

Forage resource development in Uttarakhand

Experiences and observations

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Introduction

Uttarakhand is one of the three states added to the Indian union in November 2000 carved out of the hill districts of Uttar Pradesh. The state is located along the northern border of the country with China and Nepal. This new state is comprised of 13 districts in two divisions namely Kumaon and Garhwal. The district Almora, Nainital, Champawat, Pithoragarh, Bageshwar, Pauri, Chamoli, Rudraprayag, Tehri, Uttarkashi and Dehradun are entirely in hilly terrain with exception of the Terai, Bhabar and valley areas of Nainital and Dehradun, while the district of Haridwar and Udham Singh Nagar are entirely in plain areas. Uttarakhand is thus far away from the major Urban and Industrial Centres of the country, with the accompanying limitations for industrialization. Hilly terrain and extensive forest cover of the land limit arable farming as well, making the economy of the state rather delicate to balance.

Agriculture along with Animal husbandry is still the principal occupation and source of livelihood for over 70% of its population. Uttarakhand is well endowed with a variety of livestock. Large population and low productivity are the hallmark of livestock in the state, across all species. According to the latest livestock census 2003, the state having a total of 21.88 lakh cattle (bovines), 12.28 lakh buffaloes (bubalis), 11.58 lakh goat (caprines), 2.96 lakh sheep (ovines), and 0.174 lakh equines excluding donkeys. Cattle are the preponderant and most popular species, however, buffaloes are the premier milch animal and the main stay of the state dairy industry, while goat and sheep are the popular species among marginal, sub-marginal and landless farmers of the state.

Nearly half of the arable farming in Uttarakhand takes place in the hilly slopes, on tiny terraced plots of land, often as small as 100 sq.m., almost all of it rainfed. Arable farming in the hills depend entirely on the small nondescript working bullocks for farm power and no mechanization of agriculture in this area is possible in the foreseeable future. In the state, animal husbandry plays a vital role in the rural economy largely based on different land base interventions.

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During the course of centuries the animal husbandry programme is well spread over in the life of mountainous community and until 50 yrs. back the livestock raised by the villagers were the status symbol and indicator of prosperity. Even today the livestock enterprises are important for the economic development of hilly region.

Livestock production in Uttarakhand is the endeavour of the small holders and takes place in millions of tiny and small holdings scattered across the state. The predominant farming system in the state is mixed crop-livestock farming system, most of it rainfed. Ownership of livestock is equitable, over 80 percent of all species are owned by the marginal and small farmers, with some by the landless.

Feed and Fodder scenario of the State

On the basis of the livestock census of 2003, the requirement of green and dry fodder for about 48.878 lakh cattle, buffaloes, sheep, goat and equines are about 197.40 lakh mt. and 54.31 lakh mt. respectively. Thus, about 251.71 lakh mt. of fodder (Roughage) is required per annum for the entire state. On the other hand the annual availability of green and dry fodder in the state is about 105.12 lakh mt. and 38.02 lakh mt. respectively i.e. about 143.14 lakh mt. per annum. In this way the state is in deficit of about 108.57 lakh mt. (43.13 %) of fodder (roughage) per annum. If the real intake of dry fodder is taken into account, the picture is some what different. It has been estimated that due to faulty system of feeding of dry fodder to the livestock (without chopping and without trough or mangers), about 40 percent of the dry fodder go waste with urine, dung and trampling with animal hooves. Thus, the real shortage of fodder in the state is about 118.36 mt. (47.02%) per annum.

The production and availability of green fodder is not uniform throughout the year due to shortage of irrigation facilities in hilly areas. The green fodder is available to the livestock for 4 months (monsoon) only. Remaining eight months (winter and summer) are measurable, none of the green fodder is available during this period, resulting in low production of milk, wool and other animal products. The present status of fodder requirement for the entire livestock and production of green and dry fodder in Uttarakhand are given in the table 1a and 1b as under:

Table - 1a
Status of fodder requirement and Production in Garhwal division
Year : 2007

S. No.	Disrtict	Livestock Population	Requirement of fodder, supply and deficit			Percentage of fodder deficit
			Requirement of fodder (Lakh mt.)	Total fodder supply (Lakh mt.)	Deficit of fodder (Lakh mt.)	
1	Haridwar	421813	32.85	19.17	(-)13.68	41.64
2	Dehradun	401012	18.61	9.23	(-)9.38	50.4
3	Pauri	609673	28.21	12.66	(-)15.55	55.12
4	Tehri	356445	18.67	9.41	(-)9.26	49.59
5	Uttarkashi	343867	10.96	9.00	(-)1.96	17.88
6	Rudraprayag	195481	9.81	4.71	(-)5.10	51.98
7	Chamoli	368667	16.86	10.97	(-)5.89	34.93
Total (Garhwal division)		2696958	135.97	75.15	(-) 60.82	44.73

Table - 1b
Status of fodder requirement and Production in Kumaon division
Year : 2007

S. No.	Disrtict	Livestock Population	Requirement of fodder, supply and deficit			Percentage of fodder deficit
			Requirement of fodder (Lakh mt.)	Total fodder supply (Lakh mt.)	Deficit of fodder (Lakh mt.)	
1	Nainital	359802	22.04	10.86	(-)11.18	50.72
2	Udhamsingh Nagar	347854	24.05	21.62	(-)2.43	10.1
3	Almora	525009	25.17	13.47	(-)11.70	46.48
4	Bageshwar	264781	11.57	6.53	(-)5.04	43.56
5	Pithoragarh	506645	23.22	10.34	(-)12.88	55.47
6	Champawat	186790	9.69	5.17	(-)4.52	46.64
Total (Kumaon division)		2190881	115.74	67.99	(-) 47.75	41.13
Total of the Uttarakhand		4887839	251.71	143.14	(-) 108.57	43.13

Problems of Feed and Fodder in the State

1. Due to small size of farm holdings and lack of irrigation facilities fodder is, by and large, not cultivated and the animal rearers have to depend on forests, grasslands, pastures and wastelands besides agricultural and horticulture residues to meet the fodder requirements.
2. Whereas the livestock population is increasing or is stagnant, the availability of fodder and grasses is dwindling (both in quantity and quality) due to poor management practices and degradation of land. The resource basis in this context are getting shrunk.
3. During the rainy season, the availability of fodder is in excess of demand but there is fodder crisis during winter and summer months as the farmers are unaware and are ill- equipped for scientific conservation of grasses for use in lean months.
4. Concentrates are generally not fed to cows, bullocks, sheep and goat.
5. The treeless sub-alpine and alpine pastures are extensively grazed during the summer. In most of the Himalayas, the grass species presently found, represent the third or the fourth stage of degradation and the production potential of these rangelands is only about 25% of the optimum and quality-wise only 10-15% of the possible out-turn of nutrients per unit area per unit time are available (Punjab Singh 1990). Requirement of fodder for each class of livestock during the year 2007 as per census 2003, status of fodder requirement and shortage of green and dry fodder are given in the table 1c, 2a and 2b as below :

Table - 1c

**Requirement of fodder for each class of livestock per annum -2007
(Livestock census – 2003)**

Livestock Class	Number (lakh)	Population (percentage)	Green Fodder requirement (lakh mt.)	Dry Fodder requirement (lakh mt.)	Dry matter requirement (lakh mt.)	Total Fodder requirement (lakh mt.)	Requirement Percentage
Cattle (Bovines)	21.88	(44.7%)	100.44	27.73	52.38	128.17	50.92

Buffaloes (<i>Bubalis</i>)	12.28	(25.1%)	89.46	25.05	44.80	114.51	45.49
Sheep (<i>Ovines</i>)	2.96	(6.1%)	1.21	0.24	0.37	1.45	0.58
Goat (<i>Caprines</i>)	11.58	(23.7%)	5.32	1.02	1.32	6.34	2.52
Equines (excluding dunkeys)	0.17	(0.4%)	0.97	0.27	0.46	1.24	0.49
Total	48.87	100 %	197.40	54.31	99.33	251.71	100

Table - 2a

**Status of Fodder Requirement in the State per annum
Year – 2007**

S.No.	Livestock fodder	Requirement
1.	Green Fodder	197.40 Lakh mt
2.	Dry Fodder	54.31 Lakh mt.
Total Requirement of Fodder		251.71 Lakh mt.

Table - 2b - 1

Green Fodder Production in Uttarakhand

S.No.	Sources	Production	Percentage
a	Grasses (from forests, orchards, pastures, agricultural land, grazing lands, wastelands, alpine grasslands)	32.20 lakh mt.	30.63
b	Seasonal fodder crops , Sugarcane tops and Potato leaves (from Agricultural land).	33.31 lakh mt.	31.68
c	Fodder Tree leaves (Fodder trees, bushes & perennial herbs)	39.61 lakh mt.	37.69
Total green fodder supply in Uttarakhand		105.12 lakh mt.	

Table - 2b - 2**Dry Fodder Production in Uttarakhand**

S.No.	Sources	Production	Percentage
a	Agricultural land (Straws, Stalks, Stovers)	33.26 lakh mt.	87.48
b	Grasses (grass hay and dry grasses) *	4.76 lakh mt.	12.52
Total dry fodder supply		38.02 lakh mt.	

* About 21.90 lakh mt. of green grasses are converted in to hay and dry grasses per annum.

Table - 2c - 1**Shortage of livestock fodder in the State**

S.No.	Livestock fodder	Shortage	Percentage
a	Green Fodder	92.28 lakh mt.	46.74
b	Dry Fodder	16.29 lakh mt.	29.99
Total shortage of roughage in the State		108.57 lakh mt.	43.13

Table - 2c - 2**Wastage of dry fodder due to faulty system of feeding
(40% wastage)**

S.No.	Category	Quantity	
1	Requirement of dry fodder in the state	54.31 lakh mt.	
2	Availability of dry fodder in the state	38.02 lakh mt.	
3	Shortage of dry fodder	16.29 lakh mt.	
4	Losses of dry fodder due to faulty system of feeding	9.79 lakh mt.	
Actual shortage of dry fodder in the state		26.08 lakh mt.	48.02%
Actual shortage of total fodder in the state		118.36 lakh mt.	47.02 %

Strategy to minimize shortage of fodder in Uttarakhand

There is acute shortage of fodder in the State. At present state is in deficit of about 43.13% of dry and green fodder. The shortage of green fodder is more i.e. about 46.74% in comparison to dry fodder which is 29.99% at present. There are 3 main sources of fodder supply in the state :

1. Crop residues, Potato leaves and sugarcane tops from agricultural sector.
2. Grasses from forests, orchards, agricultural land, fallows, wastelands, pastures and Bugyals (alpine grasslands).
3. Fodder leaves from forests, agricultural land, orchards, shrubs and herbs.

