Fodder Production Potential in Arid Region

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The hot arid ecosystem occupying 32 m ha area, occurs dominantly in the country's northwestern parts. Because of uncertainty of rainfall, more risk is involved in the crop farming even in the years of partial droughts. Therefore, livestock based farming system plays a pivotal role in the economy of arid ecosystem. Animal husbandry based farming system not only enhances the economic viability of farming systems but it also increases the sustainability of farming system, particularly in rainfed arid-ecosystem (Chaudhary *et al.* 1993).

Over exploitation of natural resources by increased biotic pressure resulting in scarcity of feed and fodder resources is the major constraint limiting the development of animal husbandry based farming system in the arid ecosystem. Pasture and silvipastoral systems are some of the alternate land use systems for efficient use of natural resources of rainfed arid ecosystem giving higher productivity on sustained basis on the otherwise fragile ecosystem (Beniwal, 1999). Thus feed and fodder productivity (carrying capacity) of existing rangelands can be increased many fold through the large-scale adoption of pasture /silvipasture/agroforestry and forage forestry systems. The technology for the improvement and management of these rangelands through the introduction of improved pastures, silvipasture and the farm forestry systems to increase caring capacity are also available (Faroda ,1998). However, its implementation is questionable in want of financial allocation and lack of a suitable agency to take up this gigantic and challenging task of large scale wasteland development activities in this fragile ecosystem. In addition, availability of quality seeds of arid grasses in sufficient quantity is the greatest bottleneck in large scale pasture development programme. As against the demand of 3000 tones grasses / legumes seeds for tropical region of India, only 450 tones are available at present. The state government in active collaboration with State Agriculture Universities and ICAR institutes located in the region should work in close collaboration on a special technological mission on pasture , silvipasture and agro-forestry development in the fragile arid -ecosystem to sustain the agricultural productivity and economy of this region .

Pasture grasses:

In the areas having less than 200 mm annual rainfall *Panicum antidotale*, *Lasiurus sindicus* and *Cymbopogon* spp., areas receiving rainfall between 200-400mm *Cenchrus ciliaris* and *Cenchrus setigerus* are ideal grasses with their improved varieties and production technologies have been given in table 1 . Before sowing the seed treatment of these grasses through pelleting of seeds is important for proper germination. The grasses must be sown in lines opened by desi plough or cultivator. .

Fertilizer management:

For harvesting higher forage yield of good quality from grass pastures, maintenance of optimum soil fertility is essential. Application of higher doses of chemical fertilizer may not be economical under arid and semi-arid rainfed pasture conditions. Therefore an integrated nutrient supply approach may be adopted. Introduction of legumes in the pasture lands can supply upto 40 kg N/ha. In addition to this a small amount of chemical fertilizer in combination with locally available farm yard manure or sheep manure once in four to five years can also be applied. Faroda (1971) reported that application of 40 kg N /ha increased fodder yield *in Cenchrus ciliaris* over control but phosphorus application did not affect the growth and fodder yield of grass. However, optimum economic dose of nitrogen for *C. ciliaris* under semi-arid conditions of CSWRI, Avikanagar was found to be 20 kg N/ha (Faroda, 1974). Yadav (1995 a) has recommended 30 kg N plus 30 kg P_2O_5 /ha under arid condition at Jodhpur.

Table 1: Grass species and varieties suitable for the pasture development.

Grasses	Varieties	Seed rate (kg ha $^{-1}$)	Spacing (cm)	Dry Fodder yield (q/ha)	Seed yield (kg/ha)
Lasiurus sindicus	CAZRI Nos 318,319,565,M-20	5-8	100 x 50	50-60	20
Cenchrus ciliaris	Marwar anjan,CAZRI-358, Pusa yellow Anjan	4-6	75 x 40	40-45	60
Cenchrus setigerus	Marwar dhaman, CAZRI-76	6-10	75 x 40	35-40	100
Panicum antidotale	Local, S-29, S225, CAZRI-335,331, 347, S-33	2-3	60 x 60	20-30	70

Seed production of pasture grasses:

Most of grass seed mature in September - October. However, it varies from 20th August to 31st October, depending on rainfall distribution. Seed collection is done manually. Time of seed collection is very important due to unsynchronized maturity. As soon as seed matures, it should be collected immediately. Average seed yield of pasture grass is given in Table 1.

Grass-legume mixed pastures:

Legumes play duel role in pasture *viz*, they fix atmospheric nitrogen and build up a high nitrogen content in the soil and provide nutritious forage for livestock. The drymatter production was maximum with intercropping of *Lablab purpureus* followed by *Clitoria ternatea, Atylosia scarobaeoides, Siratro,* and lowest with pure grass. In an another experiment Chauhan and Faroda (1979 b) found alternate row spacing of *Cenchrus ciliaris* / *C. setigerus* and *Lablab purpureus* better than other ratios. Evidence to support the superiority of different grass legume inter cropping system in arid ecosystem revealed that intercropping systems not only produced higher forage yield of high nutritive value but also generated higher income.

Silvipastoral system:

The common trees / shrubs suitable for silvipasture system in arid and semi -arid ecosystem are *Prosopis ceneraria, Tecomella undulata,Salvedora oleoids, Acacia spps Albezzia lebbeck , Hardwickia binata, iziphus nummularia, Colophospermum mopane ,Dichrostachys mutan etc.* The choice of these species will depend on rainfall and soil type. Suitable silvipasture techniques for arid and semi arid ecosystem are developed at CAZRI, Jodhpur, CSWRI, Avikanagar, IGFRI, and NRCAF , Jhansi. It is roughly estimated that 60 per cent of feed available to the sheep, goat and camel come from top feed only (Singh 1981).

Prosopis cineraria is an important forage tree in arid and semi-arid regions which grows in rangelands and cultivated fields (some times more than 80-100 trees/ha) without any determent to the associated ground cover. The tree is lopped for its protein rich (17.5%) leaves. Studies have shown that complete lopping of Khejri tree gives a significantly higher yield (58.7 kg per tree) than the lower two third lopping (28.5 kg per tree) and one third (19.7 kg per tree) of the crown. The dry leaf fodder yield obtained from representative trees is given in Table 2.

Table 2: Dry fodder yield and economics of fodder collection of tree leaves.

Trees	No. of trees lopped	Dry leaves production (kg/tree)	Man days required per qt. of leaves	Average cost of lopping (Rs/q)
Prosopis cineraria	45	12.0	2.21	30.94
Acacia Senegal	182	2.98	10.28	143.90
Matenus emerginata	44	4.55	4.73	66.22
Bauhinia racemosa	18	6.67	4.17	58.38
Ailanthus excelsa	68	8.65	3.06	42.38
Azadirachta indica	20	16.50	1.98	27.72