Effect of varieties and seeding rates on the growth and forage yield of Egyptian clover *Trifolium alexandrinum* L.

Saif Khalil Abdul zahra Alshaghnabi

Email: pgs.saif.khalil@uobasrah.edu.iq

Mohammed Abdul alreza Abdul alwahed

College of Agriculture, University of Basrah, Iraq

Email: mohameed.abdl_wahed@uobasrah.edu.iq

Kadhim kutami Gaber Al asady

College of Agriculture, University of Basrah, Iraq

Email: Kadamkutame@gmail.com

Abstract

A field experiment was carried out at the Agricultural Research Station, Faculty of Agriculture, University of Basra, Karma Ali site (latitude 30.57° N and longitude 47.80° E) during the 2024/2025 growing season, with the aim of studying the response of four alfalfa varieties (Mesqawi, Sumer, Berseem alberseem, and Hamdani) to three seed rates (35, 45, and 55 kg ha^{-1}) and evaluating their forage value. The experiment was conducted using a split-plot design arranged in a randomized complete block design (RCBD) with three replicationsVarieties were placed in the secondary plots and quantities of seeds in the main plots.Several growth and yield traits were measured.The varieties differed significantly in most of the studied traits.The Mesqawi cuts recorded the highest plant height across all four cuts (55.40, 62.18, 71.76, and 59.36 cm, respectively). It also achieved the highest number of branches in the first and fourth cuts (484.13 and 572.27 branches m^{-2}, respectively). The Sumer cuts excelled in the second and third cuts, giving the highest number of branches (668.96 and 743.99 branches m^{-2}, respectively). Concerning green forage yield, the Mesqawi cuts recorded the highest yield in the first and Third cut (29.34 t ha^{-1}),(Sumer)V2whereas the cuts was superior in the second and third cuts producing 28.77 and 35.12 t ha^{-1}, respectively.Regarding dry forage yield, the Sumer cuts outperformed the other varieties in the first, second, and third cuts (3.44, 4.58, and 5.00 t ha^{-1}, respectively), while the Mesqawi cuts produced the highest dry yield in the fourth cut (4.07 t ha^{-1}).The results showed that seed rates had a significant effect on most of the studied traits. The 45 kg ha^{-1} seed rate produced the highest averages for plant height and number of branches in all four cuts (50.72, 61.32, 70.73, and 56.53 cm; and 433.19, 588.34, 677.35, and 540.35 branches m^{-2}, respectively).This seed rate also gave the highest green forage yields (20.15, 26.29, 29.09, and 24.00 t ha^{-1}) and dry forage yields (3.38, 4.12, 4.52, and 3.84 t ha^{-1}) in all four cuts.The interaction between varieties and seed rates significantly affected green forage yield in all cuts. The interaction treatment Sumer × 45 kg ha^{-1} achieved the highest yield in the first and third cuts (20.51 and 36.53 t ha^{-1}, respectively). For dry forage yield, the same interaction produced the highest value in the third cut (6.60 t ha^{-1}).

Keywords: Egyptian clover , varieties , seeding rates , yield.

ISSN 2072-3857

***Study derived from a Master's thesis**

Introduction

Egyptian clover is considered one of the most important winter legume field crops that are grown in areas with a cold climate, especially in Iraq, Egypt and the Middle East countries, because of its high productivity quality, palatability and tolerance to the conditions of the region and the diversity of its varieties and its use, as it can be grown for the purpose of green fodder or as a silage or hay (dry fodder) or as green fertilizing crops in agricultural cycles for its ability to stabilize atmospheric nitrogen and its lack of needs for the addition of chemical fertilizers and service operations, in addition to it is a multi-cut crop, as it gives from 4–6 cuts under the conditions of Iraq and its production reality is about 80 t ha^{-1} [2, 20], and Egyptian clover is almost a full food for animals because it contains a high percentage of digestible crude protein and it is rich in nutritional value. Egyptian clover is an effective legume in stabilizing nitrogen, as it contributes to stabilizing about **33–66 kg N ha^{-1}**, which enhances soil fertility for cultivation. In addition, Egyptian clover has been shown to have positive effects on combating soil erosion, and combating weeds [8,16]. Moreover, Egyptian clover is characterized by its ability to adapt on a larger scale, and its rapid vegetative growth,

And its versatility, high productivity, and availability of feed during the winter period, and contains about 62% total digestible nutrients [15].