There are more possibilities to enhance the biomass production as livestock feed from above mentioned resources. Principal fodder supply sources in the state are given in the table-3a and 3b as below :

Table - 3a

Principal Fodder Supply Sources in Uttarakhand (Green and dry fodder)

S. No.	Sources	Production	Percentage
1	Agriculture Sector (green and dry excluding grasses)	66.57 lakh mt.	46.51
2	Grasses (from various sector including dry grasses)	38.96 lakh mt.	25.82
3	Fodder leaves(from various sector)	39.61 lakh mt.	27.67
Total production		143.14 lakh mt.	100

Table - 3b

Green & Dry Fodder Production from Agricultural Sector (Excluding grasses)

S.No.	Sources	Production	Percentage
1	Sugarcane tops (Bhabar, Tarai, Plains)	17.09 lakh mt.	25.79
2	Seasonal fodder crops and potato leaves	16.22 lakh mt.	24.25
3	Straws, stalks and stovers	33.26 lakh mt.	49.96
Total production		66.57 lakh mt.	100

Measures to increase fodder production from agricultural sector

1- Dry fodder :

About 38.02 lakh mt. of dry fodder is produced every year as dry grasses, straws, stovers and stalks from wheat, Barley, Paddy, Jhingora and Madua etc. from 22.13 lakh hectare of cropped area and areas under grasses in the State. The shortage of dry fodder is approximately 16.29 lakh mt. (29.99 percent). There are meagre possibilities to increase the production of crop residues, but their utilization as livestock feed may be increased many folds by providing better management practices of feeding.

- a.** About 2.11 lakh mt. (10 percent) of wheat and paddy straw out of 21.09 lakh mt. produced in plain and tarai areas are utilized by paper and pulp industries every year. There should be complete ban on the utilization of straws etc. other than feed and fodder in the state.
- b.** About 03 lakh mt. of wheat and paddy straws (14.2 percent) are left over in the fields when combine harvesters are used for harvesting the crops. Most of such crop residues are burnt and ploughed in the field. These leftover crop residues can be reaped, bailed, treated, stored and transported to deficit areas in hills.
- c.** Being bulk density of straws and stalks comparatively more, their storage needs more space and transportation to remote areas in hills is more costlier. Such dry fodders and other cellulosic wastes may be treated with urea and bailed or they can be converted into compact feed blocks in to convenient size and weight. Compact Feed Blocks and bailed dry fodder are reduced up to 1/6th of their original volume and they can be transported to very remote areas of the hilly terrains and also required lesser place for storage.
- d.** The production of dry fodder in hilly areas is approximately 24.49 lakh mt. per annum. Out of this, about 9.79 lakh mt. (40%) stalks and stovers are go waste due to faulty system of feeding. Such wheat, Paddy, Madua and Jhingora stalks and maize stovers can be fully utilized after chopping and feeding them in troughs and mangers.
- e.** About 05 decade back, when the number of livestock was lesser and plenty of nutritious grasses were available from forests, pastures and orchards, the farmers of hilly areas were used to burn the crop residues after harvesting the grain part of the cereals in the field. Now the situation is some what changed, the livestock and

human population is increasing, pressure on forest land and pasture etc. are increasing, now it is time to change the attitude of farmers to not burn the crop residues and utilize them as livestock feed.

- f. For better utilization of dry fodder in hilly areas, the farmers and livestock owners should be motivated and educated to feed the stalks, stovers, dry grasses, green fodder and tree leaves after chopping them in small pieces, soaking in water and feeding such fodders in troughs, baskets or mangers.
- g. Livestock owners and farmers should be educated to construct their animal houses and sheds on scientific lines provided with feeding and watering systems and proper ventilation. Dry fodder production from various sources and measures to increase dry fodder yield are given in the following table 4a, 4b and 4c

Table - 4a

**Districtwise dry fodder production in Uttarakhand
Straws from wheat, Barley, pulses, oilseeds and dry grasses**

S. No.	District	Areas for dry fodder production and yield (area: hectare, production : lakh mt. per annum)								Total dry fodder yield (lakh mt.)
		Straws from wheat & barley		Straws from pulses		Straws from Oilseeds		Dry grasses		
		Total area (lakh ha.)	Dry fodder yield	Total area (lakh ha.)	Dry fodder yield	Total area (lakh ha.)	Dry fodder yield	Total area (lakh ha.)	Dry fodder yield *	
1	Pithoragarh	0.30	0.62	0.06	0.19	404(Ha.)	0.01	1.14	0.52	1.34
2	Champawat	0.15	0.34	0.01	0.02	357(Ha.)	910(Mt.)	0.56	0.21	0.58
3	Bageshwar	0.17	0.41	0.01	0.02	0	0	0.32	0.31	0.74
4	Almora	0.48	0.78	0.02	0.05	504(Ha.)	0.01	0.97	0.34	1.18
5	Nainital	0.30	1.03	0.02	0.04	0.04	0.09	1.01	0.37	1.53
6	Udhamsingh Nagar	0.83	3.56	0.03	0.05	0.05	0.04	0	0	3.65
7	Chamoli	0.16	0.33	607(Ha.)	925(Mt.)	542(Ha.)	0.01	1.63	0.73	1.08
8	Uttarkashi	0.12	0.26	0.02	0.02	0.02	0.04	2.07	0.68	1.00
9	Pauri	0.43	0.75	0.04	0.08	506(Ha.)	0.01	1.58	0.75	1.59
10	Rudraprayag	0.12	0.2	0	0	0	0	0.66	0.3	0.5
11	Tehri	0.33	0.6	0.03	0.07	789(Ha.)	0.02	0.95	0.35	1.04
12	Dehradun	0.25	0.86	0.01	0.03	0.01	0.03	0.64	0.2	1.12
13	Haridwar	0.47	1.73	0.03	0.06	0.03	0.09	0	0	1.88
Total		4.11	11.47	0.29	0.64	0.18	0.36	11.53	4.76	17.23

* 4.76 lakh mt. of dry grasses are procured from 21.90 lakh mt. of green grasses.

Table - 4b
Districtwise dry fodder production in Uttarakhand
(Straws from Paddy, Ragi, Sanwa and Maize stovers)

S. No.	District	Areas for dry fodder production and yield (area: hectare, production : lakh mt. per annum)								Total dry fodder yield (lakh mt.)
		Paddy straw		Ragi Straw		Sanwa straw		Maize stovers		
		Total area (lakh ha.)	Dry fodder yield	Total area (lakh ha.)	Dry fodder yield	Total area (lakh ha.)	Dry fodder yield	Total area (lakh ha.)	Dry fodder yield	
1	Pithoragarh	0.28	0.52	0.13	0.67	0.01	0.06	0.03	0.12	1.37
2	Champawat	0.09	0.18	0.08	0.46	0.02	0.09	0.01	0.05	0.78
3	Bageshwar	0.15	0.37	0.07	0.38	934 (Ha.)	0.05	515 (Ha.)	0.02	0.82
4	Almora	0.23	0.41	0.36	1.48	0.16	0.67	0.02	0.1	2.66
5	Nainital	0.15	0.52	0.04	0.21	0	0	0.08	0.36	1.09
6	Udhamsingh Nagar	1.08	4.69	0	0	0	0	0	0	4.69
7	Chamoli	0.12	0.27	0.11	0.61	0.02	0.14	0	0	1.02
8	Uttarkashi	0.1	0.27	0.05	0.3	0.02	0.11	548 (Ha.)	0.02	0.7
9	Pauri	0.21	0.39	0.27	1.33	0.18	0.78	0.02	0.08	2.58
10	Rudraprayag	0.08	0.21	0.06	0.27	0.02	0.08	0	0	0.56
11	Tehri	0.13	0.35	0.17	0.79	0.21	1.06	0.02	0.06	2.26
12	Dehradun	0.14	0.47	0.03	0.18	0.01	0.05	0.11	0.56	1.26
13	Haridwar	0.25	0.97	0	0	0	0	0.02	0.15	1.12
Total		3.01	9.62	1.37	6.68	0.66	3.09	0.98	1.52	20.91

Table - 4c

Measures to increase dry fodder availability from Agriculture sector

1	To impose ban on supply of wheat and paddy straws to paper and pulp industries.	:	About 2.11 lakh mt. (10 %) supply every year may be diverted as fodder.
2	To procure stalks and residues of wheat and paddy left over in fields after harvesting through combines.	:	About 3 lakh mt. (14.2 %) crop residues are left over in the fields every year may be utilized as fodder.
3	To check on the burning of wheat and paddy stalks in the fields in hilly areas	:	About 25% wheat stalks are burned every year in hilly areas which may be otherwise utilized as fodder.

4	Compact feed blocks from straws & other cellulosic wastes	:	About 9.5 lakh mt. of crop residues as straws, which is 25 percent of the total dry fodder (38.14 lakh mt.) may be converted in to compact feed blocks
5	Chopping of all kind of fodders before feeding to livestock	:	Increase intake, enhanced palability and zero wastage.
6	Using of feeding troughs, baskets or mangers	:	About 40% fodder go waste due to faulty system of feeding, it can be minimised to zero percent.
7	Fortification of straws and other dry fodder with urea, common salt and jaggery.	:	04 % urea, 01% molasses / Jaggery and 01 % common salt is appropriate ratio for the treatment.

2- Green fodder :

a. Seasonal green Fodder : There is a shortage of about 46.74% of green fodder in the state. The seasonal green fodder production from 0.56 lakh ha. (4.62%) agricultural land is 14.97 lakh mt. per annum. Area under seasonal fodder in hilly districts is 19219 ha.(2.49%) while in plains, Tarai and Bhabar area is 37000 ha (8.38%). There are more possibilities to increase the area under seasonal fodder crops as well as production of fodder in both hilly and plain areas.

