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Forage (Fodder) Legumes Diversity of Rajasthan For livestock

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Abstract

Livestock contributes extremely in food and nourishment security apart from livelihood security to rural population all over the world. India has the largest number of livestock population, representing over 17% of world population and 57% in Rajasthan. Availability of forage legumes is essential for better animal growth, production and increasing the nutritive value of forage-based products, besides providing a source of biological nitrogen fixation for fertile soil, reducing land degradation and allaying climate change. Although, supply of qualitative green fodder in Rajasthan is extremely doubtful, and the gap is enormous against availability and demand. Rajasthan State represents arid climates from where reported diversity of 46 forage legumes genera and 85 species of these genera. This is an attempt to highlight eighty-five species of the forage legumes of the area. This indicates the correct botanical and common name of these plants along with their part(s) or product of use, fodder type (green or dry), occurrence of plant species, used by which type of cattle or animal, benefits of fodder, sources of information. Diversity of forage legumes were collected, evaluated and sources of information gathered from farmers, herdsman and observations taken from the field. Considering these aspects, forage legumes for livestock production, soil health and ecosystem services, diversity, evaluation and conservation of pasture lands are discussed in this paper. Some discussion on their cultivation and harvesting, overexploitation and probable remedial measures to grow and save them are also appended.

Key words: Livestock, Forage Legumes, Biological Nitrogen fixation, Diversity, Herdsman, Ecosystem, Evaluation, Conservation, Green fodder, Dry fodder, Pasture lands, Cultivation, Harvesting, Overexploitation, Remedial measures.

Introduction

Rajasthan is the third largest State of India which is situated in the North-West part of India, between 23^0 03’ to 30^0 12’ North latitudes and 69^0 30’to 78^0 17’East longitudes, and occupies an area of about 3,42,274 sq. kms. The remarkable feature of the State is Aravalli hills which bifurcate the State into two main geographical regions. Its two-third western part is sandy and not productive while its one-third eastern part is fertile and rich in vegetation. Cultivated forage legumes and wild legumes contributes in sustainable agricultural production apart from nutritional security to the livestock population of Rajasthan. Cultivated forage legumes and wild legumes are also crucial for the nutritional security for mankind as they are integral component for increased availability of animal protein and product which has higher biological value than the plant proteins. To understand the current status and scope of forage legumes of Rajasthan for

sustaining income through livestock sector, their importance in livestock production, soil health and ecosystem services can be correlate.

During the past century, there has been an increasing interest in the study of forage plants by various workers in different parts of the country or outside the country as well as in the State viz. Grassland communities of dry tropical forests by Agrawal (1961); Revision of the genera *Indigofera* L. from W. Pakistan and N. W. Himalayas by Ali (1958); The Wealth of India, Raw materials (1948 – 76); Mannual of cultivated plants by Bailey (1949); Rajputana Desert vegetation by Biswas & Rolla (1953); Indian Trees by Brandis(1874); useful plants of India and Pakistan by Dastur (1951); introduction of shrubs and tree fodders for farm animals by Devendra (1989); Ethnobotany of Aravallis by Joshi (1987); dictionary of Economic Plants in India by Maheshwari& Singh (1965); Livestock development in India by Mishra & Sharma (1990); foreword in Top feed resources, their production, utilization and constraints by Nagarcenkar (1983); plants of economic importance from Rajasthan I: Acacias by Nathawat& Deshpande (1980); an attempt at a systems approach to develop feeding strategies for dairy animals in Panchmahal district of Gujrat and Bhilwara district of Rajasthan by Rangnekar et al. (1991); plants used in veterinary medicines, glactogogeus and fodder in forest areas of Rajasthan by Sebastian (1984); an Ethnobotanical profile of Indian Desert by Shekhawat&Anand (1984); fodder Trees of India by Singh (1984); strategies for fulfilment of our fodder and fuel needs by Swaminathan (1989); the Phyto-geography of Legumes of Madhya Pradesh by Tiwari (1979); a dictionary of Economic products of India by Watt (1885-93); Livestock economy of India by Vaidyanathan (1989); vegetation of hills around Alwar, N. E. Rajasthan – Phytosociological studies by Vyas (1965).The vegetation of Rajasthan is of deciduous tropical type, and the Leguminosae*nom. cons.* (Fabaceae*nom. alt.*) are the second largest and one of the most important family of flowering plants. In the area during Ph. D. work about 277 species belonging to 81 genera of the family have been reported (Bavaliya, 1992).

