Survey of Forage Production, Quality and Carrying Capacity of Two Different Rangelands (Sulaimani and Halabja) Governorate.

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Abstract

This study was conducted during two seasons 2020-2021and 2021-2022 at two main different locations of Sulaimani, and Halabja governorate; each with some sub-locations, to estimate green forage yield, dry forage yield, dry matter percentage and animal unit. The result confirmed the highest plant height of grasses were recorded in Sulamani location; however, Halabja location provided highest plant height for legumes for the two seasons. In regarding to the effect of seasons on plant height, the second season was taller than the first season for grasses and legumes. Maximum green yield, dry yield and dry matter percentage exhibited in Sulaimani location for two seasons. Regarding seasonal effect, the second season exceeded the first season in green and dry yields and dry matter percentage; Maximum total forage yield and animal unit in 3 months provided maximum value by Sulamani location for both seasons. Results of chemical analysis for the grass plants showed that there were differences between two locations. The Sulamani location gave the maximum percentage of protein, phosphorus and calcium content. In which Halabja location was recorded maximum value for carbohydrate, Potassium, and ash content for the first season. While for legumes, plants recorded highest value for protein, phosphorus, Potassium, Calcium and ash content except carbohydrate content gave high value at Halabja location. In the relevant of the effect of seasons on chemical components for grass plants, the second season 2021-2022 predominated the first season in the chemical contents of protein, carbohydrate, phosphorus, potassium, calcium and ash. Whereas for legume plants the second season also gave maximum value for all contents, excepted protein content recorded high value in the first season.

Key words: Rangelands, Forage Crops, pasture, carrying capacity, forage yield, Dry matter, Animal unit, forage quality

مسح إنتاج ونوعية محاصيل العلف والحمولة الحيوانية في منطقتين مختلفتين للمراعى الطبيعية (محافظة السليمانية و حلبجة)

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الخلاصـــة

أجريت دراسة مسحية ضمن المنطقتين المختلفتين هما محافظة (السليمانية - حلبجة) و بضمنها مواقع الثانوية لكل الموقع الرئيسى ان الموقع الثانوية لسليمانية شملت (قلياسان ، بازيان ،عوال،قرداغ، دوكان) و الموقع الثانوية للحلبجة (زمقى،عبابيلى، باوه كجك،خورمال،بيارة، تويلة ،بلخة) خلال موسمين متتاليين 2021-و2020 -و 2021- 2022ذلك لتقدير حاصل العلف الاخضر،و حاصل الجاف و المادة الجافة و وحدة الحيوانية.دلت نتائيج على ان محافظة السليمانية اعطى اعلى نسبة للارتفاع النبات الحشائش، فيما اعطى محا فظة حلبجة اعلى الارتفاع النبات لنبات لبقول.أما بالنسبة لتأثير المواسم، حيث أظهر تفوق الموسم الثانى على الموسم الاول في ارتفاع النبات للنباتات الحشائش و البقول .اشارة النتائيج الى ان محافظة السليمانية اعطى اعلى قيمة حاصل العلف الاخضر،و حاصل الجاف و المادة الجافة للموسمين.و بالنسبة لتاثير الموسمين الموسم الثانى تفوق على الموسم الاول فى حاصل العلف الاخضر،و حاصل الجاف و المادة الجافة لكل الموسمين.بينما بلغت أعلى قيمة لحاصل الكلى للعلف و للوحدات الحيواني لكل ثلاثة أشهر في محافظة السليمانية لكلا موسمين .أظهرت نتائيج لتحليل المكونات الكيمياوية للنباتات الحشائش و البقول ،محافظة السليمانية اعطى اعلى نسبة من بروتين و الفسفور و الكاليسيوم .في حين محافظة حلبجة اعطى النسبة الاعلى لمحتوى الكربوهيدرات،بوتاسيوم والرماد فى الموسم الاول .اما بالنسبة للبقوليات سجلت اعلى نسبة لمكونات بروتين و الفسفور و الكاليسيوم و الرماد عدا محافظة حلبجة سجلت اعلى نسبة من محتوى الكربوهيدرات . حيث تفوق الموسم الثانى على الموسم الاول فى المحتوى بروتين و الكربوهيدرات والفسفور و الكاليسيوم وبوتاسيوم و الرماد .اما فى الموسم الثانى نباتات البقول اعطى اعلى نسبة لكل المكونات عدا محتوى بروتين سجلت اعلى نسبة للموسم الاول

الكلمات المفتاحية: المراعى، محاصيل العلف، الحمولة الحيوانية،المادة الجافة ،حاصل العلف،نوعية العلف

Introduction

Rangelands are the primary and cheapest source of forage for livestock (Ismail and Haris, 2014). Rangelands, uncultivated native grasslands, shrub lands, savannas, and marshes grazed by wildlife and livestock, cover some 45% of Earth's land surface (Allen et al., 2011). Forage crops are plant used for food by domestic animals, legumes and grasses are important forage crops that provide a food source for livestock animals, which in turn provide milk, meat, and labor for humans(Gellings and Parmenter, 2016).Forage quality represents nutritional value and the amount of energy that is available for livestock. In other words, it is the amount of nutrients that animals obtain in the shortest possible time from the feed(Buxton, 1996); (Baghdadi *et al.*, 2017)/Using good quality forage in animal breeding, reproduction, meat, dairy, leather and wool is very useful and effective. So that nutrient in the diets of livestock, forage quality and the amount of that is very important(Zhang, Shyy and Sastry, 2007). Forage also is an important factor that can affect the productivity of livestock, so forage must be considered for availability(Herdiawan and Krisnan, 2014).Plants vary in the quantities of different nutritive components that they deliver to consumers. They can vary in the amounts of fat, protein, carbohydrate, fiber and other micro-nutrients that are present in tissues. Herbivores vary in their requirements for these different nutritive components, and their dietary requirements change over time

(Simpson, 2004).Forage plants also vary in their palatability, with defensive or structural compounds such as lignin and fibrous compounds reducing the amount of plant material that herbivores can digest(Arnould and Thompson, 2005).Legumes are rich in protein while grasses are rich in carbohydrates, cereals constitute forages relatively low in protein (Lauriault and Kirksey, 2004)and animals usually require some form of relatively costly protein concentrate supplementation, the production of high protein and more nutritious hay of mixtures(Lithourgidis *et al.*, 2006;(Satman *et al.*, 2002). Therefore, the objective of present study was to evaluate the forage crops production, quality of grass, legume plants and carrying capacity in two different Rangelands (Sulaimani and Halabja) governorate.

