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Nutritional Evaluation of *Grewia optiva* and *Grewia populifolia* in Different Seasons and Sites of Chakwal District in Pakistan

MAAZ MAQSOOD HASHMI
KANWAL WAQAR
National Agricultural Research Centre (NARC)
Islamabad
Pakistan

Abstract:

Focusing the malnutrition of the livestock in Pothwar, the study was conducted for nutritional variation in Grewia optiva and Grewia populifolia, during different seasons and sites. Animals of the area have line and thin due to lack of forage and nutrition in past years. Population increment has also been very slow to negligible due to this reason. Nutritional analyses were made by taking the samples of both the species leaves. MC, CF, CP, EE, AC, ADF, NDF, ADL, NFE were found out ondry matter (DM) basis. The proximate analyses showed that both the species can provide good nutritional support to the animals during summer season and have high potential of nutritive values. Providing supplementary feed of this forage during the dry season could improve their nutritional status of livestock on that site. Some differences were observed affected by sites but there is no effect on interaction.

Key words: Nutritional analyses, shrubs, Pothwar rangelands

Introduction:

As the world is touching the skies of technology and modernism, the dilemma related to health is rising in humans

as well as animals. Livestock that we consume, either for meat or for other services, is in danger of nutritional deficiencies. All over the world, there is a need to overcome this issue by providing livestock with required nutrition. In Pakistan, the problem of this malnutrition of livestock has been a point of attention since many years but still there is a need to conduct studies related to animal nutrition, as livestock of Pakistan have not been improved in terms of health or populace. In 1987, Akram concluded in his study that there is an annual shortage of digestible crude protein and total digestible nutrients of about 1.6 and 12.5x 10t, respectively. According to Nawaz *et al,* (1988), Pakistan has a population of 30.6 million large ruminants (cattle and buffaloes) and 58.5 million small ruminants (sheep and goats). The increasing population of animals requires a 51% increase in feeds over the current supply. The current feed deficiency implies that the future generation of livestock will be underfed as in 1988, or perhaps even more because of anticipated increased genetic potential through breeding and upgrading (Crowder, 1988).

The nutritional deficits in animals is causing due to forage unavailability. During different seasons, there is a fluctuation in forage availability to livestock, and in low forage season, farmers feed their animals the indigenous species to fulfill the nutritional requirements. Lefroy *et a.* (1992) stated that trees, shrubs and herbs are very beneficial to the livestock for nutrition especially in those areas which have fodder of low quality or unavailability for longer period of time. This study focuses on the dominant tree species of the region i.e. *Grewia optiva* and *Grewia populifolia,* both the species belong to the Tillaceae family, native to Pakistan. Both the species are shrubs, available to animals for feeding.

Animals face nutritional problems during these periods of feed scarcity and start losing weight. Fodder trees provide nutritional forage, during such periods of fodder unattainability; through browsing and lopping. It is required to

find out the nutritional characteristics of the important fodder shrubs and trees during different seasons to identify their values as potential fodder trees, forage quality of twigs and leaves of forage trees varies in different months but the change in the forage quality at different localities is not regular as it is influenced by edaphic and climate changes (Malik, 1988). Forage quality is fair indicator of feeding values of plant species. Information of seasonal variation provides guidelines for utilizing tree fodder at specific stages to ensure optimum use (FAO, 1987). Previously done studies have mainly focused on the supplementary feeds for fulfilling the nutritional requirements of animals with limitation of plants available for forage (Azim *et al*, 2011). The present study revolves around the effect of seasonal variation on nutritional contents of *Grewia optiva* and *Grewia populifolia* and also in different locations.

Materials and Methods:

Study is based upon the species in Chakwal district in Punjab province of Pakistan. Chakwal is situated at 33°01'21"N and 72°45'49"E, upon the elevation that ranges between 450 meters to 1050 meters above the sea level. The division of the area comprises rutted land with some mountainous areas with both rock exposed surface and highly erodible soils with gullies and rills. The rainfall of the area is there or thereabouts 200 mm in summer, while in winter it ranges between 36- 50 mm. Temperature in summer is about 38°C although in winter it varies from 3-6°C. Overall climate of the area has cold winters and hot summers, and have short period of dry season before summer.

The samples of the two fodder species were collected, including leaves of *Grewia optiva* and *Grewia populifolia*, randomly from different trees of similar height and age from three different sites of the rangelands, in Chakwal. Fresh leaves were given a distilled water immersion to remove the

impurities from them, then were stored into a refrigerator for freezing. After refrigeration, these leaves were cut into small pieces for easiness in analysis. These samples after cutting were placed in hot air oven at 65°C for 24 hours. After this step, the sample leaves were further ground, passed through 1mm sieve, and were stored in the polybags at room temperature. The samples were collected during the summer and winter seasons. Chemical analyses were performed over these samples. Nutritional analyses were performed on these samples. Dry matter (DM), moisture content (MC), crude protein (CP), crude fiber (CF), acid detergent fiber (ADF), neutral detergent fiber (NDF) and lignin were known. These analyses were performed in Nutritional laboratory of National Agricultural Research Center, Islamabad. Dry matter was calculated using the formula:

$$\text{Dry matter \%} = \frac{\text{weight of dry matter}}{\text{Fresh weight of sample}} \times 100$$

Analyses of dry matter, crude protein and crude fiber were determined using the AOAC, 1990 method. Van Soest *et al,* (1991) were used for the determination of acid detergent fiber, neutral detergent fiber and lignin.

