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EFFECT OF CLIPPING NUMBER AND PLANTING DATES ON GROWTH TRAITS OF SIX VARIETIES OF BARLEY APPROVED BY THE MINISTRY OF AGRICULTURE, IRAQ

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Abstract

The experiment was carried out during the winter season 2018-2019 at the research station, Agriculture College, Al-Muthanna University, to determine the effect of clipping number and planting dates on growth traits of six varieties of barley, for three dates were 15/10, 1/11 and 15/11. Split split-plot arrangement and RCBD design with three replicates were used. The results of the analysis showed the superiority of IBA 265 strain on green and dry fodder yield for the three clips (first, second and third), which averaged (13.19, 12.40 and 13.49 t.ha^{-1}) and (3.661, 4.121 and 3,894 t.ha^{-1}) respectively. Whereas the IBA 99 outperformed the leaf area, tillers number and chlorophyll content, as for the dates of planting, it exceeded the first date (10/15) on yield of dry and green fodder, achieved the highest averages of (2,341, 2,810 and 2,458) t.ha^{-1} on dry feed for the three clips, (11.06 and 12.29) green fodder for the first and second clips, whereas, the second date of planting exceeded 11/1 compare with the third clip on a green fodder yield of 12.28 t. ha^{-1}, the same date also outperformed the tillers number and leaf area, as for the third date of planting 11/15, it surpassed the chlorophyll content in the second and third clips by an average of (49.02 and 34.54), respectively, whereas the combination (IBA 265 - first date 10/15) achieved the rest of the combinations in the characteristic of dry feed, the combination (IBA99 - first date 10/15) also excelled in leaf area.

Key words: clipping number, planting dates, growth traits, six varieties, barley.

Introduction

Hordeum vuglare barley is an important cereal crop, ranks fourth after wheat, rice and yellow corn, grown on large areas in most parts of the world and the Arab world for various purposes, including the use of green fodder or grains, as well as being used in multiple industries (Al-Fahdawi and Al-Qaisi, 2018). In Iraq, it is considered one of the important winter cereal crops after wheat in terms of cultivated area, the barley is distinguished by its high nutritional value, as it contains high protein and nucleic acids, rapid growth after clipping and ability to withstand drought and salinity (Al-Kafaei, 2018). Therefore, it is grown in large areas in the central and southern regions of Iraq, the decrease in the yield of green fodder during the winter season, therefore it is used for clipping and grazing in these areas, the area planted to the crop worldwide reached 1.158 million hectares, with an average productivity of 134 million tons. In Iraq, the percentage of cultivated area is estimated at 36% of the total area cultivated with cereal crops and with a productivity of 303,114 tons annually (Directorate of Agricultural Statistics, 2017). The barley crop contributes to coarse feed by between 3-8% of the total coarse feed for animals, barley yields gave 2-3 clips during the season, an average of 5-6 tons of green fodder per acre, depending on the variety and regrow ability, the yield of green fodder and protein content varies depending on the clipping date (Al-Kenani, 2019). Barley can be cut in the early stages of its growth, leave the fields for grazing during the period between the end of winter and early spring, the period when green fodder is few, not enough to meet the animal's need, leave the fields for the purpose of producing grains, due to the limited studies on this crop and the fact that the production of green fodder from barley is limited in Iraq, despite the appropriate environmental conditions for cultivating the matter, which requires further studies on this subject (Gill *et al.,* 2017). Asal and Fayyad (2014) indicated in an experiment carried out to study the effect of the number of shoots on some growth characteristics and the yield of green fodder for

