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THE EFFECT OF DIFFERENT LEVELS OF NITROGEN FERTILIZER AND THE DISTANCES BETWEEN PLANTS ON THE FORAGE YIELD OF GIRAFFE GRASS

Atheer A. Al-Shammari and Faisal M.M. Al-Tahir

Crop Science Department, College of Agriculture, Al-Muthanna University, Iraq.

Abstract

A field experiment was carried out in Al-Shanafiyah district (68 km south of Diwaniyah Governorate) during the autumn agricultural season 2019, to study the effect of different levels of nitrogen fertilization and the distance between plants on forage yield of Giraffe Grass. The experiment was applied using a Randomized Complete Block Design (R. C. B. D) according to the split-plot arrangement. Nitrogen fertilization levels occupied (0, 50, 100, 150 and 200) kg. ha^{-1} main plots, the distances between plants (10, 15, 20, and 25) cm are secondary plots. The results showed a significant superiority of the fertilizer level of 200 kg. ha^{-1} in green and dry forage crops, with an average of 116.79 and 30.43 tons. ha^{-1}. The green forage yield for the three clips was 45.30, 44.03 and 27.45 tons. ha^{-1}, the yield of dry forage for the first and third clips, which amounted to 10.40 and 7.78 tons. ha^{-1}, the fertilizer level exceeded 100 kg. ha^{-1} in the dry forage for the second clip, which amounted to 12.50 tons. ha^{-1}. The distance exceeded 10 cm in green and dry forage crops, averaging 124.60 and 33.48 tons. ha^{-1}. Green forage yield, which reached 51.22, 46.18 and 27.19 tons. ha^{-1}, and dry, which amounted to 12.30, 13.80 and 7.34 tons. ha^{-1} of the three clips. As for the interaction between nitrogen fertilization and the distance, the combination (level 100 kg × distance 10 cm) was superior to the green forage yield, which averaged 59.91 tons. ha^{-1}, the yield of dry forage with an average of 18.16 tons. ha^{-1} for the second clip, while the combination (level 200 × the distance of 10 cm) exceeded in the green forage yield, which amounted to 32.29 tons. ha^{-1} the yield of dry forage, which amounted to 9.41 tons. ha^{-1} for the third forage.

Key words : nitrogen fertilizer, distances between plants, forage yield, Giraffe Grass.

Introduction

Giraffe Grass is a varieties of *Sorghum bicolor* L., Poaceae family evacuees, it is a type of American forage corn hybridized by natural mating between several major improved fodder corn species, developed to withstand weather conditions, soil poverty and water scarcity, the plant is distinguished by its height that reaches about 2 m, high ability to branch and increase the number of leaves after cliping, compared to the rest of the other forage corn varieties, characterized by a high yield of green and dry forage and the percentage of protein in the leaves compared to other varieties of sorghum (Sayer, 2019). Green forage plays an important and essential role in animal feeding, a cornerstone of the development of the animal production sector in the world, any stable system must include abundant green forage for the animal, either directly after the mash, or as a dress or a silage (Sobouh *et al.,* 2011). In Iraq, however, there is a wide gap between the amount of green feed produced and the needs of livestock, due to the lack of areas planted with fodder crops, which do not exceed 2% of the total number of arable land in Iraq, as well as the limited sources of feed and the lack of diversification and high feed prices, the area of natural pastures has declined due to drought in recent years (Aalk, 2001). The increase in the forage yield per unit area comes due to the adoption of modern agricultural technologies in the field of applying important agricultural operations, Includes nitrogen fertilization, which plays a major role in increasing the yield of green and dried fodder for sorghum (Al-Tikriti and Hussein, 1992). It is necessary in all vital processes that take place inside the plant, as it greatly affects cell division, the cellular activity of cells increases, accordingly, the surface area of the leaves can be expanded, it also increases the

