

## Response of Three Cereal Crops to Different Clipping Times for Forage Yield at two Locations of Sulaimani Region



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### Abstract

The present study was conducted in Sulaimani Region at two different locations, Qlyasan and Kanipanka during the winter season of 2010-2011, to estimate the response of three cereal crops each with three varieties namely, wheat (Cham-6, Tammuz-2, IPA-95), barley (Amal-2, Arivat, IPA-99), and triticale (Eronga, Clossbied, Ruaida) to different clipping times {clipping 80 days after sowing (clipping time 1), clipping 90 days after sowing (clipping time 2), clipping 100 days after sowing (clipping time 3), and clipping 110 days after sowing (clipping time 4) as well as control (no clipping)} for Qlyasan location and the following day at Kanipanka location. The design was split plot within factorial experiment, the varieties implemented in the main plots and arranged with complete randomized design (CRBD) and replicated three times, where the clipping times implemented in sub plots. Means comparison were carried out using least significant difference test (LSD) at 0.05 significant level.

The results of the present study can be summarized as follow: IPA-99 barley variety exhibited superior values for the characters: fresh and dry yield, while IPA-95 wheat variety and Eronga triticale variety gave maximum value of dry matter%. The fourth clipping time exceeded the other clipping times in the characters: Fresh, dry yield and dry matter% with 16.706, 3.126 and 18.959 respectively. Kanipanka location produced maximum values for the characters: Fresh, dry yield and dry matter% in compare to Qlyasan location.

**Keywords:** Forages; clipping times; varieties; fresh yield; dry yield; dry matter%.

### I. Introduction

Forages are important in the world's food resources as plant materials containing high amounts of structured carbohydrates. Cereals are widespread used in livestock nutrition due to their high dry matter production and low cost [1]. Small grain

cereals can be a valuable forage supplement to summer annuals and native grass pastures, and good primary forage when back grounding beef cattle. Depending on grain and cattle prices, producers sometimes realize a higher net income by harvesting small grain cereals as forage rather than as grain. For fall

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<sup>2</sup>masl: Meter above sea level.

and spring pasture, producers can use winter wheat, rye, barley and triticale [2].

Forage cereals play an important role in many grazing enterprises by helping to overcome winter feed shortages. They have higher winter growth rates than most pastures, and with their higher carrying capacity are able to ease the grazing pressure on pasture paddocks [3]. The diversity of varieties, uses, and production conditions complicates the evaluation and choice of small grain cereal forages. Understanding the growth and development of small grain cereal plants, and the methods used to evaluate them, can help in choosing and managing varieties that are best suited for specific production conditions and end uses [4]. An understanding of factors affecting forage quality will help producers anticipate and plan for changes in forage quality. Six major factors affecting forage quality, ranked by their impact on forage quality included: Maturity (harvest date), Crop species, Harvest and storage, Environment, Soil fertility and variety (cultivar) [1]. Residual plant heights of around 5–10 cm for prostrate types and 10–20 cm for upright types [3]. Cutting height is usually conducted at 7–10 cm above ground level. Cutting higher will result in a slight increase in nutritive value but will also reduce yields accordingly. A higher cutting height will also reduce the risk of soil contamination from other equipment operations such as raking. Cutting at greater heights will leave behind increased levels of stubble which creates a problem of removal in the future and preparation for the next forage [5].

Total forage yield (combined production of triticale forage for grazing and subsequent flower-stage harvest) declined with increasing clipping frequency. A single simulated grazing was initiated at 12 inches

and combined production was not affected, a single simulated grazing at the pre-jointing stage (more mature than the 12-inch stage) depressed total production compared to no clipping. Multiple simulated grazing events, depressed combined triticale production [6].

Annual forages can be used for many purposes in cropping and livestock systems. This article focuses on forage yield and quality of unconventional annual forages and their potential for extending the livestock grazing season. Winter cereals offer good yields and good quality forage options for livestock grazing [7]. Annual cereal forages produce one cutting and typically result in a high biomass yield of hay suitable for feeding many types of livestock [8]. For forage crops, it is important to produce greater forage yields per hectare, higher nutritional quality (percentage composition of selected nutrients) or combined nutrient yields. High forage yield is very important for producers but for livestock Enterprises, it is also important to produce high quality forages [9].