Materials and Methods:

Site selection

This study was conducted at two main different locations including Sulaimani and Halabja governorate, Sulaimani (location 1) 35º 10' – 36º 27' N and 44º 40' – 46º 22' E, Halabja (location 2) 35° 10' N and 45° 58' E (Google Earth Pro, 2020). Sulaimani is a city in the east of the Kurdistan Region of Iraq, not far from the Iran–Iraq border. The Azmar, Goizha and Qaiwan mountains surround it in the northeast, Baranan Mountain in the south and the Tasluja Hills in the west. Halabja is surrounded by Hawraman and Shnrwe range in the northeast, Balambo range in the south and Sirwan River in the west. Fig (1) (a,b,c).

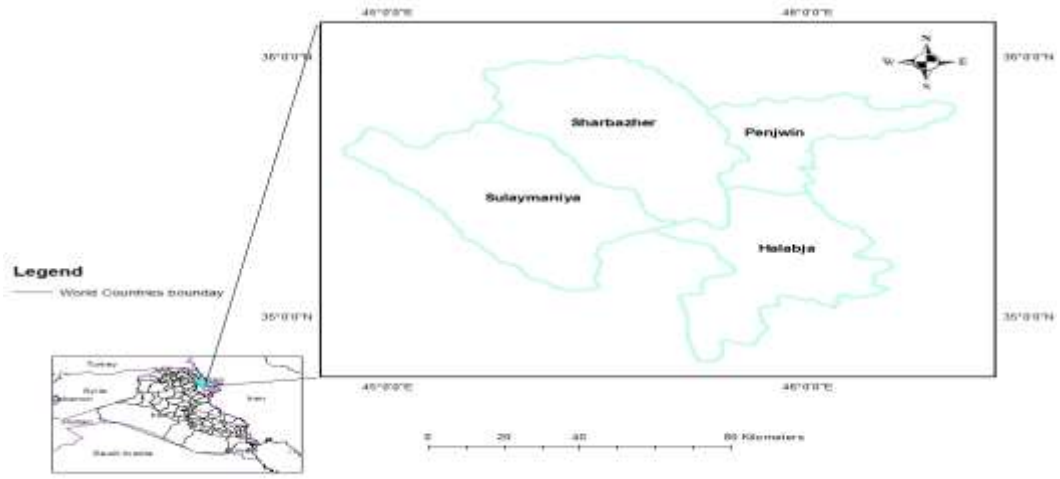

Figure (a) main location map

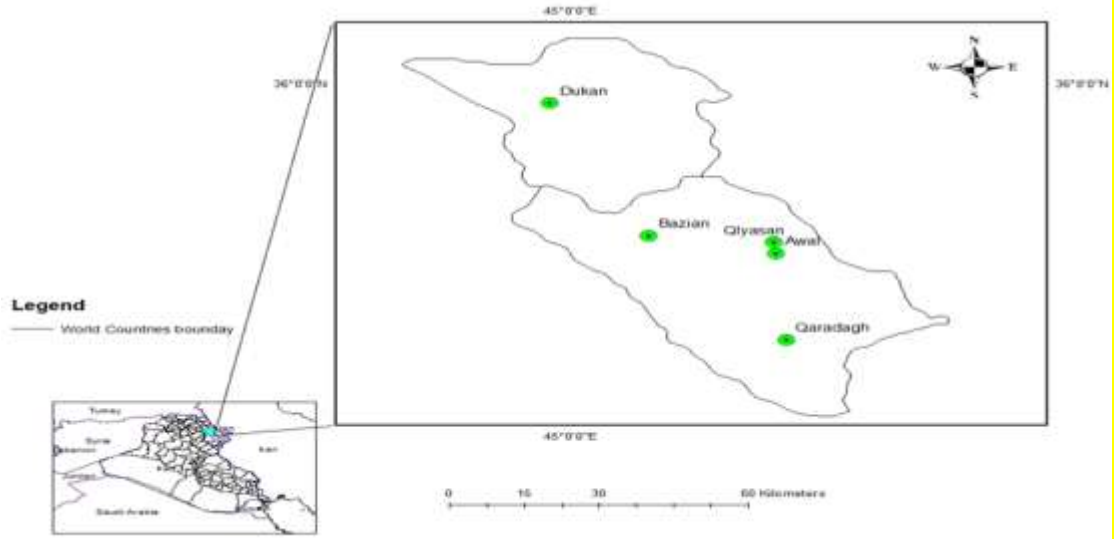

Figure (b) Sulaimani District map

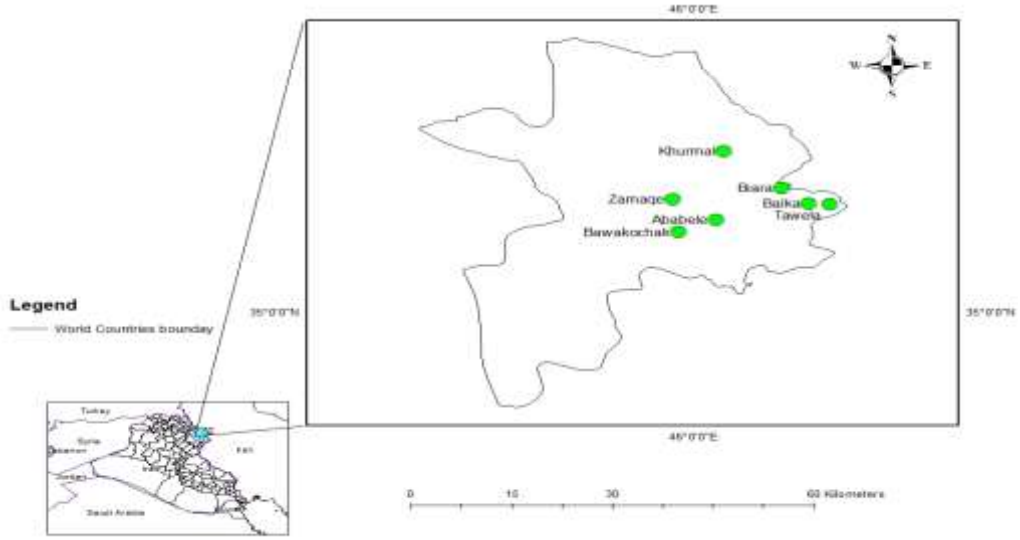

Figure (c) Halabja District map

Figure 1: Map scale of the study area, (a) main location map (b) Sulaimani region, (c) Halabja district, (e).ARC JIS used for designing all maps.

The study provide essential information about some range resources related to the biomass and plant distribution and to quantify carrying capacity and some qualitative forage characteristics in the region. The study covered two main locations each with some sub-location for two growing seasons (2020 -2021 and 2021-2022).shows ((Table: 1).

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

Main Locations			
Sub-locations		Sulaimani	Halabja
	1	Qlyasan	Zamaqe
	2	Bazian	Ababele
	3	Qaradagh	Bawakochak
	4	Awal	Khurmal
	5	Dukan	Biara
	6	-	Tawela
	7	-	Balka

Climatic conditions of the study locations:

The main locations are differing climatically with total annual rainfall about (288.1, and 484.7 mm) for Halabja, and Sulaimani locations, respectively. The maximum temperature were (25.0 and 20.4^{O}C,) while for minimum temperature were (5.4and5.0 ^{O}C) for Halabja and Sulaimani respectively, during (2020-2021). (see table.2), In which at 2021-2022 the main locations are differing climatically with total annual rainfall about (254 and 290.03 mm) for Halabja and Sulaimani locations, respectively, the maximum temperature were (34.2 and, 31.3^{O}C) while for minimum temperature were (10.2 and 9.0 ^{O}C)for Halabja and Sulaimani respectively, (Table 3).Which affected the plant material depending on climate and the variation of weather events within the climate.

