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THE EFFECT OF FERTILIZATION AND REPEATED MOWING ON SOME VEGETATIVE CHARACTERISTICS AND YIELD OF PANICUM MOMBASA PLANT

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Abstract: The experiment was perfumed according to (R.C.B.D) in triplet in field belongs to the department of crop sciences, college of Agricultre, university of Diyala, whose soil has a texture of Slity loam during spring season of 2019, to study the effect of addition of three different types of fertilizers to the soil which are Humic acid 300 kg.h^{-1}, Trichoderma 75 kg.h^{-1} and NPK 200 Kg.h^{-1}, on the growth and characters of Panicum Maximum cv Mombasa. Results showed significant superiority of humic acid fertilizer after 40 days of fertilization with regards to the plant height, branches number, leaves number, leaf area, the total yield of green feed and hay yield. In fertilization treatment with tricoderma, the weed after 40 days was outstanding in the characters of the plant height, branches number, leaves number, leaf area, the total yield of green feed and hay yield, treatment with NPK, the cut after 40 days exceeded in the plant height, branches number, leaves number, leaf area, the total yield of green feed and the hay yield.

Keywords: Fertilization, Repeated Mowing, Panicum Mombasa Plant.

1. Introduction

The development of the livestock sector depends on the development of the cultivation of forage plants, which are part of the nutritional composition of this sector, as fodder crops are the basic building block on which animal breeders depend in providing green as well as dry fodder, as well as providing concentrated feed. Among these grassy fodders is the guinea fodder called Panicum, which is a perennial fodder crop whose scientific name is Panicum maximum cv. mombasa, which is a follower of the Gramineae family and the English name Guinea grass, includes many species, the best of which are distinguished by their productive efficiency are the Panicum mombasa and the Panicum tanzanian. The panicum crop is considered one of the best types of fodder and it has a high ability to produce leaves and excel-lent quality, thus increasing the yield of green and dry fodder in quantity and quality, and its advantages are its tolerance to drought and salinity to limits that exceed many crops [1].

The use of organic fertilizers in a careful and efficient manner ensures the continuity of the high production of crops, because they contribute to improving soil properties, increasing the growth and development of roots, as well as increasing the activity of important microorganisms in the soil [2] It is a source of essential nutrients in plant nutrition. Humic acid, after adding it to the soil, increases the absorption of nutrients by the plant.

Trichoderma fungus is one of the fungi deficient in living throw, which is used in the field of biological control Biocontrol, and works to increase the readiness of some elements, such as nitrogen, phosphorus and potassium through the secretion of some enzymes, and its ability to decompose organic materials present or added to the soil, and contribute to the production of growth regulators and increase The ability of plants to resist unfavorable environmental conditions, thus improving the nutritional status of the plant and increasing the plant growth [3]. [4] showed that when adding humic acid, it has clear effects on the vegetative growth of the plant. In addition, it leads to an increase in the activity of the photosynthesis process and the index of leaf area.

[5] stated that the addition of trichoderma caused a significant increase in plant lengths. Wheat and dry weight of shoots. This study aims to search for scientific alternatives to leave the chemical fertilizers polluting the environment by knowing the response of the Panicum fodder crop to the organic and biological fertilizers added to its soil and identifying the appropriate duration of the mower, as well as breeding and improving the Panicum crop to fill the deficiency in the quantitative and qualitative yield of forage.

2. Materials and Methods

A field experiment was carried out on the panicum crop in the spring season 2019 in the fields of the Field Crops Department / College of Agriculture - University of Diyala, with the aim of studying the response of the *panicum mombasa* plant to fertilization and the extension of weeds under the drip irrigation system. Random samples were taken from different areas of the field's soil for the purpose of laboratory analysis, at a depth of 0-30 cm before the cultivation process was carried out to determine some chemical and physical characteristics of the study soil, as shown in Table (1).

Table 1. Some chemical and physical characteristics of the study soil before planting.

