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Rangelands and Their Improvement in India

Panjab Singh
Indian Agricultural Research Institute, New Delhi 110 012, India

Abstract : Grasslands are the major feed resources for livestock rearing in India since time immemorial. Due to extremities of climate, poor management and the constraints of grazing, these areas have been degraded at an alarming rate. Due to high grazing pressure and low to very low carrying capacity these grasslands have undergone tremendous changes and now pose a serious threat and challenge for rehabilitation and ecorestoration of their depleted resources. It calls for an integrated approach for management of the vast grassland areas. Technological opportunities available for restoration, regeneration and enhancement of biomass production require large scale development efforts. Future thrust areas of R&D lay emphasis, besides others, on utilization of grasslands, protection of grasslands, stocking rates, ecosystem rehabilitation and people's participation in the entire gamut of activities. Stress is to be given on production, management and utilization for sustainable development.

Key words : Rangelands, forage, livestock, grazing, stocking rate.

Rangelands/grasslands are a single resource base which contribute maximum herbage for 15% of the global livestock population in India. Although there has been an astronomical increase in the livestock population in India, the area under grasslands has gradually decreased. The annual livestock population increased by 56% during 1961-1992. It was 2.19% during 1972-82 (Singh, 1988). On the other hand, the area under grazinglands has decreased from 13.26 million ha in 1980-81 to 11.60 million ha in 1989-90 (Anonymous, 1993). Still, these grasslands/ grazinglands are sustaining the ever increasing livestock population and the livestock product biomass scenario of the country is quite encouraging. The annual output of livestock products has increased from Rs. 106 billion in 1980-81 to Rs. 516 billion in 1991-92; annual milk output from 31.6 mt in 1980-81 to an annual record of 56.6 mt in 1992-93 (Anonymous, 1993). Similarly, the annual wool production increased from 32.0 m kg in 1980-81 to 43.3 m kg in 1992-93. The grasslands have also contributed to the foreign exchange earnings of the country by producing more meat for export. In 1991-92, meat worth Rs. 2310 million was exported from India as compared to an export worth Rs. 614.9 million in 1980-81 (Anonymous, 1993).

Under such an encouraging situation, we should be more concerned about the rangelands. Since the grasslands, grazing by animals and production of animal biomass are interlinked, it is out of place to consider grasslands in isolation. Grazing is equally provided by the hill slopes, forest openings, wastelands, etc. Besides, the forage availability is considerably added by the cultivated fodders, crop residues and concentrates. In the cases where livestock depend entirely on grazing in the well defined grasslands only, the situation regarding forage availability is not so encouraging. However, the importance of rangelands/grasslands can not be underestimated, and in case their production potential reaches an optimum level, we can still achieve higher levels of animal biomass.

Present Situation

It is rather erroneous to accept that the Indian grasslands, excepting the subalpine and alpine areas, are the true grasslands, since these are not a climax community. Instead, these are resultant plant communities which have come into being due to unabated and enormous biotic activities. The clearance of arboreal component for fuel and timber, uncontrolled grazing and trampling by animals resulting in the annihilation

of bush and tree saplings and fire by the hunters in the past and local dwellers in the present time, have resulted in vast expanses of terrain devoid of any vegetation other than herbaceous elements and dominated by grasses and forbes. These are our present day grasslands.

Notwithstanding their origin, these grasslands had been a major source of livestock rearing in India since time immemorial. Utilized in a variety of ways like sedentary, semi-migratory and migratory systems of grazing, these grasslands have always been complementary to animal rearing. At present, about 121 m ha area, which comprise about 40% of the geographical area of the country, constitute the grazing lands. Due to extremities of climate, poor management and constant grazing, these areas have been degraded to an alarming stage. Such lands are less productive than the well managed grasslands and may not provide as much herbage and nutrition as the grasslands do. Still, they are an integral part of various animal rearing systems.

In the north-western part of the country, the high altitude subalpine and alpine pastures or grasslands are grazed during short summer by the migratory flocks, whereas they have to depend on the other grazing resources for remaining part of the year, which may extend upto eight months. The western region, comprising Rajasthan and Gujarat, have only 5.4% and 3.5% area, respectively, under grasslands. Yet the livestock productivity of these states is quite high due to grazing provided by other grazing lands. In the eastern region, the grasslands and pastures comprise less than 1% area. Still the animal husbandry is an important occupation of the people. The area under grasslands/pastures, their average biomass production and carrying capacity for various states of India has been compiled by Singh and Misri (1993). The highest carrying capacity of the grasslands is in Kerala, where 1.47 ACU (adult cattle unit) can be reared on 1 ha of grassland, whereas it is the lowest in Haryana, where only 0.20 ACU can be sustained on 1 ha of grasslands. In the semi-arid areas, the grazing intensity ranges from 1.04 to 51.08 ACU ha^{-1} (Shankar and Gupta, 1992) against the normal carrying capacity of 1 ACU ha^{-1}. In the arid areas, the grazing capacity is only 0.2 to 0.5 ACU ha^{-1} (Raheja, 1966). The situation is almost identical throughout the country.

