Effect of Planting and cutting dates on some growth traits green feed yield and some qualitative traits of different forage types

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Abstract :

Two field experiments were conducted during the agricultural seasons 2022-2023 and 2023-2024 in a loam clay silty soil in the experimental field of the Al-Mahnawiyah extension farm affiliated to the Extension Training Center in Babil Governorate, 8 km north of Hillah and located within latitude 32.31 o north and longitude 44.21 o east. The two experiments aimed to address the problem of scarcity of green feed during critical periods. The RCBD design was used in a split-split plot arrangement with three replicates. The main plots were occupied by planting dates :

10) th, 20th and 30th) of September respectively . The sub plots were occupied by winter feed crops: barley (bohuth 244), oats (Oat 11) and sorghum wheat (Tartekili) (Amal). Sub-sub plots were occupied by cutting dates: (40 days, 50 days and 60 days) respectivelystarting after emergence. The area of the experimental unit was (2×2=4 m2). The results for growth and yield traits showed that: The first planting date D1 had a significantly excelled in the second season only in the trait of green feed yield and dry matter yield, as it gave (24.04) tons. ha-1 and (3.68) tons. ha-1 respectively. As for the second planting date D2, it had a significantly excelled in the first season only in the trait of plant height, as it gave (96.76) cm. The third planting date D3 had a significantly excelled in the traits (stem diameter, green feed yield and dry matter yield) in the first season, as it recorded (3.517) mm and (23.62) tons. ha-1 and (3.069) tons. ha-1 respectively. While the T2 oat crop excelled in most of the traits such as plant height for both seasons and the traits (stem diameter, green feed yield and dry matter yield) for the first season, recording (105.52) cm, (103.16) cm, (3.451) mm, (23.83) t.ha-1 and (3.367) tons. ha-1 respectively, the barley crop excelled in dry matter yield for the second season only, with a value of (3.48) tons. ha-1. The third cutting date C3 was significantly excelled in most of the traits such as plant height for the first season and (stem diameter, green feed yield and dry matter yield) for both seasons, recording (9.37) cm, (3.487) mm, (2.478) mm, (22.07) tons.ha-1, (21.93) tons.ha-1, (3.359) tons.ha-1 and (3.91) tons.ha-1 respectively, except for the trait of plant height for the second season, where the second cutting date C2 was excelled, recording (99.53) cm. As for the interaction between planting dates and crop types, the oat crop that was planted on the third date (D3T2) in the second season was excelled in the trait of plant height (106.06) cm and green feed yield in the first season (30.93) tons.ha-1, while the interaction between planting dates and In most of the traits such as (plant height and stem diameter) for both seasons, it recorded (108.59) cm in combination (D2C2), (106.98) cm in combination (D3C2), (3.667) mm in combination (D3C3), and (2.588) mm, respectively. In the traits (green feed yield and dry matter yield) for the first season, it recorded (28.38) tons. ha-1 in combination (D3C2) and (3.757) tons. ha-1 in combination (D1C3), respectively. As for the interaction between crop types and cutting dates, the oat crop was significantly excelled in the second cutting date (T2C2) for both seasons in the trait of plant height, recording (112.7) cm and (110.35) cm, respectively. The barley crop was significantly excelled in the third cutting date (T1C3) in the second season, recording (26.59). ton.h-1, as for the triple

ISSN 2072-3857

interaction, it had a significant effect on the plant height trait in the second season only, and the combination (D3T2C1) was excelled in this trait, recording (119.15) cm, while it had a significant effect on the traits (stem diameter, green feed yield, and dry matter yield) for the first season, recording (4.097) mm for the combination (D2T2C3), (37.02) ton.h-1 for the combination (D3T2C2), and (4.855) ton.h-1 for the combination (D3T2C3), respectively. As for the qualitative traits, the results showed that the first planting date D1 was significantly excelled for both planting seasons in the crude protein characteristic in the plant and for both planting seasons, as it recorded (14.234% and 14.091%) in succession, while the second planting date D2 was significantly excelled for both planting seasons in the percentage of fibers only, as it reached (22.869% and 22.427%) in succession. The oat crop T2 was significantly excelled for both planting seasons in the percentage of protein in the plant, as it recorded (14.299% and 14.093%) in succession, while the barley crop T1 was significantly excelled in the percentage of fibers and for both planting seasons, as it recorded (24.01% and 23.589%) in succession. The first cutting date C1 was significantly excelled in all traits and for the two planting seasons it was excelled in the percentage of protein and the percentage of fiber, giving the highest values, reaching (14.639% and 14.429%) and (23.094% and 22.632%) respectively. As for the bi-interaction between planting date and crop types, the combination D1T2 was significantly excelled in the percentage of protein and for the two planting seasons, recording (14.889% and 14.74%) in sequence, while the combination D3T1 was significantly excelled in the percentage of fiber and for the two planting seasons, recording (27.087% and 26.274%) in sequence. As for the interaction between planting dates and cutting dates, the combination D1C1 was significantly excelled and for the two planting seasons in the percentage of protein, recording (15.639% and 15.483%) in sequence. The combination D3C1 was excelled in the percentage of fiber for the first season only, recording (25.46%). In the second season, the combination D2C3 was excelled, giving the highest value of (24.753%). As for the bi-interaction between crop types and cutting dates, it was The T3C1 combination was significantly excelled in the percentage of protein for both season, recording (15.229% and 14.975%) respectively, and The combination T1C3 was excelled in the percentage of fibers and for both season, reaching (26.758% and 26.318%) in sequence. As for the triple overlap, the combination D1T2C1 was excelled in all traits (percentage of protein and fibers) and for both season, recording (16.542% and 16.376%) and (28.9% and 28.611%) in sequence.

Keywords :Forage crops - planting dates - cutting dates - barley - oats - sorghum (triticale.(

Introduction:

The clear shortage in the provision of feed, especially green feed, especially during critical periods when feed is scarce, is one of the most important obstacles to the development of the livestock sector in any country in the world, as in our country, Iraq, and increasing the production of feed crops and their diversity is necessary to overcome these obstacles. The critical period in which Iraq generally suffers from a shortage of green feed falls from the end of October to the end of November, when the productivity of the sorghum begins to decline and the seasons of white corn, yellow corn and millet are nearing their end, and winter crops are still not ready for cutting [6]. To increase the areas of feed cultivation by taking into account global warming, drought and climate change, new strategies must be developed to increase the areas of feed cultivation [17]. These strategies include early planting, testing winter forage crops, and choosing appropriate harvest dates. Studies indicate the importance of the clear impact of planting dates, crop type, and harvest dates on seed germination, seedling emergence, field establishment, plant growth and development, and most of the vital processes within the plant, which are reflected in the quantitative and qualitative traits of the crop[5,11] . Among the most important types of winter feed crops known worldwide are (barley and oats), and (Tarticle wheat) can be used. Barley (Hordeum vulgare L.) is the fourth most important cereal crop in the world after wheat, rice and corn, as its grains represent 15% of the coarse grains used in the world and comes in second place in Iraq. It is dual-purpose and is used as green feed or made into hay and silage, and it has other uses. It also tolerates salinity more than other winter feed crops and has the advantage of growing in unsuitable environments[7].Oats (Avena sativa L.) rank fifth in terms of global grain production and are widely used as a companion crop for incomplete sowing of legumes [13]. It is one of the most important winter grain feeds, and oats are preferred over barley in animal grazing. It is mainly grown in temperate and cold semi-tropical environments [22] Also, wheat (Triticosecale rimpaui Wittm.) contains a higher protein content than barley and oats and a lower fiber content. Many studies have indicated the importance of these crops as green winter feed in terms of quantitative and qualitative traits, as well as the effect of planting dates and cutting dates on their studied traits[8,12]. Hence the importance and idea of the research to contribute to addressing the scarcity of green feed in critical periods by studying the effect of management factors and climatic conditions of the region by testing different planting dates and cutting dates.