Increasing the production of green fodder for Egyptian clover in the region requires searching for ways to raise productivity, including the introduction and cultivation of new genetic compositions, especially as it is one of the crops with wide acclimatization, making it multi-species, as the varieties are one of the main factors that determine the productivity and quality of fodder due to their difference in growth qualities, the number of cuts and their containment of dry matter and raw protein, as well as their resistance to inappropriate environmental conditions Egyptian clover is characterized by a strong regrowth ability after cutting [25]. Another factor that affects the productivity of fodder crops in general and Egyptian clover in particular is the seeding rate used when planting, as they are considered one of the main factors that determine plant density in the unit area and thus affect competition for light, water and nutrients [1,4]. Increasing seeding rates may lead to overcrowding and vice versa in the event of reducing the amount of seeds, which may negatively affect the production of fodder [3],so determining the optimal amount of seeds is an essential step in managing the crop to obtain the highest possible productivity with the efficiency of using available resources, especially since the optimal amount of seeds varies according to the cuts, types of soil, climate conditions and method of cultivation [26].

And in order to expand the cultivation of Egyptian clover in the southern region came this study, which aims to compare the performance of a number of newly introduced Egyptian clover varieties with local varieties and determine the best in terms of growth and productivity and determine the best amount of seeds that achieve the best plant density and the highest productivity of clover varieties and study the effect of interaction between varieties and seeding rates in the growth and yield qualities.

Materials and Methods

A field experiment was carried out at the Agricultural Research Station of the Faculty of Agriculture - University of Basra / Karma Ali site, which is located at (latitude 30°.57 north and longitude 47°.80) during the agricultural season 2024/2025 with the aim

ISSN 2072-3857

of studying the impact of varieties and seeding rates in the growth and fodder yield of the Egyptian clover crop *Trifolium alexandrinum*L. in loamy soil and as shown by its chemical and physical characteristics in table (1).

The experiment included the study of two factors: the first factor: four varieties of Egyptian clover (Mesqawi, Sumer, Berseem and Hamdani) it is symbolized (V1, V2, V3, and V4). The second factor: three seeding rates (35, 45and55) kg.ha^{-1}and symbolized (S1, S2, and S3). As the varieties were placed in the sub-plots and the seeding rates in the main plots.

Table (1) Some chemical and physical qualities of field soil before planting

Source	Units	Value	Qualities	
[19]	-	7.37	pH	
	dS m^{-1}	8.69	E.C	
	%	1.82	organic matter	
[23]	mg kg^{-1} soil	15.12	N	Ready-made items
		23.97	P	
		156.6	K	
[9]	g kg^{-1} soil	162.26	sand	Soil separators
		479.17	silt	
		358.57	clay	
		clayey silt	Soil texture	

Results and Discussion.

plant height (cm)

It is noted from the results table (2) the superiority of the V1 cuts over the rest of the cutses in all Four cuts, as it recorded the highest average of 55.40, 62.18, 71.76 and 59.36 cm in succession without differences in significantly from the V2 cuts in the second cut, while the V4 cuts gave the lowest average of all cuts amounted to 40.82, 49.22, 57.87 and 45.02 cm in succession, and the reason for the variation in plant height of the varieties may be due to the genetic characteristics of each cuts, and this is likely because the V1 and V2 varieties used their genetic and physiological capabilities more efficiently to meet the growth requirements compared to the V3 and V4 cutses, which was reflected on the increase in plant height and this result is consistent with this result [30], [18], [27] and [11] reported variation in plant height.

From Table (2) the moral effect of the sowing seeding rates in this trait is observed to exceed the S2 rate in all cuts as it gave the highest average of 50.72, 61.32, 70.73 and 56.53 cm for the four cuts respectively. The second seed quantity gave S3 the lowest average of all cuts at 48.92, 54.96, 63.35 and 51.11 cm for the four cuts respectively. This result is consistent with[21], [24], [6] have pointed out.

As for the interaction between the factors, it affected morally in all cuts except the second, there were no differences in significant effect. The interaction treatment (V1xS1) gave the highest average of 56.71 cm in the first cut, while the interaction treatment (V1xS2) gave the highest average of 77.61 and 62.43 cm in the third and fourth cuts respectively. While the interaction treatment (V4xS3) gave the lowest average in all cuts except the second was 39.03, 54.27 and 41.32 cm respectively.