three varieties of barley, samir cultivar significantly increased in the yield of green fodder amounted to 20.21 $t.ha^{-1}$. Abdel-Abbas (2016) emphasized in her experiment on oatmeal by using four levels of nitrogen fertilization (0, 60, 120, 180) kg. ha^{-1} above the level of 180 $kg.ha^{-1}$ by giving the highest average yield of green and dried fodder was (3.89 and 1.48) $t.ha^{-1}$. Al-Atabi (2011), when studying the effect of clipping, indicated two types of barley, treatment without clip exceeded the tiller number, the highest average, reached 554.08 tillers compared to the one-time and one-time double-tailed, were 522.63 and 476.24 tillers.m^2, respectively. Al-Sahuki *et al.,* (2013) observed during their study of five varieties of oat crops for two seasons, Alguda variety surpassed the 2011-2011 season, gave the highest average number of tillers, 145 tillers.m^2. Zayara (2014) reached a one-time clip after 50 days of planting over the rest of the treatment for the tillers number per unit area, gave 25,358 tillers.m^2 compare with comparison treatment (without clipping), which gave the lowest average of 300 tillers.m^2, whereas, a 70-day clip treatment recorded an average of 334 tillers.m^2. Amer (2004) indicated that there were significant differences between the varieties of soft wheat in the characteristic of chlorophyll content, as Iraq variety the highest average for this trait, it reached 50.16 µg. cm^2, while Adnaniya 1 variety showed the lowest mean dye concentration reached 46.6 µg. cm^2. Yasemin *et al.,* (2012) confirmed during their study that there were significant differences in the content of chlorophyll, as the genotype Antaiya TR 40707 achieved the highest average dye content of 54.00 $\mu g.cm^2$.

To support the agricultural economy and the economic importance of the crop, the possibility of cultivation in a wide range of Iraq, for the purpose of meeting the needs of the animal production sector, few studies were available on the response of the barley crop to the frequency of clipping, this experiment was conducted on six varieties of barley, to determine the number of clips each variety gives with the best realized grain quotient, to reach the required equilibrium state in a dual-purpose variety.

Materials and Methods

Location and season of the experiment

The field experiment was carried out in Al-Muthanna Governorate, Al-Warka district, 25 km from the Governorate Center, on one of the farms of the Ministry of Agriculture, during the two agricultural seasons 2018-2017 and 2019-2018, to determine the effect of clipping number and planting dates in the crop and the components of six varieties of barley, table 1 shows some chemical and physical properties of the soil of the experiment, the field is irrigated from the Euphrates river.

Study factors

For three dates were 15/10, 1/11 and 15/11. The experiment included the study of three factors, the first of which was the planting dates (15/10, 1/11 and 15/11), the second factor is the varieties, which used six varieties of barley crop, namely Amal, Buraq, IBA99, Bohoth 244, Samir and IBA265 and symbolizes (V_1, V_2, V_3, V_4, V_5 and V_6), the third factor was the clipping number included without a clipping, one, two and three clipping (W_0, W_1, W_2 and W_4) respectively. The land of experiment plowed perpendicular tillage with mulching plow, the harrowing and leveling process was then carried out, table 1. shows some chemical and physical properties of the soil of the experiment. The land was divided according to the design used to the plot with an area of (2*2m). Split split-plot arrangement and RCBD design with three replicates were used, a total of 216 experimental units, included three replicates in each replicate 72 experimental units, cultivation was carried out on the lines, 20 cm distance between line and another, separated the secondary plots from each other (0.5 m), seeds were sown according to the dates of the experiment, seed quantity (100) $kg.ha^{-1}$ (Extension bulletin, 2012). Nitrogen fertilizer was added according to the experimental treatments, by four equal batches in the form of urea fertilizer (46 N), the first after the plant eruption, the second after the first clipping, the third after the second clipping and the fourth after the third clipping. The phosphate fertilizer was added in the amount of 100 $kg.ha^{-1}$ in the form of triple superphosphate (20% P), in one batch during the preparation of soil for planting. The soil was irrigated as needed after each clip, the harvest was carried out at the

Table 1: Some physical and chemical properties of soil before planting*.

Properties	Unit	Value
Electrical Conductivity (EC)	$ds.m^{-1}$	6.4
pH		7.5
Available nitrogen	Mg. kg^{-1}	7.7
Available phosphorus		27.7
Available potassium		114.8
Soil types		
Clay soil	g/ kg^{-1}	140.00
Sandy soil		260.00
Silt soil		600.00
Soil Texture	Silt Clay mixed	

*Analysis was carried out in Soil Science Department Laboratory, Agriculture College, Al-Muthanna University.

