

PLANT SPECIES COMPOSITION, FORAGE PRODUCTION AND CARRYING CAPACITY OF RAKH DAGAR KOTLI RANGELAND (THAL DESERT)

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ABSTRACT

Data were collected from Rakh Dagar Kotli rangeland of Thal desert to determine the plant species composition, forage production and carrying capacity of the area to evaluate the current condition of the rangeland. Systematic sampling with random start procedure was adopted to collect the data. The study revealed that species composition of *Cenchrus ciliaris* was maximum (42.08%) followed by *Eleusine flagellifera* (27.41%) and *Elionurus hirsutus* (16.22%) respectively on the basis of cover percent data. The carrying capacity of the study area was 0.175 AU/ha/year which is quite low. Deteriorated condition of the rangeland could be improved by developing appropriate range improvement techniques like reseeding, protection from grazing and scientific grazing system.

INTRODUCTION

Rangelands cover about 52.20 m.ha area of Pakistan. About 8.2 m.ha (40%) of the total land area of the Punjab province comprises of rangelands (NCA, 1988; Quraishi *et al.*1993). Out of total area of rangelands in Pakistan, only 6.4 m.ha area is under the control of Provincial Forest Departments (Anonymous, 1992). These rangelands are located in the arid and semi-arid parts of the province. The major range areas are Thal, Cholistan, D.G. Khan and Pothwar (Mohammad, 1989). Livestock is a major source of income in irrigated, arid, semiarid, and rain-fed areas of Pakistan. At present, sheep and goats obtain about 60 % of their feed from rangelands (Mahmood and Rodriguez, 1991).

Measurement of the quantity and quality of vegetation is major consideration in range research. The study of range vegetation for assessment of species composition, forage production and carrying capacity is most important to correct the conventional and over use of the range. Relative cover or biomass of individual plant species has traditionally been used to estimate plant species composition (Stoddart, *et al.* 1975). The species composition and carrying capacity of an area is well determined by many factors. The existing climatic conditions and area are the expressions of the particular vegetation type of that area. But, the edaphic features and water quality seem unconventional by considering the vegetation dynamics. Both the factors influence the vegetation succession and other changes (Hussain, 2003). Forage production is a measured vegetation attribute that refers to the weight of plant material within given area. It can be calculated on individual basis, as species groups, or as a total weight for the vegetation. Species composition may also be calculated as the contribution that each species makes to the total biomass. (Bonham, 1989).

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The objectives of the present study were to determine the plant species composition, forage production and carrying capacity of Rakh Dagar Kotli rangeland of Thal.

MATERIALS AND METHODS

The present study was conducted at Rakh Dagar Kotli rangelands during the month of May, 2010. The rangeland is situated in Thal desert area of Punjab province and is administered by the Punjab Forest Department. Total area of Rakh Dagar Kotli rangeland is 3267 ha, divided into 20 pastures. Forest Department makes annual grazing programme and allot different pastures for grazing and to be reseeded with local palatable species like *Cenchrus ciliaris*. Reseeding and grazing are rotated among these pastures over time. This study was carried out in pasture 4 and 9 in Rakh Dagar Kotli rangelands.

The arid and semi-arid Thal range area receiving 150 to 200 mm annual rainfall is located at an altitude of 200 m and lies between 31- 33°N latitude and 71.07°E. Ecologically, the range area is a part of tropical and subtropical sandy plains and is considered one of the prominent rangeland of southern Punjab in Pakistan which covers an area of 2.5 m. ha. (Mohammad, 1989; Quraishi *et al.*, 2006).

Line transect method was applied to collect the vegetation parameters such as cover percent and forage yield. Quadrat was used to collect the data. Reconnaissance of the study area was carried out to layout the transect lines for data collection systematic sampling with random start was done. Four transect lines each 100 m long were laid down in the study area. On each transect line, 10 quadrats at 10 m distance were randomly located to study the cover percent and forage yield. A total of 40 quadrats were studied in the study area. In each quadrat species wise cover percent was recorded and then clipped. Carrying capacity of the study area was calculated applying 50 percent proper use factor. Average cover percent for each species was calculated by dividing the total cover percent of each species with total number of quadrat (Hussain, 1968; Ashfaq and Rafique, 1999). Data were analyzed using analysis of variance technique.

