anway J C 1976 A conceptual model of diet selection as ecosystem process; *J. theor. Biol.* 60, 93–108

Heady H F 1964 Palatability of herbage and animal preference; *J. Range Management* 17 76–82

Ivins J D 1959 *The Measurement of Grassland Productivity;* (London : Butterworths Scientific Publication)

*Ivlev V S 1961 Experimental Ecology of the Feeding of Fishes (New Haven, Conn: Yale University Press)

Pandey D D 1978 Seasonal variation in the productivity and nutritive value of four important forage species in relation to grazing; Ph.D. thesis, Banaras Hindu University

*Original not seen.