Table 2: Effect of Clipping number, planting dates, varieties and interaction on green fodder yield (t.ha^{-1}).

Clipping (C)	Varieties (V)	Dates (T)			Average varieties
		T_1	T_2	T_3	
C_0	V_1	8.84	9.80	7.89	8.84
	V_2	10.59	11.73	8.04	10.12
	V_3	9.28	9.60	6.95	8.61
	V_4	12.41	11.33	9.72	11.16
	V_5	15.80	13.77	9.99	13.19
	V_6	9.46	10.13	7.65	9.08
Average date		11.06	11.06	8.37	
$L.S.D_{0.05}$		Dates0.71	Varieties1.60	Date * VarietiesN.S	
	Varieties (V)	Dates (T)			Average varieties
		T_1	T_2	T_3	
C_1	V_1	11.04	10.12	9.52	10.23
	V_2	12.00	10.31	8.76	10.36
	V_3	12.38	8.33	8.21	9.64
	V_4	12.00	10.91	7.63	10.18
	V_5	15.24	12.71	9.27	12.40
	V_6	11.05	7.88	8.33	9.09
Average date		12.29	10.04	8.62	
$L.S.D_{0.05}$		Dates1.00	Varieties1.57	Date * VarietiesN.S	
	Varieties (V)	Dates (T)			Average varieties
		T_1	T_2	T_3	
C_2	V_1	12.97	11.87	5.20	10.01
	V_2	9.73	12.41	7.01	9.72
	V_3	9.61	11.03	7.51	9.38
	V_4	10.95	13.13	6.26	10.11
	V_5	15.25	15.11	10.11	13.49
	V_6	11.71	10.61	7.90	9.93
Average date		11.71	12.28	7.33	
$L.S.D_{0.05}$		DatesN.S	Varieties1.51	Date * Varieties3.42	

Table 3: Effect of Clipping number, planting dates, varieties and interaction on dry fodder yield (t.ha^{-1}).

Clipping (C)	Varieties (V)	Dates (T)			Average varieties
		T_1	T_2	T_3	
C_0	V_1	1.327	1.117	1.487	1.327
	V_2	1.400	1.220	1.293	1.304
	V_3	1.797	1.563	1.157	1.506
	V_4	3.587	2.713	2.343	2.881
	V_5	4.263	3.773	2.950	3.662
	V_6	1.623	1.480	1.700	1.601
Average date		2.341	1.978	1.822	
$L.S.D_{0.05}$		Dates0.29	Varieties0.23	Date * Varieties0.42	
	Varieties (V)	Dates (T)			Average varieties
		T_1	T_2	T_3	
C_1	V_1	1.654	1.228	1.561	1.481
	V_2	1.680	1.342	1.358	1.460
	V_3	2.156	1.720	1.214	1.697
	V_4	4.304	2.985	2.460	3.250
	V_5	5.116	4.151	3.097	4.121
	V_6	1.948	1.628	1.785	1.787
Average date		2.810	2.176	1.913	
$L.S.D_{0.05}$		Dates0.31	Varieties0.26	Date * Varieties0.48	
	Varieties (V)	Dates (T)			Average varieties
		T_1	T_2	T_3	
C_2	V_1	1.447	1.173	1.607	1.409
	V_2	1.470	1.281	1.423	1.391
	V_3	1.886	1.641	1.272	1.600
	V_4	3.766	2.849	2.578	3.064
	V_5	4.477	3.962	3.245	3.894
	V_6	1.704	1.554	1.870	1.710
Average date		2.458	2.077	1.999	
$L.S.D_{0.05}$		Dates0.31	Varieties0.24	Date * Varieties0.45	

beginning of April for the first date until the last third of the same month.

