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DIVERSIFICATION OF FODDER RESOURCES

BY

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INTRODUCTION:

The increase in human population will dictate a greater food supply and world food needs will increase in the future. In addition to a greater demand for food products, there will be an increasing demand for animal protein which would mean greater requirements for number of animals and their feed. The country at present pastures and feeds about 88.6 million animals which comprise of 16.6 m. cattle, 13.1 m. buffaloes, 25.0 m. sheep , 29.7 m. goats and 4.2 m. others like horses, donkeys and camels. (Chaudhry, 1987).

Forages are the major source of feed for livestock in Pakistan and are produced on rangelands, permanent pastures, meadows and cultivated lands. It is difficult to assess the importance of forages because of a primary reason that forages must be consumed by an animal before they are generally considered usable for human beings. The total maintenance and protein requirements of 88.6 million animal heads are 50 million tonnes total digestible nutrients (TDN) and 3.9 million tonnes digestible protein (DP) which are met from fodders, agricultural by-products, forages and with additional ration supplemented by concentrates (Chaudhry, 1987). Maintaining a productive agriculture is dependent upon the utilization of forage crops in overall farming operations. The main reason for the low performance of the livestock sector lies in the rapidly decreasing livestock feed resources. Improving animal production, therefore, requires improving the quantity and quality of forage.

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Although 1/6th of the total cropped area is put under fodder crops annually, the available fodder supply is much less than actually needed. The area under fodder crops in Pakistan has been estimated about 2.8 million hectares, with annual fodder production of 56 million tonnes, giving a national average yield of 20.0 tonnes per hectare (Mohammad, 1984). The per hectare fodder yield can be considerably increased two to three times if the farmers use good quality seed of improved fodder crops or varieties and improved production technology. Nutritive value of agricultural by-products, which constitute an important component of the livestock feed, needs improvement.

Rangelands in Pakistan extend over 60 percent(50.88 million ha) area of the country. At present, rangelands provide about 60 percent of the total requirements of feed for sheep and goats, about 40 percent for horses, donkeys, camels and only 5 percent for the cattle and buffaloes (Anon, 1986). The current annual forage production from rangelands is estimated about 24.47 m.tonnes dry matter (Mohammad, 1989). Because of over-grazing and unscientific use of the past, rangelands are producing only 10 to 50 percent of their potential. Rangelands, at present, are stocked with twice the number of animals that these areas can support (Anon, 1986). Therefore, it is necessary to manage this vast resource on scientific lines so that rangelands could be grazed by livestock on sustained basis without causing downward trend in the natural resources. Productivity of rangelands can be increased manifold by seeding with promising grasses, legumes and planting of suitable trees and shrubs. Hay and silage making for fodder-deficit period also needs due attention. Our objective is to utilize all available fodder/forage resources to provide as much balanced feed to our livestock as possible.

TOTAL REQUIREMENTS AND AVAILABILITY OF FODDERS:

The estimated availability of feed nutrients in Pakistan and total requirement for livestock given below in tabular form indicate a shortfall of 25% and 40% of TDN and DP respectively.

Table I. Estimated Availability of Feed Nutrients in Pakistan.

(000 tonnes)

Source	Quantity	Availability of Nutrients	
		TDN	DP
Fodder crops	55732.4	8359.9	947.5
Straws and stubbles	36410.4	11970.1	116.7
Sugar Industry by-products	32243.1	3834.6	217.4
Grain milling and oil-seed Industry by-products	17559.1	1771.8	344.7
Waste banana plants (Dry matter basis)	532.0	451.0	13.8
Grass grazing etc.	99126.5	11200.0	700.0
Total:-	241603.6	37587.4	2340.1

(Source: Chaudhry, 1987)

Table 2: Total Energy Resources Available and Actual Requirements for Livestock:

	Available (m. t.)	Requirements (m. t.)	%age shortfall in	
			TDN	DP
TDN	37.58	50.00	25	
DP	2.34	3.90		40

(Source: Chaudhry, 1987)

HIMALAYAN RANGE RESOURCES AND THEIR FORAGE PRODUCTION:

The Himalayan rangelands occupy 7.53 million hectares (Mohammad, 1989). These are over populated with livestock. Shortage of livestock feeds and fuelwood are the major problems in the region. Current total annual forage dry matter production from these rangelands is 7.54 million tonnes which can be improved upto about 20.0 million tonnes by scientific management (Mohammad, 1989). The major range areas of Himalayan region of Pakistan in different ecological zones are as under:-