AOAC (1990) method has been used for the determination of dry matter, crude protein, crude fiber, and ether extract and ash contents of the samples. Determination of dry matter was achieved by drying the foliage samples at 80°C to a constant weight. Crude protein content was known by micro kjeldhal method. Samples were oven dried and were then allowed to digest in H_2SO_4 with a catalyst mixture that contained K_2SO_4 and $CuSO_4$. A known portion of the diluted sample was purified in the occurrence of 10 ml boric acid solution of 2% concentration and then titrated beside standard 0.1 N H_2SO_4. Crude protein was estimated by calculating percent of nitrogen. Ether extract was intended by extracting it,

from sample, with diethyl ether at 60°C in soxlet`s apparatus. Crude fiber was known by refluxing the sample with 1.25% H_2SO_4 and subsequently with 1.25% NaOH for 30 minutes each. This dissolved acid and basic soluble component, the dregs containing the crude fiber was dried upto a constant weight and then it was ignited in a muffle furnace. On ignition the weight loss by the remains was known for crude fiber. Ash was determined by burning the sample in muffle furnace at 550°C, this burns the organic matter and the remainder was ash left. Nitrogen free extract was found by the difference of crude protein, crude fiber, ash contents and ether extract (Azim, *et al.* 2011).

% NFE = 100 – (%CP + %CF + %EE + %ash)

For acid detergent fiber determination, 1.5 grams of sample was boiled with 100 ml acid detergent solution for ten minutes. The sample was filtered using the Buchner funnel with an aid of suction pump. Filtered mat was filled up 2/3 with hot water, socked dry and repeated hot water washing twice. The residue transferred to Gooch crucible and dried for 3 hours in oven at 105°C. The residue was converted to ash at 600°C for 30 minutes and weighed again after one hour. The ratio of residue weight and sample weight gives acid detergent fiber. Neutral detergent fiber was estimated boiling 1.5 gram of sample in 100 ml neutral detergent solution and 0.5 gram Na_2SO_3 for 10 minutes. The mixture was refluxed for 1 hour and filtered through the Buchner funnel with a suction pump. The filtered mat was filled up to 2/3 full with hot water after soaking. The residue was transferred to Gooch crucible and dried for 3 hours in oven at 105°C and weighed after 30 minutes. The calculation further was same as of acid detergent fiber. For lignin, 1.5 grams of sample were extracted with ethanol benzene mixture for 4 hours, washed twice with diethyl ether and dried at 45°C. The extract was kept at 40°C. Pepsin solution was filtered off,

washed with hot water, ethanol and then with ether. 5% H_2SO_4 was added to extract in 250 ml conical flask, then again washed as previously. Seventy two percent H_2SO_4 was added and let stand for 2 hours. Acid solution was filtered off and washed as previously. Then the extract was refluxed for 2 hours and washed as previously. Then the remainder was dried at 105°C for 2 hours and weighed i.e. W1. Then it was ignited at 600°C for 30 minutes and then weighed i.e. W2. Lignin was calculated by ratio of the difference in weights. The total digestible nutrient was determined using the regression equation.

After the chemical analyses, statistical analysis was implemented using Completely Randomized Block Design (CRBD), two factor factorial design, with three replications of three seasons and locations to determine the relation between the site factors and seasonal variation. Duncan`s Multiple Range Test (DMRT) was applied at 5% significance level for the comparison of the means achieved (Douglas, 2005).

Results

The study revealed that the relation between location and season was significant as the probability value of the site was recorded 0.188, which was greater than the 5%. Similarly dry matter percentage for both the species as P value is non-significant. The P value (0.0044) <0.05, in case of season, shows the result is significant and seasonal variation had no effect on dry matter of both species. In case of moisture content, the seasonal difference and site factors were affected significantly as the probability value of season was 0.2332, which is higher than 5%. Similarly the species showed P (0.9924) higher, which made it non-significant to each other. Similarly, in case of crude protein, seasonal and site interaction was highly significant with site vale 0.0001 at 5% while seasonal variation showed 0.0073 at 5% that was significant. The interaction did not showed any effect on crude protein. Results showed effect in