The traits studied

Green fodder yield (t.ha^{-1}): Plants were clip 25×25 each experiment unit, then weigh the yield immediately after the clipping so that it does not lose a portion of moisture, after that the weight was transferred on a basis (t.ha^{-1}). taking into account that the clipping after the dew passed.

Dry fodder yield (t.ha^{-1}): Took the same sample to calculate the wet weight, air dried to steady weight, hence the weight is converted to t.ha^{-1}.

Leaf area (cm^2.plant^{-1}): The leaf area was calculated as the mean of ten randomly selected plants after each seed according to the following formula:

leaf length * maximum width * 0.95

The leaf content of chlorophyll (spad): The leaf

Table 4: Effect of Clipping number, planting dates, varieties and interaction on leaf area (cm^2. $plant^{-1}$).

Clipping (C)	Varieties (V)	Dates (T)			Average varieties
		T_1	T_2	T_3	
C_0	V_1	19.34	18.16	19.21	18.90
	V_2	19.27	18.73	17.93	18.64
	V_3	22.77	22.07	21.86	22.23
	V_4	19.38	18.12	18.42	18.64
	V_5	20.09	19.54	17.96	19.20
	V_6	17.70	19.19	18.19	18.36
Average date		19.76	19.30	18.93	
$L.S.D_{0.05}$		Dates0.34	Varieties1.39	Date * VarietiesN.S	
C_1	Varieties (V)	Dates (T)			Average varieties
		T_1	T_2	T_3	
	V_1	25.04	21.67	20.51	22.41
	V_2	23.34	21.58	21.50	22.14
	V_3	27.18	25.91	24.05	25.71
	V_4	21.51	20.27	21.03	20.94
	V_5	21.55	29.39	21.03	24.29
	V_6	21.60	27.88	21.93	23.52
Average date		23.37	24.45	21.68	
$L.S.D_{0.05}$		DatesN.S	Varieties1.67	Date * Varieties3.65	
C_2	Varieties (V)	Dates (T)			Average varieties
		T_1	T_2	T_3	
	V_1	21.39	23.40	20.26	21.68
	V_2	21.36	22.49	18.89	20.92
	V_3	25.33	22.86	20.04	22.74
	V_4	21.03	21.81	16.93	19.92
	V_5	21.90	21.19	16.66	19.92
	V_6	19.37	21.45	18.27	19.70
Average date		21.73	22.20	18.51	
$L.S.D_{0.05}$		Dates0.93	Varieties1.12	Date * VarietiesN.S	

content of total chlorophyll was estimated by the Japanese-origin Chlorophyll content meter as an average of ten plants, taken randomly from each experimental unit and for all replicates.

Tillers number m^2: calculated from the area (25×25) of each experimental unit and randomly, then converted on a square meter basis.

The data were analyzed statistically using the Genstat statistical program, the least significant difference test (L.S.D) was used to compare the mean averages of the coefficients at the level 0.05 (Al-Rawi and Khalaf Allah, 1980).

Results and Discussions

Green fodder yield ($t.ha^{-1}$)

Table 2 indicated that the cultivars affected the green fodder yield, the V5 variety significantly outperformed the rest of the varieties in all clipping groups, gave 13.19, 12.4 and 13.19 t. ha^{-1}, while the variety V3 gave the lowest yield of green fodder reached 8.61, 9.64 and 9.38 t. ha^{-1} in the first, second and third clips respectively, this confirms that the genotype was one of the determinants of the engineering shape.

The dates of planting significantly affected of green fodder yield in all clips, the first and second dates in the first clip exceeded compare with the third date, where gave dates averaging 11.06 and 11.06 $t.ha^{-1}$, exceeded the first date in the second clip by giving it an average of 12.29 t. ha^{-1}, whereas the second date exceeded in the third clip.

The results showed that there were no significant differences in the interaction between , variety treatments and planting dates in the first and second clips, but significant affected at the third clip, the combination (V5 × T1) gave the highest average of 15.25 $t.ha^{-1}$, while the combination (V1 × T3) gave the lowest value of 5.20 $t.ha^{-1}$, Agreed with Asal and Fayyad (2014).

