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Effect of mowing numbers and cutting height on growth and forage yield of sorghum cultivar Giraffa grass

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Abstract

A field experiment was carried out in Al-Muthanna Governorate during the summer season 2021-2022. It included a study of the effect of two treatments of mow (cut one, cut twice) and four levels of cutting heights (5, 10, 15, and 20) cm on the growth and yield of forage white sorghum variety Giraffa grass. The experiment was applied according to the design of sectors. The complete randomized R.C.B.D with three replications, the response of the variety Giraffa grass to the number of weeds and cutting heights was estimated by measuring some growth characteristics, as the results of the analysis showed that the mow treatment (cut twice) was significantly superior by giving the highest average of the characteristic of the number of tillers.m^{-2}, the ratio of leaves to stems (%), and the yield of green and dry forage (tons.h^{-1}) were 150.0 tons of m^{-2}, 41.51%, 19.14 tons.h^{-1}, and 1.53 tons.h^{-1}, respectively.

As for the treatments for cutting heights, it was observed that the treatment was superior to 10 cm in the characteristic of plant height (cm) and the number of pruning, while the treatment was superior to 5 cm in the characteristic of dry forage yield (ton.h^{-1}) and the ratio of leaves to stems (%) was 1.55 tons.h^{-1} and 34.72%, respectively, while the two cutting treatments were superior to 15 cm and 20 cm, giving the highest average yield of green forage, which reached (16.41 and 16.09) tons.h^{-1}, respectively.

Keywords: mowing numbers, cutting heights, forage yield

1. Introduction

Sorghum bicolor L. is one of the important grain crops in the world, as it is used as an important fodder crop as well as being involved in many industries such as sugar, starch and protein, It ranks fifth in terms of cultivated area and production in Iraq and the world after wheat, barley and rice and corn [1]. The Giraffa grass variety is one of the

types of fodder white corn hybridized by natural mating between several types of fodder corn, as it is considered one of the crops that can withstand a wide range of soil and climate conditions, thus providing green fodder in appropriate quantities during the summer season, which is characterized by the scarcity of fodder material due to high temperatures, the intensity of solar radiation, and the lack of relative humidity **[2]** . The ability of the plant to tolerate drought and salinity is due to the presence of a dense root system, capable of absorbing water stored in the depths of the soil, and has the ability to control water loss by closing the stomata, and the reduction of the surface area by wrapping the leaves on themselves and the presence of a waxy layer on the surface of the leaves and stems, where its grains are used as the main food for humans in many African countries and some other regions of the world, and the grains of white corn are included as a basic material in the concentrated diet of poultry due to the high percentage of protein in it, as it reaches to 12%, as it contributes significantly to meeting the need for green fodder in summer in Iraq space [3].

Sorghum has the advantage of being able to produce larger quantities of dry matter compared to feed corn [4]. However, the lignin content in the feed of sorghum varieties reaches 9.1% of the dry matter, and it is related to silage, which has a low digestibility, so when used for dairy cows, it is It reduces the consumption of dry matter and milk production **[5]**, so it is possible to reduce the concentration of lignin and improve the digestibility of silage from different forages by increasing the cutting height, as increasing the cutting height from 15 to 45 cm in sorghum reduces the lignin contents from 7.7 to 6.4% **[6]**. It was also found that the percentage of lignin decreased from 3.0 to 2.6%, while the percentage of consumption increased by 2.3% when increasing the cutting height from 12 to 45 cm **[7]**.

Therefore, the nutritional composition of silage can be improved by increasing the height of the forage cuttings. However, the dry matter yield losses can become very large if very high cutting heights are

used. The dry matter yield losses of corn forage range between 10 and 20% when the cutting height is increased above 20 cm [8,9] and from 3% to 16 when increasing the cutting height to more than 40 cm of fodder maize [10], so it is necessary to determine the best height of cutting in fodder maize Which allows an optimal balance between the nutritional composition of the silage and the dry matter yield per hectare at harvest.

This experiment aims to determine the optimal cutting height and to know the response of Giraffa grass to the number of moths (cut one, cut twice) and its effect on the yield of green and dry forage (ton.h^{-1}).

2. Materials and Methods

Field experiment was carried out in the Al-Bandar region affiliated to the College of Agriculture in Al-Muthanna Governorate during the summer season 2021- 2022.The experiment included a study of two factors, the first factor included two treatments for mowing (cut one, cut twice) and the second factor included four cutting heights (5, 10, 15, and 20) cm. The experiment was applied according to the randomized complete block design (R.C.B.D) with three replications. Some soil analyzes were conducted after taking random samples at a depth of (0-30) cm from different locations in the field to find out some necessary physical and chemical properties before executing the experiment (1), the experimental land was prepared by plowing using the tipping plow, then smoothed by disc harrows, leveled, and the field was divided according to the design used into experimental units with an area of 2m x 2 m and a distance of 75 cm between one farm and another, and the seeds were sown on 4/22/2022 by 3 seeds in each pot, then gradually reduced to one plant in each pot. Nitrogen fertilizer was added using urea (46% N) as a nitrogen source at an amount of 200 kg N.h^{-1} in three batches at planting, the elongation stage, and the flowering stage) [11,12], and phosphate fertilizer was added at a rate of 100 kg P_2O_5.h^{-1} in the form of triple superphosphate fertilizer P_2O_5 at once before planting [13].