Materials and methods

Experiment location:

Two field experiments were conducted during the agricultural seasons 2022-2023 and 2023-2024 in the experimental fields of the Al-Mahnawiyah extension farm affiliated to the Training Extension Center in Babylon province Governorate, 8 km north of Hillah, located within latitude 32.31 o north and longitude 44.21 o east. Random soil samples were taken from different locations and depths (0-30 cm) after scraping 5 cm from the surface layer of the soil. The samples were mixed well to homogenize them, then air-dried, smoothed, and passed through a sieve with a hole diameter of 2 mm. A homogeneous sample of soil was taken for the purpose of conducting some soil analyses to determine the physical and chemical properties of the soil (Table No. 1.(

ISSN 2072-3857

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

units	values	aits	
$gm.kg^{-1}$	5.16	and	oil Separators
$gm.kg^{-1}$	60.84	lt	
$gm.kg^{-1}$	34	lay	
clay silt loam			oil Separators
	7.9	pH	
$ds.m^{-1}$	3.0	lectrical conductivity EC	
ppm	43.5	itrogen available N	
ppm	7.2	hosphorus available P	
ppm	160	Potassium available	

*
Analysis was conducted at the Ministry of Water Resources / National Center for Water Resources Management.

Experimental design: I used a randomized complete block design (RCBD) with a split-split plot arrangement with three replicates, the area of the experimental unit (2×2=4 m2). The experiment includes three factors as shown in Table. (2.(

Table 2. Shows the study factors, which are planting dates, types of feed crops, and cutting dates

3	2	1	he first factor: planting dates, symbolized by	
0/9/2022	0/9/2022	0/9/2022	eason 1	ate planting dates
0/9/2023	0/9/2023	0/9/2023	eason 2	
3	2	1	he second factor: types of feed crops and is symbolized by	
riticale (Amal)	ats ats (11)	arley houth (244)	ed Crop and variety	
3	2	1	he third factor: cutting dates, symbolized by	
ay 60	ay 50	ay 40	umber of days after emergence	

ISSN 2072-3857

The data were statistically analyzed according to the ANOVA table at a probability level of 0.05, and the averages for each of the studied traits were compared according to the Least Significant Differences Test (LSD) at a probability level of 0.05 [3]. After collecting the data, the ready-made statistical program GenStat V.20 was used according to the method approved by [1..[

Field operations:

The soil of the experimental field was ploughed using a rotary plough once and the smoothing process was carried out using disc harrows, then the leveling process was carried out and the field was divided into three sectors, and each sector was divided into panels (experimental units) with an area of 4 m2 (2 × 2 m), after which the panels were planned into lines. The experimental unit included 8 lineserimental unit included 8 lines with a distance of 0.2 m between each line and a length of 2 m with a seed rate of 140 kg. ha-1 at a rate of 56 gm for the experimental unit with a length of 2 m and a seed depth of 5 cm for the three feed types. The amount of seeds for each line was calculated according to the following equation

:

$Q= (D\times L\times R\times)/10000 \times 1000$

Where Q: the amount of seeds in one line in gm/line, D: the recommended amount of seeds per hectare, L: the length of the line, R: the distance between the lines. [26.[

After planting, the field was irrigated with a gentle irrigation to ensure that the seeds did not drift from the lines. Fertilization was done with urea fertilizer (46% N) at a rate of 200 kg. ha-1 added in three equal batches, the first after planting and the second and third after each cutting and for all experimental units to ensure the recovery of growth after cutting [27] Triple superphosphate fertilizer (46% P2O5) was added at a rate of 100 kg (P2O5) ha-1 in one batch when preparing the soil after plowing before smoothing [16] The process of weeding and controlling weeds was done manually whenever necessary. Cutting was done manually according to the dates (40, 50 and 60) days from emergence. The quantitative and qualitative traits were measured in the laboratories of the College of Agriculture / Al-Qasim Green University and the laboratories of the College of Agriculture / Karbala University.

Studied traits:

Growth traits:

Plant height: The main stem of ten main stems taken randomly from the median lines of each experimental unit was measured using a metal measuring tape to estimate the height of the plants starting from the soil surface to the top of a fully formed leaf before flowering (the last third of the leaf) and to the base of the spike holder after flowering.

Main stem diameter:

The diameter of the main stem of ten main stems taken randomly from the median lines of each experimental unit was measured from the middle of the stem using a Vernie Micrometer.

Yield traits:

Green feed yield ton. ha-1:

1m2 of the central lines of each experimental unit was harvested at a height of 5-7 cm from the soil surface [4] according to the harvest date and then weighed directly using a sensitive electronic balance to avoid moisture loss due to evaporation and convert the weight to t. ha-1. This was done for all treatments and for all harvests to extract the total green feed yield.

Dry feed yield (dry matter): Calculated according to the following equation:

Dry matter yield = Green feed yield × Dry matter percentage%

Qualitative traits:

Elemental analyses: After drying the samples well in an electric dryer (oven) at a temperature of (65-70) C until the weight was constant, the dry samples were ground using an electric grinder, then a known weight was taken for each treatment, and digested according to what was stated in [14] then the digested materials were transferred to 100 ml volumetric flasks and supplemented with distilled water, after which dilution was carried out according to the concentration of each element in the plant, and the nutritional elements were analyzed in the laboratories of the College of Agriculture / University of Karbala:

Estimating the nitrogen element by distillation using the Micro Kjldhal device [15.[

The percentage of crude protein in green feed :%

Grinded and dried plant samples were taken for each treatment weighing (0.2) g, then digested and the percentage of nitrogen was estimated in one of the laboratories of the College of Agriculture / University of Karbala using the Kjeldhal method with the Micro Kjeldhal device, then the percentage of protein was calculated as follows:

Protein % = Nitrogen % × 6.25 according to [8.[

The percentage of crude fiber in green feed:%

It was estimated in one of the laboratories of the College of Agriculture / University of Karbala according to the method followed in [8.[

Results and discussion:

Plant height (cm:(

The results of Table (3) show significant differences in the arithmetic averages of the plant height trait in the first season according to the planting dates, crop types and cutting dates. As for the planting dates, the second planting date D2 gave the highest arithmetic average of the plant height trait, which amounted to 96.76 cm, and it differed significantly from the first and third dates D1 and D3, which gave 80.93 cm and 94.46 cm, respectively. As for the crop types, the oat crop T2 as a plant type gave the highest arithmetic average of the plant height trait, which amounted to 105.52 cm, and it differed significantly from the wheat Shillami (Tartekili) T3, which came after it with an average of 86.74 cm, and after it barley T1, which had an average plant height of 79.9 cm, with a clear significant difference. As for the cutting dates, the third cutting date C3 gave the highest value, which amounted to 95.37 cm, with a significant difference from the cutting date The second C2, which reached 94.54 cm, which differed significantly from the first cutting date C1, which reached 82.24 cm. The results of Table (3) also showed in the second season that there was no significant effect of planting dates on the plant height trait, while plant types and cutting dates had a significant effect on this trait, as the oat crop T2 gave the highest value for the average plant height, which reached 103.16 cm, and differed significantly from the wheat Shillami (Tretekili) T3, which reached 92.38 cm, and it also surpassed barley T1, which reached 78.8 cm. The results also showed the significant effect of cutting dates, and that the highest value for the average plant height was for Second season cutting date C2, which reached 99.53 cm, and differed significantly from the first and third dates C1 and C3, which reached 86.39 cm and 88.42 cm, respectively. As for the bi-interaction between planting dates and crop types, the results of the same table showed no significant effect on the plant

ISSN 2072-3857

height trait in the first season, while the bi-interaction had a significant effect in the second season. The highest value of the trait was for the combination D3T2, reaching 106.06 cm, and the lowest value of the trait was recorded at 63.33 cm for the combination D2T1. The data of the same table showed that the bi-interaction between planting dates and cutting dates had a significant effect in the first and second seasons, as the highest value of the stem height trait was recorded in the combination D2C2, reaching 108.59 cm, and the lowest value was 66.08 cm for the combination D1C1, while the highest value of the trait was in the second season in the combination D3C2, reaching 106.98 cm, and the lowest value was in the combination D2C1, reaching 77.59 cm. The bi-interaction between crop type and cutting dates showed an effect Morally in the first and second seasons, as the highest value of the trait was in the first season in the combination T2C2, reaching 112.7 cm, and the lowest value of the trait was in the combination T3C1, reaching 71.75 cm, while the highest value of the trait was recorded in the second season in the combination T2C2, reaching 110.35 cm, and the lowest value of the trait was in the combination T1C1, reaching 71.94 cm. As for the triple interaction between planting dates, crop types and cutting dates, it had no significant effect on the trait of plant height in the first season, while the triple interaction had a significant effect on the trait in the second season, as the highest value of the trait of plant height was recorded in the combination D3T2C1, reaching 119.15 cm, and the lowest value of the trait was in the combination D2T1C1, reaching 57.35 cm.

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The significant effect of the second planting date on plant height in the first season and the absence of that effect in the second season can be attributed to the availability of better environmental conditions in the first season, especially relative humidity, which recorded good rates in the first season and had a positive effect on plant height. With the decrease in humidity in the second season and the negative effect of temperatures, the significant effect of the second planting date itself in the second season on plant height was absent. This supports what [29,17]reached. The superiority of oats in plant height may be due to the genetic factor and the variation in the response of each type of feeding species to different environmental factors. This is consistent with what [21] reached. The superiority of the third cutting date in the first season in plant height can be explained by allowing extended growth periods, improving nutrient absorption, and stabilizing growth patterns, allowing plants to reach greater heights before cutting. This was mentioned by [13,21,17]. As for the double and triple interactions and the variation in significant effects from their presence to their absence in this trait, this indicates the existence of a precise and influential relationship between planting dates, crop types, and cutting dates. This is due to the difference in environmental conditions in terms of the difference in planting dates and their relationship to the type of response specific to each crop and the significant effect or lack thereof resulting from early or late cutting dates, as mentioned by [20] and what was reached by [15

ISSN 2072-3857

Table 3: Effect of planting dates, crop types, cutting dates, and their interaction on average plant height (cm) in the first cutting for both season (2022-2023) and (2023-2024)

second season				first season				Crop types (T)	Planting dates (D)
(T*D)	cutting dates ((C)			(T*D)	cutting dates ((C)				
	C3	C2	C1		C3	C2	C1		
80.33	85.79	93.56	61.65	67.08	85.33	62.13	53.77	T1	D1
99.64	94.06	96.37	108.5	96.04	110.31	91.89	85.92	T2	
93.64	96.43	102.78	81.7	79.68	105.99	74.49	58.56	T3	
91.21	92.09	97.57	83.95	80.93	100.54	76.17	66.08	C*D	
63.33	58.84	73.8	57.35	86.15	84.13	94.33	79.97	T1	D2
103.79	99.47	115.52	96.38	114.28	108.09	126.49	108.27	T2	
95.37	114.21	92.84	79.06	89.85	91.18	104.94	73.44	T3	
87.5	90.84	94.06	77.59	96.76	94.47	108.59	87.23	C*D	
92.73	80.81	100.56	96.83	86.46	82.8	83.44	93.15	T1	D3
106.06	96.21	119.15	102.81	106.22	95.13	119.71	103.83	T2	
88.13	69.94	101.22	93.22	90.68	95.35	93.44	83.25	T3	
95.64	82.32	106.98	97.62	94.46	91.09	98.86	93.41	C*D	
Average Crop types	88.42	99.53	86.39	Average Crop types	95.37	94.54	82.24	Average cutting dates	
78.8	75.15	89.31	71.94	79.9	84.09	79.97	75.63	T1	C*T
103.16	96.58	110.35	102.56	105.52	104.51	112.7	99.34	T2	
92.38	93.53	98.95	84.66	86.74	97.51	90.96	71.75	T3	
91.45	General Average) second season(			90.72	General Average) first season(				

ISSN 2072-3857

Least significant difference (L.S.D) value at 5% significance level

second season		first season	
T*D **:** 7.17	**Planting dates) D** **:(**N.S	**T*D** **:** N.S	**Planting dates) D** **:(** **5.168**
C*D :7.640	**Crop types) T :(**3.199	**C*D :**5.843	**Crop types) T** **:(** **4.372**
C*T **:**6.059	**cutting dates)(C(** 3.774 **:**	**C*T :**5.810	**cutting dates)(C:(** **2.936**
C*T*D **:** 11.258		**C*T*D** **:** N.S	

Average stem diameter (mm :(

The results of Table 4 showed a significant effect of planting dates, crop types and cutting dates in the first season on the trait of average stem diameter (mm), as planting dates recorded the highest value for the trait of average stem diameter in the third planting date D3, reaching 3.517 mm, with a significant difference from the first and second dates D1 and D2, which recorded 2.777 mm and 3.091 mm, respectively. As for crop types, the highest value for the trait was recorded in the oat crop T2, reaching 3.451 mm, and it significantly excelled the wheat crop T3, which reached 3.077 mm, which in turn significantly excelled the barley crop T1, as the value of the stem diameter trait reached 2.856 mm. As for cutting dates, the results of the same table showed significant differences between the average cutting dates in this trait, as the highest value was significantly excelled in the cutting date The third (cutting) C3, which reached 3.487 mm, and the lowest value for this trait was for the second cutting date C2, which reached 3.147 mm, and the first date C1 recorded a value of 2.751 mm.