Dry fodder yield ($t.ha^{-1}$)

Table 3 indicated that the varieties affected the dry feed yield, V5 outperformed by giving averages of (3.66, 4.12 and 3.89 t. ha-^{1}), no significant difference with V4, which gave fodder yield 2.88, 3.25 and 3.06 t. ha-^{1}, in all the clips, attributed to the superiority of the variety in the yield of green fodder and branches.

As for planting dates, the planting dates affected the dry feed yield, the first date of planting exceeded of the three clips, giving it the highest averages of 2,341, 2,810, and 2,458 $t.ha^{-1}$, respectively.

The results also showed that there were significant differences between the treatments of varieties and planting dates in all clips, the combination (V5 X first date) gave the highest yield of dry fodder amounting to 4.263, 5.116 and 4.477 $t.ha^{-1}$ in the three gclips respectively, the combination (V2 * third date) gave the lowest value in the first and third clips, at 1.117 and 1.173 $t.ha^{-1}$, the second clip gave lowest mean of the combination (V3 X third date), the reason for this is due to the result of the varieties (the genetic factor), which may differ according to the environmental conditions (planting dates).

Leaf area ($cm^2.plant^{-1}$)

Table 4 showed the effect of varieties on the trait of the leaf area, the verity V3 exceeded the rest of the verities significantly, gave the highest average paper area of 22.23, 25.71 and 22.74 $cm^2.plant^{-1}$, respectively, the

Table 5: Effect of Clipping number, planting dates, varieties and interaction on leaf content of chlorophyll (cm^2. $plant^{-1}$).

Clipping (C)	Varieties (V)	Dates (T) T_1	T_2	T_3	Average varieties
C_0	V_1	17.72	26.68	20.66	21.69
	V_2	17.56	25.76	22.95	22.09
	V_3	25.66	31.21	25.84	27.57
	V_4	20.78	30.63	22.37	24.59
	V_5	18.88	25.38	21.50	21.92
	V_6	17.61	28.17	22.43	22.74
Average date		19.70	27.97	22.62	
$L.S.D_{0.05}$		Dates2.71	Varieties3.63	Date * VarietiesN.S	
C_1	Varieties (V)	Dates (T) T_1	T_2	T_3	Average varieties
	V_1	19.43	19.04	21.24	19.91
	V_2	18.33	19.93	20.82	19.69
	V_3	23.48	21.24	20.29	21.67
	V_4	20.34	21.31	20.52	20.72
	V_5	19.53	20.59	19.27	19.80
	V_6	20.12	21.47	20.87	20.82
Average date		20.21	20.60	20.50	
$L.S.D_{0.05}$		DatesN.S	Varieties0.25	Date * Varieties1.63	
C_2	Varieties (V)	Dates (T) T_1	T_2	T_3	Average varieties
	V_1	20.95	20.50	21.23	20.89
	V_2	21.80	20.57	19.84	20.74
	V_3	29.06	19.85	22.71	23.87
	V_4	22.50	19.85	19.25	20.53
	V_5	22.74	21.97	21.83	22.18
	V_6	22.02	20.17	20.70	20.96
Average date		23.18	20.48	20.92	
$L.S.D_{0.05}$		DatesN.S	Varieties1.47	Date * Varieties3.17	

Table 6: Effect of Clipping number, planting dates, varieties and interaction on tiller number (cm^2).

