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SEASONAL AND ATTITUDINAL VARIATION IN FORAGE NUTRITIONAL COMPOSITION OF RANGELANDS OF DOODHGANGA RANGE PIRPANCHAL FOREST DIVISION NORTH-WESTERN KASHMIR HIMALAYA

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SUMMARY

This experiment constitutes part of a two-year research study, which was undertaken in spring 2020. The aim of this experiment was to study the seasonal & altitudinal variation in chemical composition of the grazable material in Doodhganga rangelands of Pirpanchal forest division N-W Kashmir Himalaya. The effect of altitude chemical composition (crude protein (CP), ash, ether extracts (EE) and crude fiber (CF)) were studied in herbage samples harvested from various quadrates (1m×1m) placed in 3 different altitudes (from 2200 m to 2800 m in two different seasons. Multistage random sampling method was used to collect sample from the whole area. Sample collection was accomplished by cutting aboveground biomass at a height similar to that grazed by small ruminants. Almost all nutritional parameters are strongly affected by altitudinal gradient. All the parameters show strong (p<0.001) correlation with each other. The CP and ash content increases with increase in altitude, almost during the whole experimental period. On the contrary, CF content non significantly decreases in value as altitude increases. In order to better exploit the pastures of this area it is considered wise, towards the end of spring, to move the herds from pastures of lower altitude to those of higher altitude for the summer.

Key words: Variations, forage, doodhganga range, pirpanchal forest and nutritional composition

The rangeland/grasslands of India form distinct categories of their own and differ from one another in terms of origin, structure and composition. In India rangeland vegetation cover is spread nearly to 12.15 million ha of land area. Indian Himalaya occupies nearly 35% of the geographical area (Rawat, 1998; Nabi *et al.,* 2019). Locally Himalayan grasslands are known as Bahaks/Margs are our unique heritage in Jammu and Kashmir for their species-rich, taxonomically vast flora, ecological services which they provide and for their scenic beauty, thus represent an important ecosystem. Grassland area in Jammu, Kashmir and Ladakh region is 3.53%, 13.22% and 5.76% respectively of geographical area. Elevation wise, the vertical distribution of grasslands found highest between 1500-3000 m altitudes (6.72%) of geographical area (Singh *et al.,* 2018).

Rangelands are largely used for grazing livestock which in turn support human livelihoods with meat, milk, wool and leather products and employment. Besides that, Rangelands play an important role in biodiversity conservation, soil conservation, tourism and recreation, carbon storage, conservation of habitat. Rangelands are very significant to the economy of many countries and still afford about 70% of feed requirements of domestic ruminants and 95% of wild ruminants (Holechek *et al.,* 1995).

The most important objective in range management is animal production that is based on nutritional composition of accessible forages (Stoddart *et al.,* 1975). Ganskopp and Bohnert (2003) projected that wildlife or livestock expert must know the nutritive properties of forage species to maintain reproduction and growth of animals and assure the reasonable importance of grazing land. Quality of feed is defined as the sum of nutrients that animals can attain from a feed in minimum time (Walton, 1983). Understanding of widespread nutrient ratios in forages available to livestock will support in attaining their appropriate consumption, assist to determine nutrient deficiencies and propose supplementation requirements. In contrast, the chemical composition of plants and plant communities in rangelands varies according to species, soil type.

Nutritional evaluation of pastures is mostly related with the provision of protein, minerals and

energy. Generally, in chemical determination of plant materials; dry matter digestion and crude protein are mostly measured for the assessment of forage value (Rhodes and Sharrow, 1990; Arzani *et al.,*2001, 2004). Knowledge about vegetation of grazing lands and livestock grazing responses is vital to understand animal productivity and our skill to handle both plant and animal resources to optimize the production of grazing areas (Papachristou,1997).