Unit	Value	Adjective	
gm. kg^{-1}	46.2	Clay	**Soil separators**
	789.5	Silt	
	164.3	sand	
Silty loam		**Texture**	
gm. kg^{-1}	201.88	**Carbonate minerals**	
gm. kg^{-1}	10.87	**Organic matter**	
Available elements			
mg-kg^{-1}	47.6	**Nitrogen**	
	72.38	**Phosphorous**	
	207.1	**Potassium**	
dm^{-1}	10.01	**EC**	
	7.32	**pH**	

A global experiment (fertilizer factor, mulching time factor) was applied according to the Randomized Complete Block Design (R.C.B.D) system and broadcast three replicates, and the area of one experimental unit was 4.5 m^2 (1.5 m x 3 m), in lines, the distance between one line and another is 50 cm and between one Jura and another. 50 cm and a plant density of 40,000 plants.h^{-1}. A distance of 1 m is left between one repeater and another and between an experimental unit and another to avoid interactions between transactions, such as transferring fertilizers during irrigation.

Panicum seedlings were planted 17 days old and 15 cm long in the sustainable field after irrigating the soil of the experiment on 3/23/2019 and were planted in the field soil and watered regularly until their roots are well fixed in the soil, while continuing to fight the bush manually whenever needed until the arrival Plant height to 1 m.

After confirming the readiness of the planted seedlings to receive fertilizers, on 4/8/2019, the experiment parameters (fertilizers) were added to the experimental units, and the transactions were distributed randomly, as the fertilizers included NPK fertilizer of 200 kg.h^{-1}, and humic fertilizer by 300 kg.h^{-1} and Trichoderma fertilizer of 75 kg. H^{-1}, and a hole was made in the soil with a depth of 5 cm along the planting lines and for all the experimental units and covered with soil in order to preserve fertilizers from the sun's rays. Fertilize the field soil.

These mills were manually carried out at a height of 5 cm above the soil level.

Study traits: The following traits were calculated on the basis of an average of 7 plants taken from the mean line and from among the plants for each experimental unit.

Plant height (cm): The height of the plant was measured from the level of the soil surface to the highest height of the highest leaf [6].

Number of branches per plant: The number of branches for 7 plants was calculated from the mean line for each experimental unit, then the average was taken and converted to the number of branches per plant.

The number of sheets. plant^{-1}: It was calculated as an average of the number of leaves of seven plants and for the same plants for which the number of branches were measured [7].

Leaves area (cm^2): The leaves area was measured according to the following equation:

leaves area (cm^2) = leaf length x maximum sheet width x 0.75 [8].

leaves area index (cm^2): The leaves area index was calculated according to the following equation [9]:

$$\text{leaves area index} = \frac{\text{Leaf area (cm}^2\text{)}}{\text{The area occupied by the plant from the ground (cm}^2\text{)}}$$

* The area occupied by the plant = the distance between two adjacent plants on the same line x the distance between two plants on the same line

The total yield of green fodder (tons. h^{-1}): - After calculating the yield of one plant in grams of green fodder, the total yield of green fodder (tons) was calculated according to the following equation:

Total yield of green forage (tons. h^{-1}) = average yield per plant of green fodder (gm) x plant density in hectares [10].

The hay yield (tons. h^{-1}): - After calculating the dry weight of one plant (gm), the hay yield (tons. h^{-1}) was calculated through the following equation:

Hay yield (tons. h^{-1}) = average dry weight per plant (g) x plant density in hectares. [10].

Statistical analysis: Statistical analysis of the data was performed using the Duncan test as a global experiment within the Randomized Complete Block Design (R.C.B.D) in order to compare the averages of the studied transactions under the probability level of 0.05 [11] and using the SAS program [12].

3. Results and Discussion

Plant height (cm): The results in figure (1) indicate the presence of significant differences in the average plant height after 20 days of fertilization, as humic fertilization recorded the highest average for this characteristic of 126.67 cm, with an increase of 13.43% compared to the Control treatment, and the fertilization with Trichoderma and NPK recorded the average plant height of 121.33 and 116.67 cm, respectively, compared to the Control treatment, which recorded the lowest mean of 111.67 cm.