Clipping (C)	Varieties (V)	Dates (T) T_1	T_2	T_3	Average varieties
C_0	V_1	640	607	294	514
	V_2	540	674	482	565
	V_3	780	511	542	611
	V_4	621	447	400	489
	V_5	547	600	545	564
	V_6	673	656	488	606
Average date		634	582	458	
$L.S.D_{0.05}$		Dates102.2	Varieties87.4	Date * Varieties157.2	
C_1	Varieties (V)	Dates (T) T_1	T_2	T_3	Average varieties
	V_1	592	539	511	547
	V_2	617	639	553	603
	V_3	790	643	498	644
	V_4	603	596	625	608
	V_5	611	536	556	567
	V_6	617	531	561	570
Average date		638	581	551	
$L.S.D_{0.05}$		Dates53.2	VarietiesN.S	Date * Varieties168.5	
C_2	Varieties (V)	Dates (T) T_1	T_2	T_3	Average varieties
	V_1	444	440	487	457
	V_2	488	670	429	529
	V_3	669	600	444	571
	V_4	432	444	453	443
	V_5	535	520	280	445
	V_6	499	493	353	448
Average date		511	528	408	
$L.S.D_{0.05}$		DatesN.S	Varieties85.1	Date * Varieties168.2	

reason for the superiority of variety IBA 99 in the three clips was due to the genetic factors, the nature of the variety, which is characterized by the expansion of the leafy area compared to other varieties.

As for planting dates, the results of the same table showed the effect of planting dates on the characteristic leaf area, the first and second dates exceeded the third date in all clips with averages of 19.76, 23.37 and 21.73, for the first date, 19.30 and 24.45, or 22.20 cm^2. $plant^{-1}$ for the second date, may be attributed to the differences in temperature and the length of light that work to reduce net photosynthesis while increasing the respiratory rate.

The results also showed that there was no significant difference in the interaction between varieties and planting dates in the first and third clips in all plants, but it significantly affected the second clip and gave the combination (V5 * second date) the highest value of 29.39 cm^2. $plant^{-1}$, while the synthesis (Bohoth 244 * third

appointment) recorded the lowest value of 20.94 $cm^2.plant^{-1}$.

The leaf content of chlorophyll (spad)

Table 5 showed that the varieties had affected the characteristic of chlorophyll variety V3 significantly outperformed the rest of the varieties, by giving the highest averages (27.57, 21.67 and 23.87) µg. cm^2 for the three clips, whereas, class V1 gave the lowest mean in the first clip, it reached 21.69 micrograms, cm^2 and class V2 in the second and third grades, giving it averages of 19.69 and 20.74 µg.cm^2, respectively.

The results also showed that the dates of planting affected, the date was significantly exceeded at 1/11, giving it the highest average in the first moment, reaching 27.97 µg.cm^2, while the date 10/15 gave the lowest average of 19.70 µg.cm^2, the reason for this is due to the difference in temperature and length of light.

As for the effect of interaction, the combination (V3 X date 10/15) gave the two highest averages for the second and third gestures of 23.48 and 29.06 µg. cm^2, respectively, whereas, the two combinations (V1 × 11/1) and (V4 × 11 /15) gave the two lowest mean averages (19.04 and 19.25) µg. cm^2, this difference between the dates of planting was due to the difference in the response of the varieties to the climatic conditions accompanying the date of planting.

Tillers number m^2

The results of the statistical analysis in table 6 showed that the IBA99 was significantly superior to the rest of the trial varieties, the highest average score was recorded in the two clips (the first and the third), which amounted to (611 and 571), while Amal variety recorded the lowest average in the first moment, reached (514 and 557), while the research group recorded 244 lowest mean in the third clip, it reached 443 m^2, agreed with Zayara (2013), which observed an increase in the number of branches after the clipping.

The results of the table also showed that the dates have affected this trait, significance exceeded of the date of planting 10/15, the highest averages for the first and second clips were (634 and 638) tiller.m^2, whereas the second date of planting exceeded 1/1 in the third period, it gave an average of 528 tiller.m^2, the reason for the increase in the number of branches is due to the lack of apical dominance and encouraging the growth of lateral shoots when the mowing, which led the plant to give more branches.

The results of the table showed that the interaction between varieties and planting dates affected the characteristic number of tillers, the combination (V3 * the first date) gave the highest mean for the three clips (780, 790 and 669), tiller. m^2, while the combination (V1 X third date) gave the lowest average in the first and second classes (294 and 511) tiller.m^2, whereas, the second clip gave its lowest score in the millet (V5 X, the third date), reached 280 tiller.m^2.

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