Evaluating the fodder and Quality of Two Different Rangelands in Sulaimani Governorate, Kurdistan, Iraq

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Abstract

This study was conducted during 2015 in Sulaimani governorate at two main different locations of Sharazoor and Penjwen, each with some sub-locations, to estimate fresh yield, dry yield, dry matter and animal unit. The rangeland areas of Sulaimani governorate located between 35° 10' - 36° 27' N and 44° 40' - 46° 22' E were restricted 126546.00, and 29542.00 ha for Sharazoor, and Penjwen locations, respectively. The most important results indicated that, Sharazoor location gave the maximum value of total dry yield 41380.50 ton and 125395.40 Animal unit/three months, while Penjwen location which gave the minimum value total dry yield of 25544.1 ton and77406.30 animal unit/three months. The highest fresh and dry yield were obtained by Sharazoor location which were 19563.36 and 3224.04 kg/ha, respectively, in which Penjwen location gave the minimum value of 11872.80 kg/ha and 2369.81 kg/ha for fresh yield and dry yield, respectively. Results of chemical analysis for the grass and legume plants showed that there were differences between locations. Sharazoor location gave the maximum percentage of protein content, fiber, phosphorus and potassium which were (11.81, 20.5, 1.45, and 1.02 %) respectively, for legume plants, However, chemical contents for grass plant showed that Penjwen location gave the maximum percentage of protein, carbohydrate, fiber, magnesium and calcium contents which were (9.80, 36.45, 31.50, 0.18, 0.22%), respectively. The mean of protein, oil, K, Mg, Ca and ash in legume plant were (1.56, 1.50, 1.07, 1.52, 2.25and1.16) times higher than their concentration in the grass respectively. But the value of carbohydrate and fiber in the grass were (1.73 and 1.21) times higher than their concentration in the legumes respectively. The concentration of phosphorus is equal in both types of plants and it is more than normal concentration

Key words: Rangeland, pasture, Crops Production, Forage Crops, Dry matter, Animal Unit

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Introduction

The governorate of Sulaimani area of study (AOS) shares an internal border with Erbil governorate on the north; Kirkuk governorate on the west; Salah al-Din governorate on the southwest; and Dylah governorate on the south. It is located in the northeast of Iraq on the border with Iran; its mountainous area increases towards the eastern border (7). The total area of Sulaimani governorate is 979576 ha, 31.39% is cultivated, 15.18% is pastureland and 16.23% is sub marginal, in addition to 1.41% that allocated for civil services (13and 16). Kurdistan's wealth of high-grade pasture lands has long made it suitable for a pastoralist economy, also suitable in many areas for intensive agriculture. In contrast to woodlands and the heavy damage land they have sustained and have been remained as the lost productive source of animal (17), and the Kurdish rangeland consists of a mixed vegetation cover of grasses and forbs with woody shrubs present at higher elevations (25). One of the strategies to exploit the pasture is pasture management, and one of the most important considerations in pasture management understands the requirement various forage species of livestock required for maintenance, meat production, milk production and growth pasture. Carrying capacity depends on many variables; the most important are soil productivity, rainfall and the management ability of the landowner. This fact-sheet will describe a process for determining the number of livestock that should be stocked on a given area. It will also an explain option that can be used to increase the carrying capacity of pasturelands (23). Pasture is the basis of any livestock grazing that should to be truly sustainable. And as the livestock sector continue and become significant increase lead to high feed and other input cost (24). In addition, livestock is important component of agriculture and one of the main users of natural resource(10).The survey of pasture one of the methods of evaluation that often has been considered, and concluded that the survey of pasture work deal with definition of each the elements comprised in the land systems of the area, and concerned with the assessment of rangeland condition, in respect of each land system, each property or grazing area, and lastly the whole of the survey area (13and 18).

This study was done to evaluate forage crops production and quality in Sulaimani, hence the objective of this investigation was to evaluate the carrying capacity of the rangelands of Sulaimani governorate including Sharazoor and Penjwen in term of biomass production and the quality of produced forages.

Material and Methods

This study was conducted in Sulaimani governorate, located on northeast Iraq and southeast of Iraqi Kurdistan region at 35° 10' - 36° 27' N and 44° 40' - 46° 22' E. (Figure 1).