Table (2) Effect of varieties, seeding rates, and their interaction on average plant height (cm)

First cut					
Average Seeding rates	Varieties				Seeding rates
	V_4	V_3	V_2	V_1	
49.49	40.64	48.12	53.60	56.71	S_1
50.72	42.80	49.01	54.37	55.59	S_2
48.92	39.03	49.34	53.42	53.91	S_3
	40.82	48.82	53.80	55.40	Average varieties
interaction	varieties		Seeding rates		(0.05) LSD
1.019	0.595		0.681		
Second cut					
Average Seeding rates	Varieties				Seeding rates
	V_4	V_3	V_2	V_1	
56.82	48.63	56.34	60.52	61.77	S_1
61.32	52.78	60.46	66.42	65.63	S_2
54.96	46.25	55.75	58.71	59.15	S_3
	49.22	57.52	61.88	62.18	Average varieties
interaction	varieties		Seeding rates		(0.05) LSD
N.S	1.004		1.149		

ISSN 2072-3857

Third cut					
Average Seeding rates	Varieties				Seeding rates
	V_4	V_3	V_2	V_1	
65.85	57.88	65.72	68.27	71.53	S_1
70.73	61.47	71.07	72.79	77.61	S_2
63.35	54.27	66.13	66.87	66.14	S_3
	57.87	67.64	69.31	71.76	Average varieties
interaction	varieties		Seeding rates		(0.05) LSD
2.630	1.467		1.945		
Fourth cut					
Average Seeding rates	Varieties				Seeding rates
	V_4	V_3	V_2	V_1	
53.31	45.21	51.37	57.36	59.31	S_1
56.53	48.53	55.63	59.55	62.43	S_2
51.11	41.32	51.82	54.98	56.33	S_3
	45.02	52.94	57.30	59.36	Average varieties
interaction	varieties		Seeding rates		(0.05) LSD
1.469	0.858		0.982		

Number of branches (branch.m^{-2})

The results in Table (3) show that the number of branches has differed significantly between the varieties, as the V1 cuts was superior in the first and fourth cuts and gave the highest averages of 484.13 and 572.27 branches m^{-2}, respectively, while the V2 cuts was superior in the second and third cuts, giving the highest averages of 668.96 and 743.99 branches m^{-2}. The V4 cuts gave the lowest averages in all cuts, amounting to 349.95, 386.05, 466.77, and 400.89 branches m^{-2} for the four varieties, respectively. The variation among the different varieties in this trait may be due to genetic factors and their role in

ISSN 2072-3857

determining the branching ability of the cuts, which leads to differences in the number of branches. This result agrees with what was reported by [29], [14][10].

The results in Table (3) indicate that the seeding rates differed significantly in their effect on the number of branches, as the S2 rate exceeded in all varieties and gave the highest averages of 433.19, 588.34, 677.35, and 540.35 branches m^{-2} for the four varieties, respectively, while the S3 rate gave the lowest averages of 424.33, 553.09, 614.89, and 489.72 branches m^{-2} in all four varieties, respectively. The increase in the number of branches at the S2 rate was attributed to the higher plant density per unit area, allowing plants to occupy the space without competition. This was positively reflected in the increase in the number of branches at this seeding rate, as well as due to appropriate environmental conditions. These results agree with the findings of [14][6] .

The results of Table (3) indicate that there is an effect of the interaction between varieties and seeding rates in all varieties, as the interaction treatment (V1×S2) gave the highest averages of 489.55 and 595.95 branches m^{-2} in the first and fourth cuts, respectively, while the interaction treatment (V2×S2) in the second and third cuts gave the highest averages of 682.45 and 775.08 branches m^{-2}, respectively. The interaction treatment (V4×S3) gave the lowest averages of 344.74, 351.63, 452.86, and 374.74 branches m^{-2} for the four varieties, respectively. This is due to the ability of the V1 and V2 varieties to grow well when planted at this seeding rate of 45 kg ha^{-1}.