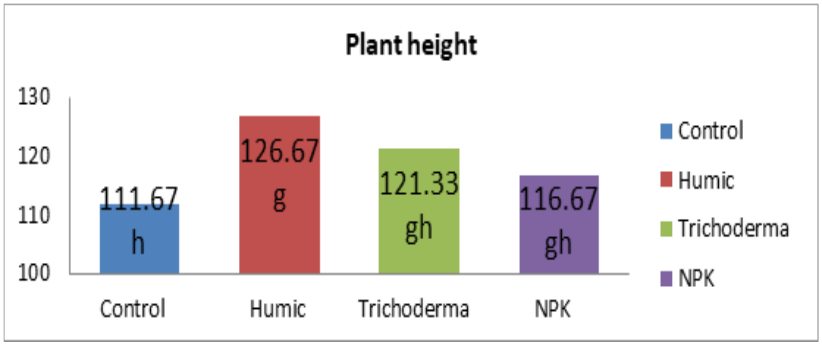

Figure 1. the effect of the type of fertilization on the average height of Panicum plants after 20 days of fertilization (cm).

The results in Figure (2) indicate the presence of significant differences in the average plant height after 30 days of fertilization, as humic fertilization recorded the highest average for this characteristic, which reached 170.67 cm, with an increase of 14.03% compared to the Control treatment. Fertilization by Trichoderma and NPK

recorded mean plant height of 164.33 and 157.00 cm, respectively, compared to the Control treatment, which recorded the lowest average of 149.67 cm.

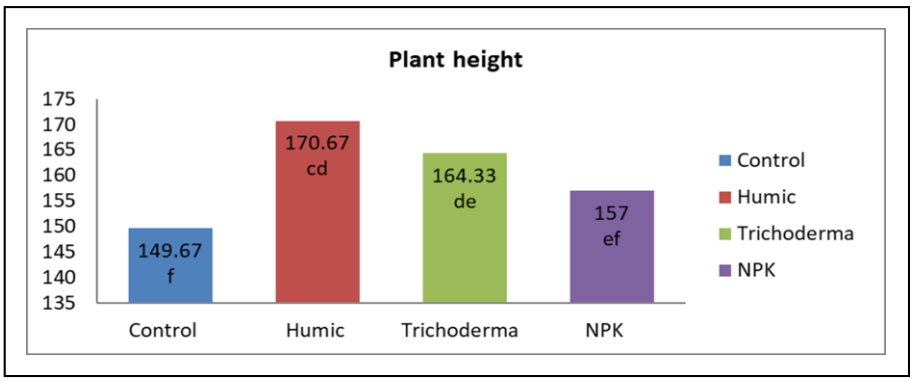

Figure 2. The effect of the type of fertilization on the average height of Panicum plants after 30 days of fertilization (cm).

As the results in Figure (3), they showed significant differences in the average plant height after 40 days of fertilization, as humic fertilization recorded the highest average for this characteristic of 190.33 cm, with an increase of 12.17% compared to the Control treatment. Fertilization with Trichoderma and NPK gave mean plant height of 182.67 and 179.00 cm, respectively, compared to the Control treatment, which recorded the lowest mean of 169.67 cm.

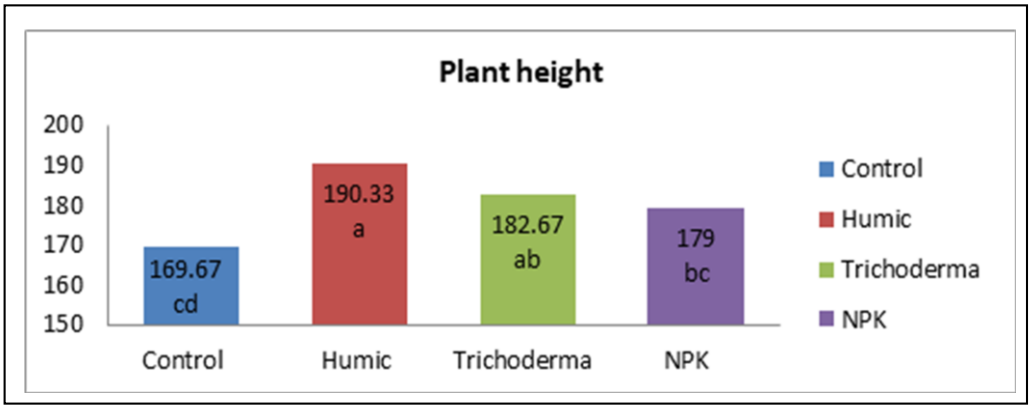

Figure 3. the effect of the type of fertilization on the average height of Panicum plants after 40 days of fertilization (cm).