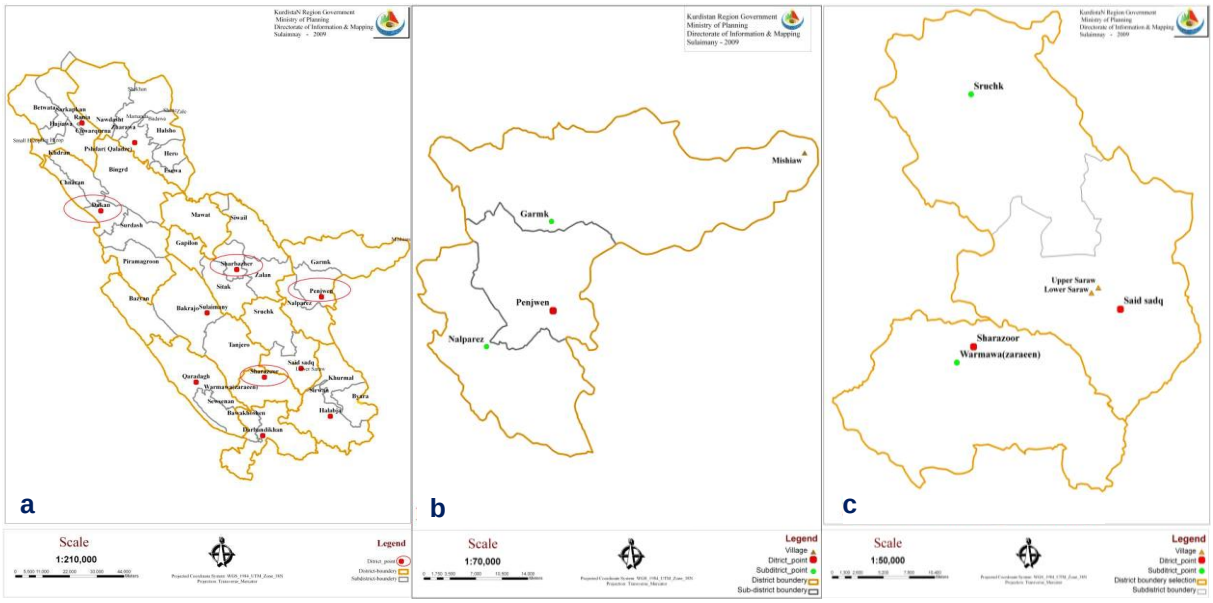

Figure 1: Map scale of the study area, (a) Sulaimani region, (b) Penjwen district, (c) SaidSadq district

The mean for maximum temperature were 36.2 and 28.8^{o}, while for minimum temperature were 7.4 and 1.4^{o} for Sharazoor and Penjwen respectively, table (2). The study included two main locations each with some sub-location at 2015 shows Table (1). The main location is differing climatically with total annual rainfall about (1041.1, 727.8) mm for Penjwen and Sharazoor locations, respectively, table (2). This affected the plant material depending on climate and the variation of weather events within the climate.

Table 1: The main and sub-locations of the studied area.

		Main Location	
		Sharazoor	**Penjwen**
Sub-locations	1	Said Sadiq	Penjwen Center
	2	Zarayan	Bashmax
	3	Tapa-Sarqwla	Blekian
	4	Bakr-Awa	Kane-Manga
	5	Xakw-Xwl	

Table 2: Rainfall, Temperature of Sulaimani governorate during (2015).

Month	**Pricpitation(mm)**		**Temperature ^{o}C**	**Avarage**
	Sharazoor	**Penjwen**	**Sharazoor**	**Penjwen**
October	164.9	198.2	23.4	16.4
November	139.0	177.6	13.3	7.6
December	96.5	201.9	8.0	1.6
January	81.4	159.2	7.4	1.4
February	70.4	76.0	9.7	4.5
March	108.0	155.2	12.6	7.5

April	42.0	46.4	17.8	11.9
May	22.0	20.1	26.2	17.8
June	-------	--------	32.2	23.6
July	-------	-------	36.2	28.8
August	--------	1.6	35.6	27.4
September	3.6	4.9	31.1	23.2
Total	727.8	1041.1		