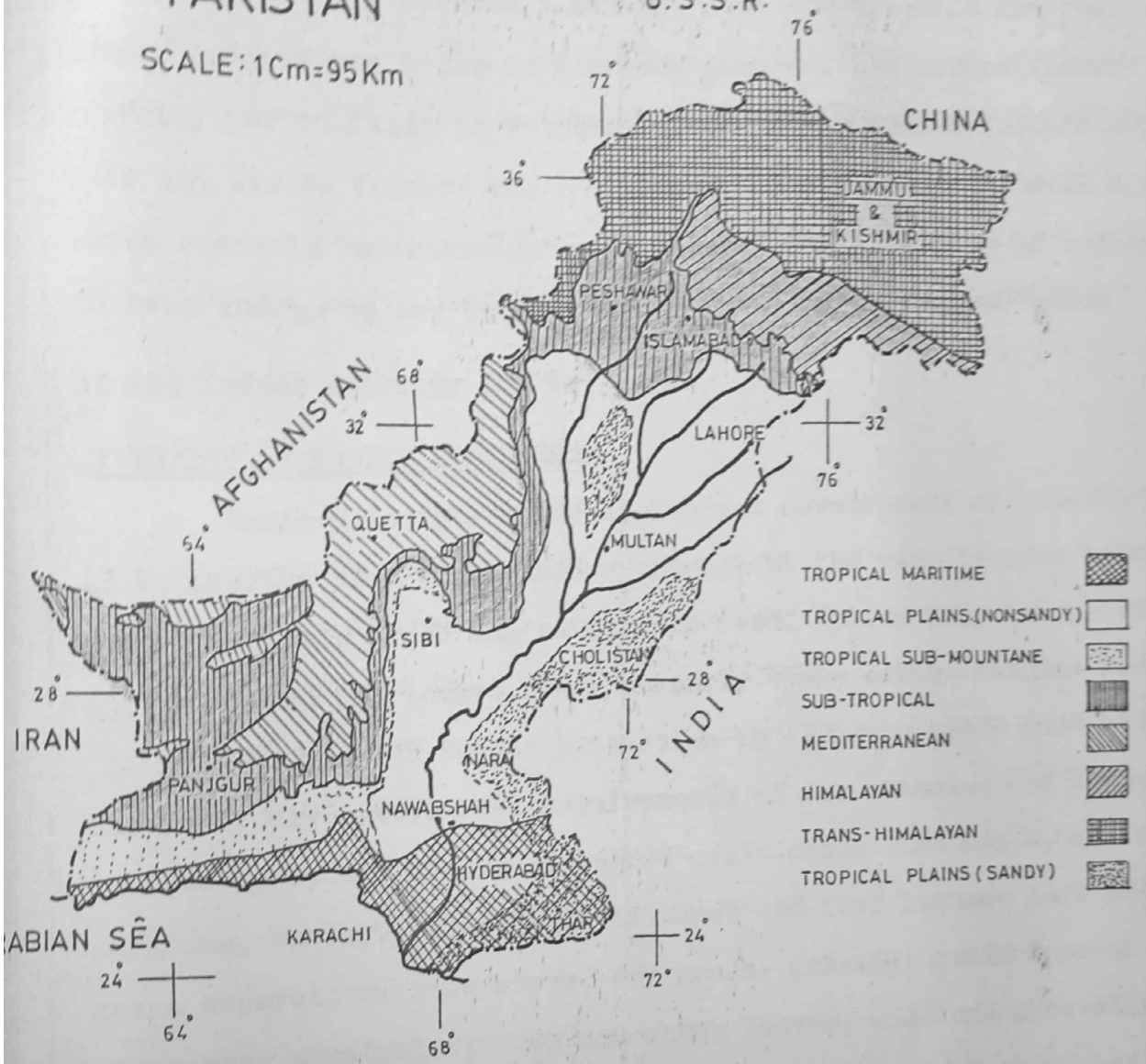
Table 3: Extent of Himalayan Rangelands and their Annual Forage Production.