MATERIALS AND METHODS

Study area

The present study on floristic composition was carried out by laying transects along altitudinal gradient in different compartments of Doodhganga Range, Pirpanchal forest division. The lower and subalpine pasture area up to 3100 m altitude of the Doodhganga range were divided into three altitudes and multistage random sampling was carried out in the given area with sampling intensity of 1.38%. In all the 18 sampling plots, blocks of 100 m × 40 m (4000 m^2) size were laid on all the nine sites of three altitudes. Average data of three sites per altitude is then obtained to represent data for the main site of an altitude.

Determination of nutrient status of selected palatable forage species of different sites

The samples of selected graze species (leaves, stems and flowers) were air dried under shade then pooled for ground using mill with 2 mm sieve for laboratory analysis. Ground samples were stored in plastic whirl-pack sample bags until put to use for further analysis. Plants were cut at 1cm above ground and then analyzed at Division of Food science & technology Faculty of Horticulture, SKUAST-Kashmir, Shalimar for nutrient analysis. Following observations were recorded as per the methods of AOAC (1990).

Crude protein

A known aliquant of the diluted sample will be distilled in the presence of 10 ml of 2% boric acid solution and titrated against standard 0.1% N H_2SO_4. The per cent of nitrogen is used for the estimation of CP.

Crude protein percentage = Nitrogen (%) × 6.25

$$\text{Where Nitrogen (\%)} = \frac{\text{ml of 0.1N } H_2SO_4 \text{ used in titration} \times 0.0014 \times \text{total volume of aliquot}}{\text{Volume of aliquot taken for distillation} \times \text{wt of sample}}$$

Ether extract

The ether extract in a species sample will be determined by extracting with diethyl ether at 60 °C in sox let's apparatus for 6-8 h.

$$\text{Ether extract (\%)} = \frac{\text{Weight of fat}}{\text{Weight of sample (g)}} \times 100$$

Wt. of fat= (Wt. of thimble + sample before extraction) - (wt. of thimble + sample after extraction).

Crude Fibre

The fat-free species sample will be reflexed first with 1.25% H_2SO_4 and subsequently with 1.25% NaOH for 30 min each to dissolve acid and alkali soluble component present in it. The residue containing crude fibre were dried to a constant weight and the dried residue will be ignited in muffle furnace at 600°C for 2 h, loss of weight on ignition will be calculated to express it as Crude fibre.

$$\text{Crude Fibre (\%)} = \frac{\text{Weight of crude fibre}}{\text{Weight of sample (g)}} \times 100$$

Where,

Wt. of crude fibre = Wt. of crucible with dry residue-Wt. of crucible with total ash

Total ash

Total ash is analyzed for expressing mineral matter in the sample. Species sample will be burned at 600°C for 2 h, all the organic matter will lose from the sample and the residue left after burning is known as total ash.

$$\text{Total Ash (\%)} = \frac{\text{Weight of ash}}{\text{Weight of sample (g)}} \times 100$$

Where, Wt. of ash = Wt. of crucible with ash - Wt. of empty crucible.

Nitrogen free-extract

It includes all soluble or easily digestible carbohydrates comprising pentose's, hexodes, disaccharides and the polysaccharides, dextrin's and starches.

NFE (%) = 100-(CP%+CF%+EE%+ash%).

Total organic matter

It is remaining portion of total ash (mineral matter) when subtracted from 100. It is calculated as:

OM (%) = CP%+EE%+CF%+NFE%
or
OM (%) = 100-Total ash

Total carbohydrates

The total carbohydrates in sample are expressed as crude fibre and NFE.

TC (%) = CF% + NFE%

RESULTS AND DISCUSSION

Determination of nutrient status of Dominant & palatable forage species of the different sites

Crude protein (%)

Crude protein (%) of most dominant and palatable herb/grass species during autum and summer season is presented in Table 13. Highest crude protein (%) in summer seson was recorded in *Trifolium repens* (4.55%) at A3 altitude (2800-3100 m) followed by *Trifolium pratense* (4.43%) at A2 altitude (2500-2800 m), *Fragaria vesca* (4.10%) at A2 altitude (2500-2800 m), *Plantago lanceolata* (4.09%) at A2 altitude (2500-2800 m) and *Trifolium repense* (4.00%) at A1 altitude (2200-2500 m). Lowest crude protein (%) in summer season was found in case of *Geum roylei* (2.91%). Similarly highest crude protein (%) in autumn season was recorded in *Trifolium pratense* (4.03%) at A3 altitude (2800-3100 m) and *Polygonum plebeium* (4.03%) at A2 (2200-2500 m) followed by *Plantago lanceolata* (5.71 %) at A3 altitude (2800-3100 m), *Plantago major* (3.87%) and *Trifolium repens* (3.87%) at A1 altitude (2200-2500 m).