The results of Table 4 in the second season showed no significant differences for planting dates or crop types for the stem diameter trait, while the results of the same table showed significant differences for cutting dates for this trait, while the highest value for this trait in cutting dates was for the third cutting date C3, which reached 2.478 mm, with a significant difference from the second and first cutting dates C2 and C1, which reached 2.276 mm and 2.124 mm, respectively.

The bi-interaction between planting dates and crop types had no significant effect on the average stem diameter trait for the first and second seasons, while the results of the same table showed that the interaction between planting dates and cutting dates had a significant effect on the stem diameter trait for the first and second seasons, as the highest value for the trait was recorded for the first season in the D3C3 combination, as the average trait was 3.667 mm, and the lowest value was recorded in the D1C1 combination, as it reached 2.259 mm, while the highest value for the trait was recorded in the second season in the D2C3 combination, as it reached 2.588 mm, and the lowest value for the trait was recorded in the D2C1 combination, as it reached 1.945 mm. The data of the same table also showed that there was no significant

ISSN 2072-3857

effect of the bi-interaction between crop types and cutting dates on the stem diameter trait for the first and second seasons. The triple interaction between planting dates, crop types and cutting dates had a significant effect on the stem diameter trait in the first season, as the combination D2T2C3 recorded the highest value for the stem diameter trait, reaching 4.097 mm, and the combination D1T1C1 recorded the lowest value for the trait, reaching 1.363 mm, while there was no significant effect of the triple interaction on the trait in the second season. The variance between the two seasons regarding the effect of planting dates and crop types on the stem diameter trait can be explained by the variance of different weather conditions between the two seasons, most notably relative humidity rates, which supports the results of [30]. As for the moral superiority of the third cutting date, it can be explained by the division of cells and the expansion of their size as a result of the long period of time or the length of their growing season, and thus they took enough time to grow and achieve an increase in the diameter of the stem, and this supports what [2] went to in their research results. As for the bilateral interaction between planting dates and cutting dates, which had a significant effect, and the triple interaction, which also had a significant effect, it can be explained that it came due to the variation in the response of plants to environmental conditions, especially climatic conditions, due to the difference in dates, and this supports the results of [10 .[

Table 4 Effect of planting dates, crop types, cutting dates and the interaction between them on the average stem diameter (mm) in the first cut for the two planting seasons (2022-2023) and (2023-2024)

cond season				rst season					lanting dates D)
T*D)	ıtting dates ((C)			T*D)	ıtting dates ((C)			rop types T)	
	3	2	1		3	2	1		
.984	.443	.713	796	233	.956	.38	.363	1	
.251	.424	.033	297	205	.339	.218	.057	2	1
.426	.584	.405	29	893	.314	.01	.356	3	
.22	.484	.051	128	777	.203	.869	.259	*D	
.053	.177	.082	9	934	.321	.932	.551	1	
.292	.793	.379	705	397	.097	.208	.886	2	2
.381	.795	.118	23	941	.353	.661	.809	3	
.242	.588	.193	945	091	.59	.934	.749	*D	
.09	.162	.006	101	401	.551	.629	.023	1	
.67	.563	.975	473	751	.971	.964	.319	2	3
.484	.362	.77	321	397	.478	.319	.395	3	

ISSN 2072-3857

.415	.362	.584	298	517	.667	.637	.246	*D	
.verage Crop types	.478	.276	124	verage Crop types	.487	.147	.751	.verage cutting dates	
.042	.261	.934	932	856	.276	.98	.312	1	
.405	.593	.462	158	451	.802	.463	.087	2	*T
.431	.58	.431	28	077	.382	.997	.853	3	
.292	eneral Average) second season(			128	eneral Average) first season(				

Least significant difference (L.S.D) value at 5% significance level

cond season2		rst season	
*D : N.S	lanting dates) D :(N.S	*D : N.S	lanting dates) D :(0.1293
*D :0.3456	rop types) T :(N.S	*D :0.2567	rop types) T :(0.2137
*T :N.S	utting dates)(C:(0.1762	*T :N.S	utting dates)(C :(0.1693
*T*D : N.S		*T*D : 0.5052	

Green feed yield (tons.ha-1 :(

The results of Table 5 show that planting dates, crop types and cutting dates had a significant effect on the green feed yield in the first season, as the third date D3 gave a good yield of 23.62 tons.ha-1, significantly excelled to the first and second dates D1 and D2, which recorded yields of 12.96 tons.ha-1 and 17.96 tons.ha-1, respectively. The oat crop T2 gave the highest green feed yield of 23.83 tons.ha-1, significantly excelled to the barley and wheat crops (Tartekili), which gave yields of 16.05 tons.ha-1 and 14.67 tons.ha-1, respectively. The cutting dates had a significant effect on the green feed yield, as The third cutting date C3 gave the highest value for this trait, reaching 22.07 tons.ha-1, and it was significantly excelled to the first and second dates C1 and C2, which recorded 11.78 tons.ha-1 and 20.70 tons.ha-1, respectively. The results of the same table in the second season showed that planting dates had a significant effect on this trait in a different way from the first season, as the first date D1 gave the highest value for this trait, reaching 24.04 tons. ha-1, with a significantly excelled over the second and third dates D2 and D3, which recorded values of 12.97 tons. ha-1 and 15.46 tons. ha-1, respectively. The results of the same table showed that there was no significant effect of crop types on the trait of green feed yield in the second season, while the same trait was affected by cutting dates in the second season, as the third cutting date C3 recorded the highest value for this trait, reaching 21.93 tons. ha-1, followed by a significant difference by the second cutting date C2, which reached 16.83 tons. ha-1, and it significantly excelled the first date D1, which recorded the lowest value, reaching 13.70 t.ha-1.

The results of Table 5 showed that the bi-interaction between planting dates and crop types had a significant effect on the green feed yield trait in the first season. The highest value of the trait was in the combination D3T2, reaching 30.93 t.ha-1, and the lowest value was in the combination D1T1, reaching 8.84 t.ha-1, while the bi-interaction between planting dates and crop types did not affect the trait for the second season. The results of the same table also showed that the binary interaction between planting dates and cutting dates in the first season had a significant effect, as the combination D3C2 gave the highest average green feed yield, reaching 28.38 tons. ha-1, and the lowest value for the same trait was given by the combination D1C1, reaching 7.79 tons. ha-1, while the binary interaction between planting dates and cutting dates in the second season did not have a significant effect, nor did the binary interaction between crop types and cutting dates in the first season have a significant effect, while the binary interaction between crop types and cutting dates had a significant effect, as the combination T1C3 gave the highest value for the trait, reaching 26.59 tons. ha-1, and the lowest value for the trait in the combination T3C1, reaching 13.32 tons. ha-1. The triple interaction had a significant effect in the first season on the green feed yield trait, as the highest value of the trait was recorded in the combination D3T2C2, reaching 37.02 t.ha-1, and the lowest value was given by the combination D1T1C1, reaching 5.45 t.ha-1, while the triple interaction did not affect the green feed yield trait in the second season. The increase in the green feed yield at the third planting date D3 and the superiority of the oat yield and the third cutting date (cutting) can be attributed to the superiority recorded in the first season for some important growth indicators such as plant height and stem diameter, which constitutes an increase in the green biomass and consequently increases the green feed yield, which supports what was mentioned by [27,30] The different course of the second season can be explained by the difference in environmental conditions, as the first early planting date was excelled in the green feed yield, which supports the results of [10]. As for the double and triple interactions, the variation in the green feed yield trait can be explained as a result of the variation in the interaction and response of plants to the effects of these interactions, as mentioned by [17,19,23[