A Fabaceea and Poaceae are occur in Sulaiamni District and which are important as a wild forage plant. (Ahmad *et al.*, 2021; Hama and Ahmad, 2020).

FABACEAE

1. *Lathyrus annuus* L.
2. *Lathyrus cicera* L.
3. *Lathyrus cassius* Boiss.
4. *Lathyrus chloranthus* Boiss. & Bal.
5. *Lathyrus inconspicuous* L.
6. *Lotus gebelia* Vent. var. *gebelia*
7. *Lotus gebelia* Vent. var. *villosus* Boiss.
8. *Lens orientalis* Popow
9. *Medicago sativa* L.
10. *Medicago turbinata* (L.) All.
11. *Melilotus indica* (L.) All.
12. *Melilotus officinalis* (L.) Lam.
13. *Pisum sativum* L.
14. *Trifolium angustifolium* L.
15. *Trifolium arvense* L.
16. *Trifolium campestre* Schreb.
17. *Trifolium dasyurum* C.Presl
18. *Trifolium grandiflorum* Schreb.
19. *Trifolium nigerscens* Viv.
20. .*Trifolium resupinatum* L.
21. *Trigonella strangulata* Boiss.

22. Vicia hybrida L.

23. Vicia narbonensis L.

24. Vicia sativa L.

25. Vicia villosa Roth.

POACEAE

1. *Avena barbata* Pott ex Link
2. *Avena wiestii* Steud.
3. *Bromus tectorum* L.
4. *Hordeum bulbosum* L.
5. *Hordeum geniculatum* All.
6. *Hordeum glaucum* Steud.
7. *Lolium multiflorum* Lam.
8. *Lolium perenne* L.
9. *Lolium persicum* Boiss. & Hohen.
10. *Poa bulbosa* L.
11. *Polypogon maritimus* Willd.
12. *Setaria viridis* (L.) P.Beauv.
13. *Sorghum halepense* (L.) Pers.
14. *Stipa kurdstanica* Bor
15. *Triticum aestivum* L.
16. *Triticum durum* Desf.

Table (2): Rainfall, Temperature of Sulaimani and Halabja locations during (2020-2021).

	Rainfall (mm)		Temperature °C	
Month	Halabja	Sulamani	Halabja	Sulamani
October	-	-	-	-
November	-	-	-	-
December	-	-	-	-
January	170.8	153.5	5.4	5.0
February	55.3	57.5	10.4	10.3
March	25.9	58.9	11.4	10.8
April	21.6	214.8	21.4	20.4
May	14.5	-	25.0	-
June	-	-	-	-
July	-	-	-	-
Total	288.1	484.7		

Source: Sulaimani and Halabja Meteorological centers

Table (3): Rainfall, Temperature of Sulaimani and Halabja locations during (2021-2022).