Materials and Methods

The plants have been enumerated here and the information about them has been gathered during the field trips in and around various regions of the State. Several persons / farmers or cattle feeders were consulted for collecting most of this information, which has been supplemented with information obtained after thorough search of literature and examination of Herbarium sheets in RUBL (The Herbarium of Botany Department, University of Rajasthan, Jaipur) and various other herbaria housing sheets from Rajasthan.

The Forage legumes of Rajasthan are enumerated in the table (T.1) which include details as: the correct botanical and common name of these plants along with their part(s) or product of use, fodder type (green or dry), occurrence of plant species (cultivated or introduced or wild or weed), used by which type of cattle or animal, benefits of fodder, sources of information collected from farmer(s) / cattle feeders or from conventional literature on forage plants.

The collected plant species were identified taxonomically with the help of various flora viz. the National flora (Hooker's Flora of British India, 1872 -97); regional floras of adjacent areas (Cooke's Flora of Presidency of Bombay, 1901 – 08, Duhie's Flora of Upper Gangetic Plains, 1903 – 29); floras from adjoining areas viz., Maheshwari's Flora of Delhi (1963), Nair's Flora of the Punjab Plains (1978), Shah's Flora of Gujrat (1978); State floras viz., Shetty and Singh's

Flora of Rajasthan Vol. 1 (1987); floras covering portions of the State viz., Bhandari's Flora of Indian Desert (1978), Sharma and Tyagi's Flora of North – East of Rajasthan (1979); district floras viz., Ramdeo's Flora of Udaipur district (1969), Sharma's Flora of Jaipur district (1974), Singh's Flora of Banswara (1983), Shetty and Pandey's Flora of Tonk district (1983) besides several thesis submitted for Ph. D. degree at Jaipur Centre viz., on : Jhalawar by Shringi (1985), Jhunjhunu by Kulhari (1988) etc. The revisionary studies of several taxa carried out in India or abroad have also been consulted.

Forage (Fodder) Leguminous Plants of Rajasthan (T-1)

S. No	Botanical and Common name	Part or product of use	Fodder type	Occurrence of plant species	Used by which type of cattle/ animal	Benefits of fodder	Source of Information
Sub-family Caesalpinioideae (Caesalpiniaceae)							
1	***Bauhinia purpuria***L. **'Kachnar' 'Jhira'**	Lvs.	Green fodder	Wild & Introduced	Livestock	Improve milk yield	G, O, L
2	***Bauhinia racemosa***L. **'Jhinjha'**	Lvs.	Green fodder	Wild & Introduced	Livestock	Improve milk yield	G, O, L
3	***Cassia tora***L. **'Panvar' 'Puadia'**	Sds.	Dry fodder	Wild	Livestock	Protein rich	G, O, L
4	***Hardwickiabinata***L. **'Anjan'**	Lvs.	Green fodder	Wild & Introduced	Cattle	Improve milk yield	L, G
5	***Parkinsoniaaculeata***L. **'Vilayati babool'**	Yng. Brs.	Green fodder	Wild & Introduced	Goats, Sheep	Improve milk yield	G, O, L
6	***Peltophorumpterocarpum*** (DC.) Baker **'PeelaGulmohar'**	Lvs.	Green fodder	Wild & Introduced	Cattle	Protein (54.7 %)	G, O, L
7	***Piliostigmamalabarica***(Roxb.) Benth. **'Jhinjora'**	Lvs.	Green fodder	Wild & Introduced	Cattle	Acidic taste	G, O, L
8	***Tamarindusindica***L. **'Imli'**	Yng. Brs.	Green fodder	Wild & Introduced	Cattle	Acidic taste	G, O, L
Sub-family Faboideae (Fabaceae)							
9	***Aeschynomeneindica***L.	Yng. Brs.	Green fodder	Wild	Cattle	Improve milk yield	G, O, L
10	***Alhagimaurorum***Medicus	Yng Brs.	Green fodder&	Wild	Camel	Good feeder	G, O, L