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Table 5 Effect of planting dates, crop types, cutting dates and their interactions on the green feed yield (tons/ha) in the first harvest for both season (2022-2023) and (2023-2024)

second season				first season				Crop types (T)	Planting dates (D)
(T*D)	cutting dates ((C)			(T*D)	cutting dates ((C)				
	C3	C2	C1		C3	C2	C1		
23.99	31.58	22.55	17.84	8.84	12.63	8.43	5.45	T1	D1
28.6	35.39	24.04	26.36	19.49	29.53	17.63	11.31	T2	
19.53	23.59	19.91	15.08	10.55	14.63	10.43	6.6	T3	
24.04	30.19	22.17	19.76	12.96	18.93	12.17	7.79	C*D	
16.1	26.32	11.83	10.15	17	23.11	17.33	10.56	T1	D2
9.91	11.98	10.64	7.09	21.08	18.03	29.43	15.77	T2	
12.89	14.34	14.93	9.41	15.82	21.58	17.9	7.97	T3	
12.97	17.55	12.47	8.89	17.96	20.91	21.56	11.43	C*D	
18.92	21.88	20.01	14.86	22.3	25.95	25.19	15.77	T1	D3
13.89	23.45	11.13	7.09	30.93	35.65	37.02	20.13	T2	
13.56	8.81	16.43	15.46	17.63	17.52	22.95	12.43	T3	
15.46	18.04	15.85	12.47	23.62	26.37	28.38	16.11	C*D	
Average Crop types	21.93	16.83	13.7	Average Crop types	22.07	20.7	11.78	Average cutting dates	
19.67	26.59	18.13	14.28	16.05	20.56	16.98	10.59	T1	C*T
17.46	23.61	15.27	13.51	23.83	27.74	28.03	15.73	T2	
15.33	15.58	17.09	13.32	14.67	17.91	17.09	9	T3	
17.49	General Average) second season(			18.18	General Average) first season(				

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Least significant difference (L.S.D) value at 5% significance level

second season		first season	
T*D: N.S	**Planting dates) D :(** 4.195	**T*D : 2.535**	**Planting dates) D :(1.954**
C*D :N.S	**Crop types) T :(N.S**	**C*D :**2.787	**Crop types) T :(1.480**
C*T : 5.665	**cutting dates)(C :(** 2.669	**C*T :N.S**	**cutting dates)(C :(1.679**
C*T*D : N.S		**C*T*D :** 4.722	

Dry matter yield (tons.ha-1 :(

The results of Table 6 showed that there are significant differences due to planting dates, crop types and cutting dates in the dry matter yield trait for the first and second seasons. The third planting date D3 in the first season recorded the highest value for dry matter yield, reaching 3.069 tons.ha-1, with a significantly excelled over the first and second dates D1 and D2, as their values reached 2.431 tons.ha-1 and 2.671 tons.ha-1, respectively. While the first date D1 in second season gave the highest value for the trait, reaching 3.68 tons.ha-1, with a significantly excelled over the second and third dates D2 and D3, as they reached 2.05 tons.ha-1 and 2.67 tons.ha-1, respectively. The results of the same table showed significant differences due to crop types in the dry matter yield trait for the first and second seasons. The oat crop T2 gave The highest peak for the trait reached 3.367 tons.ha-1, with a significantly excelled over the T3 wheat crop, which recorded 2.521 tons.ha-1, which in turn was excelled to the T1 barley crop, which recorded 2.283 tons.ha-1, which is the lowest value for this trait for the first season, while the T1 barley crop in the second season gave the highest value for the trait of dry matter yield, reaching 3.48 tons.ha-1, and was excelled to the T2 and T3 oat and T3 wheat crops, which recorded 2.67 tons.ha-1 and 2.25 tons.ha-1, respectively. The results of the same table showed that there is a significant effect of cutting dates on the trait of dry matter yield for the first season, as the third date C3 gave the highest value for the trait, recording 3.359 tons.ha-1, and was significantly excelled to the two dates. The first and second dates C1 and C2 recorded 1.88 tons.ha-1 and 2.932 tons.ha-1 respectively. The third cutting date C3 in the second season recorded the highest value for the trait, reaching 3.91 tons.ha-1, and it was significantly excelled to the first and second dates c1 and c2, which recorded 2.06 tons.ha-1 and 2.43 tons.ha-1 respectively. The bi-interaction between planting dates and crop types had no significant effect on the dry matter yield trait in the first and second seasons, while the bi-interaction between planting dates and cutting dates had a significant effect in the first season only and had no significant effect in the second season, as the combination D3C3 for the first season gave the highest value for the trait, reaching 3.757 tons.ha-1, and the combination D1C1 gave the lowest value for the trait, reaching 1.588 tons.ha-1. The bi-interaction between crop types and cutting dates had no significant effect on the dry matter yield trait for the first and second seasons. The triple interaction between planting dates, crop types and cutting

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dates had a significant effect on the dry matter yield trait in the first season, as the combination D3T2C3 recorded the highest value of the trait, reaching 4.855 tons.ha-1, and the lowest value of the trait was recorded in the combination D1T1C1, reaching 1.274 tons.ha-1, while the triple interaction did not have a significant effect on this trait for the second season.

The superiority of the third planting date D3 in the dry matter yield in the first season, the second planting date D1 in the second season, the oat yield and the third cutting date C3 in the two seasons can be explained by the increase in the green feed yield, which supports the results mentioned by [12,15,22]. This can be observed in the results of Table (5), while the double and triple interactions can be attributed to how the plants respond to the mentioned interactions.

Table 6: Effect of planting dates, crop types, cutting dates and their interaction on dry matter yield (tons/hectare) in the first cutting for both season (2022-2023) and (2023-2024)

second season				first season				Crop types (T)	Planting dates (D)
(T*D)	cutting dates ((C)			(T*D)	cutting dates ((C)				
	C3	C2	C1		C3	C2	C1		
4.19	5.53	4.07	2.99	1.997	2.785	1.931	1.274	T1	D1
4.22	6.35	3.73	2.58	3.114	4.795	2.627	1.92	T2	
2.62	3.85	2.22	1.8	2.181	3.014	1.96	1.57	T3	
3.68	5.24	3.34	2.46	2.431	3.531	2.173	1.588	C*D	
2.74	3.23	2.41	2.58	2.103	2.22	2.626	1.463	T1	D2
1.38	1.54	1.42	1.18	3.114	2.55	4.285	2.507	T2	
2.03	2.26	2.19	1.63	2.797	3.598	3.456	1.338	T3	
2.05	2.34	2.01	1.8	2.671	2.789	3.455	1.769	C*D	
3.5	5.18	2.49	2.83	2.751	3.68	2.613	1.961	T1	D3
2.41	5	1.39	0.84	3.873	4.855	4.041	2.723	T2	
2.11	2.27	1.94	2.11	2.583	2.738	2.848	2.164	T3	
2.67	4.15	1.94	1.93	3.069	3.757	3.167	2.283	C*D	
Average Crop types	3.91	2.43	2.06	Average Crop types	3.359	2.932	1.88	Average cutting dates	
3.48	4.65	2.99	2.8	2.283	2.895	2.39	1.566	T1	C*T
2.67	4.29	2.18	1.53	3.367	4.067	3.651	2.383	T2	