Due to such enormous grazing pressure, the grasslands have undergone a tremendous change. The edible species have been replaced by noxious weeds. The regeneration of plants is very poor, leading to scanty vegetation cover. This has resulted in tremendous soil and water losses from the grasslands. These losses ranged from 3.532 to 33.951 t ha^{-1} (Anonymous, 1991). The degradation has taken place to such an extent that now the once productive grasslands are rated as class IV and V lands, i.e., wastelands. Gupta and Ambasht (1979) rated 80% of the grasslands under "poor" range condition class.

Various factors like terrain, scanty vegetation cover, extremities of climate, erratic rainfall, constant neglect and an ever increasing livestock and human population, have rendered the grasslands as a fragile ecosystem. Only an integrated approach can correct the situation. Vegetating the depleted grasslands without protection, proper stocking rate and constant management can aggravate the fragility and this enormous ecosystem can be lost for ever. The situation about other grazing lands is almost identical, but proper management can convert them into potential source of herbage availability. Our future endeavours should be focused on all types of grazing lands for the sustained animal productivity.

The Challenges

In spite of the inherent limitations of animal rearing viz-a-viz grassland production, the availability of animal products has increased considerably during the past few years. This demand is going to increase manifold in the future because of the increasing human population pressure. The greatest challenge to researchers is to enhance the biomass production from the available land and to make the grassland production sustainable. The biomass production has to be increased in order to create a balance between demand and supply. Besides the grassland herbage, agrowastes

play an important role in augmenting the supply of roughages. The animal pressure on 1 ha of land providing agrowastes ranges from 0.75 to 16.80. Similarly, the pressure on cultivated fodders is equally high. The states of Gujarat, Haryana, Punjab and Rajasthan have started fodder cultivation in a big way. Still the animal pressure on 1 ha of land put under fodder crops is 19.78, 11.07, 12.90 and 15.95, respectively, in these states (Singh and Misri, 1993).

Various estimates have been made about the demand and supply position of fodder for the whole country. Singh (1987) estimated that by 2000 AD, we may require 822 mt of dry matter per year for the mere maintenance of the animals. For higher productivity, we will require at least 1253 mt of dry matter per year. Shankar and Gupta (1992) estimated that we are short of 69 mt of dry forage per annum. Besides the forage, the grazing lands have been providing fuel, timber and other minor forest products. We are losing about 1.5 m ha of forest land every year due to various processes of degradation. Still 68% of rural and 45% of urban population use wood as fuel (Qazi, 1994). We have to meet even this fuel demand from the given area which is to be utilized for both fuel and fodder production.

Opportunities

Researches undertaken on various aspects of grazing lands, animal rearing systems and restoration of wastelands at the Indian Grassland and Fodder Research Institute (IGFRI) and other research institutions in the country have generated enough technologies for restoration, regeneration and enhancement of biomass production from all these systems. Soil working, reseeding, fencing, bush clearing, provision of rest, adoption of water and soil conservation, destocking, fertilizer application, introduction of legume and tree/bush and grazing practices are some of the basic management options available for correcting the situation and meeting the challenges.

Studies conducted at the IGFRI revealed that after the sowing of suitable species in a grassland, initial protection from grazing not only leads to higher biomass yield, but also results in longer persistence of the plant species. Live hedge fences have been found to be the most economical and suitable for initial and long term protection. Tandon *et al.* (1982) found that the herbage production can be enhanced from 0.93 to 3.31 t ha^{-1} by initial protection of the grasslands. Rotational grazing schedules have not been found suitable for areas with annual rainfall between 250 and 375 mm. For these areas, wet and dry season grazing on different sites with a proper stocking rate, is best suited for maximum production. The optimum stocking rates vary from place to place. IGFRI has found that a stocking rate of 25 to 30, 20, 17, 13 and 6 ACU ha^{-1} should be maintained on excellent, good, fair, poor and very poor classes of grazing lands, respectively.

Availability of moisture by various moisture conservation techniques can lead to a sustained availability of herbage from a rangeland. Ahuja (1977) found that contour furrowing, contour bunding and contour trenching lead to the herbage increase of 638, 168 and 165%, respectively, in the grazing lands.