Rangeland	Current production			Improvement potential	
	Area (m.ha)	DM(t/ha)	Total DM(m.t)	DM(t/ha)	Total DM (m.t)
Alpine Pastures	1.68	1.5	2.52	2.50	4.20
Trans-Himalayan grazing lands.	3.50	0.6	2.10	2.00	7.00
Himalayan forest grazing lands.	0.67	0.6	0.40	3.00	2.01
Pothwar scrub ranges.	1.68	1.5	2.52	4.00	6.72
Total=	7.53		7.54		19.93

(Source: Mohammad, 1989)

RANGE ECOLOGICAL REGIONS OF PAKISTAN

SCALE: 1Cm=95Km



FODDER SCARCITY PERIODS IN PAKISTAN:

The first scarcity period is faced in May/June. The winter fodders especially berseem, lucerne, oats and brassica are over and summer fodders are still in planting process. The second fodder scarcity period falls in October/November. The summer fodders are over and winter fodders are not ready. There is another small spell which comes in December/January for few days. First cut of berseem is over and due to low temperatures second cut is delayed which causes fodder scarcity for few days.

DIVERSITY OF FODDER RESOURCES:

Basic principle of the health and development of livestock is to provide them green fodder throughout the year because green fodder is their fresh and nutritious feed. Unless they are provided suitable feed and looked after properly their output remains low.

The present fodder production in Pakistan meets just half the daily dry matter feed requirements of our animals. The deficiency is made up by dry stalks of coarse grain crops like maize, millet, sorghums, barley, oats; chaff of wheat and food legumes left after grain separation; rice straw; dry grass; grazing; green tops of sugarcane; vegetables; tree and shrub leaves; and some naturally growing grasses, weeds and medicinal plants. Grains of gram, barley, maize, wheat, millet, sorghum, oats, rice, beans, pulses; oilcake of cotton seed, brassica, etc. are also used to make the feed balanced for different kinds of livestock.

Importance and role of diverse types of fodders in the overall livestock production system is given in the succeeding paragraphs.

i. Promising Fodder Crops:

In the irrigated region, grazing opportunities for animals are limited, therefore, fodder crops are cultivated, alongwith cereal and cash crops, on nearly 15% of the total cultivated area (Chaudhry, 1987). The estimated annual production of fodder crops in Pakistan is about 56 million tonnes (Chaudhry, 1987). Ours is an agricultural country and livestock is the backbone of our agriculture. Due to extension of cultivated areas on marginal and grazing lands, our livestock has become dependent on products of cultivated areas. It is, therefore, very essential that improved varieties of fodder crops are cultivated on scientific lines like other cereal and cash crops to get the required fodder yield from the minimum area. Promising varieties of different fodder crops with good yield potential are available and their production technology is also standardized.

Table 4: Promising Fodder Crop Varieties for Rainfed Conditions

Common name	Technical name	Varieties
Lucerne	Medicago sativa	El-unico Kandhari Mesasirsa
Berseem	Trifolium alexandrinum	Synthetic 1/79 Mescavi P-157
Oats	Avena sativa	S-81 PD_2- LV-65 Fatua
Barley	Hordeum vulgare	Hybrid Por Apro Min-126
Jawar	Sorghum bicolor	H-4-2 DG Pearl
Bajra	Pennisetum typhoides	Gahi A 1/3 Gaint Bajra
Sorghum X Sudan grass hybrid (Sadabahar)		RLA x SC 4158 RLA x SG Sweet
Cowpeas	Vigna sinensis	P 76 P 489 P 518

(Source: Mohammad, 1985)

It is clearly demonstrated in the table below that 3 to 4 times higher fodder yields are possible if we use quality seed, apply proper/balanced fertilizer, maintain proper plant population, carry out cultural operations timely and undertake insect control measures.

Table 5: Fodder Yields with Improved Production Technology

Crop	Fodder Yield with FP (tonnes/ac.)	Fodder yield with IP (tonnes/ac.)
Berseem	21.92	49.2
Lucerne (alfalfa)	15.32	34.4
Oats	13.84	27.6
Sorghum	9.20	25.6
Maize	11.20	19.6
Millet/bajra	11.60	24.8
Cowpeas	7.02	12.4
B.N.Hybrid-Perennial	29.60	59.2
Sadabahar	23.20	50.8

(Source: Chaudhry, 1987)

FP = Farmers practices

IP = Improved practices

Mixed Cropping: To cope up with the conditions of malnutrition and low productivity in livestock, and malnutrition in human beings, it is most important to make the best utilization of available land for the cropping of fodder crops and forages. There is ample scope of increasing crop production through rational management practices and mixed cropping. Crop mixtures give assured return than monocultures. Mixed cropping can be done by mixing forage with forage, forage with grain/cash/oil crop, forage with trees of economic importance including fruit trees. The legume and non-legume combination produces balanced diet for animals because legumes are important sources of proteins and non-legumes

provide the energy requirements.