The study was included survey of the forage crops (legumes and grasses) around the sulaimani governorate (Table 3) for March and April at one season (2015). The samples were randomly taken in two different locations (Sharzoor and Penjwen) each with some sub- locations as shown in table (1), using quadrate (50 x 50 cm^2) Vegetative coverage (legume, grass, and mixture of grasses and legume) within the quadrate were cut at 2.5 cm above soils surface, then the total fresh weight from legumes plant, grasses and their mixture was taken. Hundred gram of total fresh weight was separated into leaf and stem and put them in an oven at 75°C for 48 hours. After the weight was constant weight at room temperature the stem and leaf dry weight were taken using balance. The comparison was conducted using standard error with the following formula:

$$SE = \frac{S}{\sqrt{N}} \quad (13)$$

S = standard deviation

N= number of sample

Study characters: -

- Plant height (cm)
- Fresh forage yield ($Kgha^{-1}$)
- Dry forage yield = forage yield x dry matter %
- Dry matter %
- Ratio of Leaves percent
- dry weight ratio of Stem percentage
- The ratio of leaves to stem
- Animal Unit/3 Months: was calculated according to the following formula as described by Arshadullah *et. al*.(5):

$$A.U3M \frac{Available\ forage\ \ (\text{Kgha} - 1)}{Animal\ requirements X\ 3\ Month} (14)$$

* Animal requirement/ month = 55 kg for goat and sheep.

* Using factor = 50%

Table 3: Scientific names of common forages of *Fabaceae* and Gramineae (Poaceae) **family in Sulaimani governorate (Al-Mashhadani *et al*., (2))**

No.	Genus	Species	No.	Genus	Species
1	*Lathyrus*	*aphaca* L.	20	*Trigonella*	*speciosum* Willd.
2		*cicero* L.	21		*monspeliaca* L.
3		*erectus* Lag.	22		*aintabensis* Boiss.
4		*nervosus* Boiss	23		*cracca* L.
5		*coronate* L. M.	24		*ervilia* Willd.
6		*lupulina* L.	25	*Vicia*	hybrida L.
7	*Medicago*	*noeana* Boiss.	26		narbonensis L.
8		*orbicularis* Bartal.	27		*sativa* L.
9		*polymorpha* L.	28		*tenifolia* Roth
10		*rigidula* L.	29		*filipes* Boiss.
11		*sativa* L.	30	*Trigonella*	*foenum-graecum* L.
12		*tuberculata* Willd	31		*monspeliaca* L
13	*Hordeum*	*bulbusum* L.	32		*arvense* L
14		*fragile* Boiss.	33		*cherleri* L.
15		*spontanum*	34		*echinatum* M.B.
16	*Lolium*	*rigidum* Gaud.	35	*Trifolium*	*fermosum* Urb.
17		*temulentum* L.	36		*pilulare* Boiss.
18			37		*purpureum* Loisel
19	*Avena*	*fatua* L.	38		*Repens*

- Chemical Component: The chemical composition of stem and leaves were determined for both legumes and grasses plants on dry weight basis, one gram of the dried samples were taken and digested with 10 ml of H_2SO_4 and 10 ml H_2O_2 (except for fiber and carbohydrate) for determining each of protein, oil, phosphours, potassium, calcium and magnesium) using the kjeldahl apparatus and the results were presented as a percent ratio of each content.

- These analyses were carried out at the Laboratory of faculty of Agricultural Engineering Sciences University of Sulaimani except carbohydrate which was followed up at the Laboratory College of Agriculture University of Salahaden; Sampling was carried out on April and May2015, when almost all the pasture plants were fully-growth to their vegetation stage at %50 flowering as described below.

- Protein content: The protein was estimated as micro chemical determination of Nitrogen, Micro-Kjeldahl method (3).

-Carbohydrate content: The carbohydrate was determined using DNC method (8)

-Fiber content: The fiber was extracted using chemical material (H_2SO_4, NaoH) according to A.O.A.C(3).

- Oil content: The oil was extracted using the instrument using Soxhlet apparatus(4).

- Phosphorus content: The phosphorus were determined using Olsen's method according to ICARDA method as described by George *et. al*.(12).

- Potassium content: The potassium was determined using flame photometric according to ICARDA method as described by George *et. al*. (12)

- Calcium content: The calcium was determined by titrimetric method using 0.01N EDTA, according to ICARDA method as described by George *et. al*. (12)

- Magnesium content: magnesium were determined by titrimetric method using (0.01N) 2Na-EDTA disodium, according to ICARDA method as described by George *et. al.* (12)

- Ash content: The ash was determined using the instrument muffle furnace (4).

Results and Discussion

Vegetation covers

Data represented in table 4 explain the means of plant height, leaf dry weight %, stem dry weight % and leaf stem ratio of legumes and grasses in Sharazoor location, which was found to be different for plant height, leaf dry weight percentage, stem dry weight percentage and leaves steam ratio among the sub location of Sharazoor.

Table 4: Effect of location on studied characters of legume and grasses in Sharazoor location 2015.