pigment chlorophyll in the leaves, increasing the efficiency of photosynthesis and dry matter production, reflects positively on the leafy area of the plant, for example, when encouraging root growth and increasing plant efficiency in absorbing water and nutrients from the soil, the vegetative growth increases, the quantity and rate of crop growth (Attia *et al.,* 2001). Choosing the optimal plant distance for the purpose of producing a higher green and dry forage yield is a good management method, can be achieved by following the best method of plant distribution per unit area, optimizing the different growth factors such as light, water and nutrients, reflected well on the accumulation of dry matter, the regulation of the distance between the lines and between plants positively reduces competition between plants, reflection on growth, yield and its components, affects the amount of transmitted light and heat available, which affects most physiological processes (Neil and Timothy, 1994 and Al-Tahir, 1999). Based on the above and the importance of the factors (nitrogen and the distance between plants), to reducing competition among plants for growth factors (light, water, and nutrients), dry matter production and abundant growth, guarantee the best quantity and quality of green and dry forage yield, this experiment was carried out with the aim of determining the best fertilizer amount of nitrogen with the optimum distance between plants, to achieve the maximum growth and optimum yield of green and dry forage in terms of quantity and quality of the Giraffe Grass plant.

Materials and Methods

A field experiment was carried out in Al-Shanafiyah district (68 km south of Diwaniyah Governorate) during the autumn agricultural season 2019, to study the effect of different levels of nitrogen fertilization and the distance between plants on forage yield of Giraffe Grass. The experiment was applied using a Randomized Complete Block Design (R.C.B.D) according to the split-plot arrangement. Nitrogen fertilization levels occupied (0, 50, 100, 150 and 200) kg. ha^{-1} main plots, the distances between plants (10, 15, 20, and 25) cm are secondary plots. The first clip was taken after the plant reached a height of 150-200 cm, the height of the mower above the soil surface is 5-7 cm, three weeks later, the second clip was performed and three weeks later, the third clip was performed.

Mix the samples well to obtain a composite sample, it was air dried, sifted from a 2 mm sieve, analyzes of some chemical, physical and biological properties were performed (Table 1).

The following characteristics were studied: green forage weight,, dry green forage weight, green forage and total forage weight (ton. ha^{-1}).

Table 1: Chemical, Physical and Biological Properties of Soil Samples before Sowing.

Parameters		Unit	Amount
pH			7.52
ECe		$ds.m^{-1}$	3.32
CEC		$Cmol.Kg^{-1}$	6.17
O.M		%	0.73
$CaCO_3$		%	35.91
Dissolved ions	Calcium	mmol/*l*	26.89
	Magnesium		16.26
	Sodium		5.07
	Potassium		1.26
	Bicarbonate		2.46
Available nitrogen		$ml.kg^{-1}$	27.82
Available phosphorus			3.74
Available potassium			222.69

The data were analyzed statistically by Randomized Complete Block Design (R.C.B.D) according to the split-plot arrangement, and the averages were compared according to the L.S.D test at the level of 0.05.

Results and Discussion

Green forage yield (ton. ha^{-1})

Table 2, 3 and 4 indicate significant differences between nitrogen fertilizer levels, gave the level 200 kg N. ha^{-1} was the highest average of 45.30, 44.03 and 27,456 tons. ha^{-1} and for the three clips without significant difference for levels 100 and 150 kg N. ha^{-1}, whereas, the comparison treatment (without adding) gave the lowest mean for the trait, as it reached 26.62, 21.59, and 15.128 tons. ha^{-1} for the three clips, the reason for the higher nitrogen fertilizer level may be higher than the rest of the other fertilizer levels, to the role of nitrogen in promoting vegetative growth by increasing plant height, leafy area, number of branches, and stem diameter, which works as a society to increase the green forage yield, was agreed with Al-Toublani (2019) that the increase in nitrogen resulted in an increase in the yield of green forage.

There were significant differences between cultivation distances, as the distance gave 10 cm higher mean for the green forage yield and for the three clips, reached 51.22, 46.18 and 27.194 tons. ha^{-1}, while the distance gave 25 cm, the lowest average characteristic was 29.95, 25.33 and 18,436 tons. ha^{-1} and for the three clips, may be that the distance exceeds 10 cm in green forage yield, to increase plant density per unit area and increase plant height, and that the increase resulting from them exceeded the decrease resulting from the decrease

Table 2: Effect of nitrogen fertilization levels and the distance between plants and their interaction on the green forage yield (ton. ha^{-1}) at the first clip.