	'Javasa'		Pasture lands				
11	***Alysicarpusmonilifer***(L.) DC.var.***monilifer***	Wh. pt.	Green fodder& Pasture lands	Wild	Cattle	Good feeder	G, O, L
12	***Alysicarpusvaginalis***(L.) DC.	Wh. pt.	Green fodder	Wild	Cattle	Good feeder	G, O, L
13	***Arachishypogaea***L. **'Moonphali'**	Wh. pt. Sds	Dry fodder asKhal& Ninani	Cultivated	Cattle	Good feeder	G, O, L
14	***Butea monosperma***(Lamk.) Taub . **'Palas', 'Dhak','Tesu'** & **'Cheela'**	Yng. Lvs.	Green fodder	Wild	Buffaloes	Improve milk yield & Fat %	F, O, L
15	***Cajanuscajan***(L.) **'Arhar'**	Lvs. Pod husk	Dry fodder	Cultivated	Livestock	As Concentrates	F, O, L
16	***Cicer arietinum*** L. **'Chana'**	Wh. pt. Sds.	Dry fodder	Cultivated	Camel and sds as pulse to Horses	As Power	F, O, L
17	***Crotalaria burhia***Buch.-Ham.ex Benth. **'Kharsana'** or **'Zhunda'**	Yng. Pt.	Green fodder& Pasture lands	Wild	Camel	Good feeder	G, O, L
18	***Crotalaria juncea***L. **'Sanai'**	Grn. pt. Sds.	Green fodder	Cultivated	Cows	Improve milk yield	F, O
19	***Crotalaria medicaginea***Lamk. **'Gugario'**	Yng. Pt.	Green fodder& Pasture lands	Wild	Camel, Goats	Improve milk yield	G, O, L
20	***Cyamopsistetragonoloba***(L.) Taub. **'Guar'**	Wh. pt. Sds.	Green fodder & Dry fodder	Cultivated	Buffalo, Goats & cattle, boiled sds.	Improve milk yield	F, O, L
21	***Dalbergialatifolia***Roxb. **'SaphedSisum'** or **'Pai'**	Lvs.	Green fodder	Wild & Introduced	Livestock	Good feeder	G, O, L
22	***Dalbergiasissoo***Roxb. **'Sesham'**	Lvs.	Green fodder	Wild & Introduced	Livestock	Good feeder	G, O, L
23	***Derris robusta***(Roxb. ex	Lvs.	Green	Wild &	Livestock	Good	G, O

	DC.) Benth.		fodder	Introduced		feeder	
24	***Desmodiumgangeticum***(L.)DC. **'Salpalini, 'Kareti'**	Wh. pt.	Green fodder& Pasture lands	Wild	Cattle	Improve milk yield	G, O, L
25	***Desmodiumrepandum***(Vahl) DC.	Wh. pt.	Green fodder& Pasture lands	Wild	Cattle	Improve milk yield	G, O, L
26	***Desmodiumtriflorum***(L.) DC.	Wh. pt.	Green fodder& Pasture lands	Wild	Cattle	Improve milk yield	G, O, L
27	***Erythrinavariegata***L. **'Pangra'** or **'Raktamadar'**	Yng. Brs. Lvs.	Green fodder	Wild & Introduced	Cattle	Good feeder	G, O, L
28	***Galactiatenuiflora***(Klein ex Willd.) Wight et Arn.	Yng. Brs.	Green fodder	Wild	Cattle	Good feeder	G, O, L
29	***Glycine max***(L.) Merr. **'Bhat'** or **'Soyabeen'**	Lvs. Sds.	Green fodder& Dry fodder also as khal	Cultivated	Cattle	Improve milk yield & Fat %	F,O, L
30	***Indigoferacassioides***Rottl. ex DC.	Yng. Brs.	Green fodder& Pasture lands	Wild	Cattle	Improve milk yield	G, O, L
31	***Indigoferacordifolia***Heyne ex Roth **'Mah-Phuli'**	Wh. pt.	Green fodder& Pasture lands	Wild	Goats	Improve milk yield	G, O, L
32	***Indigoferaglandulosa***Wendl.	Yng. Brs.	Green fodder& Pasture lands	Wild	Cattle	Improve milk yield	G, O
33	***Indigoferahochstetteri***Baker **'Khandi-Dal'**	Yng. Brs.	Green fodder& Pasture lands	Wild	Livestock	Improve milk yield	G, O
34	***Indigoferalinifolia***(L. f.) Retz. var. ***linifolia*** **'Pandar-Phali'**	Wh. pt.	Green fodder& Pasture lands	Wild	Cattle	Improve milk yield	G, O, L
35	***Indigoferaoblongifolia***For	Wh.	Green	Wild	Animals	Improve	G, O,