Due to small size of farm holdings and lack of irrigation facilities seasonal fodder is, by and large, not cultivated in the hilly parts of the state. Generally farmers prefer to grow food crops rather than animal fodder. Although the food grains produced from agricultural land is sufficient only for 3 to 4 months of a year and for remaining 8 to 9 months farmers have to depend on the market supply, but the farmers feel proud to have their own produce, what so ever the quantity is produced.

In the above context farmers and livestock owners should be motivated that the food grains can be easily procured from the local market according to their requirement but to procure fodder from the market is not possible at all. Hence, they must spare some of the agricultural land for seasonal fodder crops production. There is a possibility to utilize at least 0.30 lakh hectare of culturable land (2.5%) more for seasonal fodder production which may add 8.10 lakh mt. green fodder per annum.

b. Sugarcane tops : Sugarcane tops have major role in green fodder supply in plains, Tarai and Bhabar areas of the state. Climatic conditions of hilly areas do not favour sugarcane growing in hills. The area under sugarcane cultivation in the state

is about 1.14 lakh ha. Production of sugarcane tops is approximately 17.09 lakh mt. per annum, which is 13.45 % of the total green fodder produced in the state. There is little chance to increase the area under sugarcane cultivation. It would be desirable to keep the area under sugarcane as static.

c. Potato leaves and stems : Green leaves and stems of Potato crops are utilized as green fodder in the district of Pithoragarh, Champawat, Almora, Nainital, Chamoli, Tehri and Dehradun. Out of 0.11 lakh hectare land, about 1.25 lakh mt. green fodders from potatoes are produced per annum. Green fodder produced from sugarcane tops, potato leaves and seasonal fodder crops are given in the table-5a and measures to increase seasonal fodder crops are given in the table- 5b as under:

Table - 5a

**Districtwise green fodder production in Uttarakhand
(Fodder leaves, sugarcane tops, potato leaves and seasonal fodder crops)**

S. No.	District	Areas for fodder production and yield (area: hectare, production : lakh mt. per annum)								Total green fodder yield (lakh mt.)
		Fodder leaves		Sugarcane tops		Potato leaves		Seasonal fodder crops		
		Total area (lakh ha.)	Green fodder yield	Total area (lakh ha.)	Green fodder yield	Total area (lakh ha.)	Green fodder yield	Total area (lakh ha.)	Green fodder yield	
1	Pithoragarh	0.65	3.33	0	0	0.01	0.13	0.04	0.77	4.23
2	Champawat	0.62	2.13	0	0	808 (Ha.)	0.09	0.01	0.21	2.43
3	Bageshwar	0.48	2.72	0	0	0	0	977(Ha.)	0.2	2.92
4	Almora	1.33	6.1	0	0	0.02	0.18	0.05	1.17	7.45
5	Nainital	1.1	4.01	0.07	0.98	0.02	0.21	0.03	0.59	5.79
6	Udhamsingh Nagar	0.14	0.98	0.38	5.71	0	0	0.19	5.8	12.49
7	Chamoli	1.12	3.49	0	0	0.03	0.35	0.01	0.28	4.12
8	Uttarkashi	1.37	2.71	0	0	0	0	514(Ha.)	0.1	2.81
9	Pauri	1.27	4.84	0	0	0	0	626 (Ha.)	0.12	4.96
10	Rudraprayag	0.44	1.58	0	0	0	0	422(Ha.)	0.08	1.66
11	Tehri	1.19	3.54	0	0	0.01	0.15	680 (Ha.)	0.13	3.82
12	Dehradun	0.51	2.91	0.06	0.94	0.01	0.14	0.04	0.88	4.87
13	Haridwar	0.11	1.27	0.63	9.46	0	0	0.16	4.64	15.37
	Total	10.33	39.61	1.14	17.09	0.11	1.25	0.56	14.97	72.92

Table - 5b**Measures to increase seasonal fodder crops from agricultural sector**

1	Present Status	:	About 0.56 lakh hectare (4.62 %) area out of 12.11 lakh hectare cropped area is used for seasonal fodder cultivation.
		:	About 4.97 lakh mt. green fodder is produced per annum from 0.56 lakh hectare land.
2	Proposed future strategy	:	About 0.30 lakh hectare (2.5%) extra agricultural land should be brought under seasonal fodder crops cultivation.
		:	About 8.10 lakh mt. more green fodder may be produced per annum.

Measures to increase biomass production from grasses

The role of grasses in the fodder supply of Uttarakhand is of prime importance, specially in hilly areas. The contribution of grasses in the green and dry fodder supply is 30.63 % and 12.52 % respectively. The total production of grasses has been estimated to be 54.10 lakh mt. per annum in the state, out of which about 32.20 lakh mt. is utilized by animals as green and 4.76 lakh mt. as dry (equivalent to 21.90 lakh mt. green) per annum.

- a.** The maximum production of grasses say about 34.45 lakh mt. (63.68%) come from the forest sector (table-6a). Total area under reserved forest, Van Panchayats and Civil Soyam is 34.98 lakh hectare, but the actual area under grass production is 19.91 lakh hectare (56.92 %) only. The remaining 43.08 % area falls under rivers, riverlets, ravines, trees, shrubs, herbs, rocks and settlements. The average production of grasses from forest areas is 1.73 mt. per hectare. Grass production from forest areas can be increased many folds by introducing higher yielding varieties of grasses such as hybrid Napier, Setaria, Guinea, Deenanath, Anjan, Tall fescue, Brome and Rye grass etc., effective control over grazing, use of manures and fertilizers, eradication of weeds, harvesting at proper time, conservation as hay and silage and to follow up scientific system of grazing.

There are 350 species of grasses belonging to 116 genera (annexure-1) are fully acclimatized in hilly environment. If proper protection is provided to these grasses, the average production of 5.20 mt. per hectare may be achieved per

annum. Van Panchayats are the appropriate platforms for grass farming where all the measures for higher biomass production can be introduced. In this way about 68.9 lakh mt. additional green fodder may be procured from forest sector.

- b.** The second major source of grass production are lower Pastures, Agricultural land, Fallow, wastelands and orchards having the total area of 15.56 lakh hectare, out of which about 7.87 lakh hectare (50.58%) is available for grass production which is 14.6 lakh mt. (19.52%) per annum. The average yield of grasses from these areas is 1.85 mt. per hectare per annum. If proper protection is given to these areas and grazing is prohibited for 3 years and only **cut & carry** system is followed, the yield of grasses can be achieved upto 5.5 mt per hectare and 28.7 lakh mt. additional green fodder may be produced per annum.

c. Alpine grasslands (Bogyals)

The alpine grasslands are spread over the northern parts of the region and are mainly used by migratory grazing animals such as sheep, goat, equines, buffaloes and yak etc. besides wild animals like Bharal, Thars and other high altitude Antilopes. There are 380 important and popular Bogyals with 0.90 lakh hectares in Uttarakhand state which are situated in the districts of Pithoragarh (Munsyari and Dharchula), Bageshwar (Kapkot), Chamoli (Joshimath, Ghat and Dewal), Rudraprayag (Ukhimath), Tehri (Ghansali and Pratapnagar), and Uttarkashi (Bhatwari, Barkote, Mori and Purola). About 1.78 lakh hectare area is covered by Bogyals and about 3.10 lakh hectare is under permanent snow as glaciers, snow clad peaks and their icy basins. About 1.19 lakh hectare area is under high altitude bushes, rivers, riverlets and ravines etc. The areas under bogyals are not fully covered by grasses and grazable herbs. About 30% area is blank. Himanchal Pradesh has the largest area under alpine grasslands and permanent snow which is 22.91 lakh and 4.52 lakh ha. respectively, while in Jammu & Kashmir, the area under alpine grasslands (Marg), permanent snow and cold desert is 7.65 lakh ha., 11.15 lakh ha. and 56.22 lakh ha. respectively.

The Bogyals are utilized for summer grazing only i.e. from May to October. The Bogyals used to provide and to a larger extent still providing natural and nutritious alpine pastures between 3000 to 4800 metres above mean sea level. The alpine grasslands are having natural grasses of 80 species from 32 genera (family Poaceae), 208 species of grazable herbs from 26 families and non grazable weeds & herbs of 80 species from 19 families of angeosperms (annexure 2 and 3). The

quality of herbage of bugyals has, however, deteriorated in terms of nutrient content and palatability in recent 2-3 decades.

Valuable forage from the bugyals is available for 5 to 6 months during summer. During this period the condition of animals grazed in bugyals substantially improves. The main reasons for deterioration in the condition of bugyals may be summarized as below :

1. Overstocking.
2. Continuous and over grazing.
3. Grazing of animals in large numbers too early at regeneration stage.
4. Grazing till the very onset of severe winter denying the opportunity to the nutritious forage varieties to flower and produce seeds.
5. Proliferation of weeds.
6. Lack of manuring.
7. Mineral deficiency in the soil.
8. soil erosion.
9. Tourism.