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2.25	2.79	2.11	1.85	2.521	3.117	2.755	1.691	**T3**
2.80	**General Average)second season(**			2.724	**General Average) first season(**			

Least significant difference (L.S.D) value at 5% significance level

second season		**first season**	
T*D: N.S	**Planting dates) D :(** 0.827	**T*D : N.S**	**Planting dates) D :(0.2124**
C*D :N.S	**Crop types) T :(**0.756	**C*D :**0.4367	**Crop types) T :(0.2804**
C*T: N.S	**cutting dates)(C:(** 0.700	**C*T :N.S**	**cutting dates)(C:(0.2897**
C*T*D : N.S		**C*T*D :** 0.8068	

The percentage of crude protein in the plant :% The results of Table 7 show the significant effect of planting dates, crop types, cutting dates and their interaction on the percentage of crude protein in the plant and for the two planting seasons. The results of Table 7 indicate that planting dates had a significant effect on the percentage of crude protein in the plant, as the first date D1 was significantly excelled for the first and second seasons, recording 14.234% and 14.091%, respectively. It was followed by the third date D3 for the same cutting and for both seasons, 13.794% and 13.518%, respectively, while the second date D2 gave the lowest value for this trait and for the two planting seasons, recording 13.424% and 13.231%, respectively. From the results of the table, it is noted that the types of crops had a significant effect on the percentage of crude protein in the plant. The oat crop T2 was significantly excelled, giving the highest value of protein for both season, reaching 14.299% and 14.093% respectively, while barley recorded 13.653% and 13.473% respectively for both seasons, while the wheat crop Shillami (Tartekili) recorded the lowest value for protein content in the plant for both season, reaching 13.5% and 13.275 respectively. The results of Table 7 also showed that the difference in cutting dates had a significant effect on the percentage of crude protein in the plant for both season, as the first cutting date C1 was significantly excelled and gave the highest values for both season, recording 14.639% and 14.429% respectively, while the third cutting date C3 recorded a value for both season, reaching 13.625% and 13.414% respectively, while the second cutting date C2 recorded the lowest values and for the two agricultural seasons it reached 13.188% and 12.998% respectively.

As for the bi-interaction between planting dates and crop types, it significantly affected the percentage of crude protein in the plant and for the two agricultural seasons, as the combination D1T2 significantly excelled for the two agricultural seasons, as it recorded the highest value of 14.889% and 14.74% respectively, while the combination D3T1 recorded the lowest value for this trait and for the two agricultural seasons it reached 12.854% and 12.597% respectively. As for the bi-interaction between planting dates and

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cutting dates, it significantly affected the percentage of crude protein in the plant and for the two agricultural seasons. The combination D1C1 was significantly excelled for both planting seasons, reaching 15.639% and 15.483% in sequence, while the combination D2C2 recorded the lowest values for both planting seasons, reaching 12.562% and 12.4% in sequence. While the binary interaction between crop types and cutting dates had a significant effect on the percentage of crude protein in the plant and for both planting seasons. The combination T3C1 was significantly excelled and recorded the highest values for both planting seasons, reaching 15.229% and 14.975% in sequence, while the combination T3C2 recorded the lowest values for both planting seasons, reaching 12.375% and 12.168 in sequence. The results of Table 7 showed that there was a significant effect of the triple interaction between planting dates, crop types and cutting dates on the percentage of crude protein in the plant and for both planting seasons. It was morally superior and recorded the highest values for both season of the combination D1T2C1, reaching 16.542% and 16.376% respectively, while the combination D2T3C2 recorded the lowest value for this trait for the first and second seasons, reaching 11.188% and 10.964% respectively.

The results of Table 7 regarding the percentage of crude protein in the plant, which showed for both season the superiority of the first planting date, the oat crop, the first cutting date and the bilateral interactions between them, can be interpreted as the percentage of protein in the plant, its synthesis and accumulation, have a direct relationship with the percentage of nitrogen in the plant (unpublished data), as ([15] concluded in his study, stating that the increase or superiority in the percentage of nitrogen does not only lead to an increase in the crop, but also works to improve and enhance the content of crude protein in the plant, and [11] agreed with him in these results.

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Table 7: Effect of planting dates, crop types, cutting dates, and their interaction on the percentage of protein in the first cut for both season (2022-2023) and (2023-2024)

Second season				First season					Planting dates
(T*D)	Cutting dates ((C)			(T*D)	Cutting dates ((C)			Crop types (T)	(D)
	C3	C2	C1		C3	C2	C1		
4.252	4.603	3.118	5.036	4.396	4.75	3.25	5.188	T1	
4.74	3.489	4.355	6.376	4.889	3.625	4.5	6.542	T2	D1
3.283	2.746	2.066	5.036	3.417	2.875	2.188	5.188	T3	
4.091	3.613	3.179	5.483	4.234	3.75	3.312	5.639	C*D	
3.571	4.355	2.932	3.427	3.708	4.5	3.063	3.563	T1	
3.505	3.353	3.303	3.86	3.688	3.625	3.438	4	T2	D2
2.618	1.883	0.964	5.006	2.875	2.125	1.188	5.312	T3	
3.231	3.197	2.4	4.098	3.424	3.417	2.562	4.292	C*D	
2.597	2.495	2.495	2.801	2.854	2.75	2.75	3.062	T1	
4.033	4.394	4.271	3.434	4.319	4.687	4.562	3.708	T2	D3
3.924	3.414	3.475	4.884	4.208	3.687	3.75	5.188	T3	
3.518	3.434	3.414	3.706	3.794	3.708	3.688	3.986	C*D	
Average Crop types	3.414	2.998	4.429	Average Crop types	3.625	3.188	4.639	Average cutting dates	
3.473	3.818	2.848	3.755	3.653	4	3.021	3.938	T1	
4.093	3.745	3.976	4.557	4.299	3.979	4.167	4.75	T2	C*T
3.275	2.681	2.168	4.975	3.5	2.896	2.375	5.229	T3	
3.614	General Average) second season(			3.817	General Average) first season(				

Least significant difference (L.S.D) value at 5% significance level

second season		first season	
T*D: 0.3679	Planting dates) D :(0.3194	T*D : 0.3720	Planting dates) D :(**0.3227**
C*D :0.3559	Crop types) T :(0.1935	C*D :0.3601	Crop types) T :(**0.1959**
C*T: 0.3040	cutting dates)(C (0.1751	C*T :0.3081	cutting dates)(C :(**0.1776**

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C*T*D : 0.5469 | **C*T*D :** 0.5539