Crops which have the potential to overcome fodder scarcity problem:

(a) Mazenta- a cross between maize (Zea mays) and teosinte (Euchalaena maxicana). It has got higher crude protein and mineral content as compared to maize, and green fodder yield is 34 tonnes/ac as compared to 9.0 tonnes/ac. of maize. The hybrid when planted in February/March covers fodder scarcity period in May to August effectively. It does not lodge and remains green for 4-5 months (Chaudhry, 1987).

(b) Sadabahar - an inter specific hybrid (Sorghum x Sudan grass). It's yield potential needs no emphasis. It regenerates repeatedly when planted in February/March and assures green fodder supply upto the end of October/November (Chaudhry, 1987).

(c) Multicut Bajra (MB-87) - an important summer fodder and a variety which gives 2-3 green fodder cut and then reasonable grain yield when planted in March. During 1987 it gave a yield of 4.0+3.2+9.2=16.4 tonnes green fodder and 700 kg grain yield per acre (Chaudhry, 1987).

(d) Lucerne- a "Queen" fodder in USA. It produces more protein per hectare than grain or oilseeds. It is a fodder worth much encouragement in Pakistan for our fodder problem (Chaudhry, 1987).

ii. Agricultural By-Products as Fodders:

Inspite of handsome fraction of the total cultivated area under fodder crops, the available fodder supply is much less than the total requirements. However, major portion of the cultivated area is put under cereal and cash crops and the total production of crop residues from the cereal crops in Pakistan is estimated to be about 36 million tonnes. The major portion comes from wheat and rice straws which contribute about 85 percent of the total supply (Chaudhry, 1987).

These by-products of grain production and other cellulose crops will continue to play an important role and dictate the role of future ruminant-livestock production practices. Dry stalks of coarse grain crops like maize, millet, sorghums, barley, oats; rice straw; chaff of wheat and food legumes left after grain separation are some of the by-products which can be cheaply provided to animals but these have very low nutritive value. Their fibrous content is higher but other digestible components are low.

The nutritive value of these by-products is required to be improved by increasing their protein content to make the feed as much balanced as possible. Various physical, chemical and biological methods like Urea-Ammonia treatment, addition of molasses, crude protein and nutrients etc. to chaff of wheat and other by-products should be used.

Hay and Silage Making: The forages excess to that of requirements should be preserved for hay or silage. The excess fodder supply periods are generally noted in March/April when berseem has the maximum growth and farmers face fodder cut problems. There may also be good supply of grasses during monsoon. If fodders are stored as hay or silage they can properly be fed during scarcity period. These provide nutritious feed to the livestock during lean season, good quality legumes hay may reduce certain amount of concentrates, fodders can be harvested when there are maximum nutrients, and animal ration can be balanced.

iii. Promising Grasses and Legumes:

Pakistan, being predominantly an agricultural country, has a large cattle population and this population, particularly in hilly areas, cannot be maintained on the fodder produced on arable land alone. In Himalayan region, there is shortage of cultivable area where cereals and cash crops are grown and the

straw of these crops is used as fodder. Because of the increasing pressure of human population and also because of higher apparent income of cereal and cash crop than from forage crops, more agricultural area cannot be set apart for fodder production. Since the present availability of fodder is not enough for the livestock, it has to depend on rangelands and permanent pastures where vegetation comes up naturally due to rainfall. Grazing lands, therefore, should be improved by reseeding with better grass/legume species, fertilized and managed scientifically.