	Rainfall (mm)		Temperature ^{o}C	
Month	Halabja	Sulamani	Halabja	Sulamani
October	6.5	18.53	25.2	22.5
November	51.4	17.2	16.8	15.0
December	64.3	72.1	11.4	10.3
January	68.2	65.5	10.2	9.0
February	38.7	71.4	12.1	11.0
March	21.0	30.4	15.4	14.0
April	3.5	10.7	23.0	21.7
May	0.4	4.2	32.2	27.9
June	-	-	34.2	31.3
July	-	-		
Total	254	290.03		

Source: Sulaimani and Halabja Meteorological centers

Table 4, Chemical and Physical properties of soil of both locations

Soil properties		Halabja	Sulamani
% Sand		7.62	4.91
% Silt		37.88	36.59
% Clay		54.50	58.50
Texture		Clay	Clay
EC dS m^{-1} at 25°C		0.7	0.11
PH		7.85	7.45
N %		0.11	0.12
Organic matter %		1.66	1.33
CaCO3%		30	20.5
Available P ppm		8.360	20.367
Soluble (meq L^{-1})	K^{+}	0.070	0.130
	Na^{+}	0.165	0.304
	Ca^{+2}	2	1.8
	Mg^{+2}	1	1.7
	Cl^{-}	0.5	1

Materials processing:

The study was included survey of the forage crops (legumes and grasses) at Sulaimani and Halabja governorate for two seasons (2020-2021, 2021-2022).The samples were randomly taken in two different locations (Sulaimani and Halabja) each with some sub- locations as shown in (Table 1), using quadrate (50 x 50 cm^2) Vegetation cover (legume and grasses) within the quadrate were cut by using a cutter at 2.5 cm above soils surface, then hundred gram of total fresh weight from legumes plant and grasses was taken and put them in an oven at 75°C for 48 hours. The dry weight obtained using a digital balance(Fenetahun *et al.*, 2020;(Fenetahun *et al.*, 2021). Productivity was obtained for herbaceous cover. Sampling was carried out on April and May at two seasons 2020-2021,2021-2022,when almost all the pasture plants were fully-growth to their vegetation stage at %50 flowering. The comparison was conducted using standard error with the following formula**.**

$$SE = \frac{S}{\sqrt{N}}$$ (Lee *et al.*, 2007)

S = standard deviation

N= number of sample

The following characters were determined:

- Plant height (cm): The plant height for each species was determined by measuring the plants from ground level to the top of the main stem.
- Green forage yield (Ton/ ha): the mean of fresh weight of samples were recorded directly after cutting in each area (g/m^2), converted to (ton/ha).
- Dry matter percent: The samples were dried in the oven at 75°C for 48 hours to determine the dry matter percent.
- Dry forage yield (ton/ha): The mean of plant dry weight of the samples were recorded in each area (g/m^2), converted to (ton/ha) then dry forage yield was calculated according to the following equation:
- Dry forage yield = Green forage yield x dry matter %
- Animal Unit/3 Months: was calculated according to the following formula as described by (Darrag, 1996)

$$\text{A.U./3M} = \frac{\text{Available forage (ha)}}{\text{Animal requirement} \times 3\text{M}}$$ (Manske and Henning, 1998)

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

* Using factor = 50%

Chemical component:

- Protein content: The protein was micro chemical determination of Nitrogen, Micro- Kjeldahl method (Ahn *et al.*, 2014)
- Carbohydrate content: The carbohydrate was determined using DNC method (Gaewchingduang and Pengthemkeerati, 2010).
- Phosphorus content: The phosphorus was determined using Olsen's method according to ICARDA method as described by(Bhatt *et al.*, 2013).
- Potassium content: The potassium was determined using flame photometric according to ICARDA method as described by (Lambert *et al.*, 2013)
- Calcium content:The calcium was determined by titrimetric method using 0.01N EDTA, according to ICARDA method as described by (Abi-Ghanem *et al.*, 2013)
- Ash content**:** The ash was determined using the instrument called muffle furner (Coimbra and Jorge, 2011).

Sampling was carried out on April and May at two seasons 2020-2021,2021-2022, when almost all the pasture plants were fully-growth to their vegetation stage at %50 flowering.

The analyses of protein and carbohydrate content were carried out in the laboratory of College of Agricultural Engineering Sciences University of Sulaimani, while phosphorus, potassium, calcium and ash content ,which was followed up at the Razga company for trading general contracting quality control/ LTD of SulaImani, penjwen.

Results and dissection:

Plant height

Table (3) exhibited legume and grass plant height in Sulaimani location, with (5) sub-locations which were Qlyasan, Bazian, Qaradagh, Awal, and Dukan. It was noticed that the maximum legume plant height recorded in Qlyasan as a mean of 10 replications, which was (21.81 cm), whereas the minimum plant height legume was recorded as a mean of 7 replicates (12.85 cm) from Dukan. This means that there were significant differences in legume plant height in Sulaimani location at 2020-2021, regarding the grass plant height, as recorded in Sulaimani location, the maximum plant height was (96.00cm) obtained in Dukan as a mean of 7 replicates, while the lowest value was (54.60 cm) recorded in Qlyasan as a mean of 10 replicates.

Table (3): Means of plant height in Sulaimani Location during 2020-2021.

Loc.	Sub - Loc.		Rep.No.	Plant Height(cm)	
				Legumes	Grasses
Sulaimani	1	Qlyasan	10	21.81	54.60
	2	Bazian	9	15.66	72.00
	3	Qaradagh	12	20.00	64.50
	4	Awal	11	16.18	70.00
	5	Dukan	7	12.85	96.00
SE				1.602	6.845

Data in table (4) show plant height in Halabja location with 7 sub-locations each with some different replications. The highest plant height of legumes (29.25 cm) was recorded in Ababele as a mean of 9 replications, but the sub-location of Bawakochak exhibited the lowest legume plant.