The production of grasses from various sources are given in the table 6a,6b and 6c as below :

Table - 6a

**Districtwise fodder grass production in Uttarakhand
(Forest, Pastures and Alpine grassland)**

S. No.	District	Areas for fodder grass production and yields (area : hectare, production : lakh mt. per annum)									Total fodder grass yield (lakh mt.)
		Forest			Pastures			Alpine grasslands			
		Total area (lakh ha.)	Production area (lakh ha.)	Green fodder yield (lakh mt.)	Total area (lakh ha.)	Production area (lakh ha.)	Green fodder yield (lakh mt.)	Total area (lakh ha.)	Production area (lakh ha.)	Green fodder yield (lakh mt.)	
1	Pithoragarh	2.05	1.33	2.53	0.53	0.32	0.56	0.43	0.43	1.27	4.36
2	Champawat	1.32	0.79	1.19	0.19	0.14	0.26	0	0	0	1.45
3	Bageshwar	1.10	0.77	1.73	0.27	0.21	0.36	0.17	0.17	0.53	2.62
4	Almora	2.36	1.42	2.27	0.31	0.18	0.30	0	0	0	2.57
5	Nainital	2.98	1.94	2.91	0.18	0.14	0.37	0	0	0	3.28

6	Udhamsingh Nagar	0.94	0.37	0.84	0	0	0	0	0	0	0.84
7	Chamoli	4.39	2.41	4.59	0.13	0.10	0.18	0.60	0.60	1.71	6.48
8	Uttarkashi	7.21	3.97	5.95	0.08	0.06	0.11	0.30	0.30	0.82	6.88
9	Pauri	3.85	2.50	4.38	0.36	0.29	0.39	0	0	0	4.77
10	Rudraprayag	1.27	0.89	1.92	0.08	0.06	0.08	0.15	0.15	0.45	2.45
11	Tehri	3.22	1.93	3.09	584 (Ha.)	584 (Ha.)	0.01	0.11	0.11	0.27	3.37
12	Dehradun	2.12	1.27	2.35	0	0	0	0	0	0	2.35
13	Haridwar	0.72	0.32	0.70	514 (Ha.)	385 (Ha.)	732 (Mt.)	0	0	0	0.71
Total		33.53	19.91	34.45	2.141	1.51	2.63	1.76	1.76	5.05	42.13

Table - 6b

**Districtwise fodder grass production in Uttarakhand
Agriculture, Orchards and fallow- wastelands**

S. No.	District	Areas for fodder grass production (area : hectare, production : lakh mt. per annum)									Total fodder grass yield (lakh mt.)
		Agriculture Sector			Orchards			Fallow and wastelands			
		Total area (lakh ha.)	Production area (lakh ha.)	Green fodder yield (lakh mt.)	Total area (lakh ha.)	Production area (lakh ha.)	Green fodder yield (lakh mt.)	Total area (lakh ha.)	Production area (lakh ha.)	Green fodder yield (lakh mt.)	
1	Pithoragarh	0.44	0.24	0.3	0.28	0.12	0.31	0.7	0.41	0.7	1.31
2	Champawat	0.27	0.16	0.2	0.26	0.12	0.32	0.3	0.19	0.34	0.86
3	Bageshwar	0.24	0.14	0.17	0.21	0.09	0.25	0.26	0.17	0.36	0.78
4	Almora	0.77	0.24	0.3	0.28	0.13	0.13	0.8	0.46	0.65	1.08
5	Nainital	0.48	0.24	0.32	0	0	0	0.33	0.21	0.48	0.8
6	Udhamsingh Nagar	0	0	0	0	0	0	0.11	0.07	0.08	0.08
7	Chamoli	0.33	0.2	0.25	0.22	0.1	0.25	1.24	0.65	0.98	1.48
8	Uttarkashi	0.29	0.17	0.22	0.04	0.02	0.06	0.44	0.31	0.53	0.81
9	Pauri	0.77	0.19	0.15	0.57	0.31	0.47	1.01	0.16	1.12	1.74
10	Rudraprayag	0.19	0.11	0.13	0.13	0.06	0.16	0.7	0.37	0.56	0.85
11	Tehri	0.6	0.16	0.18	271 (Ha.)	271 (Ha.)	745 (Mt.)	0.22	0.15	1.41	1.60
12	Dehradun	0.53	0.14	0.09	0.04	0.03	0.08	0.26	0.17	0.31	0.48
13	Haridwar	0	0	0	0	0	0	0.11	0.07	0.1	0.1
Total		4.91	1.99	2.31	2.03	0.98	2.04	6.48	3.39	7.62	11.97

Note : Out of 54.10 lakh mt. of green grasses produced, about 21.90 lakh mt. are converted in to hay and dry grasses, hence quantity of green grasses available as animal fodder is only 32.20 lakh mt. per annum.

Role of grasses in the feeding system of livestock in Uttarakhand

The position of feed and fodder supplies in the hills are quite different from the plain areas. While in the plains about 90 percent of green and dry fodder are available from the agricultural land and only 10% come from the forest, pastures and grazing lands, the scenario in the hilly areas are quite different. About 30.63 % of the green fodder is made available in the form of grasses, about 37.69 % as tree leaves and only about 31.68 percent of the fodder is available from agricultural land in the form of green fodder crops, sugarcane tops and potato leaves.

In Uttarakhand only about 14.02 % of the total geographical area is under crop cultivation and only 10% of the agricultural land is irrigated. Land holdings are so small that farmers prefer to grow only food crops in their holdings. Thus, there are meagre chances to motivate the farmers to grow annual fodder crops in agricultural land. At present about 4.62 % of the total agricultural land is used for the cultivation of seasonal fodder crops.

The natural grasses are the potential source of green and dry fodder supplies in the hilly areas of Uttarakhand. The production source of grasses in Uttarakhand are the 75% of geographical area under various forests, natural grazing lands, alpine grasslands, pastures, orchards, bunds and rizers of agricultural fields, leftover and abandoned agricultural fields, barren and fallow lands. The total production of green biomass from the grasses in Uttarakhand is about 54.1 lakh mt. out of which about 4.76 lakh mt. dry grasses (hay) are procured from 21.90 lakh mt. green grasses. Green and dry grasses contributes about 30.63% and 12.52% respectively of the total supply of fodder in Uttarakhand.

Uttarakhand is quite rich in grass biodiversity. There are about 350 species of grasses from 116 genera are naturalized and acclimatized and growing all over Uttarakhand from 500 m to 4500 meter altitude above mean sea level. The list of grasses with their ecosystem and nutritional value is given as annexure – 1,2 and 3.

Biomass production from natural grasses are not satisfactory. The Biomass production from protected and well conserved grasslands in the forests is about 120 quintals per hectare per annum, while in the regular grazing lands, the biomass production is about 15 to 25 quintals green per hectare per annum.

For the last about 30 yrs. research and development programme has been carried out to increase the biomass production of some improved and naturalized grass species. Results available so far, reveals the facts that the cultivation of grasses are

successful in forest lands and a target of about 250 to 400 quintals of green biomass can be achieved per hectare per annum. Hybrid Napier grasses are successfully cultivated under pine forest, bunds and risers of agricultural land. Other high productive grasses are Setaria, Guinea, Anjan, Rye, Fescue, Cocksfoot and Brome etc. Some legume fodders such as White Clover, Red Clover, Persian Clover, Perennial Lucerne, Stylo, Centro, Desmanthus, Desmodium and Indigo etc. are being successfully cultivated in the forest land under pines and other trees. Status of green grass production and expected increase in grass yield by adopting improved package of practices in the state are given in the table -6c and 6d as below:

Table - 6c

Status of green grass production in the state

S. No.	Sources	Area	Production	Percentage
1	Non culturable & fallow land	3.39 lakh ha.	7.62 lakh mt.	14.08
2	Permanent pasture	1.51 lakh ha.	2.63 lakh mt.	4.86
3	Alpine meadows	1.76 lakh ha.	5.05 lakh mt.	9.34
4	Agricultural land	1.99 lakh ha.	2.31 lakh mt.	4.26
5	Forest land	19.91 lakh ha.	34.45 lakh mt.	63.68
6	Orchards	0.98 lakh ha.	2.04 lakh mt.	3.78
Total		29.54 lakh ha.	54.10 lakh mt.	100

Table - 6d

Expected increase in grass production by adopting improved package of practices in the state

1	Forest sector	Area under grasses	-	19.91 lakh ha.	56.92 %
		Average production	-	1.73 mt. green grasses per ha.	
		Anticipated increase in grass production	-	3.47 mt. more green per ha.	200.58 %
		Cultivable grasses in the forests	-	Hybrid Napier, Guinea, Setaria, Tall fescue, Rye, Brome, Cocksfoot etc.	
		Cultivable legumes in the forests	-	Stylo, Centro, Desmodium , Alfalfa, Clovers etc.	

2	Nonculturable fallow, abandoned agri. land & wastelands	Area under grasses	-	3.39 lakh ha.	52.31%
		Average production	-	2.24 mt. per ha.	
		Anticipated increase	-	3.26 mt. more green grass per ha.	145.53%
3	Permanent pasture	Area under grasses	-	1.51 lakh ha.	70.56%
		Average production	-	1.74 mt. per ha.	
		Anticipated increase	-	3.26 mt. more green grass per ha.	187.35%
4	Agricultural sector	Area under grasses	-	1.99 lakh ha.	40.53%
		Average production	-	1.16 mt. per ha.	
		Anticipated increase	-	1.84 mt. more green grass per ha.	158.62%
5	Orchard sector	Area under grasses	-	0.98 lakh ha.	48.27%
		Average production	-	2.08 mt. per ha.	
		Anticipated increase	-	1.92 mt. more green grass	92.31%
6	Alpine grasslands	Area under grasses	-	1.76 lakh ha.	100%
		Average production	-	2.08 mt. per ha.	
		Anticipated increase	-	2.13 mt. more green biomass per ha.	74.22%

Role of Van Panchayats in grassland development

Historical background of Van Panchayat

The British rule in Uttarakhand was promulgated during the year 1815 in Kumaon and Garhwal region. During the year 1822, the fourth land settlement was carried out by the Kumaon commissioner, Mr. Trail, under which village boundaries and rights for the fuel wood and animal grazing were established and this type of land was mentioned as civil soyam and gochar (grazing land). This land settlement was known as eightieth settlement due to its promulgation in the Vikrami Samvat year 1880 and it is still popular as *Aassishala Vandovast* among the people of Kumaon and Garhwal.

Indian Forest act was promulgated by the British rulers in the year 1865 to have a check on the destruction of Forests and the forests were classified in to the form of protected and reserved forests. Management of the protected and reserved forests were entrusted to the Kumaon commissioner and the department of forests respectively. In the year 1878, 1893 and 1919, the areas under reserved forests were increased many-folds, which resulted in mass dissatisfaction among the local people and the first forest movement was erupted against the British empire.