Crude fibre (%)

Table 14 presents the Crude fibre (%) of herb/grass spp. at various site and seasons. Highest crude fibre in summer season was recorded in *Fragaria nabicola* (23.16) %) at A1 altitude (2200-2500 m) followed by *Cynodon dactylon* (22.32%) at same site 2200-2500 m), *Cynodon dactylon* (21.87%) at A3 altitude (2800-3100 m), *Poa pratense* (19.65%) at Haigen A1 altitude (2200-2500 m*), Alchemilla trolli* (*19.41%) at*A3 altitude (2800-3100 m).Highest crude fibre in autumn season was recorded highest in *Cynodon dactylon* (26.67%) and (24.40%) at A1 altitude (2200-2500m) and A2 altitude (2500-2800m) respectively, *Fragaria nabicola* (23.16%) at A1 altitude (2200-2500 m), *Cynodon dactylon* (22.42%) at A3 altitude, *Fragaria vesca* (21.12%) at (2500-2800 m) at A2 altitude.

Ether extract (%)

The value of ether extract in laboratory conditions for different grass/herb spp. is presented in table 15. The data presented in table 15 reveals thatether extract % in summer season was found highest in *Teraxicum officinale*(3.38%) at A1 altitude (2200-2500 m) followed by *Trifolium repense*(3.30%) at same altitude, *Fragaria vesca* (3.14%) at A2 altitude (2500-2800 m), *Geum elatum* (3.06%) at A3 altitude (2800-3100 m), *Poa pratense* (2.99%) at A1 altitude (2200-2500 m). Highest ether extract (%) was found in *Plantago major* (4.08%) at A1 (2200-2500 m) in autumn season followed by *Teraxicum officinalis* (3.29%) at same altitude*, Fragaria vesca* (3.02%) at A2 altitude (2200-2500 m), *Malva sylvestris* (2.99%) at A3 altitude (2800-3100 m), *Cynodon dactylon* (2.82%) at A3 altitude (2800-3100 m).

Total ash (%)

The data regarding variation in total ash (%) in summer season is presented in Table 16 which revealed that highest total ash (%) was found in *Trifolium Pratense* (20.8 %) at A2 altitude followed by *Trifolium repense* (20.69%) and (20.56%) at A1 altitude (2200-2500 m) and A3 (2800-3100 m) respectively. The ash content recorded in case of *Plantago lanceolata* is (19.11%) at A2 altitude (2500-2800 m) & in case of *Poa pratense* is (13.68%) at A1 altitude (2200-2500 m). Minimum ash content was

TABLE 1
Altitudinal variation in Crude Protein (%) of dominant and palatable forage species of Doodhganga rangelands

Nutritional parameter (%)	Grass/herb spp.	A1 (Haigen)		A2(Doobkhal)		A3(Aayud)	
		S	A	S	A	S	A
Crude Protein (%)							
	Cynodon dactylonpers	2.92	2.78	3.19	3.03	3.68	3.12
	Trifolium repens L.	4.00	3.87	-	-	4.55	-
	Trifolium pretense L.	-	-	4.43	4.05	-	4.03
	Fragaria nubicola Lindl.	3.78	-		-	-	-
	Poa pretense L.	2.92	-	-	-	-	-
	Teraxicum officinale Weber.	3.80	3.59	-	-	-	-
	Plantago major L.	-	3.87	-	-	-	-
	Sibaldeae cuneata Edgew.	-	-		2.99	4.90	3.67
	Geum elatum Wall.	-	-	2.91	-	4.58	-
	Plantago lanceolata L.	-	-	4.09	-	-	5.71
	Alchemillatrolli L.	-	-	-	-	4.51	-
	Rumex nepalensis Spreng.	-	-	-	3.56	-	-
	Fragaria vesca Lindle.	-	-	4.10	3.92	-	-
	Polygonum plebeium R.Br.	-	4.03	-	-	-	-
	Malva sylvestris Linn.	-	-	-	-	-	2.89