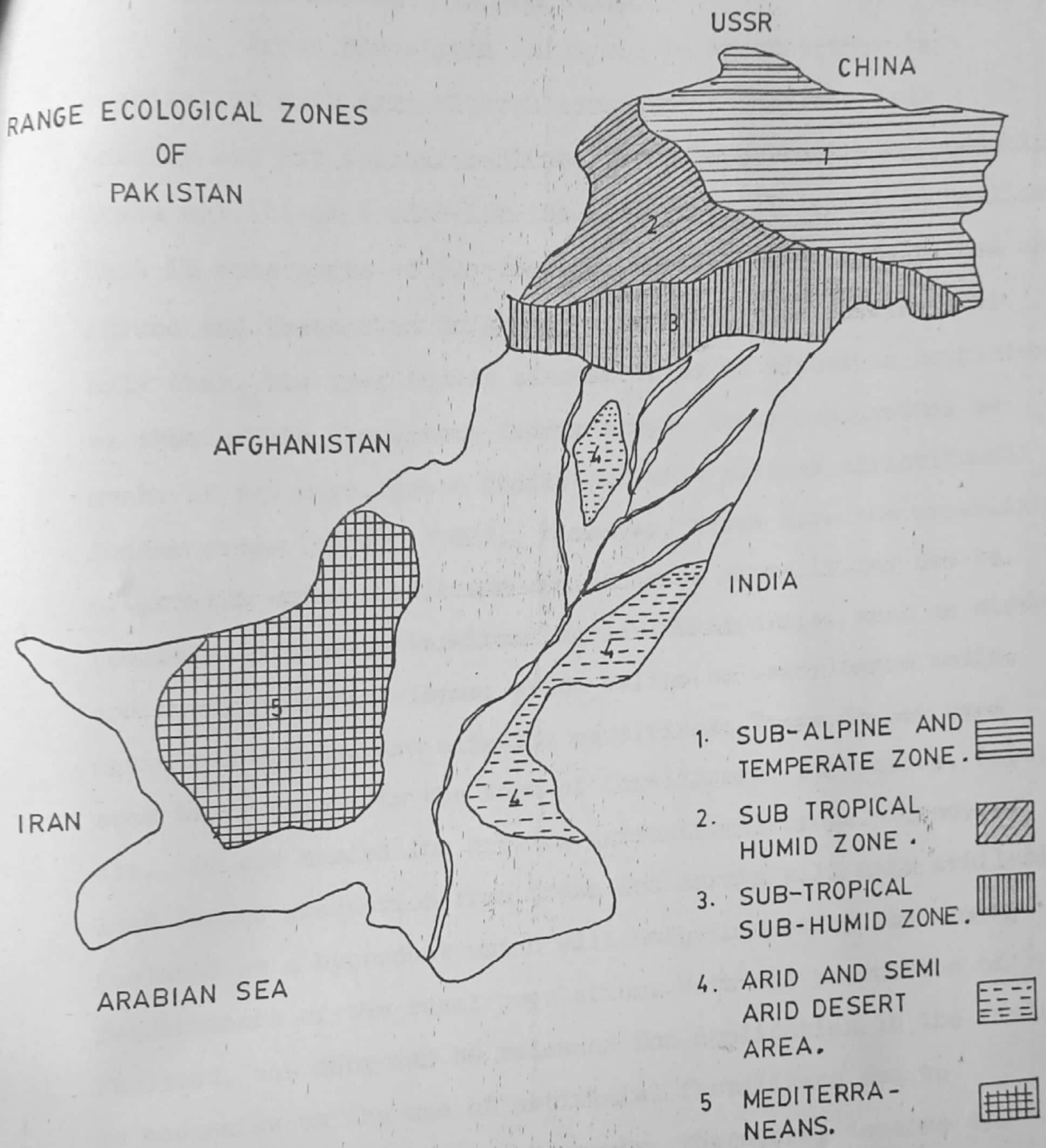
Increased forage production is the result of proper species selection, which is often a grass plus a legume that may provide some of the additional nitrogen for the grass component of the forage. Reseeding depleted ranges with improved grasses has been extensively practised all over the world. A few indigenous and exotic grasses that have performed well are recommended for large-scale reseeding in the relevant range ecological zones of the Himalayan region.

Legumes are an excellent source of feed for livestock. They also improve soil fertility by hosting nitrogen fixing bacteria. A few promising varieties of alfalfa, clovers, vetches, annual medics and cowpeas selected during the past over one decade are also recommended for introduction in different ecological zones.

Table 6: Promising Grasses and Legumes Suitable for Reseeding Various Range Ecological Zones.

Range ecological zone	Recommended species
Alpine pastures	Phleum alpanicum Festuca arundinacea Elymus junceus Medicago falcata Trifolium pratense
Sub-alpine and temperate	Festuca arundinacea Lolium multiflorum Chrysopogon spp. Dactylis glomerata Bothriochloa pertusa Medicago sativa Potarium sanguiserba Trifolium pratense T. repens
Sub-tropical humid	Chrysopogon aucheri C. montanus Chloris gayana Dicanthium annulatum Sorghum almum Festuca elatior Lolium multiflorum Macroptilium atropurpureum Medicago sativa Vigna sinensis Trifolium pratense
Sub-tropical sub-humid	Chrysopogon aucheri C. montanus Panicum antidotale Cenchrus ciliaris Pennisetum purpureum Sorghum almum Medicago sativa M. spp.