ash content, by site and seasonal interaction was highly significant. The range of ash content values for *Grewia optiva* ranges from 8.93 to 14.23% and *Grewia populifolia* 6.91 to 10.25% by the season and site interaction. Different seasons and sites affected the ether extract results significantly, as the site showed 0.0000 P value while season showed P 0.0060. Seasonal and site variations did not affect the values of crude fiber. At 5% level of significance, P value for site was 0.000, while season had P 0.0002. The table shows the values of different nutritive parameters for both the species. Nitrogen free extract was affected by this interaction on season and site. Site showed a P value of 0.0017 i.e. less than 0.05 and seasonal variation showed P 0.0010. This showed that interaction of both showed no effect on NFE. The cell wall parameters ADF, NDF and ADL showed variation of site and seasonal interaction. Neutral detergent fiber showed a probability for site 0.0866 and season showed P 0.4255 >0.05, this showed that NDF was affected by this interaction significantly. Acid detergent fiber was not affected by this interaction significantly. Probability values for site and season were 0.1053 and 0.2610, respectively. These values were higher than 0.05. Similarly, Acid detergent fiber also had no effect, probability value for site was0.0392 and for seasons P 0.0000. This shows that ADL had no effect on the site and seasonal variation.

Discussions:

The results were similar to that of Toukhey et al. (2005) who concluded greatest values of dry matter forage during the dry season from browsed plants while the Shaer (2000) recorded the highest values in spring compared to the summer season. Significant seasonal variations were observed in the moisture content ratios between leaves and twigs of both the species in different locations. Grewia optiva showed the highest MC in winter and lowest in summer season while Grewia populifolia

showed lowest MC in winter and highest in spring season. These observations can be attributed to the high rainfall and vegetative growth of leaves. The findings were similar to that of Toukhey et al. (2005), for the MC as well. Crude protein content was higher in spring and winter, followed by the summer season, in Grewia optiva while in Grewia populifolia it was higher in both spring and summer seasons. It was due to suitable soil temperature and moisture content in spring and winter as compared to summer season. The findings are true to the findings of Kumar et al. (2003) who reported 8.9 to 25.2 % CP in different shrubs. Singh et al. (2004) assessed that the CP was greater in leaves. Similar to that, Tesfey and Tekley et al. (2004) expressed statistical significant difference in CP of all green and senesced leaves of different shrubs. The findings were also similar to that of Evitayani et al. (2006) who found CP higher in rainy season as compared to dry season. Similar to above parameters, ash content was also affected by the seasonal and site variation significantly i.e. highest in winter and lowest in spring for both species at 5 % level of significance. Findings were significant to the Papanastasis et al. (2008) who scripted the ash content values higher in winter than in dry season. Toukhey et al. (2005) observed lowest values during dry season. Ether Extract was higher in winter and summer ascribed by the rainfall and soil temperature. Kumar et al. (2003) reported higher EE during winter. Similar to that Tesfay and Tekley (2004) also observed higher EE during the wet season. Crude fiber percentage were significantly variant as described by the Evitayani et al. (2006) who scripted low CF in winter than in summer. The neutral detergent fiber showed similar variation to that of the Evitayani et al. (2006), observations showed low NDF in wet season than dry season.

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Annexes

Table 1: Mean Values for Different Seasons (%)

Mean Percentage Values						
Species	***Grewia optiva***			***Grewia populifolia***		
Nutritional analyses/ Seasons	Summer	Winter	Spring	Summer	Winter	Spring
Moisture Content	28.6	60.45	45.5	43.2	40.12	67.6
Dry matter	71.4	39.55	54.6	56.8	59.87	32.4
Crude protein	15.12	19.37	17.47	13.88	10.07	13.79
Crude fibre	25.61	17.84	20.82	23.92	26.66	30.55
Ether extract	2.21	2.49	3.74	2.96	3.19	2.8
Ash	10.34	13.91	9.17	9.05	10.05	7.48
Acid detergent fiber	36.7	24.8	27.1	39.1	36.2	36.4
Neutral detergent fiber	50.4	41.7	41.3	54.2	51.7	55
Lignin	6.9	8.6	6.2	11.6	11.6	12.5
Nitrogen free extract	46.72	46.37	38.8	50.19	50.05	45.64

Fig: 1. Percentage of Grewia Optiva in Summer Season

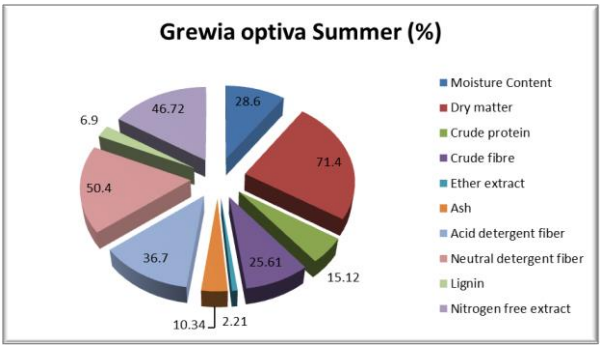

Fig: 2. Percentage of Grewia Populifolia in Summer Season