S Summer, A - Autumn, - Not found dominant, A1 2200-2500 m, A2 2500-2800 m, A3 2800-3100 m.

found in *Teraxicum officinale* (10.11%). Similarly, in autumn season highest ash content was found in *Trifolium pratense* (18.73%) at A3 (2800-3100 m) followed by *Plantago major* (18.62%) at A1 altitude (2200-2500 m) and *Trifolium repense* (17.89%) at same altitude, *Trifolium pratense* (17.87%) at A2 altitude (2500-2800 m) and *Cynodon dactylon* at same altitude.

Nitrogen free extract (%)

The variation recorded *w.r.t.* NFE (%) in different grass/herb spp. growing at different altitudes of Doodhganga range, pirpanchal forest division is presented in table 17. The analysis of data done under laboratory conditions reveals that highest total ash (%) was found in *Trifolium pratense* (20.8 %) at A2 altitude,

TABLE 2
Altitudinal variation Crude fibre (%) of dominant and palatable forage species of Doodhganga rangelands

Nutritional parameter (%)	Grass/herb spp.	A1 (Haigen)		A2(Doobkhal)		A3(Aayud)	
		S	A	S	A	S	A
Crude fibre (%)							
	Cynodon dactylonpers	22.32	26.67	19.21	24.40	21.87	22.42
	Trifolium repens L.	21.03	22.80	-	-	19.40	-
	Trifolium pretense L.			15.42	16.45	-	16.52
	Fragaria nubicola Lindl.	23.16					
	Poa pratense L.	19.65	-	-	-	-	-
	Teraxicum officinale Weber.	13.92	18.50	-	-	-	-
	Plantago major L.	-	16.57	-	-	-	-
	Sibaldeae cuneata Edgew.	-	-		15.75	18.60	18.85
	Geum elatum Wall.	-	-	16.67	-	18.28	-
	Plantago lanceolata L.	-	-	19.26	-	-	25.06
	Alchemillatrollii L.	-	-	-	-	19.41	-
	Rumex nepalensis Spreng.	-	-	-	18.11	-	
	Fragariavesca Lindle.	-	-	20.19	21.12	-	
	Polygonum plebeium R.Br.	-	13.22				
	Malvasylvestris Linn.						19.95

S Summer, A - Autumn, - Not found dominant, A1 2200-2500 m, A2 2500-2800 m, A3 2800-3100 m.

followed by *Trifolium repense* (20.69%) and (20.56%) at A1 altitude (2200-2500 m) and A3 altitude (2800-3100 m) respectively, *Plantago lanceolata* (19.11%) at A2 altitude (2500-2800m), *Poapratense* (13.68%) at A1 altitude (2200-2500 m) above MSL. Similarly, for autumn season highest ash content was found in *Trifolium pratense* (18.73%) at A3 altitude (2800-3100 m) followed by *Plantago major* (18.62%) at A1 altitude (2200-2500 m), *Trifolium repense* (17.89%) at A1 altitude (2200-2500m), *Trifolium pratense* (17.87%) at A2 altitude (2500-2800 m), *Cynodon dactylon* (14.95%) at A2 altitude (2500-2800 m).