The present scenario of the Van Panchayats in Uttarakhand

After the emergence of Uttarakhand State in the year 2000, 11 hilly districts namely Nainital, Almora, Bageshwar, Pithoragarh, Champawat, Dehradun, Tehri, Uttarkashi, Pauri garhwal, Rudraprayag and Chamoli, are covered under the Van Panchayat Act 2003. The Total number of revenue villages in 11 hilly districts are 13,729 and the area of civil soyam forests in these villages was 10,47,867 hectares. Till today, more than 13 thousand Van Panchayats covering more than 5 lakh hectares of land are constituted so far. In the second phase the extension of already constituted Van panchayat would be taken up by adding more civil soyam forest land. In this way the state targets to provide every revenue village with their own village forest would be fulfilled in near future.

Measures to increase fodder leaves production

Contribution of the tree leaves in fodder supply of the state is 27.67 %. The green biomass produced from fodder trees, bushes and herbaceous plants is 39.61 lakh mt. per annum. Various sources of fodder leaves supply in state are as under :

1. Forest sector

The total area under various type of forests such as reserved forest, Van Panchayat, Civil Soyam forest, Cantt. Forest and private forest is 34.98 lakh hectare. Pine is the dominant species in almost all type of forests up to 1800 metre altitude. Among fodder trees, *only Banj, phalyat, Moru, Kharsu and Pharbanj* are forming pure forest. Other fodder trees are growing as mixed species in *Sal, Pine, Banj, Pharbanj, Moru, Kharsu, Burans and Bhoj* Forests. Certain popular fodder tree species such as *Bhimal, Kharik, Quairal, Bitain, Robinia, Timla, Thelka and mulberry* etc. prefers agroclimatic conditions (annexure-4). These tree species generally do not grow well in forest area.

The fodder trees are found only in 10.33 lakh hectare area (29.53 %) of forest. The trees having age of 10 to 75 yrs. are lopped for fodder leaves. The average production of fodder leaves is only 3.83 mt. per hectare. About 39.61 lakh mt. green leaves are procured from forest sector. To increase the biomass yield from forest as fodder, the tree density of fodder trees in all the forests should be at least 250 per hectare and it should be 50% of the total tree population. There is need to educate and motivate villagers to follow the scientific system of lopping. Districtwise production of fodder leaves has been given in the table - 5a.

2. Bushes and Herbaceous plants

There are more than 300 species of bushes and herbaceous plants growing in 37.85 lakh hectare of land in the state. Among them about 40 species of bushes and 65 species of herbaceous plants are enumerated as popular fodder species (annexure- 5 and 6). Bushes are generally lopped ruthlessly for fuel as well as for fodder. Certain bushes are uprooted for their medicinal values. Bushes and herbaceous plants needs only protection and not replantation as they are easily propagated naturally through the birds in very short time. Artificial propagation of bushes and herbs are not required.

3. Agricultural and Horticultural Sector

There are certain popular fodder trees are propagated in Agricultural land and orchards. Among these trees, *Bhimal, Kharik, Thelka, Timla, Bitain, Quairal, Mulberry and Chanchari* etc. are grown extensively in agriculture fields and orchards. About 4.05 lakh mt. fodder leaves produced per annum. To increase the biomass from trees, farmers should be provided with saplings of popular fodder trees and should be given some incentive also. Measures to increase fodder leaves production, sources and expected increase in fodder leaves in the state is given in the table 7a and 7b as below

Table -7a

Expected possible increase in fodder leaves production in the state

S.No.	Production sources	Expected increase in area	Expected yield per hect.	Expected leaves production	Production Percentage
1	Forest Sector	01.50 lakh ha.	8.5 mt. per ha.	12.75 lakh mt.	66.06
2	Agricultural Sector	0.75 lakh ha.	2.25 mt. per ha.	1.68 lakh mt.	8.72
3	Orchards	0.35 lakh ha.	3.75 mt. per ha.	1.31 lakh mt.	6.78
4	Bushes and perennial Herbs	4.75 lakh ha.	0.75 mt. per ha.	3.56 lakh mt.	18.44
Total		7.35 lakh ha.	Av. Yield 3.81 mt. per ha.	19.30 lakh mt.	100

Table -7b**Fodder Leaves Production Sources**

S. No.	Leaves production sources	No. of species	Local Name of species
1	Recognized Fodder Trees	15	Bhimal, Kharik, Timala, Shahtut, Quairal, Thelka, Paiyya, Bitain, Banj, Phalyat, Moru, Kharsu, Manipuri Banj, Kadwi, Chanchari (Annexure -4).
2	Recognized Fodder Bushes	15	Jamila, Kilmora, Pilkhan, Beduli, Puli, Ghingharu, Bhekal, Hinsalu, Titmuia, Kunja, Janu, Dadvia, Ringal, Ningal, Dhurkunja (Annexure -5).
3	Recognized perennial Herbs	12	Jhirna, Kokali, Khadkhadi, Chamalii, Boner, Dudila, Kandali, Sakina, Padheda, Phirma, Sirala, Sugandhbala. (Annexure -6).

Measures :

1. *To increase area under fodder trees.*
2. *To increase density of fodder trees in the forest area.*

Measures to enhance the utility of Roughages**Compact Feed Block / complete Feed System**

A novel feeding system has been evolved in last two decades known as complete feed. Complete feed is a system of feeding concentrate and roughages together in blended form and except water all dietary essentials are supplied through it. Complete feed system has advantages against conventional system of feeding by reduced labour cost, maintenance of uniform roughage and concentrate ratio, uniform feed intake favouring uniform supply of nutrients and maintenance of rumen environment. This system of feeding is well suited to hilly states like Uttarakhand.

Compact feed system help utilizing locally available crop residues, agro-industrial byproducts and non conventional feeds. Minimizing feed cost and labour cost and maximizing production is the need of time and can be achieved by complete feed system. This system is economical and efficient as it allows inclusion of low cost agro-industrial by-products and low quality crop residues with their efficient utilization. Complete feed supplies are readymade balanced ration for ruminants for the benefit of landless labourers, small and marginal farmers.

Complete Feed Blocks (CFB) are found to be very nutritious, easily digestible, handy to transport in remote areas of the hills and require comparatively lesser space for storage. The CFB are made of proportionate mixture of wheat straw, paddy straw, wheat bran, rice bran, mustard and ground nut cakes, one percent urea, 10% molasses, minerals and common salts. The CFB should be standardized so that it may contain 13% protein and 50-55% total digestible nutrients (TDN). The common formulation of standard CFB should be as follows:

- | | | |
|--|---|------|
| 1- Wheat straw / Cellulosic waste | - | 60 % |
| 2- Concentrate feed & Minerals mixture | - | 30% |
| 3- Molasses | - | 10% |

Urea-Molasses- Mineral Lick Blocks (UMMB)

As the name suggests, these are lick blocks containing urea, molasses, vitamins, minerals and other multi-nutrients. The licking of blocks by the animals is a convenient and inexpensive methods of providing a range of nutrients required by both the rumen microbes and the animal, which may be deficient in the diet. The main justification for using the blocks depends on their convenience for packaging, storage, transport and ease of feeding.

The ingredients are designed to provide wide range of nutrients to cover all potential deficiencies. The molasses being a concentrated plant juice will provide a range of trace minerals and a complete mixture of vitamins. Cereal brans are high in phosphorus, trace minerals and vitamins. In addition they provide a slow release aminoacid source from the relatively insoluble proteins to the microbes. Oilseed meals are a good source of phosphorus and soluble and insoluble proteins.

Bone meal, salt and lime or cement will provide much of the macro mineral requirements. Urea provides the small amount of extra nitrogen required, for utilization of the dry matter, in addition to that present in the forage. The multi-nutrient block, therefore, provides the nutrient requirement of both the microbes and the host animal. An adult animal should be allowed to lick approximately 100 to 150 gms. per day, hence an UMMB weighing 2.5 kg. will suffice for 15 to 20 days.

It is a safe and effective method of feeding and contains by-pass protein for improved animal performance. UMMB is very cost effective animal feed. Normal composition of UMMB is as follows :

- | | | |
|-------------|---|-----|
| 1- Molasses | - | 40% |
| 2- Urea | - | 10% |

3- Bran (Wheat/Rice)	-	20%
4- Cakes	-	13%
5- Mineral	-	2%
6- Salt	-	5%
7- Cement/Slaked lime (binder)	-	10%

Enrichment of straws/cellulosic waste

Maximum number of cattle heads in Uttarakhand are on grazing and are not stall fed. This leads to consumption of very poor quality crop residues, paper, pulp, leftovers and even inconsumable goods which ultimately leads to improper production status. During winters and summers , the animals are solely reared on straws, stovers and dry grasses which are deficient in digestible protein and T.D.N. Thus, it is a need of time to enhance the nutritive value of currently available dry fodder, straws and dry grasses. Urea enrichment is a major source of protein supplementation. Urea can replace one-fourth to one-third of total protein on nitrogen basis. It can be used as source of protein at 7 to 8 % level of protein in dry foddors. Straws and other cullulosic wastes can be treated with 4% of urea.

The procedure to enrich/treat the straws and other dry fodder is very simple. Even the rural ladies and illiterate farmers can follow up the procedure after getting educated a little.

For small farmers, 100 kg. of straw can be treated as the procedure laid down as under:

a. Straws / Cellulosic waste	-	100 kg.
b. Urea (fertilizer grade)	-	04 kg.
c. Molasses / Jaggery	-	01 kg.
d. Common salt	-	01 kg.
e. Water	-	40 litres

Urea, Jaggery and common salts are dissolved in 40 litres of water using a trough or bucket. Straws/cellulosic waste are spread over the pucca floor/ tripoline/ gunny bags patti and urea solution is sprinkled over the straws through Hazara/Mugs. It should be kept in mind that entire straw is well soaked with the solution. Urea treated straw should be well covered with polythene sheets or with any air tight covering material so that the ammonia gas produced during curing period may not released. It

takes about 25 to 30 days for perfect blending and curing. Urea treated forage can be fed to every type of ruminant except the calves below 6 to 10 months of age. The quantity to be fed every day should be 2 to 5 kgs. Measures to increase the utility of dry fodder and cellulosic wastes and other measures to increase fodder production and to enhance their utility is given in the Table – 8a and 8 b.