The objective of the present study was to assess the response of three cereal crops each with three varieties to different clipping times for forage yield at two locations.

## **II. Materials and Methods:**

Factorial experiment was conducted at two different locations, the first was at Qlyasan Agricultural Research Station, Faculty of Agricultural Sciences-University of Sulaimani located (Lat 35° 34' 307"; N, Long 45° 21' 992"; E, 765 masl) 2Km North West of Sulaimani City, the second was at Kanipanka Nursery Station (Lat 35° 22'; N, Long 45° 43'; E, 550 masl) in Shahrzoor valley 35 Km East of Sulaimani City during the winter season of 2010-2011, to study the response of three cereal species to some

clipping times conducted in split plot design. The varieties namely, three wheat varieties (Cham-6, Tammuz-2, IPA-95), three barley varieties (Amal-2, Arivat, IPA-99), and three triticale varieties (Eronga, Clossbied, Ruaida) were implemented in the main plots and arranged according to CRBD and replicated three times, and the cutting treatments allotted in sub plots which consisted of {no cut (control), cut 80 days after sowing (cut1), cut 90 days after sowing (cut2), cut 100 days after sowing (cut3), and cut 110 days after sowing (cut4)}, dated March 8, 18, 28, and April 7 for cutting treatments at Qlyasan location respectively, while at Kanipanka location they were dated March 9, 19, 29, and April 8 respectively. Each sub plots consist of 10 rows, 4m long with 0.25m apart between rows.

Sowing was conducted during Dec.18 and Dec.19 of 2010 at Qlyasan and Kanipanka location respectively according to the recommended seed rates 200Kg/ha for all used varieties and the recommended dose of fertilizer was used 80 kg N/ha and 80 kg P<sub>2</sub>O<sub>5</sub>/ha. All required agricultural practices were used as needed.

The experiment were harvested for grain yield according to the full maturity on June 14, 2011 for barley, and June 17, 2011 for wheat and triticale at Qlyasan location, while at Kanipanka location all varieties were harvested on June 23, 2011.

Forage clipping were conducted at the height (6 cm) from the soil surface to determine:

1. Fresh yield: forage weight were taken by gm from m<sup>2</sup> and converted to ton/ha
2. Dry yield: 200g forages from m<sup>2</sup> dried in oven at 65C<sup>0</sup> for 72 hours and then weighted and converted to ton/ha.

3. Dry matter%: dry weight of 200gm were taken and then calculated for 100gm.

### **Statistical analysis:**

The data were statistically analyzed according to the methods of analysis of variance using SAS version; and combined analysis of variance across locations also was conducted [10].

### **III. Results and Discussion:**

#### *A. Effect of varieties on forage yield characters:*

Fresh yield: Results of fresh yield were represented in (Table 1) confirmed that the differences among varieties were highly significant at Qlyasan location and the average of both locations, while it was significant at Kanipanka location. Maximum fresh yield recorded by IPA-99 barley variety at both locations and their average were 11.161, 13.726 and 12.443 t/ha respectively. IPA-95 wheat variety gave minimum fresh yield at both locations and their average with 3.220, 8.686 and 5.953 t/ha respectively.

Regarding the means of varieties, the means of barley varieties exhibited maximum fresh yield at both locations and their average with 9.368, 12.915 and 11.141 t/ha respectively, while the means of wheat varieties recorded minimum fresh yield at both locations and their average with 4.189, 10.202 and 7.195 t/ha respectively. The differences among varieties in forage yield may be due to their differences in relative performance of each genotype regarding to the characters plant height and no. of tillers/plant, and the forage yield was positively and strongly related to the time between sowing and cutting. These results were in agreement with the results reported by [11].

Dry yield: Data of dry yield in (Table 1) showed significant differences among varieties at both locations, while at the average of both locations, the differences among varieties were highly significant.

The highest values of dry yield produced by IPA-99 barley variety were 1.704, 2.356 and 2.030 t/ha at both locations and their average respectively, whereas the lowest dry yield values exhibited by IPA-95 wheat variety at both locations and their average were 0.562, 1.617 and 1.090 t/ha respectively. Concerning the means of studied varieties, the means of barley varieties recorded maximum dry yield were 1.415,

2.261 and 1.838 t/ha at both locations and their average respectively, while the means of wheat varieties gave minimum dry yield at both locations and their average with 0.713, 1.849 and 1.281t/ha respectively. It has been reported that there were no significant differences in the rate of dry-weight accumulation between triticale varieties [12], while triticale had superior forage production compared to wheat [13]. Also they confirmed that biomass yield potential of triticale was similar, or greater than other cereals [14].