Fertilizer application is one of the most important management options for enhancing biomass yield. Investigations at IGFRI revealed that the annual forage yield from natural grasslands of *Sehima nervosum*, *Heteropogon contortus* and *Iseilema laxum* can be increased from 4.13 to 7.56, 3.47 to 5.57 and 4.49 to 6.37 t ha^{-1}, respectively, by application of 40 kg N ha^{-1} (Shankar and Gupta, 1992). Herbage production from the Himalayan grasslands can be enhanced from 1.78 t ha^{-1} to 7.01 t ha^{-1} by the application of 60 kg each of N and P ha^{-1} (Sharma and Koranne, 1988). Introduction of legumes in the grasslands can improve the nutritional quality of herbage and can also compensate for nitrogen application. It has been found at IGFRI that by introduction of 14 different legumes, the soil gets enriched to the extent equivalent to 40 kg N ha^{-1} and the herbage yield increases from 3.3 to 4.0 t ha^{-1}.

Controlled burning and weed eradication are some of the important practices for biomass increase in the grasslands. A grazing land having a high density of bushes (1300 bushes ha^{-1}) may yield only up to 0.8 t ha^{-1}, while with total eradication of bushes, the herbage yield can be increased to 4.2 t ha^{-1} (Kaul and Ganguly, 1963). However, for a sustained availability of herbage from a grassland, it has been recommended that 14% of the area should be covered with bushes.

In order to meet various requirements like fodder, fuel and timber from a single land unit, introduction of silvipasture system in the grazing lands holds promises. For various agroclimatic regions of the country, suitable tree species have been identified by Singh (1992). It was found at IGFRI that planting *Leucaena leucocephala* in rangelands can provide additional biomass of 20 t ha^{-1}, *Acacia tortilis* 14.6 t ha^{-1} and *Albizzia amara* 9.5 t ha^{-1}.

Apart from the above major technologies, there are other technologies now available for various regions and systems. These have to be integrated and the grassland/grazing land management has to be a coordinated endeavour whereby enhanced biomass is obtained, soil and water is adequately conserved, and the environment is improved. Once these are obtained, there will be a need for proper management so that the whole system remains sustainable.

Future Thrust Areas of R & D

Utilisation of grassland

The grassland herbage should be used with utmost care. In established or natural grasslands deferment in grazing schedules is important to allow some time for vegetation to complete biological cycle to produce and disperse seed. Grasslands reseeded with perennial species should not be grazed during the first year of establishment. In the second year, grazing may be permitted after seed dispersal, and in subsequent years grazing should not exceed the carrying capacity of the grassland, which should be predetermined in each situation.

Protection of grasslands

In order to introduce controlled grazing, fences are a prerequisite in most dry areas. With effective fencing, pasture yield may register more than 3-fold increase within five years.

Stocking rate

A suitable stocking rate should be determined and strictly adhered to, according to the type and strength of a herd and the biomass available from the rangeland. Herd diversification is another important aspect of the grassland development strategy. An area containing both grasses and shrubs may be utilised best with a combination of different ruminant species and different grazing habits.

Ecosystem rehabilitation

Rangeland rehabilitation needs to be initiated wherever necessary, by planting suitable plant species, management of eroded grasslands, stock control, better land management and destocking. Different management systems significantly influence rangelands and livestock health through their effect on soil, water, nutrients and biomass yield.

Education

The most important factor for bringing about desired management is the creation of a cadre of sophisticated and educated range managers. Inclusion of range management as a subject in the curriculum of various universities should be given priority.

Financial inputs

A major social and economic need is for a flexible credit system which allows capital to be borrowed from financial institutions for development and purchase of livestock. The repayment schedule should be on a long term basis with nominal interest.

Marketing

Suitable marketing networks for livestock products should be created by the government, in which the produce is purchased directly from

the producer at a remunerative price. A system of support price may also be introduced.

Health cover

Health cover schemes, totally or partially financed by the government, should be implemented in the areas of livestock production.

Fodder conservation

To supplement forage availability from rangelands, efforts should be made to bring more areas under fodder cultivation and agroforestry systems. This will greatly reduce the pressure on rangelands. Creation of fodder banks in drought-prone and other potentially dry areas should be given priority. The fodder available from these banks can save a lot of precious livestock.

People's participation

Keeping in view the social and cultural factors, participation of people is the most important input for range and livestock management. The prevailing management practices have to be carefully studied and blended with those envisaged to be superimposed. It is ultimately the local people whose participation can lead to successful implementation of the programmes.

Research Needs

Research programmes should stress the following points:

- Collection, evaluation and introduction of suitable legume species with high palatability and drought resistance.
- Breeding and biotechnological programmes to create palatable, high-yielding and stress-resistant grasses, shrubs and fodder trees.
- Evaluation studies for diversification of the herds to enable the livestock to survive under various ecological stresses.
- Extensive grassland surveys and ecological research on different habitats.
- Soil and water conservation and utilisation techniques under various land and climatic conditions.
- Role of mycorhizae and nonsymbiotic nitrogen-fixing bacteria in relation to productivity of grasses and the crops.
- Rangeland production, management and utilisation for sustainable development.

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