Total carbohydrates (%)

The variation recorded regarding total carbohydrate (%) in grass/herb species ispresented in Table 18. The data reveals that highest total carbohydrate (%) in plant species during summer season was recorded in *Plantago lanceolate* (83.72 %) at A3 altitude (2800-3100 m) followed by *Cynodon dactylon* (81.61%) at A1 altitude, *Teraxicum officinale* (81.24%) and *Poa pratense* (81.19%) at A1 altitude (2200-2500 m) and *Sibaldeae cuneata* (81.09%) at A3 altitude (2800-3100 m). In case of autumn season highest carbohydrate (%) were found in *Fragaria vesca* (85.38%) and *Sibaldeae cuneata* (84.98%) at A2 altitude (2500-2800 m) followed by *Cynodon dactylon* (84.62 %) and *Fragaria vesca* (84.20%) at A1 altitude (2200-2500 m), *Plantago lanceolata* (83.72%) at A3 altitude site.

Total organic matter (%)

Data tabulated in Table 19 presents the total organic matter (%) in meadow herbs/grasses in different seasons of year. During summer highest total organic matter (%) was recorded in *Geum elatum* (90.01%) and *plantago lanceolata* (88.53%) at A2 altitude (2500-2800 m) followed by *Poa pratense* (88.06%) at A1 altitude (2200-2500 m), *Geum elatum* (87.53%) at A3 altitude (2800-3100 m), *Cynodon dactylon* (87.28 %) at A1 altitude (2200-2500 m). Similarly in case of autumn season highest organic matter (%) was found in *Cynodon dactylon* (90.03 %) and *Teraxicum officinale* (89.82%) at A1 altitude followed by *Trifolium pratense* (89.10) at A2 altitude (2500-2800 m), *Cynodon dactylon* (87.46%) at A3 altitude (2800-3100 m), *Fragaria vesca* (85.96%) at A2 altitude.

Present study revealed that percentage of crude fibre, total carbohydrates and total organic matter of different grasses/herbs was found highest in autumn season as compared to summer season where as percentage of crude protein, total ash, ether extract and nitrogen free extract were found maximum in summer season as compared to autumn season at all three altitudinal sites. Further as plant

TABLE 3
Altitudinal variation Ether extract (%) of dominant and palatable forage species of Doodhganga rangelands

Nutritional parameter (%)	Grass/herb spp.	A1 (Haigen)		A2(Doobkhal)		A3(Aayud)	
		S	A	S	A	S	A
Ether extract (%)							
	Cynodon dactylon Pers.	2.56	2.54	2.68	2.61	2.93	2.82
	Trifolium repens L.	3.30	2.47	-		2.80	
	Trifolium pratense L.	-	-	2.45	2.32		2.69
	Fragaria nabicola Lindl.	2.93	-			-	-
	Poa pretense L.	2.99	-	-	-	-	-
	Teraxicum officinale Weber.	3.38	3.29	-	-	-	-
	Plantago major L.	-	4.08	-	-	-	-
	Sibaldeae cuneata Edgew.	-	-		2.59	2.87	2.81
	Geum elatum Wall.	-	-	2.32		3.06	-
	Plantago lanceolate L.	-	-	2.21			2.92
	Alchemilla trollii L.	-	-	-	-	2.64	
	Rumex nepalensis Spreng.	--	-	-	2.65	-	-
	Fragaria vesca Lindle.	-	-	3.14	3.02	-	
	Polygonu mplebeium R.Br.	-	2.48	-	-	-	-
	Malva sylvestris Linn.	-	-	-	-	-	2.99

S Summer, A - Autumn, - Not found dominant, A1 2200-2500 m, A2 2500-2800 m, A3 2800-3100 m.

TABLE 4
Altitudinal variation Total Ash (%) of dominant and palatable herb/Grass species of Doodhganga rangelands