Dry Matter percent (DM %): As shown in (Table 1) there were significant differences among varieties for the character dry matter%

Table.I: Effect of different varieties on forage yield characters at both locations and their average.

Varieties	Fresh yield (t/ha)		Dry yield (t/ha)		Dry matter %	
	Varieties mean	Genus mean	Varieties mean	Genus mean	Varieties mean	Genus mean
Qlyasan						
W	Cham-6	4.432		0.764		16.173
	Tammuz-2	4.915	4.189	0.813	0.713	16.077
	IPA-95	3.220		0.562		16.808
B	Amal-2	6.651		1.069		15.887
	Arivat	10.291	9.368	1.473	1.415	14.843
	IPA-99	11.161		1.704		14.631
T	Eronga	9.077		1.615		16.850
	Clossbied	7.757	8.112	1.292	1.363	16.693
	Ruaida	7.503		1.183		16.248
LSD <sub>(P&lt;0.05)</sub>		3.738		0.720		1.231
Kanipanka						
W	Cham-6	10.125		1.813		16.263
	Tammuz-2	11.794	10.202	2.118	1.849	17.160
	IPA-95	8.686		1.617		17.172
B	Amal-2	12.053		2.134		17.387
	Arivat	12.967	12.915	2.292	2.261	16.890
	IPA-99	13.726		2.356		16.168
T	Eronga	10.753		1.964		17.129
	Clossbied	11.830	11.653	2.128	2.116	17.193
	Ruaida	12.376		2.255		17.549
LSD <sub>(P&lt;0.05)</sub>		2.518		0.398		N.S
Average of both locations						
W	Cham-6	7.278		1.288		16.218
	Tammuz-2	8.354	7.195	1.466	1.281	16.618
	IPA-95	5.953		1.090		16.990
B	Amal-2	9.352		1.602		16.637
	Arivat	11.629	11.141	1.882	1.838	15.867
	IPA-99	12.443		2.030		15.399
T	Eronga	9.915		1.790		16.990
	Clossbied	9.794	9.883	1.710	1.740	16.943
	Ruaida	9.940		1.719		16.899
LSD <sub>(P&lt;0.05)</sub>		2.415		0.447		0.964

- N.S : No significant , W: wheat varieties, B: barley varieties, T: triticale varieties.

at Qlyasan location, and highly significant differences occurred among varieties at the average of both locations, while there were no significant differences among varieties at Kanipanka location in this character.

Regarding the Qlyasan location, the highest dry matter% obtained by Eronga triticale variety was %16.850, while at the average of both locations, IPA-95 wheat variety and Eronga triticale variety exhibited the highest value of dry matter% with %16.990. The lowest dry matter% recorded by IPA-99 barley variety with %14.631 and %15.399 at Qlyasan location and the average of both locations respectively.

As shown in the same table, the means of triticale varieties gave maximum dry matter% were %16.597 and %16.944 at Qlyasan location and the average of both locations respectively, whereas the minimum dry matter% recorded by the mean of barley varieties were %15.120 and %15.968 at Qlyasan location and the average of both locations respectively. These results were in agreement with previous research which confirmed that the efficiency of the plant to accumulate dry matter was greater in triticale than in barley [15].

#### *B. Effect of clipping times on forage yield characters:*

Fresh yield: Table (2) confirmed the presence of highly significant differences among clipping times due to this character at both locations and their average. Maximum fresh yields produced by the treatment of fourth clipping time were 13.567, 19.849 and 16.708 t/ha at both locations and their average respectively, whereas the minimum fresh yields exhibited by the treatment of first date were 1.732, 5.119 and 3.426 t/ha at both locations and their average respectively.

Forage yield increased as clipping times delayed across growing season as the crop mature. These results agreed with the previous result who found that highly significant differences were observed in forage yield due to date of harvest and genotype [16].