Table - 8a

Measures to enhance the nutritive value of dry fodder and cellulosic wastes

S.No.	Products	Composition	Percentage
1	Compact Feed Block Formation (05 kg. each block)	straw concentrate, mineral mixtures and vitamins molasses.	60 30 10
2	Urea-Molasses-Mineral Bricks (2.5 kg. each block)	molasses urea (fertilizer grade) rice/wheat Bran oil cakes minerals common salt binder (<i>Cement & Slaked lime</i>)	40 10 20 13 02 05 10
3	Urea treatment of dry cellulosic wastes (straw, stovers, grasses etc.)	urea (fertilizer grade) molasses/Jaggery common salt liters of water	04 01 01 40
4	Silage from green fodder	fodder crops and grasses	
5	Grass Hay	from wild and cultivated grasses	

Table - 8b

Other Measures to increase fodder production

1	Grass farming in Van Panchayat area.
2	Minikit distribution of seasonal Fodder Seeds.
3	Minikit distribution of Grass & Legume seeds.
4	Scientific grazing system in the pastures & grasslands
5	Fodder Banks in remote areas.

Summary

1. On the basis of livestock census -2003, annual requirement of green and dry fodder for 48.87 lakh heads of cattle, buffalo, sheep, goat and equines is 197.40 lakh mt. and 54.31 lakh mt. respectively. The total requirement of green and dry fodder is 251.71 lakh mt. per annum in the state of Uttarakhand.
2. Production estimates of green and dry fodder from all the sources in the state is 105.12 lakh mt. and 38.02 lakh mt. respectively. Total availability of green and dry fodder is 143.14 lakh mt. per annum.
3. Uttarakhand state is in deficit of 92.28 lakh mt. green and 16.29 lakh mt. of dry fodder, a total of 108.57 lakh mt. per annum which is 43.13 percent.
4. There are 3 main supply sources of green and dry fodder in the state namely Agricultural sector, grasses and fodder tree leaves. From these supply/production sources, green and dry fodder are produced to the tune of 66.57 lakh mt. (46.51%), 36.96 lakh mt. (25.82%) and 39.61 lakh mt. (27.67%) respectively.
5. To minimize the fodder deficiency in the state, following measures should be adopted :
 - To impose ban on supply of straw of wheat and paddy to paper and pulp industries.
 - To procure stalks and other crop residues left over in the field after harvesting the crop through combines.
 - To check on the burning of wheat and paddy stalks in field in hilly areas.
 - Enrichment of straws/ cellulosic wastes through urea.
 - Compact feed block from wheat and paddy straw, concentrate & molasses.
 - Urea- Molasses- Mineral lick blocks from cakes, brans, molasses, minerals, salts and binders.
 - Chopping of green and dry fodder before feeding to animals in hilly areas.
 - Using of feeding troughs, Baskets or mangers in hilly areas.
 - Grazing of animals in lower pastures and alpine grasslands should be regulated according to the carrying capacity of the land.
 - Scientific grazing systems should be adopted on grazing lands and alpine grasslands.
 - Number of popular fodder trees in all type of forests such as reserved, Van Panchayats and civil soyam should be kept at least 50% of the total tree planted.
 - Bushes and herbaceous plants should be given well protection in their ecosystem.
 - Farmers should be motivated for scientific lopping system in the forests.
 - Green and dry fodder should be conserved as Silage and Hay respectively.
 - Grass farming in Van Panchayat and reserved forests.
 - Establishment of Fodder Banks in remote hilly areas.

Important fodder grasses in Himalayan Region growing in the ecosystem of forests, pastures and agricultural sector in Uttarakhand

S. No.	Scientific name	Native name	Crude protein (percentage)	Organic matter digestibility (percentage)
1	<i>Andropogon lividus</i>	नीलाभ घास	7.84	71.2
2	<i>Andropogon longipes</i>	दीर्घपादी घास	7.39	72.6
3	<i>Apluda mutica</i>	भंजूरा घास	6.43	65.7
4	<i>Apocopis paleacea</i>	असंकुल घास	5.27	61.8
5	<i>Agrostis stolonifera</i>	देहांकुरी घास	6.1	67.7
6	<i>Alopecurus nepalensis</i>	जम्बुक घास	5.8	63.4
7	<i>Aristida royleana</i>	रज्जुक घास	5.5	59.7
8	<i>Arthraxon lancifolius</i>	कुंतवर्णी घास	4.64	57.7
9	<i>Bothriochloa pertusa</i>	जरगी घास	7.68	70.8
10	<i>Brachiaria brizantha</i>	गमनी घास	6.5	68.5
11	<i>Capillipedim assimile</i>	स्वांगी घास	6.42	64.2
12	<i>Chrysopogon fulvus</i>	गोड़िया घास	8.54	74.8
13	<i>Chrysopogon gryllus</i>	लमगुच्छी घास	6.39	68.5
14	<i>Cymbopogon distans</i>	दुरग्राही घास	4.67	54.7
15	<i>Cymbopogon pendulus</i>	लोलक घास	5.17	57.3
16	<i>Cenchrus ciliaris</i>	अंजन घास	7.6	75.8
17	<i>Cenchrus setigerus</i>	धामन घास	7.3	74.6
18	<i>Coix lacryma-jobi</i>	हलवा घास	5.3	62.2
19	<i>Dichanthium annulatum</i>	अपंग घास	7.54	69.6
20	<i>Dichanthium caricosum</i>	मारबल घास	7.27	68.8
21	<i>Dimeria ornithopoda</i>	तन्तुरी घास	5.83	60.4
22	<i>Digitaria adscendens</i>	पंगोला घास	7.6	74.8
23	<i>Deyeuxia simlensis</i>	शिमला घास	5.4	59.3
24	<i>Elyonurus royleanus</i>	सेवान घास	5.47	58.5
25	<i>Eremopogon foveolatus</i>	मरूधर घास	6.64	67.3
26	<i>Erianthus ravennae</i>	गधेरी घास	4.17	53.5
27	<i>Eulalia mollis</i>	लैला घास	5.92	63.3
28	<i>Eulaliopsis binata</i>	बैब घास	4.78	59.7
29	<i>Echinochloa colonum</i>	वनझिंगरा घास	6.2	67.6
30	<i>Eriochloa procera</i>	हरित घास	6.5	69.2
31	<i>Eragrostis curvula</i>	लव घास	5.9	68.3
32	<i>Heteropogon contortus</i>	कुमरिया घास	6.26	57.4
33	<i>Imperata cylindrica</i>	सीरू घास	4.38	52.7
34	<i>Ischaemum duthiei</i>	रोधी घास	5.37	60.9
35	<i>Iseilema laxum</i>	मासल घास	6.56	89.2
36	<i>Microstegium ciliatum</i>	सच्छद घास	5.68	62.4
37	<i>Miscanthus nepalensis</i>	फेयरी घास	5.32	61.7

38	<i>Muhlenbergia duthieana</i>	मुहली घास	5.8	60.8
39	<i>Narenga fallax</i>	सुवर्णी घास	4.31	52.5
40	<i>Ophiuros exaltatus</i>	समशिख घास	4.46	51.7
41	<i>Panicum antidotale</i>	नीलम घास	6.2	70.6
42	<i>Panicum coloratum</i>	वर्णद घास	6.4	71.3
43	<i>Panicum maximum</i>	गुणी घास	6.9	72.7
44	<i>Paspalum notatum</i>	बहिया घास	6.7	72.8
45	<i>Paspalum dilatatum</i>	डलिस घास	6.4	73.2
46	<i>Pennisetum clandestinum</i>	किकूयू घास	10.8	78.7
47	<i>Pennisetum orientale</i>	भिमल्सा घास	8.7	77.2
48	<i>Pennisetum purpureum</i>	नैपियर घास	5.9	63.5
49	<i>Phleum pratense</i>	टिमोथी घास	7.9	73.8
50	<i>Phragmites karka</i>	बाड़ घास	4.3	51.5
51	<i>Pogonatherum crinitum</i>	कोमलरोमी	5.62	60.4
52	<i>Saccharum bengalense</i>	मंजू घास	4.42	51.5
53	<i>Saccharum spontaneum</i>	कांस घास	4.18	50.7
54	<i>Sclerostachya fusca</i>	मेरुदंडी घास	5.9	58.7
55	<i>Sorghum halepense</i>	बरू घास	4.4	51.6
56	<i>Setaria glauca</i>	वनकौणि घास	5.8	68.7
57	<i>Setaria sphacelata</i>	सीता घास	6.9	72.6
58	<i>Themeda anathera</i>	प्रतीक घास	6.5	59.2
59	<i>Thysolaena maxima</i>	बुहारी घास	5.9	63.7
60	<i>Urochloa panicoides</i>	कलेजी घास	5.2	60.3
61	<i>Vetiveria zizanioides</i>	खस घास	4.2	50.7

