

## Impact of Grazing on the Plant Composition and Dominance of Natural Grassland and Established Silvopasture

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**Abstract:** The impact of grazing on plant composition and dominance of natural grassland, as well as plant population of established silvipasture, were studied at Jhansi from October 1991 to June 1994. There was no harmful effect on the plant composition and dominance of the perennial grasses in natural grassland due to round the year grazing. Similarly, plant population of *Chrysopogon fulvus* was also not affected due to round the year grazing by sheep and goats under silvipastoral system. However, legume components drastically decreased under natural grassland, as well as in silvipastoral system. Out of three tree species, *Leucaena leucocephala* survived minimum (11.5%), followed by *Dichrostachys cinerea* (64.0%) under grazing conditions. Thus, it can be concluded that the legume components are affected severely by grazing in both the types of pasture even with optimum stocking rate of animals. In tree species, *L. leucocephala* was also affected adversely, while perennial grasses did not show any harmful effect of grazing.

**Key words:** Grassland, composition, silvipasture and grazing.

Rotational grazing is among the commonly used systems for pasture utilization. The influence of rotational grazing on natural grassland and established silvipasture can not be excluded in an effort to evaluate the changes in botanical composition.

In India, Singh (1967) reported the pattern of inter-specific association in Varanasi grasslands under various grazing managements. Mall and Das (1973) reported the results from similar studies on protected *Sehima* grassland of Ujjain. Shankar *et al.* (1975) and Velayudhan *et al.* (1977) reported the results of such studies on *Sehima - Heteropogon* grassland at Jhansi under different systems of management and emphasized the importance of such information in condition classification of natural grass-

lands. Similarly, Rai *et al.* (1981) reported the clues for management of *Cenchrus ciliaris* pasture for its better stability and production.

The present study was conducted to assess the impact of grazing on plant composition of *Sehima - Heteropogon* natural grassland, as well as on established silvipasture after about three years of grazing through rotational system.

### Materials and Methods

The study was conducted at the farm of National Research Center for Agroforestry, Jhansi. In the natural grassland, two hectare area was fenced and divided into four paddocks. In the case of silvipasture, one hectare area consisting of fodder trees

Table 1. Impact of grazing on plant composition and dominance of natural grassland

Species	Composition (%)		Dominance (%)	
	1990	1994	1990	1994
<i>Sehima nervosum</i>	20.4	23.7	47.9	52.5
<i>Heteropogon contortus</i>	23.6	14.2	21.8	27.0
<i>Iseilema laxum</i>	0.5	1.0	0.8	1.1
<i>Themeda quadrivalvis</i>	2.4	29.6	1.8	8.3
Other grasses*	26.5	7.5	17.7	3.3
Legumes**	14.1	7.5	4.3	1.2
Forbs***	12.4	16.3	5.7	6.6

\* Other grasses were *Eragrostiella biferia*, *Aristida reducta*, *Setaria slauca*, *Apluda varia*, *Panicum* sp. and *Eragrostis* sp.

\*\* Other legumes included *Indigofera cordifolia*, *Indigofera linifolia*, *Indigofera hirsuta*, *Atylosia scarabaeoides*, *Phaseolus trilobus*, *Tephrosia* and *Cassia* sp.

\*\*\* Other forbs included *Boraria stricta*, *Lepidogothis trineris*, *Corcorus* sp., *Tricodesma* sp., *Cyprus* sp. and *Eimbristylis* sp.

(*Albizia amara*, *Dichrostachys cinerea* and *Leucaena leucocephala*), grass (*Chrysopogon fulvus*) and pasture legumes (*Stylosanthes hamata* and *S. scabra*) was established during July 1990. *A. amara* and *D. cinerea* were planted at 5 x 5 m spacing in alternate rows and in between two plants of either *A. amara* or *D. cinerea*, *L. leucocephala* was planted. Thus, the total plants of *A. amara*, *D. cinerea* and *L. leucocephala* were 200, 200 and 400, respectively. In between two rows of trees, *C. fulvus* was planted at 100 cm spacing and in between two rows of grass, a mixture of *S. hamata* and *S. scabra* was sown. Every year, 40 kg N + 20 kg P<sub>2</sub>O<sub>5</sub> per ha was applied for both types of pastures.

Six male sheep of Muzzafemagari breed and six goats of Barbari breed (adults) were introduced for grazing in both the types of pastures during October 1991 and continued up to June 1992. Again, same number of lambs and kids (4 to 5-month

old) of the same breed were introduced for grazing during August 1992 and continued up to June 1994. Rotational grazing system was followed at two week interval. Thus, each paddock got 6 week rest in both the cases. In case of natural grassland, data on plant composition were recorded during September-October 1990 and 1994 by line intercept method (Cainfield, 1941). The line transects were taken randomly at 20 places, each of 5 m length, during 1990 and permanently demarcated with angle iron pegs to take observation from the same place during 1994. In case of established silvipasture, data on plant population of grass and legumes were taken by quadrat method randomly from 20 places during September 1990, as well as in 1994. The size of quadrat was 1 x 1 m. In case of trees, the survival count was done during December 1990 and 1994. The total rainfall and number of rainy days recorded from July 1990 to June 1994 were 943.9 mm (37 rainy days), 957.7 mm (35 days), 786.4

mm (44 days), 788.3 mm (40 days) and 128.3 mm (11 days), respectively.