SPECIES COMPOSITION

The species composition was determined from the vegetative cover and forage production data. With the help of cover data and forage production data, species composition was calculated as:

Species composition from cover percentage data:

It was calculated with this formula:

$$\text{Species composition (\%)} = \frac{\text{Average cover of a species} \times 100}{\text{Total cover of all the species}}$$

Species composition from forage production data:

It was calculated with this formula:

$$\text{Species composition (\%)} = \frac{\text{Air dry wt. (gm. /m}^2\text{) of an individual species} \times 100}{\text{Total wt. of all the species}}$$

Carrying Capacity

Data collected in the field was analyzed to calculate the carrying capacity. Carrying capacity is the maximum stocking rate possible which is consistent with maintaining or improving vegetation or related resources (SRM, 1989).

$$\text{Carrying capacity in AU} = \frac{\text{Total usable air dried forage production (kg/ha)}}{\text{Forage requirement of one Animal Unit (kg per year)}}$$

RESULTS AND DISCUSSION

Data on vegetation cover and forage production (air-dried) species wise was collected from Rakh Dagar Kotli pasture (Compartment 4 and 9) using 1 m² quadrat in May, 2010 to calculate species composition and carrying capacity of the area.

Cover Percent

Species wise cover percent data is presented below in table 1. The average cover percent of *Cenchrus ciliaris*, *Eleusine flagellifera*, *Elionurus hirsutus*, and *Zizyphus nummularia* was 21.8, 14.2, 8.4 and 2.0 percent respectively in the study area at Rakh Dagar Kotli. The results indicate that the cover percent of *Cenchrus ciliaris*, *Elionurus hirsutus* and *Eleusine flagellifera* were significantly higher as compared to other species.

Table 1. Average cover (%) data of forage species

Name of Species	Average Cover (%)
<i>Cenchrus ciliaris</i> (Dhaman)	21.8
<i>Cymbopogon jwarancusa</i> (Khavi)	2.5
<i>Elionurus hirsutus</i> (Gorkha)	8.4
<i>Suaeda fruticosa</i> (Lana)	1.2
<i>Zizyphus nummularia</i> (Mallah)	2.0
<i>Prosopis juliflora</i> (Mesquite)	1.7
<i>Eleusine flagellifera</i> (Chimber)	14.2
Total	51.8

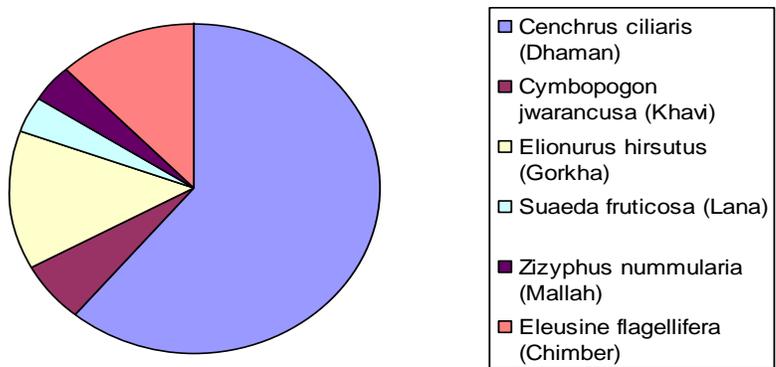
Forage Yield

Species wise forage yield (air-dried) data of various species is presented below in table 2. The average forage yield of *Cenchrus ciliaris*, *Elionurus hirsutus* and *Eleusine flagellifera* was 700 Kg/ha, 159 Kg/ha and 141 Kg/ha respectively. The results indicate that the forage yield of *Cenchrus ciliaris*, *Elionurus hirsutus* and *Eleusine flagellifera* were significantly higher as compared to other species.

Table 2. Average air-dried forage yield (Kg/ha)

Name of Species	Air Dried Forage Yield (Kg/ha)
<i>Cenchrus ciliaris</i> (Dhaman)	700
<i>Cymbopogon jwarancusa</i> (Khavi)	69
<i>Elionurus hirsutus</i> (Gorkha)	159
<i>Suaeda fruticosa</i> (Lana)	42
<i>Zizyphus nummularia</i> (Mallah)	40
<i>Eleusine flagellifera</i> (Chimber)	141
Total	1151

Air Dried Forage Yield (Kg/ha)



Average Cover (%)