Nutritional parameter (%)	Grass/herb spp.	A1 (Haigen)		A2(Doobkhal)		A3(Aayud)	
		S	A	S	A	S	A
Total Ash (%)							
	Cynodon dactylon Pers.	12.72	9.94	13.33	14.95	12.54	-
	Trifolium repens L.	20.69	17.89	-	-	20.56	-
	Trifolium pretense L.	-	-	20.84	17.87		18.73
	Fragaria nubicola Lindl.	12.60	-	-	-	-	-
	Poa pretense L.	13.68	-	-	-	-	-
	Teraxicum officinale Weber.	11.94	10.11	-	-	-	-
	Plantago major L.	-	18.62	-	-	-	-
	Sibaldeae cuneate Edgew.	-	-		9.80	11.45	11.42
	Geum elatum Wall.	-	-	10.00		12.47	-
	Plantago lanceolata L.	-	-	19.11	-	-	9.71
	Alchemilla trollii L.	-	-	-	-	13.51	
	Rumex nepalensis Spreng.	-	-	-	11.03	-	-
	Fragaria vesca Lindle.	-	-	12.77	13.03	-	-
	Polygonum plebeium R.Br.	-	10.20	-	-	-	-
	Malvasylvestris Linn.	-	-	-	-	-	11.09

S Summer, A - Autumn, _ Not found dominant, A1 2200-2500 m, A2 2500-2800 m, A3 2800-3100 m.

TABLE 5
Altitudinal variation Nitrogen free extract (%) of dominant and palatable herb/Grass species of Doodhganga rangelands

Nutritional parameter (%)	Grass/herb spp.	A1 (Haigen)		A2(Doobkhal)		A3(Aayud)	
		S	A	S	A	S	A
Nitrogen free extract (%)							
	Cynodon dactylon Pers	12.76	11.30	14.56	13.31	12.54	11.06
	Trifolium repens L.	20.45	17.68			20.56	
	Trifolium Pratense L.			19.65	18.72		18.73
	Fragaria nabicola Lindl.	12.60				-	
	Poa pretense L.	13.68	-	-	-	-	-
	Teraxicum officinale Weber.	12.45	10.87	-	-	-	-
	Plantago major L.	-	18.62	-	-	-	-
	Sibaldeae cuneate Edgew.	-	-		9.80	11.45	11.42
	Geum elatum wall.	-	-	10.00		12.47	-
	Plantago lanceolate L.	-	-	19.11	-	-	9.71
	Alchemilla trollii L.	-	-	-	-	13.51	
	Rumex nepalensis Spreng.	-	-	-	11.03	-	-
	Fragaria vesca Lindle.	-	-	13.82	13.03	-	-
	Polygonum plebeium R. Br.	-	10.20	-	-	-	-
	Malva sylvestris Linn.	-	-	-	-	-	11.09

S Summer, A- Autumn, _ Not found dominant, A1 2200-2500 m, A2 2500-2800 m, A3 2800-3100 m.

species starts proceeding to maturity crude protein percentage and ether extract shows increasing trend along increasing altitude. This is supported by findings of Magray *et al.,* (2019) who estimated and revealed that protein content in grasses increases with increase in elevation in Langate forests of Jammu and Kashmir. Mountousis *et al*., (2008**)** obtained similar trend regarding crude protein, fibre, ether extract along altitudinal gradient in rangelands of northern Greece. Nutritive value of any range forage is influenced by number of factors like maturity stage, plant species, edaphic factors, climate prevailing in area, range conditions and animal class. The reason for increase of percentage of crude fibre, total carbohydrates, total organic matter with increasing age of plant is that proportion of potentially digestable

TABLE 6
Altitudinal variation Total carbohydrates (%) of dominant and palatable herb/Grass species of Doodhganga rangelands

Nutritional parameter (%)	Grass/herb spp.	A1 (Haigen)		A2(Doobkhal)		A3(Aayud)	
		S	A	S	A	S	A
Total carbohydrates (%)							
	Cynodon dactylon pers	81.61	84.62	80.82	79.52	80.12	81.40
	Trifolium repens L.	72.06	75.74			72.09	74.55
	Trifolium Pratense L.	-	-	76.79	75.66	-	-
	Fragaria nabicola Lindl.	80.53	-	-	-	-	-
	Poa pretense L.	81.19	-	-	-	-	-
	Teraxicum officinale Weber.	81.24	82.80	-	-	-	-
	Plantago major L.	-	73.43	-	-	-	-
	Sibaldeae cuneate Edgew.	-	-	-	84.98	81.09	79.78
	Geum elatum wall.	-	-	80.40	-	79.69	-
	Plantago lanceolate L.	-	-	74.30	-		83.72
	Alchemilla trollii L.	-	-	-	-	77.83	-
	Rumex nepalensis Spreng.	-	-	-	79.56	-	-
	Fragaria vesca Lindle.	-	84.20	-	85.38	-	
	Polygonum plebeium R.Br.	-	-	-	-	-	-
	Malva sylvestris Linn.	-	-	-	-	-	78.33