**Important fodder grasses in the ecosystem of alpine grasslands
(Bugyal) in Uttarakhand**

S. No.	Scientific name	Native name	Crude protein (Percentage)	Organic matter digestibility (percentage)
1	<i>Agrostis munroana</i>	बक्री	8.64	66.8
2	<i>Agrostis myriantha</i>	बहुपरागी घास	7.54	68.5
3	<i>Agropyron canaliculatum</i>	नलकी घास	6.94	68.2
4	<i>Alopecurus aequalis</i>	जलजम्बुक घास	5.82	71.8
5	<i>Alopecurus arundinaceus</i>	टुलजम्बुक	7.79	62.7
6	<i>Alopecurus himalaicus</i>	हिमजम्बुक	8.37	59.6
7	<i>Andropogon tristis</i>	मंदवर्णी घास	6.18	70.6
8	<i>Brachypodium sylvaticum</i>	ननखुट घास	5.87	61.5
9	<i>Bromus himalaicus</i>	हिमानी	8.62	72.3
10	<i>Bromus inermis</i>	ब्रोम घास	7.94	75.2
11	<i>Bromus ramosus</i>	शाखी	6.86	74.8
12	<i>Bromus scoparius</i>	स्कोपर	6.94	73.6
13	<i>Calamagrostis epigejos</i>	भूपरिक घास	6.15	68.8
14	<i>Calamagrostis garhwalensis</i>	गढ़वा	6.16	62.8
15	<i>Dactylis glomerata</i>	गुच्छी घास	9.12	78.7
16	<i>Danthonia cachemyriana</i>	खड़	7.29	59.7
17	<i>Danthonia Jacquemontii</i>	मामुला घास	7.17	72.6
18	<i>Deschampsia caespitosa</i>	गुच्छित बुग्गी	4.82	62.3
19	<i>Deschampsia koelerioides</i>	कोलर	6.55	63.7
20	<i>Deschampsia nubigena</i>	नूबी	7.78	61.9
21	<i>Deyeuxia kashmeriana</i>	संहत बुग्गी	6.52	60.5
22	<i>Deyeuxia scabrescens</i>	रूक्ष घास	4.35	58.4
23	<i>Eragrostis nigra</i>	कौलालव घास	4.85	60.8
24	<i>Festuca ovina</i>	अनवाल घास	8.34	76.8
25	<i>Festuca pratensis</i>	मीडो फेस्क्यु	8.78	74.4
26	<i>Festuca rubra</i>	ललित	8.70	75.8
27	<i>Festuca valesiaca</i>	याक बुग्गी	8.55	76.7
28	<i>Glyceria tonglensis</i>	मधुरिम घास	4.86	57.8
29	<i>Helictotrichon pratense</i>	शाद्वल बुग्गी	3.75	61.9
30	<i>Helictotrichon virescens</i>	हरिताभ	8.83	64.5
31	<i>Hierochloe laxa</i>	गंधारी घास	5.45	51.6
32	<i>Hordeum leporinum</i>	बनजौ	8.18	79.2
33	<i>Koeleria argentic</i>	रजत	8.63	74.9
34	<i>Koeleria cristata</i>	किरीटी बुग्गी	8.16	72.6
35	<i>Lolium perenne</i>	बहुवर्षीराई	10.84	78.3
36	<i>Lolium temulentum</i>	मस्तानी बुग्गी	8.31	78.5
37	<i>Melica nutans</i>	नूतन	8.55	65.7
38	<i>Melica scaberrima</i>	स्काबर	8.37	62.6

39	<i>Miscanthus nudipes</i>	सुरम्या	6.42	63.7
40	<i>Muhlenbergia himalayensis</i>	हिमुली बुग्गी	5.78	62.9
41	<i>Oryzopsis munroii</i>	स्वर्णतुषी	6.68	66.8
42	<i>Oryzopsis wendelboi</i>	बरम	7.96	68.5
43	<i>Phalaris arundinacea</i>	रिबनघास	7.95	70.2
44	<i>Phleum alpinum</i>	शीर्ष बुग्गी	7.97	78.6
45	<i>Phleum himalaicum</i>	बलुआ	8.84	71.7
46	<i>Phleum pratense</i>	टिमोथी	8.98	78.9
47	<i>Poa alpina</i>	नीलाभ बुग्गी	8.35	84.8
48	<i>Poa angustifolia</i>	तनुपर्णी	7.85	71.8
49	<i>poa annua</i>	मौसमी पोआ	7.97	78.7
50	<i>Poa bulbosa</i>	बीबीपार	7.87	76.2
51	<i>Poa falconeri</i>	अमरनाथी	7.92	74.6
52	<i>Poa infirma</i>	दुर्गमी	6.37	72.8
53	<i>Poa nemoralis</i>	वणपोआ	7.94	73.6
54	<i>Poa pratensis</i>	नीलिमा घास	8.14	79.5
55	<i>Poa stapfiana</i>	स्टाफी	7.76	79.4
56	<i>Polypogon fugax</i>	आशुपाती घास	5.82	60.5
57	<i>Puccinellia himalaica</i>	रूपशी	7.83	71.9
58	<i>Puccinellia kashmiriana</i>	कामरी	7.92	72.5
59	<i>Puccinellia minuta</i>	कोमलिया	8.18	74.3
60	<i>Secale cereale</i>	अन्नारार्ई	8.82	78.7
61	<i>Stipa concinna</i>	शुभ्रा बुग्गी	6.37	62.4
62	<i>Stipa copensis</i>	कपीना	6.55	60.6
63	<i>Trisetum aeneum</i>	सोनाली	7.98	76.7
64	<i>Trisetum clarkei</i>	भूरिया	7.85	70.3
65	<i>Trisetum micans</i>	जइया घास	6.17	74.5
66	<i>Trisetum spicatum</i>	कणिशधर	8.18	72.8

**Important grazable herbs in ecosystem of alpine grassland (Bugyal)
in Uttarakhand**

S. No.	Scientific name	Plant Family	Native name	Crude protein (Percentage)	Organic matter digestibility (Percentage)
1	<i>Achillea atrata</i>	Asteraceae	कौला बुग्गी	8.49	75.7
2	<i>Androsace lanuginosa</i>	Primulaceae	दूध बुग्गी	6.32	62.8
3	<i>Arabis perfoliata</i>	Cruciferae	लाही बुग्गी	7.73	74.6
4	<i>Arenaria serpyllifolia</i>	Caryophyllaceae	सैन्ड बुग्गी	6.39	64.3
5	<i>Aster alpinus</i>	Asteraceae	ऐस्टर बुग्गी	6.87	68.7
6	<i>Astragalus alpinus</i>	Fabaceae	मसुड़िया बुग्गी	15.83	68.4
7	<i>Crepis aurea</i>	Asteraceae	सोन बुग्गी	7.62	69.7
8	<i>Capsella pastoris</i>	Cruciferae	अनवाल खल्दी	7.49	60.7
9	<i>Carex vulgaris</i>	Cyperaceae	सैज	4.96	52.8
10	<i>Cerastium alpinum</i>	Caryophyllaceae	सींग बुग्गी	7.53	74.9
11	<i>Circae alpina</i>	Onagraceae	जदुई बुग्गी	6.13	75.5
12	<i>Calamintha alpina</i>	Labiatae	सुगन्ध बूटी	6.24	75.5
13	<i>Campanula barbata</i>	Campanulaceae	रोमिल घंटी	7.58	70.4
14	<i>Cyperus niveus</i>	Cyperaceae	बुग्याली मोथा	4.22	51.9
15	<i>Dianthus alpinus</i>	Caryophyllaceae	देव बूटी	5.84	46.6
16	<i>Draba aizoides</i>	Cruciferae	सदाबहार बुग्गी	6.22	60.7
17	<i>Epilobium roylaenum</i>	Onagraceae	गुलाबी बूटी	5.49	61.8
18	<i>Erysimum hieracifolium</i>	Cruciferae	फली बूटी	6.93	68.5
19	<i>Fragaria vesca</i>	Rosaceae	जंगली स्ट्रोवरी	6.16	54.8
20	<i>Gypsophila repens</i>	Caryophyllaceae	प्लास्टर बूटी	5.48	48.5
21	<i>Hieracium vulgatum</i>	Asteraceae	श्येन बूटी	8.68	76.8
22	<i>Hippocrepis comosa</i>	Fabaceae	नील क्लोवर	14.96	64.5
22	<i>Ligusticum mutellina</i>	Umbelliferae	धनिया बुग्गी	7.48	76.8
23	<i>Linaria alpina</i>	Scrophulariaceae	पटसन बुग्गी	6.82	76.7
24	<i>Plantago major</i>	Plantaginaceae	बड़कदली	9.21	75.7
25	<i>Lotus corniculatus</i>	Fabaceae	श्रृंग क्लोवर	15.79	70.8
25	<i>Polygala crotalarioides</i>	Polygalaceae	क्रास पुष्पी	6.73	79.9
26	<i>Polygonum viviparum</i>	Polygalaceae	गांठ कन्दी	5.18	58.4
27	<i>Primula denticulata</i>	Primulaceae	प्रथम पुष्पी	7.86	68.5
28	<i>Taraxacum officinale</i>	Asteraceae	सिंहदन्ती	8.47	74.6
31	<i>Trifolium pratense</i>	Fabaceae	लाल क्लोवर	16.62	67.2
32	<i>Trifolium repens</i>	Fabaceae	श्वेत क्लोवर	15.87	68.4
33	<i>Veronica biloba</i>	Scrophulariaceae	पत्थरभेट	6.25	62.8

Important Fodder Trees of hilly regions in Uttarakhand

S. No.	Scientific name	Plant Family	Native name	Curde protein (Percentage)	Organic matter digestibility (Percentage)
1	<i>Ailanthus excelsa</i>	<i>Simarubaceae</i>	अरदू	10.26	68.2
2	<i>Albizzia lebbek</i>	<i>Mimosaceae</i>	सिरिस	19.72	64.6
3	<i>Acacia mollissima</i>	<i>Mimosaceae</i>	अकैशिया	16.82	65.2
4	<i>Acer oblongum</i>	<i>Aceraceae</i>	पुतली	10.88	72.2
5	<i>Acer caesium</i>	<i>Aceraceae</i>	कमिआ	10.74	61.3
6	<i>Acer caudatum</i>	<i>Aceraceae</i>	कांजुला	10.18	60.6
7	<i>Aesculus indica</i>	<i>Sapindaceae</i>	पांगर	9.84	54.6
8	<i>Alnus nepalensis</i>	<i>Betulaceae</i>	उतीस	10.18	56.4
9	<i>Bauhinia variegata</i>	<i>Caesalpiniaceae</i>	क्वैराल	16.35	61.8
10	<i>Boehmeria rugulosa</i>	<i>Urticaceae</i>	गेठी	11.66	60.6
11	<i>Betula alnoides</i>	<i>Betulaceae</i>	सौड़	9.39	54.2
12	<i>Buxus wallichiana</i>	<i>Euphorbiaceae</i>	पपड़ी	7.86	49.6
13	<i>Crataeva nurvala</i>	<i>Capparidaceae</i>	बरना	11.48	43.8
14	<i>Castanopsis tribuloides</i>	<i>Fagaceae</i>	कटौज	10.86	59.6
15	<i>Celtis australis</i>	<i>Ulmaceae</i>	खड़िक	15.26	62.4
16	<i>Cordia dichotoma</i>	<i>Boraginaceae</i>	लिसोड़ा	15.96	62.7
17	<i>Cornus capitata</i>	<i>Salicaceae</i>	भमोर	8.35	47.8
18	<i>Cornus macrophylla</i>	<i>Cornaceae</i>	खगसा	10.24	57.8
19	<i>Carpinus viminea</i>	<i>Betulaceae</i>	चमखड़िक	10.78	53.8
20	<i>Corylus colurna</i>	<i>Betulaceae</i>	कबसी	10.84	53.4
21	<i>Diploknema butyracea</i>	<i>Sapotaceae</i>	च्यूरा	9.58	72.8
22	<i>Ehretia laevis</i>	<i>Boraginaceae</i>	चमरोड़	12.65	56.7
23	<i>Euonymus lacerus</i>	<i>Celastraceae</i>	पिन्ना	9.37	56.7
24	<i>Flacourtia indica</i>	<i>Flacourtiaceae</i>	कटई	14.26	56.8
25	<i>Ficus palmata</i>	<i>Moraceae</i>	बेडू	11.96	68.3
26	<i>Ficus roxburghii</i>	<i>Moraceae</i>	तिमला	12.74	66.2
27	<i>Ficus nemoralis</i>	<i>Moraceae</i>	दुधिला	12.46	72.8
28	<i>Fraxinus micratha</i>	<i>Oleaceae</i>	अंगू	9.64	56.4