Nitrogen fertilization levels	Distance				Mean
	10	15	20	25	
0	35.84	29.38	24.09	17.17	26.62
50	56.31	41.53	36.17	30.85	41.22
100	53.42	39.10	36.53	32.27	40.33
150	53.81	48.31	36.01	31.87	42.50
200	56.75	46.39	40.48	37.60	45.30
Mean	51.22	40.94	34.66	29.95	
L.S.D$_{0.05}$	Nitrogen fertilization		Distance		Interaction
	6.13		2.37		N.S

Table 3: Effect of nitrogen fertilization levels and the distance between plants and their interaction on the green forage yield (ton. ha^{-1}) at the second clip.

Nitrogen fertilization levels	Distance				Mean
	10	15	20	25	
0	26.25	24.88	19.59	15.63	21.59
50	39.71	32.16	26.01	21.11	29.75
100	59.91	45.87	39.11	30.32	43.80
150	46.27	39.53	28.50	28.73	35.76
200	58.75	46.66	39.88	30.84	44.03
Mean	46.18	37.82	30.62	25.33	
L.S.D$_{0.05}$	Nitrogen fertilization		Distance		Interaction
	45.7		42.2		8.37

Table 4: Effect of nitrogen fertilization levels and the distance between plants and their interaction on the green forage yield (ton. ha^{-1}) at the third clip.

Nitrogen fertilization levels	Distance				Mean
	10	15	20	25	
0	17.99	17.49	15.71	9.31	15.12
50	26.70	25.07	22.38	18.97	23.28
100	28.01	26.94	25.10	21.26	25.33
150	30.97	29.19	26.18	20.53	26.72
200	32.29	29.33	26.10	22.09	27.45
Mean	27.19	25.60	23.10	18.43	
L.S.D$_{0.05}$	Nitrogen fertilization		Distance		Interaction
	0.46		0.21		0.59

in the remaining components of the green fodder yield, which pushed to increase the feed yield, agreed with Hadef (2017) and Sayer (2019) who noticed that the increase in plant density resulted in an increase in the yield of green fodder despite the low average weight of one plant.

As for the interaction, the combination (100 kg N e - 1×10 cm) outperformed the rest of the combinations and gave the highest average yield of green forage for the second clip was 59.91 tons. ha^{-1}, while the combination (200 kg N e - 1×10 cm) excelled in the third clip and gave the highest average cof the trait reaching 32,291 tons. ha^{-1}, while the blend (0 kg N ha $^{-1}$×25 cm) gave the lowest mean for green forage yield for the second and third clips at 15.63 and 9,315 tons. ha^{-1}, the result of the interaction was consistent with the results of the individual factors in the third clip, however, the difference in the second clips can be explained by the high plant density due to the use of the distance of 10 cm between plants, as the increase resulting from the increase in the number of plants exceeded the decrease resulting from the decrease in the weight of one plant, the distance of 10 cm between plants has recorded the highest averages with the difference in the amount of added nitrogen fertilizer compared to the rest of the distances, this happened only the second clip without the rest of the clips, the stage of resuming growth after the first clip, and the resulting effects of competition, which are most severe due to the display of plants, its ability to vegetative growth due to the hormonal imbalance.

Total green forage (ton. ha^{-1})

Table 5 shows the significant differences between the levels of nitrogen fertilizer, gave the level 200 kg N. ha-1 The highest average value of the total green forage yield was 116.79 tons. ha^{-1}, without significant difference for compost level 100 and 150 kg N. ha^{-1}, whereas, the comparison treatment (without adding) gave the lowest mean of 64.17 tons. ha^{-1}, the reason for the superiority of the aforementioned level may be due to its superiority in the green forage yield for the three clips, and this result was agreed what Ahmed and Aboud (2016), however, the increase in nitrogen led to an increase in the yield of green forage.