Table (4): Means of plant height in Halabja Location during 2020-2021.

Loc.	Sub - Loc.		Rep.No.	Plant Height(cm)	
				Legumes	Grasses
Halabja	1	Zamaqe	8	26.5	56.87
	2	Ababele	9	29.25	46.25
	3	Bawakochak	8	18.00	69.87
	4	Khurmal	7	22.14	49.42
	5	Biara	10	23.20	73.00
	6	Tawela	6	20.00	40.83
	7	Balka	5	20.00	68.00
SE				2.251	4.813

Height (18.00 cm) as a mean of 8 replicates. Concerning the grass plant height in Halabja location, it was noticed significant differences among its sub-locations in this character, the highest grass plant height (73.00 cm) was recorded in(Biara) as a mean of 10 replicates, while the lowest grass plant heights were (40.83cm) was recorded in (Tawela) as a mean of 6 replicates.Sub-locations related to Sulaimani location (Table 5),

showed that the legume plant height was recorded from five sub-locations.It was noticed that the legume plant height ranged from (34.45 cm) as a mean of 11 replicates at Dukan to (26.91 cm) as a mean of 12 replicates at Qaradagh sub-location, while for grass plant height, it was restricted between (93.00 cm) as a mean of 12 replicates at Qaradagh and (60.20 cm) as a mean of 8 replicates in Awal.

Table (5): Means of plant height in Sulaimani Location during 2021-2022

Loc.	Sub - Loc.		Rep.No.	Plant Height(cm)	
				Legumes	Grasses
Sulaimani	1	Qlyasan	8	33.12	83.00
	2	Bazian	10	27.10	67.00
	3	Qaradagh	12	26.91	93.00
	4	Awal	8	29.50	60.20
	5	Dukan	11	34.45	77.00
SE				1.541	5.786

Sub-locations related to Halabja location (Table 6), showed that the legume plant height was recorded from five sub-locations only out of 7 sub-locations, because two sub-locations were excluded from legume plants. It was noticed that the legume plant height ranged from (45.28 cm) as a mean of 7 replicates at Ababele to (36.42 cm) as a mean of 10 replicates at Zamaqe sub-location, while for grass plant height, it was restricted between (75.00 cm) as a mean of 10 replicates at Zamaqe and (45.80 cm) as a mean of 9 replicates in Biara.

Table (6): Means of plant height in Halabja Location during 2021-2022

Loc.	Sub - Loc.		Rep.No.	Plant Height(cm)	
				Legumes	Grasses
Halabja	1	Zamaqe	10	36.42	75.00
	2	Ababele	7	45.28	64.57
	3	Bawakochak	12	42.25	57.91
	4	Khurmal	11	42.81	72.00
	5	Biara	9	41.22	45.80
	6	Tawela	8	---	60.5
	7	Balka	10	---	71.00
SE				7.736	3.825

Data in (Table 7) show that the location of halabja for plant height during both seasons produced the highest plant height for legume plants in the first season which was (22.72 cm) in Halabja location but the lowest plant height (17.3 cm) was exhibited in Sulaimani.Regarding grass plant height in the first season, the location of Sulaimani with (71.42 cm) showed the tallest plant height, while the shortest plant height recorded in Halabja, which was (57.74cm).Data recorded legume on plant height in the second season the location of Halabja with (41.59cm) showed the tallest plant height, while the shortest a, while the fluctuation in precipitation for the total and monthly precipitation caused the great differences in this trait as a means of both seasons table (2and3

Table (7): Means of plant height for two locations during both seasons 2020-2021 and 2021-2022

#	Loc./ seasons	2020-2021		2021-2022	
		Legumes	Grasses	Legumes	Grasses
1	Sulaimani	17.3	71.42	30.21	76.04
2	Halabja	22.72	57.74	41.59	63.82
$\bar{X}$		20.01	64.58	35.9	69.93
SE		2.71	6.84	5.69	6.11

The means of legumes and grasses across both seasons reported in table (8).it was revealed the exceeding of the second seasons compare to the first in both traits by 44.26 and 7.65% respectively. This is may be due to the suitability of the prevailing environmental condition during the second season in relation to the amount of rain and its distribution during the season, in addition to the suitability of the temperature. The out yielding of

the second season in these traits resulted in the suitability of its environmental condition especially the amount and the monthly distribution of rainfall in this season(Wessels et al , 2012),(Devendra and Thomas, 2002).

Table (8): Effect of seasons on the average of legume and grasses plant height 2020-2021 and 2021-2022

seasons	legumes	Grasses
2020-2021	20.01	64.58
2021-2022	35.90	69.93
Cal.t0.05	5.32	2.09
Tab t.05	1.860	-

Forage yield:

Significant differences exhibited among sub-locations of Sulaimani location in green forage yield, dry forage yield and dry matter at the first season (Table 9).Regarding green forage yield, it was noticed that the sub-location of Qlyasan produced the highest Green forage yield which was (21.21 t/ha) followed by sub-location of Awal with (16.83t/ha), whereas the sub-location of Qaradagh with (10.38 t/ha) gave the minimum Green forage yield. The percentage of dry mater as shown in the same table had a significant difference between the sub-locations. The values of these characters were ranged between (0.26 and 0.12 %) for sub-locations of Qlyasan and Qaradagh, respectively.The sub-location of Qlyasan with (5.51 t/ha) gave maximum dry forage yield followed by Awal sub-location with (3.70 t/ha) .While Qaradagh with (1.24 t/ha) exhibited the minimum dry forage yield. It was established that the precipitation amount and its monthly distribution had a great role in green and dry forage yields, This result was in good agreement with(Amin *et al.*, 2020),(Mohammed *et al.*, 2021),(Bøås and Jennings, 2005). Whom indicated to the importance of the role of climatically condition in growth characters.