The reason for this is that humic acid is one of the stimulating and stimulating factors for the growth and reproduction of microorganisms that secrete organic acids and stimulating hormones such as auxins and gibberellins that stimulate the growth and elongation of stem cells and increase plant height [13].

Number of branches (branch. Plant $^{-1}$): The results in Fig. 4 indicate the presence of significant differences in the average number of branches per plant after 20 days of fertilization, as humic fertilization recorded the highest average for this trait, reaching 44.33 branches. Plant^{-1}, with an increase of 23.13%, Fertilization with Trichoderma and NPK recorded an average of 41.33 and 40.33 branches. Plant^{-1}, respectively, compared to the Control treatment, which recorded the lowest average of 36.00 branches. Plant^{-1}.

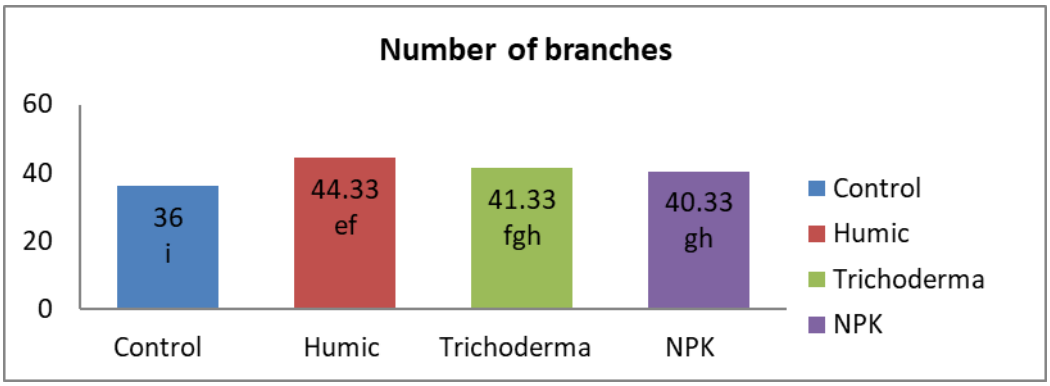

Figure 4. The effect of the type of fertilization on the average number of branches in Panicum plants after 20 days of fertilization.

The results also showed in Figure (5) the presence of significant differences in the average number of branches per plant after 30 days of fertilization, as humic fertilization recorded the highest average for this trait, reaching 49.33 branches. Plant^{-1}, with an increase of 29.81%, Fertilization with Trichoderma and NPK recorded an average of 45.00 branches and 43.00 branches. Plant^{-1}, respectively, compared to the Control treatment, which recorded the lowest average of 38.00 branches. Plant^{-1}.

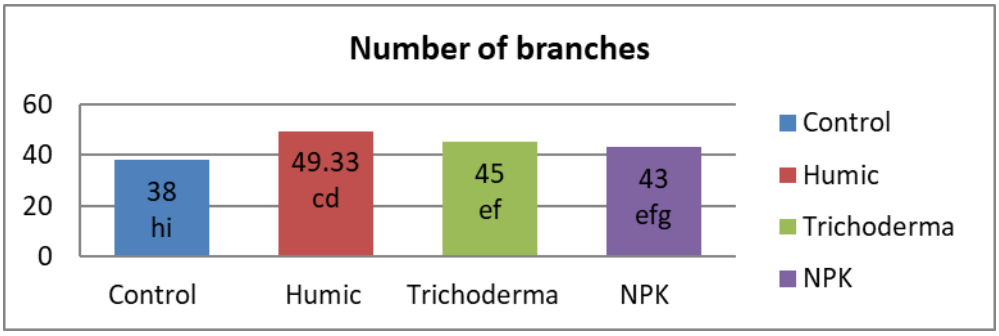

Figure 5. The effect of the type of fertilization on the average number of branches in Panicum plants after 30 days of fertilization.

Figure (6) indicates the existence of significant differences with the average number of branches per plant after 40 days of fertilization, as humic fertilization recorded the highest average for this trait, reaching 59.33 branches. Plant^{-1}, with an increase of 27.15%, Fertilization with Trichoderma and NPK recorded an average of 55.66 branches and 51.00 branches. Plant^{-1}, respectively, compared to the Control treatment, which recorded the lowest average of 46.66 branches. Plant^{-1}.