	sk. **'VilayatiJhojhru'**	pt.	fodder& Pasture lands			milk yield	L
36	***Indigoferatrita***L.f. subsp. ***subulata***var.***subulata***(Vahl ex Poir.) Ali	Wh. pt.	Green fodder	Wild	Animals	Improve milk yield	G, O, L
37	***Lathyrusaphaca***L. **'Pili Matar'** &**'JangliMatar'**	Wh. pt.	Green fodder& Pasture lands	Wild	Cattle	Good feeder	F,O, L
38	***Lathyrussativus***L. **'ChaptaMatar'**	Wh. pt.	Green fodder& Dry fodder	Cultivated	Cattle	Good feeder	F,O, L
39	***Lens culinaris***Medic. **'Masoor'**	Wh. pt.	Green fodder& Dry fodder	Cultivated	Cattle	Good feeder	F,O, L
40	***Medicagolupulina***L.	Wh. pt.	Pasture lands	Wild	Cattle	Improve milk yield	F,O, L
41	***Medicagopolymorpha***L.	Wh. pt.	Green fodder as concentrates	Cultivated	Cattle except Sheep, Horses	Improve milk yield	F,O, L
42	***Medicago sativa***L. **'Rijka', 'Rajka', 'Lucern'** or **'Alf-alfa'**	Wh. pt. Sds.	Green fodder	Cultivated	Animals	Vit. A , E & Protein rich 33%	F,O, L
43	***Melilotus alba***Medic. ex Desr. **'Metha'**	Wh. pt.	Green fodder	Cultivated	Animals	Improve milk yield	F,O
44	***Melilotusindica***(L.) Ali **'Chinkali'**	Wh. pt.	Green fodder	Weed	Horses	As Power	F,O
45	***Milletiaextensa***Benth.	Wh. pt.	Green fodder	Wild	Elephant	Rich in protein, Ca and P	F,O
46	***Ougeiniaoojeinensis*** (Roxb.) Hochr. **'Sandan' 'Tinsa'**	Lvs.	Green fodder	Wild & Introduced	Animals	Improve milk yield	G, O, L
47	***Phaseolus vulgaris***L. **'VilayatiSem',** or **'Kidney Bean'**	Lvs.	Green fodder& Dry	Cultivated	Animals	Improve milk yield	F, O, L