Grasses			Legume			Plant Height (cm)		Replication number of sampling	Sub-Location	Location
Leaf Stem ratio	Stem D.W%	Leaf D.W%	Leaf stem ratio	Stem D.W%	Leaf D.W%	Grasses	Legumes			
-	-	-	0.92	7.39	6.87	-	37.70	5	Saidsadiq	1
0.66	9.46	6.28	1.80	3.04	5.49	61.18	39.11	5	Zarayan	2
0.71	3.94	2.80	1.02	6.01	6.14	93.75	66.71	4	Bakr awa	3
0.99	4.29	4.25	1.04	5.66	5.92	41.80	41.10	6	Xakw xwl	4
0.72	7.74	5.64	0.91	3.80	3.48	67.70	33.20	3	Tapasarqula	5
0.07	1.34	0.77	0.16	0.78	0.57	10.73	5.93		SE	

D.W%: Dry weight percent, SE: standard error

The maximum value were 66.71 and 93.75cm as the means of four replicates for legumes and grasses in Bakrawa, respectively, while the minimum mean plant height for legumes was 33.2cm in Tapasarqula, in which Xakwxwl gave the minimum value of plant height of grasses (41.8 cm). The legume plant gave the highest value of leaf dry weight percent and stem dry weight percent with 6.87 and 7.39% respectively, as the means of five replicates at Saidsadiq, while the minimum mean for leaf dry weight for legumes was 3.48% in Tapasarqula. In which the minimum value of stem dry weight was 3.04% Furthermore, the mean of leaves stem ratio gave maximum value of 1.80% in Zarayan for legume plant, in which for grasses, leaf dry weight percent and stem dry weight percent exhibited the highest values of 6.28 and 9.46 % as the means of five replicate in Zarayan .While Bakrawa gave the lowest values (2.80 and3.94 %) for leaf dry weight and stem dry weight percentage as the means of four replicates respectively. Regarding grass leaves stem ratio, it was restricted between 0.99 and 0.66% for Xakwxul and Zarayan as the means of six and five replications respecively. Data of leaf dry weight percent, stem dry weight percent and leaf stem ratio at Saidsadiq sub-location excluded from grasses plant due to the little amount of precipitation at this season. This results in agreements with (20) who stated that different in all characteristics between the locations is due to difference environmental condition between all locations table (2).

Data in table (5). shows the plant height for sub-location related to Penjwen location, in which among these sub-location differences were observed for legumes and grasses plant height (72.32 and 63.68cm) were recorded at Bashmax as a mean of seven replicates respectively, and followed by 68.95cm in Belkiyan for legumes as a mean of five replicates. It was noticed that data on plant height was recorded only on legumes because the sub –location of Penjewn center and Belkiyan location were excluded from grass plants due to the little amount of precipitation at this season. While the lowest value for plant height were 32.58 and 46.69cm as the mean of five replicates in Kane-manga for both legumes and grasses, respectively.

At the same table, it was realized that the maximum values were { (13.43% by legumes , 14.87% by grasses), (8.58% by grasses), and (2.34% by legumes , 1.73% by grasses) as a mean of seven replicates in Bashmax for leaf dry weight, stem dry weight, and leaf / stem ratio respectively. } These results were in consistent with Adjolohoun *et.al*., Darrag(1), Rafaat(22).

Table 5: Effect of location on studied characters of legume and grasses in Penjwen location 2015.

Grasses			Legumes			Plant Height (cm)		Replicates number of sampling	Sub-location	Location
Leaf Stem ratio	Stem D.W%	Leaf D.W%	Leaf Stem ratio	Stem D.W%	Leaf D.W%	Grasses	Legumes			
		_	1.70	7.31	12.43		64.17	5	Penjwen-Ccenter	1
1.73	8.58	14.87	2.34	5.73	13.43	63.68	72.32	7	Bashmax	2
			1.91	6.63	12.67	_	68.95	5	Belkiyan	3
1.20	6.05	7.31	1.39	3.64	5.08	46.69	32.58	5	Kane Maga	4
0.26	1.26	3.78	0.19	0.79	1.95	8.49	9.12			S.E