Significant superiority among cultivation distances, as it gave the distance 10 cm, the highest average of the total green forage yield amounted to 124.60 tons. ha^{-1}, while the distance gave 25 cm the lowest average of 74.45 tons. ha^{-1}, the reason for the distance exceeding 10 cm in the total green forage yield may be due to the greater distance in the same green forage yield for the three clips, agreed with Al-Dulaimi and Al-Nimrawi (2014) on the effect of distance on the

Table 5: Effect of nitrogen fertilization levels and the distance between plants and their interaction on the total green forage yield (ton. ha^{-1}).

Nitrogen fertilization levels	Distance				Mean
	10	15	20	25	
0	80.08	71.75	59.40	45.45	64.17
50	122.72	99.10	84.90	71.26	94.50
100	141.33	111.92	100.75	83.86	109.46
150	131.05	117.04	90.70	81.13	104.98
200	147.79	122.38	106.47	90.53	116.79
Mean	124.60	104.44	88.44	74.45	
L.S.D$_{0.05}$	Nitrogen fertilization		Distance		Interaction
	13.28		3.52		14.29

Table 6: Effect of nitrogen fertilization levels and the distance between plants and their interaction on the dry forage yield (ton. ha^{-1}) at the first clip.

Nitrogen fertilization levels	Distance				Mean
	10	15	20	25	
0	8.58	7.14	5.42	3.82	6.24
50	13.06	10.70	8.80	7.21	9.94
100	14.18	10.08	8.69	7.68	10.15
150	13.12	10.65	8.58	7.87	10.06
200	12.57	10.89	9.73	8.41	10.40
Mean	12.30	9.89	8.24	7.00	
L.S.D$_{0.05}$	Nitrogen fertilization		Distance		Interaction
	1.50		0.69		N.S

Table 7: Effect of nitrogen fertilization levels and the distance between plants and their interaction on the dry forage yield (ton. ha^{-1}) at the second clip.

Nitrogen fertilization levels	Distance				Mean
	10	15	20	25	
0	8.40	7.61	5.83	5.53	6.84
50	12.61	10.40	8.39	5.65	9.26
100	18.16	12.72	10.69	8.44	12.50
150	13.08	11.01	9.20	7.96	10.31
200	16.74	13.15	10.63	8.45	12.25
Mean	13.80	10.98	8.95	7.21	
L.S.D$_{0.05}$	Nitrogen fertilization		Distance		Interaction
	2.07		0.82		47.2

yield of green forage.

As for the interaction, the combination (200 kg N. ha^{-1} × 10 cm) was superior to other combinations, the highest average yield of total green forage was 147.79 tons. ha^{-1}, without significant difference from the combination (100 kg N. ha^{-1} × 10 cm), an average of 1 41.33 tons. ha^{-1}, while the blend (0 kg N × 25 cm) gave the lowest mean for the total green forage yield of 45.45 tons. ha^{-1}.

Dry forage yield (ton ha^{-1})

Table 6, 7 and 8 indicate a level superiority of 200 kg N. ha^{-1} on the remaining nitrogen levels added, gave the highest averages for the first and third clips, which reached 10.40 and 7.788 tons. ha^{-1} and without significant difference from the fertilizer levels 100 and 150 kg N. ha^{-1}, whereas, the level exceeded 100 kg N. ha^{-1} and gave the highest average forage yield for the second clip was 12.50 tons. ha^{-1}, the comparison treatment (without adding) gave the lowest mean of the trait amounting to 6.24, 6.84 and 2,938 tons. ha^{-1} for the three consecutive sequences, and the reason for this may be attributed to the superiority of the level mentioned in the fodder yield of green forage, and this result agreed with Afzal and Ahmed (2012) and Al-Toublani (2019) Nitrogen fertilizers increase the yield of dry forage for sorghum.

Significant differences were observed between cultivation distances, as the average distance of 10 cm gave the highest average yield of dried forage and for the three clips, 12.30, 13.80 and 7.382 tons. ha^{-1}, while the distance gave 25 cm the lowest mean characteristic was 7.00, 7.21 and 4,476 tons. ha^{-1} and for the three clips, the reason for exceeding the distance of 10 cm in the yield of dry forage may be due to superiority in the yield of green forage, agreed with Al-Rawi (2005) findings on the effect of distance on the increase in the dry feed yield.