(Source: Mohammad, 1985; Mohammad, 1989; Anon, 1983)



iv. Suitable Fodder Trees and Shrubs:

Trees and shrubs which can be grown either in combination with agricultural crops or on separate land usually not fit for agriculture, offer opportunity of producing green nutritious fodder for the livestock. It is seldom realised that in some parts of the region, probably more animals feed on shrubs and trees than on grass or grass-legume pastures. Not only that, the leaf-fodder of some trees is almost as nutritious as that of the leguminous fodder crops. Trees can produce as much, if not more, green fodder per unit area as agricultural fodder crops (Singh, 1982). Moreover, trees have the capability of growing under conditions and in areas where it may not be possible to grow conventional agricultural crops, such as steep and rocky mountain slopes, arid, saline or waterlogged soils, and areas with severe climatic conditions. Trees do not need such heavy inputs in the form of fertilizers, pesticides, labour, etc., as are needed for growing agricultural crops. Moreover, leaf-fodder production from trees and shrubs will make available fuelwood as a by-product which will help in meeting the energy requirements of the rural population. With the production of fuelwood, cow dung can be released for application in the fields to economise on the use of artificial fertilizers and to increase the yield. Trees and shrubs, therefore, deserve due attention for the production of green nutritious fodder for livestock, specially in the Himalayan region where conventional agriculture may not be possible or desirable because of the dangers of site degradation.

Table 7: Suitable Fodder Trees and Shrubs for Planting in Various Range Ecological Zones

Range ecological zone	Suitable Trees and Shrubs
Alpine pasture	Artemisia maritima
	Haloxylon spp.
	Amorpha fruticosa
	Indigofera gerardiana
Sub-alpine and temperate	Amorpha fruticosa
	Indigofera gerardiana
	Prunus padus
	Fraxinus excelsior
	Aesculus indica
	Alnus nepalensis
	Celtis australis
	Quercus dilatata
	Q.semicarpifolia
	Hybrid poplar
Sub-tropical humid	Amorpha fruticosa
	Grewia oppositifolia
	Prunus spp.
	Robinia pseudoacacia
	Quercus incana
	Indigofera pulchella
Sub-tropical sub humid	Acacia modesta
	A.aneura
	Ceratonia siliqua
	Leucaena leucocephala
	Olea ferruginea
	Robinia pseudoacacia
	Gleditchiatriacanthos

(Source: Mohammad, 1989; Mohammad, 1985; Anon, 1983)

RECOMMENDATIONS

1. Productivity of rangelands can be increased manifold by seeding with promising grasses, legumes and planting of selected suitable trees and shrubs and should be undertaken.
2. To meet the fodder and firewood demand, planting of fast growing fodder and fuel trees and shrubs should be encouraged in all ecological zones.
3. Productivity of fodder crops should be increased through use of good quality seed of their improved varieties and use of latest production technology. Fodder crops like Mazenta, Sadabahar, Multicut Bajra and Alfalfa need much encouragement for their cultivation on large scale.
4. Nutritive value of agricultural by-products should be improved.
5. Vast rangeland resource should be managed on scientific lines so that livestock could be grazed on sustained basis without causing downward trend in the natural resources.
6. During summer growing season, there is plenty of forage which could be preserved as hay to be used during winter forage-deficit period. The harvesting of grass should be done at boost stage so that nutritive contents of the forages are not lost.
7. Hay and silage making and preservation of fodder for deficit period should receive high priority in research.
8. Evaluation of nutritive value of grass, legumes, cereal and other fodder species/varieties including fodder trees and shrubs should be done.

9. Because there is extreme shortage of green fodder for livestock, the improved varieties of fodder crops should be grown in available cultivated and marginal lands for use during winter forage-deficit period.

10. Crop production should be increased by mixed cropping of legume with non-legume, forage with forage, forage with grain/cash crop or forage with trees of economic importance.

11. Collection and introduction of germ-plasm of superior exotic and local fodder species/varieties and their selection under different ecological conditions should be continued on larger scale.