SE: Standard error, D.W%: Dry weight percent

Forage yield

Result in tables (6) reveals the differences for Bakrawa gave the maximum values of fresh and dry yield (28007.60 and 4349.58 kg.ha^{-1}) as a mean of four replicates respectively, and followed by said Sadiq sub-location with 21238.00 kg/ha for fresh yield and (3150.38 kg.ha^{-1}) for dry yield at Tapa- sarqwla as a mean of three replicates. In which Zarayan gave the maximum value of 19.42% as a mean of five replicates for dry matter percent, whereas the lowest dry matter percentage exhibited at Said Sadiq sub-location (14.27%) as a mean of five replicate. It was established that the precipitation amount and its monthly distribution had a great role in fresh and dry yields, Therefore the difference between the locations under the study in plant height for both legumes and grasses resulted in the climatically conditions especially the temperature and precipitation, or maybe due to the difference in soil chemical, physical and biological properties of the sub-locations, this result was in agreement with Geleti(11) as indicated to the importance of the role of climatically condition in growth characters.

Table 6: Effect of locations on forage yield for Sharazoo location 2015.

Dry yield (Kg.ha^{-1})	Dry Matter (%)	Fresh yield (Kg.ha$^{-1)}$	Rep. No of sampling	Sub-location	Location
3030.66	14.27	21238.00	5	Saidsadiq	
3150.38	18.25	17262.40	3	Tapa- Sarqwla	
4349.58	15.53	28007.60	4	Bakrawa	
2387.49	19.42	12294.00	5	Zarayan	
2840.81	14.94	19014.80	6	Xakwu- Xwl	
326.36	0.99	2574.37		S.E	

It was established from data in Table 7 that there was difference among the sub-locations of Penjwen location, the highest fresh and dry yield were produced by the sub- location of Penjwen center which were 19971.20 and 3942.31 kg.ha^{-1}, as the means of five replicates respectively, while the lowest yields of fresh and dry forage were 6711.2 and 1295.26 kg.ha^{-1}, respectively, as the means of five replicates at sub-location of Bellikyan. In which the present of dry matter restricted between 17.67-23.13% at Kane-manga and Bashmax sub-locations, respectively. Nasra (19). We found that the low vegetation ground cover in all sites was caused by low and fluctuated precipitation characterizing the semi-arid area.

Table 7: Effect of locations on forage yield for Penjwen location 2015.

Dry yield (Kg.ha^{-1})	Dry Matter (%)	Fresh yield (Kg.ha^{-1})	Rep. No of sampling	Sub-location	Location
3942.31	19.74	19971.20	5	Penjwen center	
2748.76	23.13	11884.00	7	Bashmax	
1295.26	19.30	6711.20	5	Belikyan	
1577.01	17.67	8924.80	5	Kane mang	
605.37	1.14	2899.95		S.E	

Data in table (8) shows that the location of sharazoor produced the highest fresh and dry yields with 19563.36 and 3224.04 kg/ha, respectively, but the lowest fresh and dry yields produced by the location of Penjwen with 11872.8 and 2369.81 kg/ha, respectively. Regarding dry matter percentage, it was ranged between (16.48-19.96 %) for Sharazoor and Penjwen locations respectively. The out yielding of Sharazoor location resulted in the suitability of its environmental condition especially the amount and the monthly distribution of rainfall and temperature (Table 2). In spite of the highest amount of rainfall at Penjwen location table (2), the lowest dry yield per heater was recorded, this may be due to environmental factor especially rainfall distribution.

Table 8: Effect of locations on forage yield for sharazoor and Dukan location 2015.

Dry yield (kg.ha^{-1})	Dry matter (%)	Fresh yield (kg.ha^{-1})	Location	NO.
3224.04	16.48	19563.36	Sharazoor	**1**
2369.81	19.96	11872.80	Penjwen	**2**
2796.92	18.46	15718.08		**X**
427.115	4.282	3845.28		**S.E**

Carrying capacity and Rangeland

Data in Table (9) shows the total area, total yield and animal unit.3month^{-1} for all locations, recording in the main locations used in this survey. Regarding the total area, it was observed that Sharazoor location gave the maximum of total area, rangeland and total yield/ton with 126546.00 ha, 12835.00 ha and 41380.50 ton, respectively. Assuming that the monthly required forage is 55 kg and the proper range use is 50%, the animal unit for three month can be calculated as reported in Table 8 according to (5), who reported that the carrying capacity is usually determined using the proper use factor (PUF) of 50% in which only one half of forage biomass produced is considered as available for grazing. The location of Sharazoor was able to provide forage for the maximum number of animal.3months^{-1} which was 125395.40 A.U.3M^{-1}. Investigated that the carrying capacity may vary from another location and from year to year in the same area as a result of damage by human or animals or forage production may fluctuate according to the rainy season. The differences in plant height due to all locations were affected in forage yield, and also carrying capacity. It was observed that there were differences between locations for all characters. These results were agree with the previous studies, which confirm the importance of climatically condition in determining rangeland production and carrying capacity(22 and 26) .