Table (3) Effect of varieties, seeding rates, and their interaction on average number of branches (branch m^{-2})

First cut					
Average Seeding rates	Varieties				Seeding rates
	V_4	V_3	V_2	V_1	
429.62	352.09	420.21	468.09	478.11	S_1
433.19	353.03	424.03	466.16	489.55	S_2
424.33	344.74	419.56	448.27	484.73	S_3
	349.95	421.27	460.84	484.13	Average varieties
interaction	varieties		Seeding rates		LSD(0.05)
6.713	4.294		2.806		
Second cut					
Average Seeding rates	varieties				Seeding rates
	V_4	V_3	V_2	V_1	
571.89	387.85	579.62	664.87	655.23	S_1
588.34	418.68	587.45	682.45	664.76	S_2
553.09	351.63	547.83	659.57	653.34	S_3
	386.05	571.63	668.96	657.78	Average varieties
interaction	varieties		Seeding rates		LSD(0.05)
1.279	0.785		0.714		
Third cut					
Average Seeding rates	varieties				Seeding rates

ISSN 2072-3857

	V_4	V_3	V_2	V_1	
650.33	453.19	644.44	760.26	743.43	S_1
677.35	494.27	683.49	775.08	756.56	S_2
614.89	452.86	594.94	696.62	715.15	S_3
	466.77	640.96	743.99	738.38	Average varieties
interaction	varieties		Seeding rates		LSD(0.05)
3.218	2.060		1.336		
Fourth cut					
Average Seeding rates	varieties				Seeding rates
	V_4	V_3	V_2	V_1	
518.26	386.19	542.08	577.10	567.67	S_1
540.35	441.75	539.05	584.64	595.95	S_2
489.72	374.74	495.61	535.35	553.19	S_3
	400.89	525.58	565.70	572.27	Average varieties
interaction	varieties		Seeding rates		LSD(0.05)
6.150	3.628		3.989		

Leaves to stems weight ratio (%)

The results of Table 4 showed that there was no effect on the significantly of the varieties and the seeding rates and the interaction between them in all four cuts in the leaf-to-stem ratio characteristic

Table (4) Effect of varieties, seeding rates, and their interaction on average leaves-to-stems weight ratio (%)

First cut					
Seeding rates	varieties				Average Seeding rates
	V_1	V_2	V_3	V_4	
S_1	59.20	51.97	70.10	52.82	58.52
S_2	60.30	75.95	67.52	54.61	64.59
S_3	57.60	72.50	59.27	56.34	61.43
Average varieties	59.03	66.81	65.63	54.59	
LSD(0.05)	Seeding rates		varieties		interaction
	N.S		N.S		N.S
Second cut					
Seeding rates	varieties				Average Seeding

ISSN 2072-3857

	V_1	V_2	V_3	V_4	rates
S_1	69.03	66.08	69.03	56.18	65.08
S_2	81.63	87.17	78.18	70.84	79.46
S_3	66.29	57.72	59.31	43.03	56.59
Average varieties	72.32	70.33	68.84	56.68	
LSD(0.05)	Seeding rates		varieties		interaction
	N.S		N.S		N.S
Third cut					
Seeding rates	varieties				Average Seeding rates
	V_1	V_2	V_3	V_4	
S_1	68.56	53.81	55.79	44.03	55.55
S_2	82.38	68.39	59.35	57.99	67.03
S_3	51.67	64.57	54.83	49.11	55.04
Average varieties	67.54	62.26	56.65	50.38	
LSD(0.05)	Seeding rates		varieties		interaction
	N.S		N.S		N.S
Fourth cut					
Seeding rates	varieties				Average Seeding rates
	V_1	V_2	V_3	V_4	
S_1	47.59	50.61	57.29	40.58	49.02
S_2	58.35	65.55	72.29	53.85	62.51
S_3	51.78	60.51	46.41	51.37	52.52
Average varieties	52.57	58.89	58.66	48.60	
LSD(0.05)	Seeding rates		varieties		interaction
	N.S		N.S		N.S

ISSN 2072-3857

Green fodder yield (t ha⁻ ¹)

Among the table (5) we note the superiority of the V1 cuts in the first and fourth cuts, as it gave the highest averages of 19.78 and 25.09 t ha⁻ ¹ respectively, and there were no significant differences between V1 and V2 in the first cut, while the V2 cuts was superior in the second and third cut, as it gave the highest averages of 28.77 and 35.12 t ha⁻ ¹ on the sequence, while the V4 cuts gave the lowest average in all cuts, amounting to 16.74, 19.27, 20.45 and 18.93 t ha⁻ ¹ respectively, and the reason for the superiority of the V1 cutses in this cuts may be attributed to the genetic difference. V2 in growth traits such as plant height and number of branches table (2 and 3) This finding is consistent with the findings of [7], [12], [22], [17].