Table (9): Means of green forage yield, D.M% and dry forage yield for Sulamani location during 2020-2021

Location	Sub-loc	No. of Sample	Green forage Yield (t/ha)	Dry Matter (%)	Dry forage yield (t/ha)
Sulaimani	Qlyasan	10	21.21	0.26	5.51
	Bazian	9	12.12	0.16	1.93
	Qaradagh	12	10.38	0.12	1.24
	Awal	11	16.83	0.22	3.70
	Dukan	7	15.91	0.14	2.22
SE			1.896	0.026	0.761

Table (10) show significant differences between the sub-locations of Halabja in green and dry forage yields and dry matter percentage. The sub-locations of Tawela gave maximum green and bawakochak dry forage yields maximum with (11.83 and 2.03t/ha), respectively. While the lowest green and dry forage yields were produced by the sub-location of Balka with (1.97 and 0.19 t/ha), respectively. Regarding dry mater percentage, it was restricted between 0.20 and 0.10%) for both sub-locations, Biara and Balka respectively.

Table (10): Means of green forage yield,D.M% and dry forage yield for Halabja location during 2020-2021.

Location	Sub-loc	No.of Sample	Green forage Yield (t/ha)	Dry Matter (%)	Dry forage yield (t/ha)
Halabja	zamaqe	8	6.76	0.16	1.08
	bawakochak	9	11.28	0.18	2.03
	Ababele	8	6.99	0.16	1.11
	Khurmal	7	5.87	0.14	0.82
	Biara	10	8.65	0.20	1.73
	Tawela	6	11.83	0.12	1.41
	Balka	5	1.97	0.10	0.19
SE			0.112	0.012	0.228

Table (11) which shows green and dry forage yields and percent dry matter of forage crops grown in Sulaimani location with its selected sub-locations during 2021-2022, indicates that the values of these traits, restricted between (21.14 -12.27 t/ha) in sub-locations of Dukan and Qaradagh and(4.86-2.14 t/ha) in sub-locations of Dukan and Awal for green forage dry forage yield and (0.25-0.16%) for dry mater percentage in sub-locations of Qaradagh , Qlyasan and Awal respectively.

Table (11): Means of green forage yield,D.M% and dry forage yield for Sulamani location during 2021-2022.

Location	Sub-loc	No.of Sample	Green forage Yield (t/ha)	Dry Matter (%)	Dry forage yield (t/ha)
Sulaimani	Qlyasan	8	20.16	0.16	3.22
	Bazian	10	14.23	0.21	2.98
	Qaradagh	12	12.27	0.25	3.06
	Awal	8	13.38	0.16	2.14
	Dukan	11	21.14	0.23	4.86
SE			1.835	0.018	0.443

Table (12) also established also the presence of significant deference's among the sub-locations of Halabja location, in these traits, the green forage yield ranged between (13.76-4.54 t/ha) in Ababele and Balka, while for dry forage yield, it was restricted between (3.30 t/ha) in Ababele to (0.95 t/ha) in Balka sub-location, while the perecent dry matter restricted between (0.25-0.14%) in zamaqe and bawakochak sub-locations, respectively

Table (12): Means of green yield,D.M% and dry yield for Halabja location during 2021-2022.

Location	Sub-loc	No.of Sample	Green forage Yield(t/ha)	Dry Matter (%)	Dry forage yield(t/ha)
Halabja	zamaqe	10	12.72	0.20	2.54
	bawakochak	7	10.12	0.14	1.41
	Ababele	12	13.23	0.25	3.30
	Khurmal	11	9.87	0.23	2.27
	Biara	9	9.11	0.19	1.73
	Tawela	8	13.76	0.16	2.20
	Balka	10	4.54	0.21	0.95
SE			1.205	0.0144	0.292

Table (13): Means of green forage yield and dry forage yields and percent dry matter percent during both season 2020-2021 and 2021-2022 for studied location.

#	Loc	2020-2021			2021-2022			Cal.t.05		
		Green forage Yield (T/ha)	Dry Matter (%)	Dry forage yield (T/ha)	Green forage Yield (T/ha)	Dry Matter (%)	Dry forage yield (Ta/ha)	Green Yield (Ta/ha)	Dry Matter (%)	Dry forage yield
1	Sulaimani	15.29	0.18	2.75	16.23	0.20	3.25	0.59	0.12	0.25
2	Halabja	7.62	0.15	1.14	10.47	0.19	1.98	0.27	0.07	0.1
$\bar{X}$		11.45	0.16	1.94	13.35	0.19	2.61	0.43	0.09	0.17
SE		3.83	0.01	0.80	2.88	0.005	0.635	0.16	0.025	0.075

Data present in table(14) confirmed that the differences between both seasons was significant for green forage yield only, but for dry forage yield and dry matter was not significant . The second season gave higher green forage yield compare to the first season by (16.59%). Out yielding, the second season in these traits resulted in the suitability of its environmental condition especially the amount and the monthly distribution of rainfall in this season.(Undersander, et al., 2002),(Ragsdale *et al.*, 2007).