Table 9: The mean of Total area, rangeland, total yield (ton) and animal unit/3 months for Sharazoor and Penjwen locations 2015.

Animal unit.3month^{-1}	Total dry yield (ton)	Range land (ha)	Total area (ha)	Location	NO.
125395.40	41380.50	12835.00	126546.00	Sharazoor	**1**
77406.30	25544.10	10779.00	295422.00	Penjwen	**2**
101400.85	33462.3	11807	210984.00		**X**
23994.55	7918.2	---	---		**S.E**

Forage quality and Chemical Component.

Results of chemical analysis for legume plants was recorded in Table 10 .The location of Sharazoor recorded the maximum protein content, fiber content, phosphorus, potassium, ash and Magnesium content with 11.81, 20.50, 1.45, 1.02, 0.24, 11.98 while the location of Penjwen showed the highest Calcium contents with 0.28 , and for ash it was 11.98 recorded at sharazoor , This result was in agreement with Njidda(2 0) , while the results disagree with those recorded by Rafaat(22) due to difference in the sub-location of the study.

Table 10: Effect of locations on Chemical contents percent of legume plants for Sharazoor and Penjwen locations 2015.

Ash	Ca	Mg	K	P	Oil	Fiber	Carbohydrate	Protein	Location	No.
11.98	0.20	0.24	1.02	1.45	0.78	20.50	9.60	11.81	Sharazoor	**1**
8.59	0.28	0.16	0.70	1.35	1.37	18.50	13.74	10.50	Penjwen	**2**
10.28	0.24	0.2	0.86	1.4	1.07	19.5	11.67	11.16	X	
1.495	0.040	0.040	0.160	0.050	0.295	1.000	2.070	0.655	S.E	

Table (11) shows that the chemical composition of grass plants are differing among the studied locations. Sharazoor location showed the maximum contents of phosphorus potassium and Ash with 1.36%, 0.96% and 9.04% respectively. Maximum contents of protein location, carbohydrate fiber, oil, phosphorus and potassium were recorded at Penjwen, magnesium and calcium with 9.80%, 36.45%, 31.50%, 0.82%, 0.18%, and 0.22 % respectively. In grass plants. This result was in agreement which (8). This fluctuation in results of chemical analyses may be due to variation in soil chemical, physical and biological proportion in addition to variation in climate among the studied locations table (2). It is appear from chemical analyses of legume and grass plants, that most of the studied parameters were higher in legume plant except carbohydrate and fiber which were higher in grass plants. The highest mean value of most of the studied parameters in legume like protein, oil, P, K, Mg, Ca, and ash presented maybe due the higher root action exchange capacity (RCEC) of legumes in compare with its value for grass which were 60 and 15 meq.$100g^{-1}$ dry root respectively (17).

Table 11: Effect of locations on Chemical Contents percent of grass plants for Sharazoor and Penjwen locations 2015.

Ash	Ca	Mg	K	P	Oil	Fiber	Carbohydrate	Protein	Location	No.
9.04	0.08	0.10	0.96	1.36	0.70	18.5	19.48	3.50	Sharazoor	**1**
7.89	0.22	0.18	0.65	1.33	0.82	31.50	36.45	9.80	Penjwen	**2**
8.46	0.15	0.14	0.80	1.35	0.76	25.00	27.96	6.65	X	
0.575	0.070	0.040	0.155	0.015	0.060	6.500	6.000	3.150	S.E	

Conclusions:

From the results of this study it was noticed that the sub location of said sadiq of sharazoor gave the maximum value of leaf dry weight, stem dry weight and leaf stem ratio for legume plants. While Sharazoor location gave the maximum value of total dry yield, fresh yield and Animal unit/three months. It can be concluded from the results that, the different locations gave the variable forage yield and chemical composition. Also from the results of this study it is conclude that Penjwen location

was higher than Sharazoo locations for Dry matter, while Sharazoo location was able to provide forage yield and fresh yield for maximum number of animal /3 months.

The result of chemical analysis for legumes and grass indicated the differences between all contents. The location of Sharazoor gave maximum value for protein, fiber, phosphorous, potassium, and ash for legume plants, While Penjwen location showed the highest carbohydrate, hosphorous, potassium, and ash contents for grass plants.

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