As for the effect of seeding rates, the results of table (5) showed the superiority of the S2 seeding rates in all cuts, as it gave the highest averages of 20.15, 26.29, 29.09 and 24.00 t ha⁻ ¹ respectively, while the S3 rate gave the lowest average in the first, second and third cuts, amounting to 17.92, 23.22 and 26.38 t ha⁻ ¹ respectively. In the fourth cut, the S1 seeding rates gave the lowest average of 21.43 t ha⁻ ¹. The reason for the superiority of S2 seeds may be attributed to the increase in plant density resulting from planting in appropriate seeding rates, which leads to an increase in the plant table (2) and an increase in the number of plants per unit area and thus increasing the number of branches (3). This has a positive effect on the productivity of green fodder, at the same time increasing the amount of seed over the optimal amount is likely to increase competition between plants, leading to lower productivity (Read et al., 2014). These results are in agreement with [4],[13], [3]

The interaction between varieties and seeding rates in the first and third cuts affected the table (5) as the interaction treatment (V2xS2) gave the highest average of 20.51 and 36.53 t ha⁻ ¹ respectively while the interaction treatment (V4xS3) gave the lowest average of both cuts of 15.12 and 18.17 t ha⁻ ¹ respectively.

Table (5) Effect of varieties, seeding rates, and their interaction on average green fodder yield (t ha⁻ ¹)

Seeding rates	varieties				Average Seeding rates
	V_1	V_2	V_3	V_4	
S_1	19.57	19.19	18.73	15.65	18.29
S_2	20.40	20.51	20.24	19.45	20.15
S_3	19.38	18.93	18.25	15.12	17.92
Average varieties	19.78	19.54	19.08	16.74	
LSD(0.05)	Seeding rates		varieties		interaction
	0.259		0.716		1.087
Second cut					
Seeding rates	varieties				Average Seeding rates

	V_1	V_2	V_3	V_4	
S_1	23.68	28.62	23.77	19.35	23.85
S_2	28.37	29.91	26.07	20.82	26.29
S_3	24.59	27.77	22.87	17.63	23.22
Average varieties	25.55	28.77	24.24	19.27	
LSD(0.05)	Seeding rates		varieties		interaction
	2.207		1.469		N.S
Third cut					
Seeding rates	varieties				Average Seeding rates
	V_1	V_2	V_3	V_4	
S_1	29.32	35.03	27.76	20.61	28.18
S_2	29.09	36.53	28.15	22.57	29.09
S_3	29.62	33.81	23.93	18.17	26.38
Average varieties	29.34	35.12	26.61	20.45	
LSD(0.05)	Seeding rates		varieties		interaction
	0.788		0.961		1.540
Fourth cut					
Seeding rates	varieties				Average Seeding rates
	V_1	V_2	V_3	V_4	
S_1	23.47	22.64	21.72	17.91	21.43
S_2	26.65	26.59	23.09	19.68	24.00
S_3	25.16	24.53	20.09	19.21	22.25
Average varieties	25.09	24.59	21.64	18.93	
LSD(0.05)	Seeding rates		varieties		interaction
	0.496		1.027		N.S

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

The results of the table (6) show the superiority of the V2 cuts over the rest of the varieties in the category of dry fodder crop in the second and third cuts, as it gave the highest average of 4.58 and 5.00 t ha^{-1} respectively, as there are no differences in significantly between the V2 and V1 cuts in the second cut, while the V1 cuts in the first and fourth cut with an average of 3.44 and 4.07 t ha^{-1} and there are no differences in significantly between the V1 and V2 cuts, while the V4 cuts gave the lowest average in all cuts of 1.88, 2.71, 3.04 and 2.60 t ha^{-1} respectively. The reason for the superiority of this cuts in the dry fodder crop is due to its superiority in the green feed green fodder yield Table (5), and this result is consistent with what [28], [31], [32], [33].