			fodder				
48	***Pisumarvense***L.	Wh. pt.	Green fodder	Wild	Cattles	Improve milk yield	F, O, L
49	***Pisumsativum***L. **'Matar'**	Wh. pt.	Green fodder	Cultivated	Cattles	Improve milk yield	F, O, L
50	***Pterocarpus marsupium***Roxb. **'Bija-Sal'**	Lvs.	Green fodder	Wild & Introduced	Cattles	Improve milk yield	L, O
51	***Rhynchosiacapitata***(Heyne ex Roth) DC. **'Papro'**	Wh. pt.	Green fodder& Pasture lands	Wild	Animals	Improve milk yield	G,O, L
52	***Sesbaniabispinosa***(Jacq.) W.F. Wight **'Dadon'**and **'Ekad'**	Wh. pt.	Green fodder	Weed	Goats and Camels	Improve milk yield	F, O, L
53	***Sesbaniaprocumbens***(Roxb.) Wight et Arn.	Wh. pt.	Green fodder	Weed	Cattle	Improve milk yield	F, O
54	***Tephrosiaapollinea***(Del.) Link.	Yng. Brs.	Green fodder& Pasture lands	Wild	Camels	Improve milk yield	G,O
55	***Trifoliumalexandrium***L. **'Barseem' Égyptian clover'**	Wh. pt.	Green fodder	Cultivated	Livestock	Improve milk yield & Fat %	F, O, L
56	***Trifoliumrepens***L.	Wh. pt.	Green fodder	Cultivated	Livestock	Highly prized	F, O, L
57	***Trigonellafoenum-graecum***L. **'Methi'**	Wh. pt. Sds.	Green fodder & Dry fodder	Cultivated	Livestock	Improve milk yield & Fat %	F, O, L
58	***Trigonellaocculta***Delile	Wh. pt.	Green fodder	Weed	Animals	Improve milk yield & Fat %	F, O
59	***Viciafaba***L. **'Sangari**' &**'Baklasem'** (Broad bean)	Wh. pt.	Green fodder	Cultivated	Livestock	Improve milk yield & Fat %	F, O, L
60	***Viciahirsuta***(L.) S. F. Gray	Wh. pt.	Green fodder	Cultivated	Cattles	Excellent	F, O, L
61	***Vicia sativa***L. var.***sativa*** **'Chatri-Matri'**	Wh. pt.	Green fodder	Cultivated	Cattles	Improve milk	F, O, L

						yield & Fat %	
62	***Vicia sativa***L. var. ***angustifolia***L. **'Matri'**	Wh. pt.	Green fodder	Cultivated	Cattles	Improve milk yield	F, O,L
63	***Viciatetrasperma***(L.) Schreber	Wh. pt.	Green fodder	Cultivated	Cattles	Improve milk yield & Fat %	F, O,L
64	***Vignaaconitifolia***(Jacq.) Marechal **'Moth'**	Wh. pt.	Dry fodder	Cultivated	Cattles	Improve milk yield & Fat %	F, O
65	***Vigna mungo***(L.) Hepper **'Urad'**	Lvs. Pods	Dry fodder	Cultivated	Cattles	Improve milk yield & Fat %	F, O
66	***Vignaradiata***(L.) R. Willcz. **'Green Moong'**	Lvs. Pods	Dry fodder	Cultivated	Cattles	Improve milk yield & Fat %	F, O
67	***Vignatrilobata***(L.) Verdcourt **'Jangli Moth'**	Wh. pt.	Dry fodder	Cultivated	Cattles	Improve milk yield & Fat %	G, O
68	***Vignaunguiculata***(L.) Walp. **'Chaula' 'Cowpea'**	Wh. pt.	Dry fodder	Cultivated	Cattles	Improve milk yield & Fat %	F, O, L
69	***Zorniagobbosa***Span.	Wh. pt.	Green fodder& Pasture lands	Wild	Cattles	Good feeder	G,O
Sub-family Mimosoideae (Mimosaceae)							
70	***Acacia farnesiana***(L.) Willd. **'VilayatiBabool' 'Babool'**	Lvs. Sds.	Green fodder	Wild	Sheep & Goats	Improve milk yield & Fat %	G,O, L
71	***Acacia jacquemontii***Benth. **'Boonli'**or **'Bawnli'**	Lvs.	Green fodder	Wild	Sheep & Goats	Improve milk yield & Fat %	G,O
72	***Acacia leucophloea***(Roxb.) Willd. **'Runjh'**	Lvs. pods	Green fodder	Wild & Introduced	Sheep & Goats	Improve milk yield & Fat %	G,O, L