S Summer, A - Autumn, _ Not found dominant, A1 2200-2500 m, A2 2500-2800 m, A3 2800-3100 m.

components that includes lignin, hemicelluloses and other indigestible fractions such as cuticle, silica increases with age of grasses/herbs (Mwale, 1993). Our results are in conformity with Kermit Oelberg (1956) who studied Crude protein (%), ether extracts and nitrogen free extracts are more in young juvenile stage than in old stage. Protein are essential for plant growth, body weight gain, milk secretion etc. Mountousis *et al*., (2008) revealed that crude protein, ash, ether extract, crude fibre and IVDMD affected significantly ($P<0.01$) by both harvest month and altitudinal zone. The decrease in protein content from summer to autumn is attributed to relative increase of fibre content in plant. Present findings is also supported by Dogra *et al*. (1994) and Butler and Bailey (1973) who also concluded that there was

TABLE 7
Altitudinal variation Total organic matter (%) of dominant and palatable herb/Grass species of Doodhganga rangelands

Nutritional parameter (%)	Grass/herb spp.	A1 (Haigen)		A2(Doobkhal)		A3(Aayud)	
		S	A	S	A	S	A
Total organic matter (%)							
	Cynodon dactylon Pers	87.28	90.03	86.90	85.05	86.54	87.46
	Trifolium repens L.	79.31	82.11			79.44	83.27
	Trifolium pratense L.			87.23	89.10		
	Fragariana bicola Lindl.	86.26	-	-	-	-	-
	Poa pretense L.	88.06		-	-	-	-
	Teraxicum officinale Weber.	81.24	89.82	-	-	-	-
	Plantago major L.	-	81.38		-	-	-
	Sibaldeaecuneata Edgew.	-	-		80.20	81.03	81.20
	Geum elatumwall	-	-	90.01	-	87.53	-
	Plantago lanceolata L.	-	-	88.53	-		82.40
	Alchemillatrollii L.	-	-	-	-	86.90	-
	Rumex nepalensis Spreng.	-	-	-	78.80	-	-
	Fragaria vesca Lindle.	-	-	84.02	85.96	-	-
	Polygonum plebeium R.Br.	-	85.35	-	-	-	-
	Malva sylvestris Linn.	-	-	-	-	-	84.56

S Summer, A Autumn, _ Not found dominant, A1 2200-2500 m, A2 2500-2800 m, A3 2800-3100 m.