The results of Table (6) show the superiority of the S2 seed quantity in all cuts, as it gave the highest average of 3.38, 4.12, 4.52 and 3.84 t ha^{-1} respectively, while the S1 seeding rate gave the lowest average in the first, second and fourth cuts of 2.04, 3.29 and 3.10 t ha^{-1} respectively. In the third cut, the S3 seeding rate gave the lowest average of 3.65 t ha^{-1}. The reason for the superiority of the S2 seeding rate in all cuts over the seeding rates of other seeds in the dry fodder crop may be attributed to its superiority in the green fodder crop Table (5), and this result is consistent with [4], [3], [5].

The interaction between varieties and seeding rates affected significantly in the dry fodder crop in the third cut as the interaction treatment (V2xS2) gave the highest average of 6.60 t ha^{-1} while the interaction treatment (V4xS3) gave the lowest average of 2.87 t ha^{-1}.

Table (6) Effect of varieties, seeding rates, and their interaction on average dry fodder yield (t ha^{-1})

First cut					
Seeding rates	varieties				Average Seeding rates
	V_1	V_2	V_3	V_4	
S_1	2.19	2.48	2.10	1.41	2.04
S_2	4.43	3.91	2.77	2.42	3.38
S_3	3.70	3.35	1.68	1.81	2.63
Average varieties	3.44	3.25	2.18	1.88	
LSD(0.05)	Seeding rates		varieties		interaction
	0.406		0.473		N.S
Second cut					

ISSN 2072-3857

Seeding rates	varieties				Average Seeding rates
	V_1	V_2	V_3	V_4	
S_1	3.43	3.96	3.20	2.58	3.29
S_2	4.21	5.48	3.71	3.06	4.12
S_3	3.44	4.29	3.46	2.49	3.42
Average varieties	3.70	4.58	3.45	2.71	
LSD(0.05)	Seeding rates		varieties		interaction
	0.570		0.432		N.S
Third cut					
Seeding rates	varieties				Average Seeding rates
	V_1	V_2	V_3	V_4	
S_1	3.41	4.72	3.43	3.10	3.66
S_2	4.39	6.60	3.96	3.15	4.52
S_3	4.16	3.69	3.90	2.87	3.65
Average varieties	3.99	5.00	3.76	3.04	
LSD(0.05)	Seeding rates		varieties		interaction
	0.562		0.368		0.698
Fourth cut					
Seeding rates	varieties				Average Seeding rates
	V_1	V_2	V_3	V_4	
S_1	3.70	3.46	3.01	2.24	3.10
S_2	4.53	4.39	3.31	3.14	3.84
S_3	3.98	3.79	3.62	2.43	3.45
متوسط الاصناف	4.07	3.88	3.31	2.60	
LSD(0.05)	Seeding rates		varieties		interaction
	0.272		0.651		N.S

ISSN 2072-3857

Conclusion

-

1The V1 cuts is superior to Mesqawi and Sumer in most of the growth traits and in both green and dry fodder yield among the four varieties.

2-Using a seeding rate of 45 kg ha^{-1} is the most appropriate under the conditions of Basra Governorate, as it excelled in all growth traits and in green and dry fodder yield for each cut.

3- The interaction between varieties and seeding rates was significant, as the two interaction treatments (V1×S2) and (V2×S2) exceeded most of the traits studied.

References

[1].

Al-Shuwaili, Mohammed Hassan Faris. (2014). Effect of nitrogen fertilization and seeding seeding rates of Egyptian clover (*Trifolium alexandrinum* L.) with barley (Hordeum vulgare L.) in the yield and quality of feed. Master Thesis, Faculty of Agriculture, University of Basra1-67.

[2]. **Al-Tikriti, Ramadan Ahmad, Tawakkol Younis Rizk, Hikmat Askar Al-Roumi, 1981.** Dar Al-Kutub Foundation for Printing and Publishing. University of Mosul.

[3]. **Al-Zalzali, Mohamed Hajem (2021).** Effect of NPK fertilizer coefficients and seeding rates in feed and seed crops in Egyptian clover. Master's Thesis. College of Agriculture. Al-Muthanna University 1-88.

[4]. **Al-Zerjaoui, Mohammed Abdel-Rida Abdel-Wahid. 2011**. Impact of planting dates, sowing rates and cuts on the fodder yield and quality of Egyptian clover. Master Thesis, Faculty of Agriculture, University of Basra.