Dry yield: Data represented in Table (2) revealed that there were highly significant differences among clipping times at both locations and their average for this character. The treatment of fourth clipping time gave maximum dry yields at both locations and their average with 2.348, 3.903 and 3.126 t/ha respectively, while minimum dry yield recorded by the first clipping time were 0.238, 0.738 and 0.488 t/ha at both locations and their average respectively. Dry yield of the varieties increased significantly when harvesting date was delayed. These results agreed with the findings of [14, 17 and 18] who confirmed that the increasing of dry yield may be attributed to the completion of its growth cycle by the plant and to the storage of newly-formed photosynthates in the grain. While they reported that the increasing in dry yield was referred to increase biomass in 90 days as compared to 75 days [19].

Dry Matter percent (DM %): The results in Table (2) ratified highly significant differences among clipping times due to this character at both locations and their average. The highest dry matter percent recorded by the treatment of fourth clipping time were %18.129, %19.789 and %18.959 at both locations and their average respectively, whereas the treatment of first clipping time gave minimum dry matter% were %14.316, %14.117 and %14.216 at both locations and their average respectively.

The dry matter% depends on the stage of maturation at the time of harvest, and it increases as plant mature. These results were

in agreement with the results of [20] who reported that the rate of DM% was increased

varieties and clipping times did not reach the significant level of 0.05 at both locations for

Table.II: Effect of clipping times on forage yield characters for both locations and their average.

Clipping times	Fresh yield (t/ha)	Dry yield (t/ha)	Dry matter %
	Qlyasan		
1	1.732	0.238	14.316
2	4.815	0.709	15.423
3	8.777	1.360	16.226
4	13.567	2.348	18.129
LSD <sub>(P&lt;0.05)</sub>	2.274	0.349	0.573
Kanipanka			
1	5.119	0.738	14.117
2	8.328	1.371	16.459
3	13.064	2.289	17.595
4	19.849	3.903	19.789
LSD <sub>(P&lt;0.05)</sub>	1.797	0.313	0.833
Average of both locations			
1	3.426	0.488	14.216
2	6.571	1.040	15.941
3	10.920	1.824	16.910
4	16.708	3.126	18.959
LSD <sub>(P&lt;0.05)</sub>	1.432	0.232	0.500

during the later growth stages, and the rate of DM accumulation increases due increase in crop growth rate (CGR) through the linear phase of growth in which maximum dry matter may be accumulated [21].

*C. Effect of interaction between varieties and clipping times on forage yield characters:*

Fresh yield: Tables (3, 4) confirmed the presence of no significant interaction effects between varieties and clipping times due to this character at both locations with the exception of the character fresh yield at Qlyasan location which was found to be significant, and IPA-99 barley variety with the fourth clipping time gave maximum fresh yield with 20.657 t/ha among clipping times due to this character at both locations.

Dry yield: The results from (Tables 3, 4) revealed that the interaction effects between

the character dry yield.

Dry Matter percent (DM %): No significant interaction effects between varieties and clipping times were observed due to this character at both locations (Tables 3, 4).

*D. Effect of locations on forage yield characters:*

Table (5) confirmed that there were highly significant effects of locations on all forage yield characters with the exception of the character dry matter% which was found to be not significant. The mean values represented in this table revealed that the effect of Kanipanka location was greater than Qlyasan locations effect which gave the highest values of fresh yield and dry yield with 11.608 and 2.084 t/ha respectively compared to Qlyasan location with 7.222 and 1.163 t/ha respectively.

The superiority of Kanipanka location in forage yield may be due to the suitability of environmental condition across vegetative growth stage especially the temperature in compare to Qlyasan location.

Previous results confirmed that the variations in yield and quality can occur because of variations in genetic, soil, weather, and other growing conditions [22 and 23]. Also previously, it was noticed that the dry matter weight of a typical small grain plant will approximately double from booting to soft dough stage, although that increase may vary from a 50% to a 200% increase

depending on variety and growing conditions (4).

#### **IV. Conclusion:**

Forage yields were differed among cereal crops sown under the present study, barley predominated both wheat and triticale crops after first forage removal date and both wheat and triticale varieties were approximately similar in their yield potential, but lower than barley varieties. Arivat barley variety does prepare forage earlier than wheat and triticale and might provide earlier cutting opportunities compared to wheat and triticale.