73	***Acacia nilotica***(L.) Willd. subsp. ***indica*** (Benth.) Brnan **'Babool', 'Kikar'**	Lvs. pods	Green fodder	Wild & Introduced	Sheep & Goats	Improve milk yield & Fat %	G,O, L
74	***Acacia nilotica***(L.) Willd. subsp. ***cupressiformis***(J.L. Stewart)Ali ' **SuliKikar'**	Lvs. pods	Green fodder	Wild & Introduced	Sheep & Goats	Improve milk yield & Fat %	G,O,L
75	***Acacia nilotica***(L.) Willd. subsp. ***tomentosa*** (Benth.)Brnan **'Kikar'**	Lvs. pods	Green fodder	Wild & Introduced	Sheep & Goats	Improve milk yield & Fat %	G,O
76	***Acacia raddiana***Savi '**IsrayaliKikar'**	Pods	Green fodder	Wild & Introduced	Goats, Cattles	Improve milk yield & Fat %	G,O
77	***Albizialebbeck***(L.) Benth. **'Siras'**	Yng Brs. Lvs. Pods	Green fodder	Wild & Introduced	Goats, Cattles	Improve milk yield & Fat %	G,O, L
78	***Albiziaodoratissima*** (L. f.) Benth. **'Kali Siras'**	Yng Brs. Lvs.	Green fodder	Wild & Introduced	Goats, Cattles	Improve milk yield & Fat %	G,O, L
79	***Albiziaprocera***(Roxb.) Benth. **'Safed Siras'**	Lvs.	Green fodder	Wild & Introduced	Goats, Cattles	Improve milk yield & Fat %	G,O, L
80	***Dichrostachyscineria***(L.) Wt. et Arn. **'Goya-Khair'**	Lvs.	Green fodder	Wild	Goats, Cattles	Improve milk yield & Fat %	G,O, L
81	***Mimosa hameta***Willd. '**Jhinjhni**' & '**Bandar kiRakhi'**	Lvs.	Green fodder	Wild	Camels	Improve milk yield & Fat %	G,O
82	***Mimosa pudica***L. **'Chui-Mui', 'Lajwanti'**	Yng. parts	Green fodder	Cultivated	Cattle	Improve milk yield & Fat %	G,O, L
83	***Pithecellobiumdulce***(Roxb.) Benth. **'Jangal Jalebi'**	Lvs.	Green fodder	Wild & Introduced	Goats	Improve milk yield & Fat %	G,O, L
84	***Prosopischilensis***(Molina)	Yng.	Green	Wild &	Sheep &	Improve	G,O

	Stuntz **'AngrejiBavanlio'**	pods	fodder	Introduced	Goats	milk yield & Fat %	
85	***Prosopis cineraria***(L.) Druce **'Khejri', 'Janti'**	Yng. pods	Green fodder & Dry fodder	Wild & Introduced	Sheep & Goats	Improve milk yield & Fat %	G,O, L

Abbreviations used in above table are – Wh. Pt. = Whole Plant, Brs. = branches, Yng. =Young, Lvs. = Leaves, Frts. = Fruits, Sds. =Seeds, F = Farmer, G = Gwala, O =Observation,L=Literature

Discussion

Agricultural, cultivational and botanical practices are increasing regularly in developing and developed countries. The business of plant products is also increasing rapidly in the national and international market. Any nation cannot progress without maintain their national heritage and rituals. The todays need of population is the sustainable use of biodiversity and associated indigenous knowledge system for more intelligible and accessible. Forage legumes used as fodder for livestock in various forms. The rural community uses these fodder plants for many benefits.

An exploration was carried out during 1990-1991 in various part of the State for the study of Agricultural, cultivational and botanical practices. The study shows that the people of this area still to use various leguminous plants for fodder purposes either the whole plant or different parts like young leaves and branches, pods (fruits) or dried form of these directly or in different forms viz., Green fodder, Dry fodder (Ninani, Loam or Hay), Pasture lands (Charagahbhoomi) or as 'Banta' or 'Kutti' etc.

As compared to humans, legumes are even important food sources to domestic animals. India has the largest cattle population in the world. Agricultural and dairy farming are the most important means of livelihood to the majority of the people in India from time immemorial.

The legumes are universally recognized as having higher food values than non-legumes as they contain higher percentage of protein which is an essential food constituent, not only present in the seeds but also in the leaves and stem when harvested a little earlier to the stage of maturation.

The quality of the protein of the legumes is such as to make them specially valuable feed to supplement the cereal grains which do not have proper protein for a balanced livestock feed. Nutrition experts have started feeling that a mixture of proteins from different sources provide better digestibility and assimilation both in man and animals, in comparison to protein diet from a single source. Thus the feed from legumes not only supplements the deficiencies in the fodder from grass but it equally helps in its better assimilation.