[5]. **Arif, M., Kumar, A., Pourouchottamane, R., Gupta, D. L., & Rai, B. (2022).** Assessment of forage berseem (Trifolium alexandrinum L.) for productivity and profitability under varying seed rates and phosphorus fertilization.

[6]. **Badawy, A. E. S., Abd El-Monem, A., Mohamed, D. A., & Hassan, H. H. (2023).** EFFECT OF SOWING DATE AND SEEDING RATE ON FORAGE AND SEED PRODUCTIVITY OF FAHL BERSEEM (Trifolium alexandrinum L.). *Sinai Journal of Applied Sciences*, *12*(2), 173-196.

[7]**Bakhtiyari, F., Zamanian, M.,&Golzardi, F. (2020).** Effect of mixed intercropping of clover on forage yield and quality. South-Western Journal of Horticulture, Biology and Environment, 11(1), 49-65.

[8]. **Balazadeh, M., M. Zamanian, F. Golzardi and A. Mohammadi Torkashvand. 2021.** Effects of limited irrigation on forage yield, nutritive value and water use efficiency of Persian clover (Trifolium resupinatum) compared to Berseem clover (Trifolium alexandrinum). Communications in Soil Science and Plant Analysis, 52 (16): 1927-1942.

[9]. **Black, A. L;and Power, J. F. (1965).** Effect of chemical and mechanical fallow methods on moisture storage, wheat

ISSN 2072-3857

yields,and soil erodibility. Soil Science Society of America Journal, 29(4), 465-468.

[10]. **Bulut, H. (2023).** Developmental Response of Berseem (Trifolium alexandrinum L.) to Boron. *Black Sea Journal of Agriculture*, *6*(5), 552-557. **Marinova, D., & Stoyanova, S. (2024).** ESTABLISHMENT OF PHENOTYPIC VARIABILITY AND CORRELATIONS OF SEED YIELD AND YIELD RELATED TRAITS IN ALFALFA (Medicago sativa L.) CLONAL PROGENIES. *Turkish Journal Of Field Crops*, *29*(1), 64-72.

[11]. **Darwish, Abd al-Abbas's table. (2025).** The response of the barley mixture (Hordeum vulgare L.) and alfalfa (Trifolium alexandrinum L.) to different combinations of nitrogen and phosphate fertilization and their effect on certain growth, yield and quality qualities. Master Thesis, Faculty of Agriculture, University of Basra.

[12]. **El-Nahrawy, S., Badawy, A. S. M., & Rady, A. M. (2023).** Differential Response of Two Base Populations of Egyptian Clover. *Journal of Plant Production*, *14*(3), 135-139.

[13]. **Zerjaoui, Mohammed Abdel-Rida Abdel-Wahid. 2017.** Effect of np fertilizer levels and seeding rates on the yield and quality of Egyptian clover (Trifolium alexandrinum.L) Journal of Dhi Qar University for Agricultural Research Volume 6, Issue 1, pp. 251-261.

[14]. **Gondal, M. R., Ijaz, S., Ali, N., Ashraf, M. S., Khan, M. N., Arshad, M., ... & Zulfiqar, B. (2022).** Apposite seeding density to enhance productivity of berseem. *Pakistan Journal of Agricultural Research*, *35*(2), 317-323.

[15]. **Gondal, M. R., Rizvi, S. A., Naseem, W., Ahmad, F., Muhammad, G., Ali, A., & Ahmad, I. (2021).** Optimizing cutting intervals to exploit forage and seed yield potency of clover cultivars. *Pakistan Journal of Agricultural Sciences*, *58*(3),317-323.

[16]. **Govindasamy, P., V. Singh, D.R. Palsaniya, R. Srinivasan, M. Chaudhary and S.R. Kantwa. (2021).** Herbicide effect on weed control, soil health parameters and yield of Egyptian clover (Trifolium alexandrinum L.). Crop Prot., 139.

[17]. **Hindoriya, P. S., Kumar, R., Meena, R. K., Ram, H., Kumar, A., Kashyap, S., ... & Bhattacharjee, S. (2024).** The Impact of Integrated Nutrient Management on Trifolium alexandrinum Varietal Performance in the Indo-Gangetic Plains: A Comparative Yield and Economic Analysis. *Agronomy*, *14*(2), 339.