The percentage of fiber in the plant:%

The results of Table 8 showed that the planting dates, crop types, cutting dates and the interaction between them had a significant effect on the percentage of fiber in the plant for the first and second seasons. Through it, the significant effect of the planting dates can be observed, as the second planting date D2 was significantly excelled in the percentage of fiber in the plant for the two planting seasons, as it reached 22.869% and 22.427% in succession, while the first date D1 gave the lowest values in this characteristic for the two planting seasons, as it reached 21.157% and 20.946% in succession, while the third date D3 gave intermediate values between the two previous dates and for the two planting seasons, as it reached 22.578% and 21.901% in succession. Through the results of Table 8, the significant effect of the crop types on the percentage of fiber in the plant can be observed, as the significantly excelled of the barley crop T1 is noted, recording the highest values for the two planting seasons, as it reached 24.01% and 23.589% respectively, and the T3 wheat crop gave the lowest values in this trait for the two planting seasons, reaching 20.67% and 20.181% respectively, while the T2 oat crop gave average values for the two planting seasons, reaching 21.924% and 21.504% respectively. The results of Table 8 showed a significant effect of cutting dates on the fiber percentage for the two planting seasons, as the first cutting date C1 was significantly excelled, recording the highest values for the first and second seasons, recording 23.094% and 22.632% respectively, and the second cutting date C2 recorded the lowest values for this trait for the two planting seasons, reaching 21.031% and 20.639% respectively, while the third cutting date C3 gave average values for the two planting seasons. Agriculture, as it reached 22.48% and 22.003% respectively. The results of Tables 8 showed that the bilateral interaction between planting dates and crop types had a significant effect on the percentage of fibers in the plant and for the two planting seasons, where it was noted that the significantly excelled of the combination D3T1 gave the highest values in this trait and for the two planting seasons, recording 27.087% and 26.274% respectively, while the combination D3T3 recorded the lowest values in this trait and for the two planting seasons, as it reached 19.114% and 18.54% respectively. It was noted that the bilateral interaction between planting dates and cutting dates had a significant effect on the percentage of fibers in the plant and for the first and second seasons. It is noted that the D3C1 combination had the highest value for the trait in the first planting season, reaching 25.46%, and the D2C3 combination had the highest value in the second planting season, reaching 24.753%, while the D1C2 combination recorded the lowest values for the two planting seasons, reaching 19.363% and 19.169% respectively. It is also noted from the results of Tables 8 that the bi-interaction between crop types and cutting dates had a significant effect on the percentage of fibers for the two planting seasons, as the T1C3 combination had a significantly excelled, recording the highest values for this trait for the two planting seasons, reaching 26.758% and 26.318% respectively, while the T3C2 combination recorded the lowest values for the two planting seasons, reaching 18.298% and 17.879% respectively. The results of Table 8 showed that the triple interaction between planting dates, crop types and cutting dates had a significant effect on the percentage of fibers in the plant and for the two planting seasons. The combination D1T2C1 was significantly excelled, as it recorded the highest values for this trait and for the two planting seasons, reaching 28.9% and 28.611% respectively, while the combination D1T3C1 recorded the lowest values for this trait and for the two planting seasons, reaching 16.711% and 16.21% respectively. The superiority of the first planting date and the two planting seasons in the percentage of fiber in the plant can be attributed to the fact that there is a significant negative correlation between this trait and the percentage of crude protein, which had given a low value in the first date. This supports what was reached by [17,25]. The superiority of the barley crop and the two planting seasons in this trait can be explained by the inverse relationship between the percentage of protein and the percentage of fiber or by the increase in the percentage of dry matter in the plant (unpublished data). The superiority of the first cutting date and the two planting seasons may be attributed to the high temperatures in this trait due to the long growth period, which leads to a decrease in the percentage of protein and an increase in the percentage of fiber with the age of the plant. This is what was mentioned by [10,9,2]. The results of the effect of the binary and triple interactions can also be attributed to the results of the individual factors and their superiority or decline in their values and to the variation in environmental and climatic conditions and the reflection of that variation as different results, as mentioned. [10.14,18.[

Table 8 Effect of planting dates, crop types, cutting dates and their interaction on the percentage of fibers in the first cut for both season (2022-2023) and (2023-2024)

cond season				rst season					lanting da tes
T*D)	ıtting dates ((C)			T*D)	ıtting dates ((C)			rop types T)	D)
	3	2	1		3	2	1		
1.458	3.274	7.587	3.513	1.675	3.56	7.765	3.7	1	
1.952	5.594	0.65	3.611	2.174	5.762	0.859	3.9	2	1
9.427	7.503	9.27	1.509	9.624	7.68	9.465	1.726	3	
0.946	0.791	9.169	2.878	1.157	1.001	9.363	3.109	*D	
3.035	5.548	5.8	7.756	3.267	5.806	5.061	7.935	1	
1.672	5.18	3.007	5.83	2.066	5.959	3.239	7	2	2
2.575	3.531	7.809	5.384	3.273	4.259	3.36	7.2	3	
2.427	4.753	2.205	0.323	2.869	5.341	2.553	0.712	*D	
6.274	5.131	6.928	5.763	7.087	5.908	7.761	7.591	1	3
0.887	9.953	3.139	4.57	1.533	0.57	3.7	5.33	2	

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3.54	5.309	5.556	2.756	9.114	5.813	7.068	3.46	3	
1.901	0.464	0.541	4.697	2.578	1.097	1.176	5.46	*D	
verage Crop types	2.003	0.639	2.632	verage Crop types	2.48	1.031	3.094	verage dates	cutting
3.589	5.318	3.439	1.011	4.01	5.758	3.862	1.409	1	
1.504	0.576	0.599	3.337	1.924	1.097	0.933	3.743	2	*T
0.181	9.114	7.879	3.55	0.67	9.584	8.298	4.129	3	
1.758	eneral Average) second season(2024			2.201	eneral Average) first season(2023				

Least significant difference (L.S.D) value at 5% significance level

second season2024		first season2023	
T*D : 0.2125	Planting dates) D :(0.1497	T*D : 0.2150	Planting dates) D :(0.1509
C*D :0.1718	Crop types) T :(0.1301	C*D :0.1737	Crop types) T :(0.1318
C*T: 0.1735	cutting dates)(C:(0.0881	C*T :0.1760	cutting dates)(C :(0.0893
C*T*D : 0.2941		C*T*D : 0.2980	

Conclusions and recommendations:

_Due to the superiority of the third planting date D3 in most of the most important traits (growth and yield) and the superiority of the oat crop T2 in most of the traits and the superiority of the third cutting date C3, and as a result of the superiority of the second planting date D2 and the first cutting date C1 in (the most important qualitative traits), and to address the scarcity of green feed, we recommend:

_1Planting oats as a green feed crop at the end of September 30/9 and to optimally .

Quality benefit from the highest amount of green feed yield, the cutting date is two months (60) days after the date of seedling emergence. To obtain the highest qualitative traits, it is planted at the end of September 20/9 and the cutting date is after (40) days after the date of seedling emergence.

_2Testing planting dates and introducing feed crops suitable for the Iraqi environment and testing different cutting dates to find out the best combination for use as green feed

ISSN 2072-3857

References

-1
Al-Asadi, Maher Hamid Salman. (2019). GenStat for the analysis of agricultural experiments. Al-Qasim Green University - College of Agriculture. Dar Al-Warith Printing and Publishing Press. Iraq. 304 pp.

