

Chapter 8

Conclusions



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Objectives of the present study were accomplished satisfactorily. Significant observations could be recorded in all the aspects of the study. Some new interesting findings were found as the highlights of the study. Results of present study are of high value for the management of studied grasslands and can be considered as recommendations for the same. Outcomes have been concluded briefly and are presented as follow:

Diversity documentation revealed that Poaceae and Leguminosae are two largest families of both the regions.

- ✓ In Bandheli grassland, a total of 173 species were encountered that belong to 43 different families and 125 genera. Leguminosae was the most dominant family (with 42 species) followed by Poaceae (with 32 species), Euphorbiaceae (with 9 species), Asteraceae and Rubiaceae (with 6 species). Likewise, at Rampur grassland, a total of 204 species were encountered that 47 belong to families and 142 genera. Here also Leguminosae was the most dominant family (with 59 species) followed by Poaceae (with 52 species), Euphorbiaceae (with 10 species), Rubiaceae (with 8 species), Acanthaceae (with 5 species). The proportions of family to genera, family to species and genera to species were higher in Rampur grassland than the Bandheli grassland.
- ✓ Likewise, Simpson index was higher for Bandheli grassland (0.52) i.e. ≥ 0.5 inferring clubby occurrence of dominant species while the same index of Rampur grassland is 0.48 (≤ 0.5) which infers somewhat gregarious occurrence of dominant species. Bandheli grassland few species were dominant indicating lower stability of this grassland and

the Rampur grassland seems to be more stable as it has high spp. diversity.

- ✓ In both the grasslands among top six species *Cymbopogon martinii* shows high IVI value which clearly says that this unpalatable species has conquered the area and its removal and suppression is essential for successful establishment of palatable species as well as for increasing species diversity especially in Bandheli area. Though at Rampur the dominance of *Heteropogon contortus* is also remarkable and if proper attention is not given on the control of *Cymbopogon martinii*, the amount of other palatable species like *Heteropogon contortus* will also reduce.

Reproductive Potential assessment was done through phenological records.

- ✓ Obtained phenological data can help in collecting seeds for regenerating pure patches for desired species or fodder for cattle at appropriate stage with good quality. While results of seed output per plant gives details about individual plant species and can help in getting knowledge about seed quantity for collection. Among grasses *Apluda mutica*, *Cynodon dactylon*, *Dichanthium caricosum*, *Digitaria adscence*, *Digitaria granularis*, *Thelepogon elegans* were found to have high seed potential and legumes like *Aeschynomene indica*, *Crotalaria leptostachya*, *Crotalaria nana*, *Desmosium giganticum*, *Indigofera enneaphylla*, *Indigofera tinctoria*, *Sesbania sesban*, *Tephrosia villosa* showed high regenerative potential because of higher seed output.

Seed Processing was a challenging task especially for the minute grass seeds.

- ✓ Through appropriate technology, an attempt was made to design and create a modified model of a manual grass seed cleaner, this stands as one of the major achievement of this study. The machine consisted of two units; the sieves stand and seed thresher. The sieve stand was used

for the removal of bigger trash and seed thresher for the removal of minute chaff particles. Both of these equipments were designed based on basic sieving process and considering the physical properties of seeds. Instead of conventional large machines with high power consumption, these two manual handy ones are affordable and is a new attempt to get quality seeds in forage reestablishment i.e. mainly for minute forage grass seeds. The sieving process of the sieve stand separates bigger trash while thresher separates associated chaff.

- ✓ In total about 50% of collected forage grass species could be efficiently cleaned up to pure caryopses level. Even though, these species shows minor dimensions of their seeds whose manual separation is next to impossible. For better field establishment, separation of such small sized forage grass seeds through such sieve stand and handy, conventional seed thresher might be so promising for future revegetation programs. Our work has highlighted alternative methods of harvesting and processing that will go a long way towards coping with stand establishment problems of a diverse range of the grasses found in the study area. Prepared seed thresher and sieve stand can be used for other grass species based on its mentioned performance. Obtained pure caryopses will be more helpful in pasture regeneration program.

Seed Quality testing was done through different parameters like physical purity, seed density, maturity index, viability, germination, vigor and seed lot screening.

- ✓ Germination process was intensely studied, by comparing the germination curves for increasing and decreasing temperature regimes (IT and DT) and also by examining the effects of other eco-physiological parameter (viability) on the germination patterns in the

test system, we could extract information on the germination characteristics of individual seed populations: the presence or absence of induction or breakage of dormancy by certain thermal (temperature) regimes, the permissible or optimal temperature range for the germination of non-dormant seeds and, the range of thermal time required for germination in different storage durations.