## Results and Discussion

### Natural grasslands

The plant composition (number of plants) of *S. nervosum*, *I. laxum*, *T. quadrivalvis* and forbs increased from 1990 to 1994 after about 3 years of grazing round the year by sheep and goats (Table 1). While percentage of *Heteropogon contortus*, other grasses and legumes decreased during 1994 as compared to those in 1990, the decrease in per cent composition of *H. contortus*, other grasses and legumes might be due to round the year grazing of animals and as such, most of the annual species could not form the mature seeds.

Data on per cent dominance (basal area) of all the perennial grass species increased during 1994 as compared to that of 1990. However, increase in *T. quadrivalvis* was very high. There was no harmful effect of grazing on the health of the perennial grasses. The per cent basal cover of other grasses and legumes decreased considerably during 1994 than that of 1990. This shows that the vegetation was more utilized by the animals, as well as mostly they are of annual nature, more damage occurred during the grazing period. Increase in per cent composition, as well as dominance during 1994, in case of forbs, shows the aggressiveness of these species as most of species were less palatable. Decrease in per cent composition and dominance of other grasses and legumes may be attributed to their more palatability and high grazing frequency.

### Established silvipastoral system

The population of *C. fulvus* increased four times during 1994 as compared to that in 1990 (Table 2), while decrease in population of *S. hamata* and *S. scabra* was 67.0 and 93.4%, respectively, after 3 years of grazing of sheep and goats. Thus, the results showed that there was no adverse effect of grazing on *C. fulvus* stand and as such, it can tolerate grazing for many

Table 2. Impact of grazing on population of grasses and legumes under silvipastoral systems.

Species	Plant number m <sup>-2</sup>	
	1990	1994
<i>Chrysopogon fulvus</i>	2.0	8.0
<i>Stylosanthes hamata</i>	10.6	3.5
<i>S. scabra</i>	10.7	0.7

years with optimum stocking rate of animals. In case of *Stylosanthes* species, it can be attributed that these species may not withstand grazing for many years. However, *S. hamata* seemed to be more tolerant to grazing than *S. scabra*. Thus, for getting nutritious forage, reseedling of *Stylosanthes* is required every fourth year.

The survival of *A. amara* was excellent and that of *D. cinerea* was medium, while *L. leucocephala* was very poor during 1994 (Table 3). However, during grazing period, it was noticed that sheep and goats browsed leaves of *L. leucocephala* and even bark during the summer season followed by the leaves of *D. cinerea*, while preference of *A. amara* was negligible. It is difficult to explain as to why animals utilized bark of *L. leucocephala* only and also not preferred the leaves of *A. amara*, although, the C.P. content in the leaves of *A. amara* was found to be 16.25% (average of two years). The more preference of *L. leuco-*

Table 3. Impact of grazing on tree survival under silvipastoral system

Species	Survival (%)	
	1990	1994
<i>Albizia amara</i>	100.0	92.5
<i>Dichrostachys cinerea</i>	93.3	64.0
<i>Leucaena leucocephala</i>	96.6	11.5

*cephala* may be due to higher C.P. content in the leaves (18.69%) and its palatability. The C.P. content of *D. cinerea* leaves was 12.39% (Rai and Tiwari, 1994).

### Acknowledgements

Author is thankful to Dr. R. Deb Roy, Ex-Director and Dr. K.R. Solanki, Director, for providing necessary facilities and encouragement and to Mr. G.R. Rao, Scientist, for assistance in analysis and Mr. Rajendra Singh, T-II-3, for collection of data.

### References

- Cainfield, R.H. 1941. Application of line intercept method in sampling range vegetation. *Journal of Forestry* 39: 338-394.
- Mall, S.L. and Das, R.R. 1973. Interspecific association between *Sehima nervosum* and other five species in protected grassland of Ujjain (India). *Tropical Ecology* 4: 167-172.
- Rai, P., Kanodia, K.C. and Trivedi, B.K. 1981. Stability of *Cenchrus* pasture after four years of management. *Forage Research* 7: 115-118.
- Rai, P. and Tiwari, R. 1994. Evaluation of multipurpose tree species for their crude protein content. *Agroforestry Newsletter* 6: 8-9.
- Shankar, V., Velayudhan, K.C. and Trivedi, B.K. 1975. Pattern of interspecific association in *Sehima-Heteropogon* grasslands under three different systems of management. *Annals of Arid Zone* 14: 358-366.
- Singh, J.S. 1967. Seasonal variation in composition, plant biomass and net community production in the grasslands at Varanasi. *Ph.D. Thesis*, Banaras Hindu University, Varanasi, India.
- Velayudhan, K.C., Rai, P. and Kanodia, K.C. 1977. Interspecific association in *Sehima nervosum* (Rottl.) Stapf. community under two different systems of grazing management. *Geobios* 4: 94-97.