Table.III: Effect of interaction between varieties and clipping times on forage yield characters at Qlyasan location.

Varieties	Clipping times	Fresh yield	Dry yield	Dry matter	
		(t/ha)	(t/ha)	%	
		Qlyasan			
W	Cham-6	1	0.836	0.117	13.643
		2	3.530	0.548	15.903
		3	4.860	0.812	16.667
		4	8.499	1.576	18.480
	Tammuz-2	1	2.070	0.276	14.280
		2	3.347	0.510	15.377
		3	6.282	1.044	16.633
		4	7.962	1.421	18.017
	IPA-95	1	0.977	0.147	15.053
		2	2.930	0.473	16.070
		3	4.060	0.702	17.310
		4	4.912	0.927	18.800
Amal-2	1	1.251	0.176	14.430	
	2	3.713	0.542	15.387	
	3	7.419	1.116	15.920	
	4	14.219	2.441	17.810	
B	Arivat	1	2.673	0.356	13.620
		2	4.943	0.667	14.367
		3	15.093	2.114	14.887
		4	18.455	2.753	16.500
IPA-99	1	2.563	0.321	12.647	
	2	10.093	1.380	13.873	
	3	11.330	1.656	14.980	
	4	20.657	3.459	17.023	
Eronga	1	1.843	0.267	14.937	
	2	4.295	0.648	15.663	
	3	10.906	1.759	16.293	
	4	19.264	3.787	20.507	
T	Clossbied	1	1.627	0.250	15.550
		2	5.314	0.849	16.440
		3	9.691	1.572	16.733
		4	14.396	2.497	18.047
Ruaida	1	1.749	0.236	14.680	
	2	5.170	0.761	15.730	
	3	9.351	1.463	16.607	
	4	13.741	2.272	17.977	
LSD <sub>(P&lt;0.05)</sub>		4.858	N.S	N.S	

- N.S : No significant , W: wheat varieties, B: barley varieties, T: triticale varieties.

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Table.IV:.. Effect of interaction between varieties and clipping times on forage yield characters at Kanipanka location.

Varieties	Clipping times	Fresh yield	Dry yield	Dry matter	
		(t/ha)	(t/ha)	%	
Kanipanka					
W	Cham-6	1	4.370	0.534	10.737
		2	7.381	1.259	16.823
		3	10.621	1.922	18.413
		4	18.127	3.539	19.077
	Tammuz-2	1	4.505	0.668	14.800
		2	8.206	1.385	16.817
		3	14.633	2.584	17.560
		4	19.830	3.837	19.463
	IPA-95	1	4.102	0.587	12.840
		2	6.902	1.173	16.860
		3	8.581	1.559	18.240
		4	15.158	3.149	20.747
Amal-2	1	5.112	0.775	15.280	
	2	9.582	1.566	16.540	
	3	13.796	2.435	17.597	
	4	19.724	3.762	20.130	
B	Arivat	1	5.848	0.858	14.550
		2	8.058	1.337	16.737
		3	13.177	2.357	17.727
		4	24.786	4.614	18.547
	IPA-99	1	6.154	0.801	13.230
		2	9.470	1.425	14.900
		3	17.601	2.796	15.873
		4	21.677	4.404	20.667
	Eronga	1	4.792	0.711	14.840
		2	7.180	1.195	16.447
		3	10.957	1.951	17.690
		4	20.084	3.999	19.540
T	Clossbied	1	5.749	0.874	15.187
		2	8.539	1.365	16.077
		3	13.600	2.418	17.667
		4	19.432	3.853	19.840
	Ruaida	1	5.441	0.835	15.587
		2	9.633	1.637	16.930
		3	14.608	2.580	17.590
		4	19.823	3.969	20.090
LSD <sub>(P&lt;0.05)</sub>		N.S	N.S	N.S	

- N.S : No significant , W: wheat varieties, B: barley varieties, T: triticale varieties.

Table.V: Effect of locations on forage yield characters.

Locations	Fresh yield	Dry yield	Dry matter
	(t/ha)	(t/ha)	%
Qlyasan	7.222	1.163	16.023
Kanipanka	11.608	2.084	16.989
LSD(P<0.05)	3.403	0.614	N.S

- N.S : No significant.

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