About 85 plant species belonging to 46 genera and 3 subfamilies are used by the rural people of the area for their cattle feed. Documentation of traditional knowledge on the fodder value of these plants is essential for conservation efforts for the plant resources and new hybrid variety development.

(a). Green fodder:

Quite a large number of species under Faboideae are renowned fodder sources since ages namely, *Crotalaria juncea, Cyamopsistetragonoloba, Glycine max, Lathyrussativus, Lens culinaris, Phaseolus vulgaris, Medicagopolymorpha, M. sativa, Melilotus alba, M. indica, Pisumarvense, P. sativum, Sesbaniabispinosa, S. procumbens, Trifoliumalexandrium, T. repens, Trigonellafoenum-graecum, Viciafaba, V. hirsuta, V. sativa* var. *sativa, V. sativa* var.*angustifolia, V. tetrasperma*. These are widely cultivated as fodder and cash crop on commercial scale. Species belonging to genera *Alhagi,Alysicarpus, Crotalaria,Cyamopsis, Desmodium, Indigofera, Lathyrus, Medicago, Melilotus, Trifolium* and *Vicia* are excellent sources of fodder. *Cyamopsistetragonoloba* and *Vicia sativa* are reputed to increase milk yield in the milch animals.

In Caesalpinioideae there are several species of fodder value, the most valuable being *Bauhinia purpurea, B. racemosa,Hardwickiabinata, Parkinsoniaaculeata, Peltophorumpterocarpum* and *Tamarindusindica*, which are heavily lopped for the purpose.

In Mimosoideae leaves of *Acacia leucophloea, Acacia nilotica, Albizialebbeck, Prosopis cineraria* are good fodder specially to goats and sheep. Their pods are equally good. The pods (fruits) of *Acacia leucophloea* and *A. nilotica* are very much relished by sheep, goats and camels.

Butea monosperma out excels all species of Faboideae in Rajasthan and are especially preferred by bufalloes.

(b). Dry fodder ('Ninani', 'Loam' or 'Hay'):

The plant remains and husk (after harvesting) of most of the cultivated species is good for the cattle specially that of *Arachishypogaea* (Moongphali), *Cajanuscajan* (Arhar), *Cicer arietinum* (Chana), *Cymopsistetragonloba* (Guar), *Glycine max* (Soyabeen), *Lathyrussativus, Lens culineris* (Masur), *Phaseolus vulgaris*, *Trigonellafoenum-graecum* (Methi), *Vignaaconitifolia* (Moth), *V. mungo* (Urd), *V. radiata* (Green Moong), *V. unguiculata* (Chaula or Lobia), and *Prosopis cineraria* (Khejra).

Feeds and concentrates ('Bant' or 'Banta') count a great deal for food upkeep of cattle. The seed husk of most of the pulse species like Arhar, Moong, Chana, Lobia or Chaula, Moth, Masur and other cultivated species are widely used all over the country as important concentrates for all types of cattle. Seed husk is specially rich in proteins and vitamins and it sells sometimes at the same rate as that of wheat or any other cereal. In Western India *Cyamopsistetragonoloba* (Guar) seeds are widely used as concentrates. The most important oil cakes used in feeding cattle is that of groundnuts and of Soyabeen.

Large quantities of broken pulse pieces ('Choori') utilized by the cattle and Poultry industry is fast growing in recent times and is partly usurping the food grains required by man. Further investigations on various species of the family, may reveal. There are chances of finding several alternate species for feeds and fodders for cattle, poultry and other domesticated animals and birds.

(c). Pasture lands:

The bulk of feeding of cattle is by grazing in pastures as it is difficult and uneconomic to stall feed cattle of poor quality on large scale. In countries like Australia, New Zealand and America which are quite advanced in dairy-farming, human population is low and big stretches of land are

available for pastures. The plant species fit for pastures must have a strong root system to withstand being uprooted totally during grazing and should be able to give out new shoots quickly. The pastures in the State are rich in *Alhagimaurorum, Alysicapusmonilifer, A. vaginalis, Crotalaria burhia, C. medicaginea, Desmodiumgangeticum, D. rependum, D. triflorum, Indigoferacordifolia, I. hochstetteri, I. linifolia*var.*linifolia, I. oblongifolia, Lathyrusaphaca, Rhynchosiacapitata, Tephrosiaapollinia, Zorniagibbosa* etc.