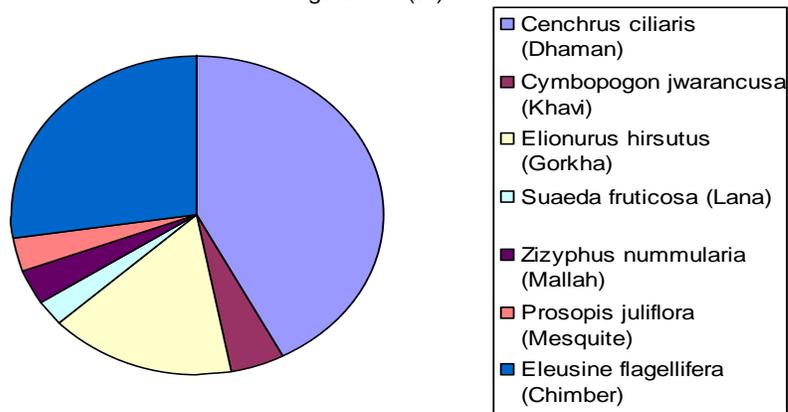


Table 3. Average cover (%) and species composition (%) data of forage species

Name of Species	Average Cover (%)	Species composition (%)
<i>Cenchrus ciliaris</i> (Dhaman)	21.8	42.08
<i>Cymbopogon jwarancusa</i> (Khavi)	2.5	4.83
<i>Elionurus hirsutus</i> (Gorkha)	8.4	16.22
<i>Suaeda fruticosa</i> (Lana)	1.2	2.32
<i>Zizyphus nummularia</i> (Mallah)	2.0	3.86
<i>Prosopis juliflora</i>	1.7	3.28
<i>Eleusine flagellifera</i> (Chimber)	14.2	27.41
Total	51.8	100

Table 4. Average air-dried forage yield (gm/m²) and species composition (%) data

Name of Species	Average air-dried forage yield (gm/m ²)	Species composition (%)
<i>Cenchrus ciliaris</i>	70	59.42
<i>Cymbopogon jwarancusa</i>	6.9	5.85
<i>Elionurus hirsutus</i>	15.9	13.49
<i>Suaeda fruticosa</i> (Lana)	4.2	3.56
<i>Eleusine flagellifera</i>	14.1	11.97
<i>Prosopis juliflora</i>	2.7	2.29
<i>Zizyphus nummularia</i>	4	3.39
Total	117.8	99.97

Carrying Capacity

Carrying capacity of the study area was calculated based on data from 40 quadrats pasture from Compartment 4 and 9 of Rakh Dagar Kotli. Mean forage production was 1151Kg/ha. The Carrying Capacity in the study area was 0.175 AU/ha/year which is very low.

Parameter	Value
Air dried forage production (Kg/ha)	1151
Carrying Capacity (AU/ha/year)	0.175

The results of the study revealed that species wise results of forage production and cover percent of *Cenchrus ciliaris*, *Elionurus hirsutus* and *Eleusine flagellifera* were much higher in study area as compared to other species. The forage production and cover percent of *Suaeda fruticosa*, *Cymbopogon jwarancusa* and *Zizyphus nummularia* were much less in the study area. The greater air-dried forage production and cover percentage of *Cenchrus ciliaris*, *Elionurus hirsutus* and *Eleusine flagellifera* in the study area is attributed to reseeding and protection from grazing of reseeded areas for about 3 years. The low production and cover percent of *Zizyphus nummularia* may be due to cutting down of bushes for fuel as there is no alternative. The lower production of the

rangeland is mainly due to mismanagement of rangeland. The results of the study are in consistent with the studies conducted by Chaudhry *et al.* (2000) regarding carrying capacity and vegetation cover of Rakh Dagar Kotli (Thal) and Chaudhry *et al.* (2004) regarding assessment of range vegetation and carrying capacity in Rakh Goharwala (Thal). These studies revealed carrying capacity of 0.177 AU/ha/growing season and 1.003 AU/ha/year respectively. *Cenchrus ciliaris* stood at the top of the palatable species (24.80%). The other species included *Eleusine flagellifera* (27.52%) and *Elionurus hirsutus* (13.85%).

CONCLUSION

It is concluded from the study that *Cenchrus ciliaris* is the main forage species of Rakh Dagar Kotli rangeland based on the cover percent and forage production data. The carrying capacity of the area is quite low which depicts the deteriorating condition of the rangeland due to heavy grazing pressure.

RECOMMENDATION

The present deteriorating condition of the rangeland can be improved by adopting appropriate range improvement practices like reseeding, protection from grazing and scientific grazing system. Reseeding of grasses like *Cenchrus ciliaris* and *Elionurus hirsutus* on suitable sites would be useful for improving the deteriorated condition of rangeland.

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