As for the interaction, the combination (100 kg N. ha^{-1} × 10 cm) was superior to the rest of the combinations and gave the highest average yield of dry forage for the second clip was 18.16 tons. ha^{-1}, the combination (200 kg N. ha^{-1} × 10 cm) at the third clip and yields the highest average of 9.412 tons. ha^{-1}, while the combination gave (0 kg N ha^{-1} ×25 cm) the lowest mean for the green fodder yield for the second and third stocks was 5.53 and 2,078 tons. ha^{-1}, perhaps the reason for the superiority of the combinations mentioned in the dried fodder yield is due to the superiority in the green fodder yield.

Total dry forage yield (ton. ha^{-1})

Table 9 shows the significant differences between the levels of nitrogen fertilizer, as the level gave 200 kg N ha^{-1}, the highest average characteristic of the total dry

Table 8: Effect of nitrogen fertilization levels and the distance between plants and their interaction on the dry forage yield (ton. ha^{-1}) at the third clip.

Nitrogen fertilization levels	Distance				Mean
	10	15	20	25	
0	3.40	3.23	3.02	2.07	2.93
50	8.00	7.20	6.54	4.11	6.46
100	7.60	7.13	6.14	5.47	6.59
150	8.47	7.57	6.98	5.09	7.03
200	9.41	8.81	7.29	5.62	7.78
Mean	7.38	6.79	5.99	4.47	
$L.S.D_{0.05}$	Nitrogen fertilization		Distance		Interaction
	200.		140.		320.

Table 9: Effect of nitrogen fertilization levels and the distance between plants and their interaction on the dry forage yield (ton. ha^{-1}).

Nitrogen fertilization levels	Distance				Mean
	10	15	20	25	
0	20.40	17.99	14.28	11.43	16.03
50	33.68	28.31	23.73	17.14	25.71
100	39.94	29.94	25.52	21.59	29.25
150	34.67	29.23	24.77	20.92	27.40
200	38.73	32.86	27.65	22.48	30.43
Mean	33.48	27.67	23.19	18.71	
$L.S.D_{0.05}$	Nitrogen fertilization		Distance		Interaction
	2.58		1.17		3.25

forage yield was 30.43 tons. ha^{-1} significantly outperforming the rest of the levels, whereas, the comparison treatment (without adding) gave a lower average of 16.03 tons. ha^{-1}, the reason for the superiority of the compost level 200 kg N ha^{-1} may be attributed to superiority in the dry forage yield of the three clips because it is a reflection of them and represents the sum of the three composts, agreed with Muhammad (2009) concluded, that the total dry forage yield increases with increasing nitrogen fertilization.

There was a significant difference among cultivation distances, as the distance gave 10 cm higher the average mean for the total dry forage yield of 33.48 tons. ha^{-1} was significantly superior to the other distances, while the distance gave 25 cm, the lowest average characteristic was 18.71 tons. ha^{-1}, the reason for the distance exceeding 10 cm in the total dry fodder yield may be due to the greater distance in the dry fodder yield for the three clips, agreed with Alak (2001) and Sayer (2019) on the effect of the small distance and its role in increasing the yield of dry forage compared to the large distances.

As for the interaction, the combination (100 kg N ha^{-1} × 10 cm) outperformed the rest of the combinations and gave the highest average total dry feed yield of 39.94 tons. H-1 without significant difference from the combination (200 kg N ha^{-1} × 10 cm), which averaged 38.73 tons. ha^{-1}, while the combination (0 kg N ha^{-1} × 25 cm) gave the lowest mean for the total dry feed yield of 11.43 tons. ha^{-1}, the reason for the superiority of the higher combination is between nitrogen fertilizer and distance, it can be attributed to the same reasons that were mentioned in the discussion of factors, which were unique because there was harmony in the results of the factors, which were interaction.

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