-2 Al-Dulaimi, Nihad Muhammad Abbud and Muhammad Saeed Abdul-Khalifaoui. Al-Anbar Journal of Agricultural Sciences, 2016, Volume 14, Issue 1, Pages 173-182.

-3 Al-Rawi, Khasha Mahmoud and Abdul Aziz Muhammad Khalaf Allah. (2000). Design and Analysis of Agricultural Experiments. Dar Al-Kutub Foundation for Printing and Publishing. University of Mosul. Iraq. 488 pp.

-4 Salem, Abdullah Younis and Abbas Mahdi Al-Hassan. (2012). Effect of nitrogen fertilization and growth phase on growth traits and forage yield of oat (Avena sativa L.) varieties. The Second Scientific Conference / University of Karbala.

-5 Al-Taie, Ali Abis Hussein. (2016). Effect of nitrogen fertilizer and cutting dates on the growth and yield of green feed and grains of barley, Research 244. Master's thesis. College of Agriculture. Al-Qasim Green University.

-6 Mansour, Hassan Najm. (2018). Effect of planting dates and seed quantities on the nutritional value of the feed mixture (barley, clover, millet). PhD thesis - College of Agriculture - University of Baghdad.

-7 Al-Younis, Abdul Hamid Ahmed, Mahfouz Abdul Qader Muhammad and Zaki Abdul Elias (1987). Cereal crops, Ibn Al-Atheer House for Printing and Publishing, University of Mosul.

-8 A.O.A.C. 2005. Official Methods of Analysis. Association of Official Analysis Chemists. 18th Ed., P.O. Box 540, Washington, D.C., USA

-9 Al-freeh, L. M., & AL-zergawy, M. A. (2015). Effect of seeding rates and number of cutting on growth and yield of Barley (Hordeum vulgare L.) in Basrah. Thi-Qar University Journal for Agricultural Researches, 4(2.(

-10 B., S., Dhillon., R.S., Uppal. (2024). Effect of sowing time and cutting - management on growth, productivity and economics of barley (Hordeum vulgare). Indian Journal of Agronomy, 65(2):214-219. doi: 10.59797/ija.v65i2.5592.

-11 Bali, A. S., M. A. Wani and M. H .Shah . 2010. Forage yield, growth rate and botanical composition of Oat, barley and Berseem intercrops under different sowing dates, cutting management. Crop Sci, 51: 2334–2344.

-12 Billman, E. D., de Souza, I. A., Smith, R. G., Soder, K. J., Warren, N. D., & Brito, A. F. (2022). Identifying optimal early- season harvest timing in annual fall forages. Crop, Forage & Turfgrass Management, 8(2), e20179.

-13 Dost, M.(1997). End of Assignment report on feed component. PAK/86/027. FAO/UNDP, Gilgit, Pakistan.

-14 Gresser,M.S.and J.W.Parson.(1979). Sulphuric—perchloric acid digestion of plant material for the determination of nitrogen, phosphorus, potassium, calcium and magnesium.Analytical Chemical Acta.109:431-436.

-15 Haynes, R. J. (1980). A comparison of two modified kjeldhal digestion techniques for multi-element plant analysis with conventional wet and dry ashing method common in soil. Sci. Plant Analysis, 11: 459 – 467.

-16 Jadou, Khadir Abbas. (1995). Wheat Facts and Guidelines. Publications of the Ministry of Agriculture. General Authority for Agricultural Cooperation and Guidance.

-17 Maninder, Kaur., Harpreet, Oberoi. (2023). Production potential, quality and thermal utilization of feed pearl millet varieties under different sowing environments in irrigated conditions of central Punjab in India. Range Management and Agroforestry, doi: 10.59515/rma.2023.v44.i1.23.

-18 Md., Hasanuzzaman., Mausami, Rana., Faridul, Islam., M, O, A, Mollick., Shah, Md., Masum. (2024). 1. Effects of Sowing Date and Cutting Management on the Grain and Feed Yield of Barleyeffects of Sowing Date and Cutting Management on the Grain and Feed Yield of Barley. Bangladesh Journal of Agriculture, doi: 10.3329/bjagri.v49i1.74027.

-19 Mihir, B., Modh., Vinod, B., Mor. (2024). 2. Exploring the nexus between weather variables and wheat quality across different sowing dates and varieties: a comprehensive correlation study. Plant Archives, doi: 10.51470/plantarchives.2024.v24.no.1.126.

-20 Moustafa, E. S., El-Sobky, E. S. E., Farag, H. I., Yasin, M. A., Attia, A., Rady, M. O., ... & Mansour, E. (2021). Sowing date and genotype influence on yield and quality of dual-purpose barley in a salt-affected arid region. Agronomy, 11(4), 717.

-21 Mustafa, T. A. N., & Yolcu, H. (2021). Current status of forage crops cultivation and strategies for the future in Turkey: a review. Journal of Agricultural Sciences, 27(2), 114-121.

-22 Nagwa, Ebrahim, Shalaby., Sedhom, Abdelkhalik., Khaled, I., M., Gad. (2023). 1. Effect of sowing date on grain yield and quality of some Egyptian bread wheat genotypes. Egyptian Journal of Agricultural Research, doi: 10.21608/ejar.2023.191360.1332.

-23 Ross, S. M., King, J. R., O'Donovan, J. T., & Spaner, D. (2005). The productivity of oats and berseem clover intercrops. I. Primary growth traits and forage quality at four densities of oats. Grass and forage Science, 60(1), 74-86.

-24 Sharma SK, Bhunia SR (2000). Response of oat (Avena sativa) to cutting management, method of sowing and nitrogen. Indian J. Agron. 46(3):563-567.

-25 Shriyesh, Patel. (2024). 1. Effect of date of sowing and crop geometry on growth, yield and quality of ajwain (Trachyspermum ammi L.). Deleted Journal, doi: 10.56093/ijss.v92i1.10.

-26 Thomas, T.C. (1975). Visual quantification of wheat development. Agron.J.65:116-119.

-27 Tom, De, Swaef., Veerle, De, Schepper., Maurits, W., Vandegehuchte., Kathy, Steppe. (2015). 5. Stem diameter variations as a versatile research tool in ecophysiology.. Tree Physiology, doi: 10.1093/TREEPHYS/TPV080.

-28 Violeta, Mandić., Snežana, Đorđević., Nikola, Đorđević., Zorica, Bijelić., Vesna, Krnjaja., Maja, Petričević., Milan, Brankov. (2020). 4. Genotype and Sowing Time Effects on Soybean Yield and Quality. Agriculture, doi: 10.3390/AGRICULTURE10110502.

-29 Xiaomei, Bao., Canrong, Tian. (2019). 4. Delay driven vegetation patterns of a plankton system on a network. Physica A-statistical Mechanics and Its Applications, doi: 10.1016/J.PHYSA.2019.01.062.

-30 O., T., Андреева. (2024). Productivity of less common agricultural crops depending on the sowing dates in the conditions of Transbaikalia. Сибирский вестник

сельскохозяйственной науки, 54(5):37-48.
doi: 10.26898/0370-8799-2024-5-3.