Conclusion

The major forage legume crops cultivated in Rajasthan as green fodder are *Crotalaria juncea, Medicagopolymorpha, Medicago sativa, Melilotus alba, Melilotusindica, Sesbaniabispinosa, Sesbaniaprocumbens, Trifoliumalexandrinum, Trifoliumrepens, Viciafaba, Viciahirsuta, Vicia sativa* var. *sativa, Vicia sativa* var.*angustifolia, Viciatetraspermaa*s dry fodder are*Arachishypogaea, Cajanuscajan, Cicer arietinum, Vignaaconitifolia, Vigna mungo, Vignaradiata, Vignaunguiculata*and as green as well as dry fodder are*Cyamopsistetragonoloba, Glycine max, Lens culinaris, Phaseolus vulgaris, Trigonellafoenum-graecum*and pasture legumes are*Alhagimaurorum, Alysicarpusmonolifer, A. vaginalis, Crotalaria burhia, C. medicaginea, Desmodiumgangeticum, D. rependum, D. triflorum, Indigoferacordifolia, I. hochsteteri, I. linifolia*var.*linifolia, I. oblongifolia, Lathyrusaphaca, Medicagolupulina, Rhynchosiacapitata, Tephrosiaapollinea, Zorniagibbosa*and many more fodder tree species are found in pasture lands as well as in cultivated fields from their people or animals lopped young branches, leaves and pods (fruits) as green fodder these are *Bauhinia purpuria, B. racemosa, Hardwickiabinata, Parkinsoniaaculeata, Peltophporumpterocarpum, Piliostigmamalabarica, Tamarindusindica, Butea monosperma, Dalbergialatifolia, D. sissoo, Erythrinavariegata, Ougeiniaoojeinensis, Pterocarpus marsupium, Acacia farnessiana, A. jacquemontii, A. leucophloea, A. nilotica,* subsp.*indica, A. nilotica*subsp.*cupressiformis, A. nilotica*subsp.*tomentosa, A. raddiana, Albizialebbeck. A. odoratissima, A. procera, Dichrostachyscineria, Pithecellobiumdulce, Prosopischillensis, P. cineraria.*

Eighty-five (c.f. t.-1) leguminous plant species are reported as forage plants which belongs to 46 genera, amongst 7, 33 and 6 genera are from sub-families Caesalpinioideae, Faboideae and Mimosoideae respectively. From the sub-family Caesalpinioideae the highest number of species from *Bauhinia* (2) while only one species have been reported from rest of the genera are viz., *Cassia, Hardwickia, Parkinsonia, Piliostigma, Peltophorum, Tamarindus*. From the sub-family Faboideae the highest number of species from *Indigofera* (7) then 5 species from each genera are viz., *Vicia,Vigna* then 3 species from each genera are viz., *Crotalaria, Desmodium, Medicago*and2-2 species from*Alysicarpus, Dalbergia, Lathyrus, Melilotus, Pisum, Sesbania, Trifolium, Trigonella* and while only one species from each genera are viz., *Aeschynomenae, Alhagi, Arachis, Butea, Cajanus, Cicer, Cyamopsis, Derris, Erythrina, Glycine, Lens, Milletia, Ougeinia, Pongamia, Phaseolus, Pterocarpus, Rhynchosia, Tephrosia, Zornia.* From the sub-family Mimosoideae the highest number of species from *Acacia* (7) then in *Albizia* (3) and2-2 species from *Mimosa, Prosopis* while only one species from each genera are viz., *Dichrostachys, Pithecellobium.*Forage legumes have been promoted in the previous years with the major focus on livestock production in India as well as Rajasthan. This has led to a substantial decrease in research on forage legumes. In view of dry climate and water scarcity problems and environmental issues, research on forage legumes should be resumed with adequate funding

support at national level. Newer biotic and abiotic stress tolerant varieties should be developed for the changing environmental conditions. Forage legumes have potential to contribute significantly to environment-friendly agricultural land use and sustainable livestock production in the State.

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