[18]. **Jabbar, A., Iqbal, A., Iqbal, M. A., Sheikh, U. A. A., Rahim, J., Khalid, S., ... & Hamad, A. A. (2022).** Egyptian clover genotypic divergence and last cutting management augment nutritive quality, seed yield and milk productivity. *Sustainability*, *14*(10), 5833.

[19]. **Jackson, M. L. (1958).** Soil chemical analysis. Prentic-Hall Inc. Englewood, Cliffs, N. J; pp 498.

[20]. **Kharbeet, Hamid Khalaf and Khalda Ibrahim Hashem. 2017.** University of Baghdad. College of Agriculture. World of Knowledge Press, 298.

[21]. **Kim, J. G., Jeong, E. C., Li, Y. F., Kim, H. J., & Ahmadi, F. (2021).** Effect of seeding rate on forage quality components and productivity of Alfalfa in alpine area of

Korea. *Journal of the Korean society of Grassland and Forage Science*, *41*(3), 168-175.

[22]. **Kumar, N., SATPAL, N. K., Kharor, S., Kumar, D., Phogat, S., & Jindal, Y. (2021).** Genotypic response of berseem (Trifolium alexandrinum L.) to different phosphorus levels. *Forage Res.*, *47*(3), 329-333.

[23]. **Page, A. L; Miller, R. H; and Keeney, D. R. (1982).** Methods of soil analysis. Part 2. American Society of Agronomy. Soil Science Society of America, Madison, WI, USA, 4(2): 167-179.

[24]. **Rajab, M. N.,&Kasem, E. S. (2022).** Influence of Planting Methods and Seeding Rates on Productivity of Egyptian Clover Forage and some Water Relations. *Journal of Plant Production*, *13*(7), 305-313.

[25]. **Salama, H.S.A.; El-Zaiat, H.M.; Sallam, S.M.A.; Soltan, Y.A.** Agronomic and qualitative characterization of multi-cut berseem clover (Trifolium alexandrinum L.) cultivars. J. Sci. Food Agric. 2020, 100, 3857–3865.

[26]. **Shah, A.U.H., M.S. Hanif, M.R. Gondal, M.S. Akhtar, M. Adnan, A. Basit, S. Hayat, A. Jabbar, A. Pervez, A. Hussain, M.S. Farooq, A. Razzaq and A.A. Khan. 2020.** Effect of seed rate on the yield and yield components of Berseem (Trifolium alexandrinum L.). Int. J. Biosci., 16(5): 302-309.

[27]. **Shereen M.A. EL-Nahrawy1 , Rania A. Khedr2 , Badawy A.S.M.1 , El-Gaafarey T. G.1 and Nagwa E. Shalaby3. (2022**). AGRO-PHYSIOLOGICAL AND SEED VIABILITY RESPONSE OF FIVE EGYPTIAN CLOVER GENOTYPES TO DIFFERENT LEVELS OF SALINE IRRIGATION WATER Future J. Agric; 4, 1-17

[28]. **Tucak, M., Horvat, D., Čupić, T., Krizmanić, G., & Ravlić, M. (2023).** Assessment of alfalfa populations for forage productivity and seed yield potential under a multi-year field trial. *Agronomy*, *13*(2), 349.

[29]. **Tufail, M. S., Krebs, G. L., Southwell, A., Piltz, J. W., Norton, M. R., & Wynn, P. C. (2020).** Enhancing performance of berseem clover genotypes with better harvesting management through farmers' participatory research at smallholder farms in Punjab. *Scientific Reports*, *10*(1), 3545.

[30]. **Tufail, M., Krebs, G., Khan, M. S., Southwell, A., Piltz, J., Norton, M., & Wynn, P. (2024).** Seed germination and seedling growth performance of berseem clover (Trifolium alexandrinum L.) populations under different irrigation water sources. *Journal of Agriculture and Biology*, *2*(1), 1-12.

[31]. **Zamanian, M., & Golzardi, F. (2024).** Evaluation of forage yield, water-use efficiency and drought tolerance of Persian clover genotypes. *Crop Science Research in Arid Regions*, *5*(3), 721-740.

ISSN 2072-3857