Table (14): Effect of seasons on the average green forage Yield and dry forage yields and D.M%

Seasons	Green forage Yield (t/ha)	Dry forage yield (t/ha)	Dry Matter (%)
2020-2021	11.45	1.94	0.16
2021-2022	13.35	2.61	0.19
Cal.t0.05	2.011	1.603	0.210
Tab t.05	1.943	-	-

Carrying capacity and Rangeland:

Data in table (15) show the total area, rangeland, total dry forage yield and animal unit/3 month for both seasons 2020-2021and 2021-2022, recorded in the main locations used in this survey. Regarding to the total area, it was observed that the maximum area belongs to Sulaimani location with (222506.7 ha). The minimum area belongs to Halabja with (78595.0 ha). As shown in this table, the maximum rangeland belongs to the location of Sulaimani with (48974.5 ha) .The minimum rangeland area is (15191.0 ha) belongs to Halabja location.The location of Sulaimani produced maximum total dry forage Yield with (134679.8ton) but the lowest total dry forage yield was (17317.74 ton) produced by Halabja location. Regarding to the second season, the differences between the locations for total dry forage yield was also significant and maximum total dry forage yield produced by Sulaimani location, which was (159167.1 ton), while the minimum total dry forage yield exhibited in Halabja location, which was (17317.74 ton). Assuming that the monthly-required forage is (55 kg) and the proper range use is (50 %), we can calculate the animal unit for three months as reported in table (15). In the first season, the location of Sulaimani was able to provide forage for maximum number of animal/3 months, which were 4081.20 A.U. /3M). Halabja can provide the forage for minimum number of animals (524.78 A.U. /3M).Data of animal unit in the second season as reported in the same table also indicate to the presence of these results were agree with the previous studies, which confirm the importance of climatically condition in determining rangeland production and carrying capacity (Abi-Ghanem *et al.*, 2013),(Thalji, 2006).

Table (15): Total area, rangeland, total dry forage yield/ton and animal unit/3 months for two locations during both seasons.

#	Location	Total area (ha)	Range land (ha)	Total dry forage Yield/ton (2020-2021)	Total dry forage Yield/ton (2021-2022)	Animal unit/3 month (2020-2021)	Animal unit/3 month (2021-2022)
1	Sulaimani	222506.7	48974.5	134679.8	159167.1	4081.20	4823.24
2	Halabja	78595.0	15191.0	17317.74	30078.1	524.78	911.45
$\bar{X}$				75998.77	94622.6	2302.99	2867.34
SE				58681.03	64544.5	1778.21	1955.89

Forage quality and Chemical Component:

Results of chemical analyses for grass plants during 2020- 2021 recorded in table (16) for each location which show the protein content was (11.07%) as the average of two locations. Sulaimani location accepted maximum protein content, which was (12.96%), were as Halabja with (9.18%) showed minimum protein percentage. Data of carbohydrate content in grass plants showed significant differences among locations, the location of Halabja produced more carbohydrate contents in compare to the average of sulamani location, which was (17.96%). Halabja location showed maximum carbohydrate content (20.16%). The lowest carbohydrate content was (15.76%) exhibited by Sulaimani location. As shown in the same table, the amount of phosphorus as the average of locations was (0.48%) and significant differences were recorded between two main locations in this trait. Sulaimani location showed maximum phosphorus content (0.50%), while the lowest phosphorus content was (0.47%) in Halabja location. Significant differences among the locations were noticed in potassium content the average amount of potassium for locations was (1.87%), the maximum amount was (1.90%) recorded in Halabja location and Sulaimani location showed minimum value of potassium content, in their grass plants (1.85 %). From table (16). Significant differences between locations exhibited due to calcium content, which restricted between (0.93-0.80%) for both locations, Sulaimani and Halabja respectively. Regarding Ash content, there were significant differences between the locations which restricted between (9.97%) in Sulaimani to (10.80%) in Halabja location. The changes in climate and soil conditions depending on the aspect of the rangeland also lead to the differentiation of vegetation's, which also affects the quality of rangeland hay (Altın and Gençöz, 2011).This result was in agreement with (Mengel, 2001), while the results disagree with those recorded by(Hassan, Rafaat and Aziz, 2010).

Table (16): Chemical contents % of grass plants during 2020-2021.

#	Location	Protein	Carbohydrate	P	K	Ca	Ash
1	Sulaimani	12.96	15.76	0.50	1.85	0.93	9.97
2	Halabja	9.18	20.16	0.47	1.90	0.80	10.80
$\bar{X}$		11.07	17.96	0.48	1.87	0.86	10.38
SE		1.89	2.2	0.01	0.02	0.06	0.41

Chemical analyses for the legume plants represented in (Table 17) which indicates the presence of significant differences among the locations for contents in the first season., It was established that the location of Sulamani gave maximum value for protein, phosphorus, potassium, calcium and ash with(12.92, 0.51, 2.50, 0.80 and 10.33 %)respectively. While minimum value recorded by halabja location wih (11.06, 0.45, 1.88, 0.11 and 9.70%) respectively, for protein, phosphorus, potassium, calcium and ash. Data of carbohydrate content as represented in the table indicate the presence of significant differences between the locations, which restricted between (16.33 - 12.32%) for Halabja and Sulaimani,respectively. These result values are similar to those reported in various studies on the same species (Nandeesha *et al.*, 2001) ,(Bogunovic *et al.*, 2009).

Table (17): Chemical contents % of legume plants during 2020-2021.

#	Location	Protein	Carbohydrate	P	K	Ca	Ash
1	Sulaimani	12.92	12.32	0.51	2.50	0.80	10.33
2	Halabja	11.06	16.33	0.45	1.88	0.11	9.70
$\bar{X}$		11.99	14.32	0.48	2.19	0.45	10.01
SE		0.93	10.32	0.03	0.31	0.34	0.31

The chemical analyses of forage grasses in the second season and represented in table(18), revealed the maximum contents of protein, carbohydrate, phosphorus , potassium and ash recorded in Halabja location with (17.50, 21.30, 0.65, 3.08 and 13.73%), respectively. As shown in the same table, the location of Sulaimani showed the highest calcium contents with (0.97%). While Sulaimani location gave minimum values for protein, carbohydrate, phosphorus and potassium and ash (10.75, 16.64, 0.52, 2.56 and 9.56%) respectively.This current result was comparable to that reported that Brachiaria grass species can give production between chemical ranges for this result was in agreement with Njidda (2010), while the results disagree with those recorded by Rafaat (2010) due to difference in the sub-location of the study.