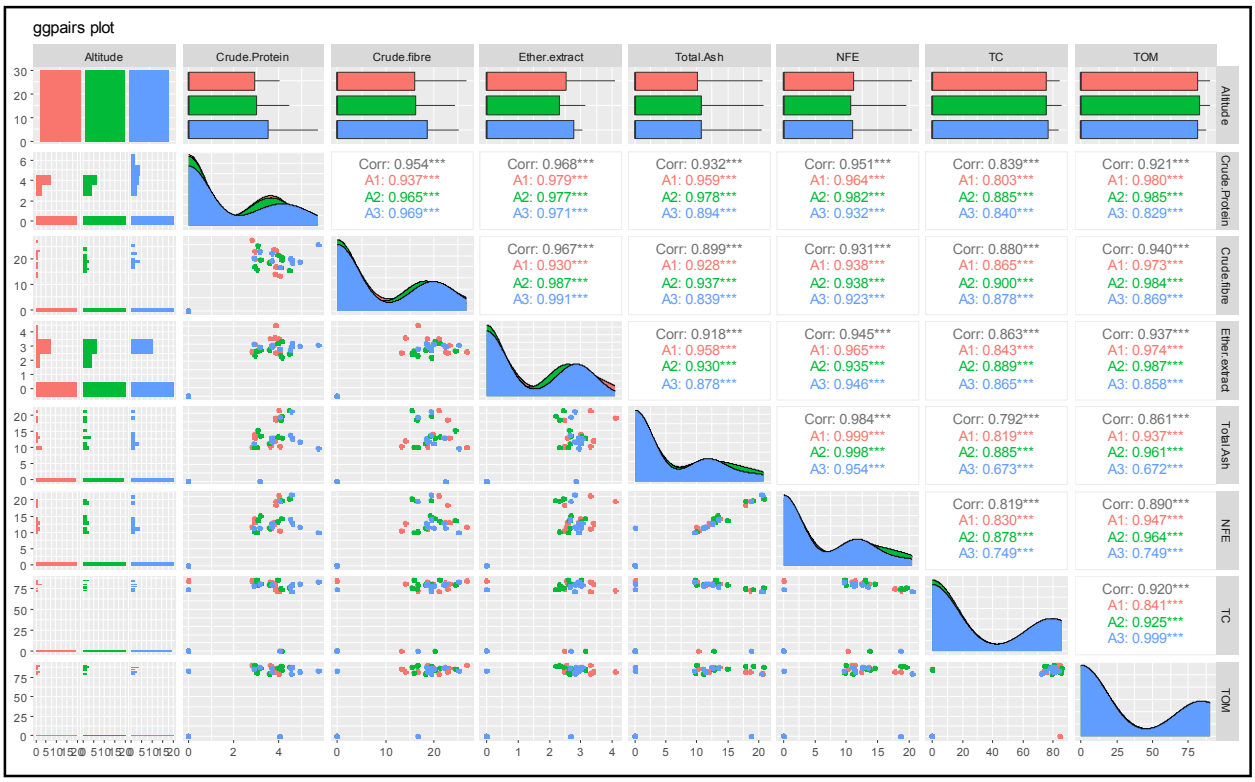

Fig. 1. Correlation between nutritional parameters.

decrease in crude protein content from summer to autumn as plant matures.

Further present study recorded maximum crude protein percentage in legumnacious forage like *Trifolium repens* and *Trifolium pratense* as compared to non legume herbs or grasses. These legumes were found slightly low in fibre content but high in protein content.Pure grasses like *Cynodon dactylon* were found low in crude proteins and high in fibre content compared to pure legumes.It is general observed fact that the forage legumes contain higher amount of crude protein but less amount of fibre content irrespective of season factor. This results in higher digestability than grasses. Present study results are similar to the findings done by Tessema and Baars (2006), who reported pure legumes and grass legumes mixture produce contain higher crude protein and lower fibre concentration. Azim *et al.,* 2011 obtained similar results for legumes.

Present study revealed increase of fibre content, with advancement of season as was expected. Reason for the increase of fibre content is as plant grows there is greater need of fibrous tissue for maintenance of body structure, thereby increases the structural carbohydrates and lignin. Mayouf and Arbouche (2015) studied the seasonal variation in chemical composition and nutritional characteristics on three pastoral species in semi arid Algerian islands and reported that in wet season plant species have good nutritive value as compared to dry season.

Ether extract decreases with advancement of season in present study, same is confirmed from the study of Garmo *et al*., (1986) in their study on chemical composition and *in vitro* digestibility of indigenous pastures plants.

Present study revealed range of Crude protein percent from 2.89 - 4.55, ether extract (%) from 2.21 - 4.08, crude fibre (%) from 13.22-26.67 and total ash (%) from 9.80-20.69. Tuna *et al., (*2004) reported that protein content of grasses ranged from 3.85-7.80 (%) and our results got conformity from his findings. Rafay *et al., (*2013) also reported similar range values of Cholistan desert grasses, ether extract was in range of 1-2.51(%), ash between 4.62-20.69 (%), total ash content was between 30.89-58.80 (%) which is much higher than recorded in present study.

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