- ✓ The results of the germination study show numerous instances where the different species showing similar kind of seed characteristics reoccurs in association with species of same ecology. And such information can be used through the extrapolation in regeneration activities. It also can be a satisfactory analysis in which laboratory results are complemented by studies of production and chance of seeds under natural conditions. The present study indicated that, along with temperature and dormancy, seed longevity i.e. seed viability play a crucial role in determining germinability due to which seedling establishment can be regulated in the field condition. Thus, the seed distribution of seeds in field condition is expected to determine the proportion of germination and also act to maintain seed banks over a time.

Seed Lot Screening was done by specially modified X-ray technique.

- ✓ Almost all grass seeds and many of legume seeds studied using x-raying was very small and study with normal characterization was not possible. For these efforts were done with modifying the specifications, successful results could be obtained and results stands as one of the major achievement and can be successfully used in the field of pasture development.
- ✓ The findings show that the method is reliable and can be used for detecting empty, filled and mechanically damaged seeds or fruits. The

applications of x-ray radiography in pasture development for good quality seed collection, seed processing, nursery practice, seed trade and plant quarantines, and for research etc. is now possible.

- ✓ The main benefit of x-ray imaging is that, on the basis of % of mature seeds, we can assume that how much seeds may be viable. The ration of the mature seeds can predict the quality of seed lot of the particular species.

Palatability and Nutritive Value of grasses and legume was done to identify better forage sources.

- ✓ Obtained results suggests that the promotion of highly palatable species like *Bothriochloa pertusa*, *Cenchrus ciliaris*, *Coix lachryma-jobi*, *Dichanthium annulatum*, *Sehima nervosum*, etc. must be enhanced. While spread of unpalatable or less palatable species like *Cymbopogon martinii*, *Sorghum halepanse*, etc. should be controlled. Other less palatable species can be used during drought periods.
- ✓ It is often difficult or impossible to achieve, since selection of forage material is based on what is available rather than what may be desirable. As the study area was unexploited and there is demand of healthy forage for the livestock, in present study we tried to understand about the palatability potentials present in some dominant and few rare grass species at two different stages. The rare species were selected because if they exhibit good quality of forage then those species can be cultivated in pure patches.

Temporal changes in rainfall pattern were recorded and its impact on grassland Diversity was studied.

- ✓ At both these grasslands, the grass vegetation is composed of (1) perennial grasses whose aerial parts wither and die (and are often

burnt) annually, (2) annual grasses of varying length of life whose seed lies dormant in the ground till the next rains. In favorable conditions the succession can proceed positively while due to climate change especially due to uneven and erratic rainfall it also can precede negatively.

- ✓ In the present study, evaluation was done for temporal changes occurred in rainfall pattern and its influence on vegetation, during three successive years. The study was conducted to observe short term successional changes and to record variation if any in the pattern of species emergence. Data was collected simultaneously at different selected sites, and was analyzed. The structure, composition and life-forms changed, significantly during successive years.
- ✓ In our selected study sites, the environment was very fluctuating during these years. The rains were very erratic; temperature fluctuation level was very high which directly affected the plant growth. Another effect of these fluctuating environments was that, at the time of seed setting, the plants got dried. Thus, almost all dominant perennial palatable grass species of the study area like, *Apluda mutica*, *Bothriochloa pertusa*, *Cenchrus ciliaris*, *Chrysopogon fulvus*, *Dichanthium annulatum*, *Heteropogon contortus*, *Sehima nervosum*, *Themeda triandra* and many other less dominant species did not show seed formation. This affected the community composition and species diversity in the next season.
- ✓ At both the grasslands, one unexpected result observed during our studies was that in certain portions of the land where the grasses were left uncut, with the assumption of allowing them to rot and so add humus to the soil; the grass, however, was so fibrous that it did not decay but laid on the ground acting as a denuding agent, effectively killing vegetation, preventing germination of seeds and preventing

percolation of rainwater to the ground. The areas which had been denuded in this manner by the overlying debris were in the following season invaded by ruderals such as *Vicoa auriculata* (Sarpankho). It is therefore suggested, that the grass produced must be cut, grazed (but not over-grazed) or burnt if it is not to form an obstacle to next year's growth. Overgrazing also caused an increase of ruderals such as *Echinops echinatus*. Improvement of such areas is distinctly possible. The first essential is fencing, so that the free movement and indiscriminate grazing of cattle may be checked.