Table (18): Chemical contents % of grass plants during 2021-2022.

#	Location	Protein	Carbohydrate	P	K	Ca	Ash
1	Sulaimani	10.75	16.64	0.52	2.56	0.97	9.56
2	Halabja	17.50	21.30	0.65	3.08	0.81	13.73
$\bar{X}$		14.12	18.97	0.58	2.82	0.89	11.64
SE		3.37	2.33	0.045	0.26	0.08	2.08

Table (19) explains the chemical analyses of legume plants at 2021-2022 for two locations, Sulaimani and halabja, for each location which show the protein content was (10.86%) as the average of two locations. Sulaimani location accepted maximum protein content, which was (11.61%), were as Halabja with (10.12%) showed minimum protein percentage. Data of carbohydrate content in legume plants showed significant differences among locations, the location of halabja produced more carbohydrate contents in compare to the average of sulamani location, which was (15.33%). Halabja location showed maximum carbohydrate content (17.23%). The lowest carbohydrate content was (13.43%) exhibited by Sulaimani location. As shown in the same table, the amount of phosphorus as the average of locations was (0.65%) and significant differences were recorded between two main locations in this trait. Halabja location showed maximum phosphorus content (0.65%), while the lowest phosphorus content was (0.61%) in Sulaimani location. Significant differences among the locations were noticed in potassium content the average amount of potassium for locations was (12.59%), the maximum amount was (2.73%) recorded in Sulaimani location and Halabja location showed minimum value of potassium content, in their legume plants (2.45 %). From table (19). Significant differences between locations exhibited due to calcium content, which restricted between (1.05-0.76%) for both locations,Halabja and Sulaimani respectively. Regarding Ash content, there were significant differences between the locations which restricted between (12.95%) in Sulaimani to (8.55%) in Halabja location. This result was in agreement which was investigated that by (Beyene and Mlambo, 2012)

Table (19) Chemical contents % of legume plants during 2021-2022.

#	Location	Protein	Carbohydrate	P	K	Ca	Ash
1	Sulaimani	11.61	13.43	0.61	2.73	0.76	12.95
2	Halabja	10.12	17.23	0.65	2.45	1.05	8.55
$\bar{X}$		10.86	15.33	0.63	2.59	0.90	10.75
SE		0.74	1.9	0.02	0.14	0.14	2.2

Data present in table (20) illustrate the effect of seasons in chemical composition for grass plants. The differences between the seasons were significant for protein, Carbohydrate and potassium while for the other traits it was not significant. The second season exceeded the first season in some traits; this may be due to the suitability of the environmental condition during the second season.These results reflect the importance of using chemical components , especially when associated with (Giese and Mizuno, 2013)favorable rainfall and temperature conditions.

Table (20) Effect of seasons on chemical components % for grass plants

#	seasons	Protein	Carbohydrate	P	K	Ca	Ash
1	2020-2021	11.07	17.96	0.48	1.87	0.86	10.38
2	2021-2022	14.12	18.97	0.58	2.82	0.89	11.64
Cal.t0.05		2.612	2.236	1.171	3.14	0.65	0.34

Data in the table (21) explain the effect of seasons on some chemical compounds for legume plants, comparing the values of calculated (t) with table(t),it was revealed significant differences between both seasons due to the traits protein, Carbohydrate, phosphorous and calcium ,while for the other traits not significant differences recorded between both season. The second season showed better values for some traits except protein%. 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 (table3.2).Previous results significant the importance of climate conditions in determinate forage quality .(Rouquette *et al.*, 2009); (Foster *et al.*, , 2011) .

Table (21): Effect of seasons on chemical components % for legume plants.

#	Location	Protein	Carbohydrate	P	K	Ca	Ash
1	2021	11.99	14.32	0.48	2.19	0.45	10.01
2	2022	10.86	15.33	0.63	2.59	0.90	10.75
Cal.t0.05		3.240	5.220	2.24	1.78	3.51	0.12

Conclusions:

From the results of this study, it was noticed that the location of Halabja for plant height during both seasons produced the highest plant height for legume plants in the first season. While Sulamani location for grass plants in the first season, gave the tallest plant height, also, from the results of this study it is conclude that Sulamani location gave the maximum green forage yield, dry forage yields and dry matter percentage for both seasons. Sulamani location was able to provide total forage yield for maximum number of animal /3 months at two seasons. The result of chemical analysis for legumes and grass indicated the differences between two locations .The location of Halabja gave maximum value for protein, Carbohydrate, Phosphorus, potassum and Ash contents for grass plants. While sulamani location showed the highest Carbohydrate, potassium and ash contents at the first season. However, for legume plants Sulamani location gave maximum value for protein, potassium and ash contents in the second season. At the effect of seasons on chemical components for grass plants, the second season exceeded the first season in all contents except carbohydrate content.

Recommendations:

Further investigation is required to estimate and classifying the forage types of the region using satellite images and GIS data for more precision estimation with less cost to be used in the conservation program of forage coverage.

To reduce the grazing load on the current pastures further study should be investigated on different crops and trees residues for animal feeding along different seasons in the region. Establishment of prompt grazing programs along different rangelands to determine suitable timing for grazing and size of animals in addition to practicing awareness program for the animal breeders in the areas of rangelands.

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