29	<i>Grewia optiva</i>	<i>Tiliaceae</i>	भिमल	18.84	77.2
30	<i>Holoptelia integrifolia</i>	<i>Ulmaceae</i>	पपड़ी	12.26	48.7
31	<i>IIIex dipyrina</i>	<i>IIIicineae</i>	कन्देल	11.86	65.8
32	<i>Lagerstroemia parviflora</i>	<i>Lythraceae</i>	धौरा	9.37	50.4
33	<i>Leucaena leucocephala</i>	<i>Mimosaceae</i>	सूबबूल	19.82	66.5
34	<i>Litsea umbroja</i>	<i>Lauraceae</i>	बैलरा	8.92	54.3
35	<i>Machilus odoratissima</i>	<i>Lauraceae</i>	कौला	11.65	54.6
36	<i>Melia azedarach</i>	<i>Miliaceae</i>	वितैण	13.27	72.8
37	<i>Machilus duthei</i>	<i>Lauraceae</i>	काले	9.97	57.6
38	<i>Morus alba</i>	<i>Moraceae</i>	शहतूत	16.32	66.5
39	<i>Morus serrata</i>	<i>Moraceae</i>	कीमू	15.63	68.9
40	<i>Prunus cerasoides</i>	<i>Rosaceae</i>	पदम	12.18	62.1
41	<i>Pyrus pashia</i>	<i>Rosaceae</i>	मेहल	10.68	54.6
42	<i>Prunus cornuta</i>	<i>Rosaceae</i>	जामन	12.68	62.9
43	<i>Quercus glauca</i>	<i>Fagaceae</i>	फल्यांट	10.24	52.6
44	<i>Quercus leucotrichophora</i>	<i>Fagaceae</i>	बांज	11.56	68.7
45	<i>Quereus lanata</i>	<i>Fagaceae</i>	रांज	10.37	68.7
46	<i>Quereus dilatata</i>	<i>Fagaceae</i>	मोरू	10.28	70.8
47	<i>Quercus semicarpifolia</i>	<i>Fagaceae</i>	खरसू	10.68	69.4
48	<i>Robinia pseudoacacea</i>	<i>Papilionaceae</i>	रोविनिया	21.64	68.5
49	<i>Salix tetrasperma</i>	<i>Salicaceae</i>	बैस	13.82	64.4
50	<i>Salix wallichiana</i>	<i>Salicaceae</i>	गधवैस	11.86	61.7
51	<i>Symplocos crataegoides</i>	<i>Styraceae</i>	लोघ	9.56	56.4
52	<i>Stranvaesia nussia</i>	<i>Rosaceae</i>	गढ़मेहल	12.74	69.2
53	<i>Ulmus wallichiana</i>	<i>Ulmaceae</i>	चमड़मोवा	11.83	66.8

Annexure -5

Important fodder bushes in hilly regions of Uttarakhand

S.No	Scientific name	Plant Family	Native name	Crude protein (Percentage)	Organic matter digestibility (Percentage)
1	<i>Aechmanthera tomentosa</i>	<i>Aecanthaceae</i>	जमिला	10.85	60.5
2	<i>Bauhinia vahlii</i>	<i>Caesalpiniaceae</i>	मालू	16.44	59.7
3	<i>Berberis aristata</i>	<i>Berberidaceae</i>	किलमोड़ा	11.86	63.5
4	<i>Buddleia paniculata</i>	<i>Loganiaceae</i>	फुरपत्तिया	10.92	61.4
5	<i>Carissa spinarum</i>	<i>Apocynaceae</i>	करौदा	10.73	64.8
6	<i>Callicarpa macrophylla</i>	<i>Verbenaceae</i>	दैया	9.86	75.3
7	<i>Crataegus crenulata</i>	<i>Rosaceae</i>	धिंंगारू	12.26	69.7
8	<i>Debregeasia velutina</i>	<i>Urticaceae</i>	तुशियारी	11.58	58.8
9	<i>Deutzia staminea</i>	<i>Saxifragaceae</i>	गुर्तों	8.35	53.9
10	<i>Ficus infectoria</i>	<i>Moraceae</i>	पिलखान	12.84	66.2
11	<i>Ficus foveolata</i>	<i>Moraceae</i>	बेडुली	11.63	64.6
12	<i>Flemingia fruticulosa</i>	<i>Papilionaceae</i>	भटुला	17.12	63.7
13	<i>Hypericum cernuum</i>	<i>Hypericaceae</i>	प्युली	10.64	56.9
14	<i>Meliosma pungens</i>	<i>Sabiaceae</i>	ग्वेब	8.62	54.4
15	<i>Princepia utilis</i>	<i>Rosaceae</i>	भेकल	11.63	72.4
16	<i>Rhus cotinus</i>	<i>Anacardiaceae</i>	जलतुंगा	11.85	66.8
17	<i>Reinwardtia tirgyna</i>	<i>Linaceae</i>	पियुली	12.64	60.9
18	<i>Rubs ellipticus</i>	<i>Rosaceae</i>	हिन्सालू	13.25	66.8
19	<i>Ribes glaciale</i>	<i>Glossulariaceae</i>	दड़विया	10.82	66.9
20	<i>Rosa macrophylla</i>	<i>Rosaceae</i>	कुन्जा	12.27	72.4
21	<i>Strobilanthes glutinosus</i>	<i>Acanthaceae</i>	लोलार	12.65	71.4
22	<i>Strobilanthes alatus</i>	<i>Acanthaceae</i>	जानू	13.87	72.8
23	<i>Viburnum cariaceum</i>	<i>Caprifoliaceae</i>	तितमुइया	13.04	72.5
24	<i>Vitis lanata</i>	<i>Vitaceae</i>	पुलैन	12.34	60.4

Annexure -6

Important herbaceous fodder in hilly regions of Uttarakhand

S. No	Scientific name	Plant Family	Native name	Crude protein (Percentage)	Organic matter digestibility (Percentage)
1	<i>Achyranthes aspera</i>	<i>Amarantaceae</i>	अपामार	8.86	61.8
2	<i>Asparagus curillus</i>	<i>Liliaceae</i>	झिरना	9.52	66.5
3	<i>Cassia laevigata</i>	<i>Caesalpinaceae</i>	तोर	16.86	65.4
4	<i>Cassia occidentalis</i>	<i>Caesalpinaceae</i>	बनाड़	16.32	67.5
5	<i>Caucalis anthriscus</i>	<i>Umbelliferae</i>	कोकली	8.37	60.6
6	<i>Crotalaria albida</i>	<i>Papilionaceae</i>	सनई	15.93	65.5
7	<i>Crotalaria prostrata</i>	<i>Papilionaceae</i>	खड़खड़ी	16.26	64.7
8	<i>Daphne cannabina</i>	<i>Thymelaceae</i>	सतपूड़ा	9.25	53.5
9	<i>Desmodium gyrans</i>	<i>Papilionaceae</i>	चमलाई	16.28	62.9
10	<i>Desmodium polycarpum</i>	<i>Papilionaceae</i>	बोनेर	16.64	65.5
11	<i>Dicliptera bupleuroides</i>	<i>Acanthaceae</i>	बंदपाखी	8.18	54.5
12	<i>Excaecaria acerifolia</i>	<i>Euphorbiaceae</i>	दुदिला	12.78	68.7
13	<i>Ephedra gerardiana</i>	<i>Gnetaceae</i>	सोमलता	9.89	52.9
14	<i>Girardinia heterophylla</i>	<i>Urticaceae</i>	शिशुण	11.66	63.6
15	<i>Heracleum canescens</i>	<i>Umbelliferae</i>	हरकूल	12.42	60.2
16	<i>Indigofera Cylindracea</i>	<i>Papilionaceae</i>	सकीना	16.67	68.4
17	<i>Indigofera gerardina</i>	<i>Papilionaceae</i>	नीलम	15.92	67.6
18	<i>Indigofera pulchella</i>	<i>Papilionaceae</i>	नीलमा	16.23	70.2
19	<i>Justicia simplex</i>	<i>Acanthaceae</i>	जस्टिस	10.76	53.8
20	<i>Leptodermis lanceolata</i>	<i>Rubiaceae</i>	पधेड़ा	9.81	56.5
21	<i>Phryma leptostachya</i>	<i>Vervencaceae</i>	फिरमा	8.45	57.7
22	<i>Pueraria tuberosa</i>	<i>Papilionaceae</i>	सिराला	16.87	59.2
23	<i>Siegesbeckia orientalis</i>	<i>Asteraceae</i>	लीचाकूटा	9.38	51.9
24	<i>Urtica diocea</i>	<i>Urticaceae</i>	हाऊँ	11.96	68.7
25	<i>Urtica parviflora</i>	<i>Urticaceae</i>	कन्दली	12.52	67.3
26	<i>Valeriana hardwickii</i>	<i>Valerianaceae</i>	सुगन्धबाला	9.34	56.7
27	<i>Wikstroemia canescens</i>	<i>Thymelaceae</i>	चमलिया	10.65	52.8