Table (1) some physical and chemical properties of the experimental field soil before planting.

Adjective		Value	Measuring unit
Soil articulations	Sand	128	gm Kg^{-1} Soil
	Silt	483	gm Kg^{-1} Soil
	Clay	389	gm Kg^{-1} Soil
Soil reaction (PH)		7.20	--
Electrical (1:1) (EC) conductivity		7.6	$ds.m^{-1}$
Organic matter		4.51	gm.Kg^{-1} Soil
Nitrogen		28.01	mg.Kg^{-1} Soil
Phosphorous		15.55	mg.Kg^{-1} Soil
Potassium		109.06	mg.Kg^{-1} Soil
Soil texture		muddy alluvial mixture	

2.1 Studied traits:

2.1.1 Plant height (cm): Ten plants were selected and their height from the base to the top of the plant was measured [14].

2.1.2 Number of stems in plant (m^{-2}) : It was calculated at harvest time for an area of 2 m^2 from the two central lines.

2.1.3 Leaves to Stem Ratio (%) : The leaves were separated from the stems and their percentage was calculated based on the green weight as an average of ten randomly taken plants.

2.1.4 Yield of green fodder (tons. h^{-1}): The plants were cut according to the heights of the pieces from the soil surface from the two middle lines of both batches, then the green forage yield was weighed in the field directly with an electronic balance to ensure that no part of the moisture was lost as a result of evaporation. On the basis of that, the green forage yield was calculated and then converted from kg to tons. h^{-1}.

2.1.5 forage yield Dry (tons. h^{-1}) : Dry forage yield was calculated

for all cutting heights, depending on the air-drying process for the green forage yield until the weight was proven, then it was converted from kg to tons.

The data was analyzed statistically for all the studied traits using the statistical program Genstat, and the arithmetic means were compared using the least significant difference (L.S.D) at the level of 0.05 [15].

3. Results and discussion:

3.1Effect of mowing numbers on growth and yield characteristics:

The results of Table (2) indicate that there are significant differences between the cut twice treatments, as the treatment from which cut twice were taken was significantly superior to the treatment from which cut one was taken in terms of number of combs.m^{-2}, the ratio of leaves to stems (%), the yield of green fodder (ton.h^{-1}), and the yield of dry fodder (ton.h^{-1}), where their averages were 150.0 m^{-2}, 41.51%, and 19.14 tons.h^{-1} and 1.53 ton.h^{-1}, respectively, the reason for the superiority of the mowing treatment (twice) in these characteristics is due to obtaining sufficient time to reach the maximum stages of growth, which led to an increase in the number of branches for this treatment, which was reflected in an increase in the yield of green and dry fodder, while there were no significant differences between the two weed treatments in plant height (cm).

Table 2: Effect of mowing numbers on growth and yield forage of sorghum cultivar (Giraffa grass).

Number of mowing	Plants height (cm)	Number of stems in plant (m^{-2})	Leaves to Stem Ratio (%)	Yield of green fodder (tons. h^{-1})	Dry forage yield (tons. H^{-1})
cut one	113.2	112.0	23.50	13.70	1.35
cut twice	109.9	150.0	41.51	19.14	1.53
L.S.D 0.05	N.S	9.24	3.661	2.142	0.031

3.2 The effect of cutting heights on growth and yield characteristics:

The results of Table (3) showed a significant effect of cutting heights on all growth and yield characteristics, as the two treatments 10 cm and 15 cm were significantly superior in giving the highest average plant height of 116.9 and 112.2 cm, respectively, while the 20 cm treatment gave the lowest average for this trait amounted to 106.7 cm, and the 10-cm treatment was significantly superior to the rest of the treatments in terms of the number of cuts, giving the highest average of 144.4 strands. m^{-2} in succession, the reason for the increase in the number of branches is attributed to the process of cutting the main stem and its effect in stopping the apical in dominance and encouraging the formation of terminal and lateral buds [16], this result agreed with what was mentioned in [17] that the best cutting height is at 10 cm, which contributes greatly to protecting the new branches in order to preserve the area, the crown that bears buds and produces new vegetative growth after mowing, while the 5cm cutting treatment excelled with no significant difference between the average of the two treatments (10 and 15) cm in the characteristic of the leaf-to-stem ratio (%), as their averages reached 34.72%, 32.99%, and 32.60%, respectively, while The lowest percentage for this trait was when treating 20 cm cuttings (29.72%).

While the treatment of 10 cm cuttings was significantly superior in giving the highest average green fodder yield of 18.56 $tons.h^{-1}$, while the rest of the treatments (5, 15 and 20) gave averages of 14.61,16.41 and 16.09 $tons.h^{-1}$, respectively, while the results showed Table (3) The two cutting treatments (5 and 10) cm were significantly superior in giving the highest average for the characteristic of dry fodder yield of 1.55 and 1.52 $tons.h^{-1}$, respectively, while the two treatments (15 and 20) gave an average of 1.34 and 1.35 $tons.h^{-1}$ sequentially.

Table 3: Effect of cutting heights on growth and yield forage of sorghum cultivar (Giraffa grass).

Cutting	Plants	Number of	Leaves to	Yield of	Dry forage

height (cm)	height (cm)	stems in plant (m^{-2})	Stem Ratio (%)	green fodder (tons. h^{-1})	yield (tons. h^{-1})
5	**110.5**	**127.8**	**34.72**	**14.61**	**1.55**
10	**116.9**	**144.4**	**32.99**	**18.56**	**1.52**
15	**112.2**	**118.3**	**32.60**	**16.41**	**1.34**
20	**106.7**	**133.5**	**29.72**	**16.09**	**1.35**
L.S.D 0.05	**6.08**	**9.72**	**2.925**	**1.432**	**0.0997**

3.3 Effect of the overlap between the number of mowing and cutting heights:

The results of Table (4) indicated a significant effect of the interaction of the numbers of mowing and the heights of the cuttings in the plant height characteristic, if the treatment of the cuttings was 10 cm superior under the treatment of the cut one without a significant difference with the average of the two combinations (cut one x 15 cm) and (cut twice x 5 cm). giving the highest mean plant height of (121.3, 120.8 and 117.6) cm, respectively, while the two combinations (cut one x 5 cm) and (cut twice x 15 cm) gave the least two averages for this trait, which were 103.4 cm and 103.6 cm, respectively.

The results of Table (4) showed a significant effect of overlapping the number of mowing and cutting heights in the characteristic of the numbers of mowing, as the overlap of the treatment was 10 cm under the treatment of mowing (cut twice) significantly by giving the highest mean for this characteristic of 180.8 weeds m^{-2}, while the treatment gave 5 cm when The first litter, the average number of stripes, was 91.0 strips m^{-2}, the reason for the output of cutting is 10 cm in the status of the number of forest and giving an average of the number of buds resulting from the grassroots and modern vegetables.

It was observed from the results of Table (4) that the overlap of the 10 cm cutting height treatment with the tamping treatment (cut one) was superior to the 15 and 20 cm cutting treatment, which amounted to 14.84, 13.52, and 14.68 tons h^{-1}, respectively, while the treatment gave 5 cm in the first haystack had the lowest green fodder yield of 11.76 tons h^{-1}, and the 10 cm cutting treatment was superior with the hay treatment (cut twice)

by giving the highest mean of 22.28 tons h^{-1}.

The results of Table (4) indicate that there is a significant effect of the interaction between mowing treatments and cutting heights in the characteristic of dry forage yield (ton h^{-1}). 671 ton h^{-1} sequentially, while the two combinations (cut one x 15 cm) and (cut twice x 20) gave the lowest dry fodder yield of 1.242 and 1.284 ton h^{-1} respectively.

We conclude from the results of the experiment the significant effect of the numbers of mowing and cutting heights on some growth characteristics and its reflection in the yield of green and dry forage of the crop, as the treatment of (cut twice) excels in most traits, while the treatment of cuttings with a height of (5 cm) gives the highest dry forage yield of (1.55 tons. h^{-1}), the reason for more than this recipiency is exceeded in the status of the number of praises and provides enough time for growth and the composition of the larger locations, increasing the optical representation process and then increased green and dry feed,

Table 4: Effect of mowing numbers and cutting heights on growth and yield forage of sorghum cultivar (Giraffa grass).

Number of mowing	Cutting height (cm)	Plants height (cm)	Number of stems in plant (m^{-2})	Leaves to Stem Ratio(%)	Yield of green fodder (tons. h^{-1})	Dry forage yield (tons. h^{-1})
cut one	5	103.4	91.0	26.22	11.76	1.434
	10	121.3	108.1	22.78	14.84	1.307
	15	120.8	119.8	22.37	13.52	1.242
	20	107.4	129.1	22.64	14.68	1.432
cut twice	5	117.6	164.6	43.23	17.46	1.671
	10	112.5	180.8	43.19	22.28	1.738
	15	103.6	116.7	42.83	19.31	1.452
	20	106.1	137.9	36.79	17.49	1.284
L.S.D 0.05		7.71	12.70	N.S	2.074	0.1229

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