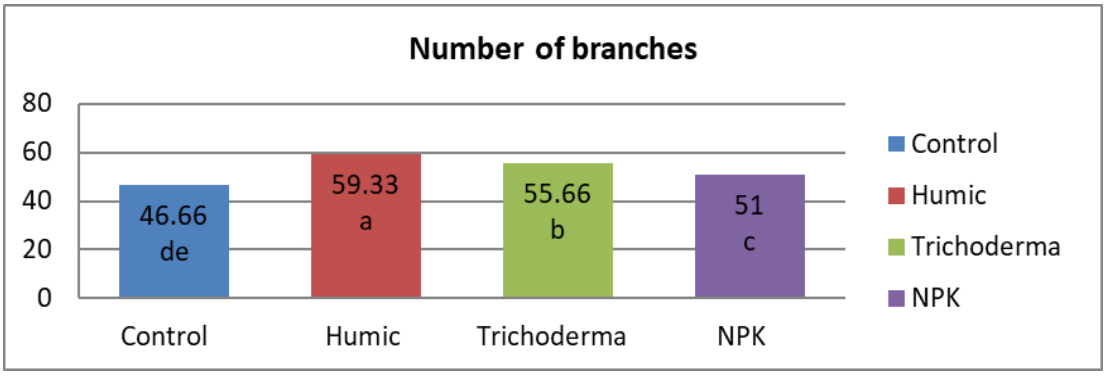

Figure 6. The effect of the type of fertilization on the average number of branches in panicum plants after 40 days of fertilization.

The reason for this is that the addition of humic acid has a significant effect on the emergence and growth of roots and the increase in their length, which leads to an increase in the absorption of macro and micro nutrients [14]. Number of leaves (leaf. Plant $^{-1}$): Figure (7) shows the presence of significant differences in the charac-

teristic of the average number of leaves per plant after 20 days of fertilization, as it was superior to humic fertilization, and the highest average for this trait was recorded at 235.67 (leaf-plant $^{-1}$), with an increase of 37.81%, Fertilization with Trichoderma and NPK recorded an average of 192.33 and 185.53 (leaf-plant^{-1}) plant leaves, respectively, compared to the Control treatment, which recorded the lowest average of 171.00 (leaf-plant^{-1}).

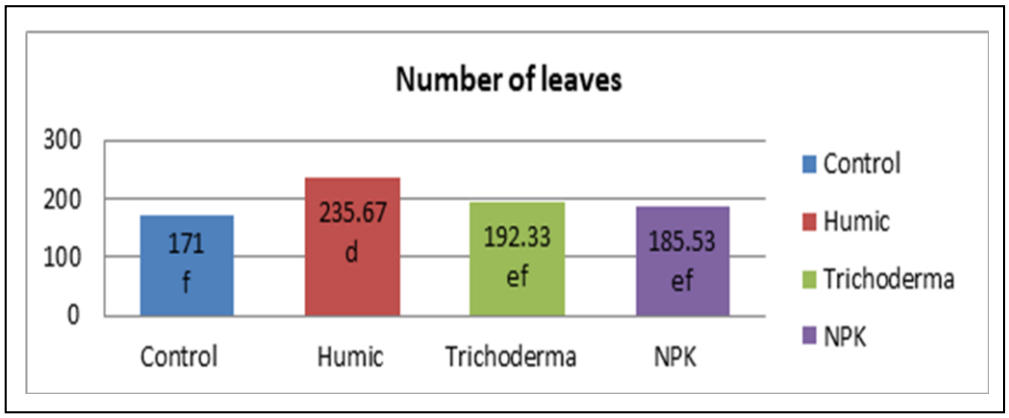

Figure 7. The effect of fertilization type on average number of leaves in panicum plants after 20 days of fertilization.

Figure (8) indicates the presence of significant differences in the average number of leaves per plant after 30 days of fertilization, as humic fertilization recorded the highest average for this characteristic, reaching 313.00 (leaf-plant^{-1}), with an increase of 37.28%, Fertilization with Trichoderma and NPK recorded an average of 269.33 and 258.00 (leaf-plant^{-1}), respectively, compared to the Control treatment, which recorded the lowest average of 228.00 (leaf-plant^{-1}).

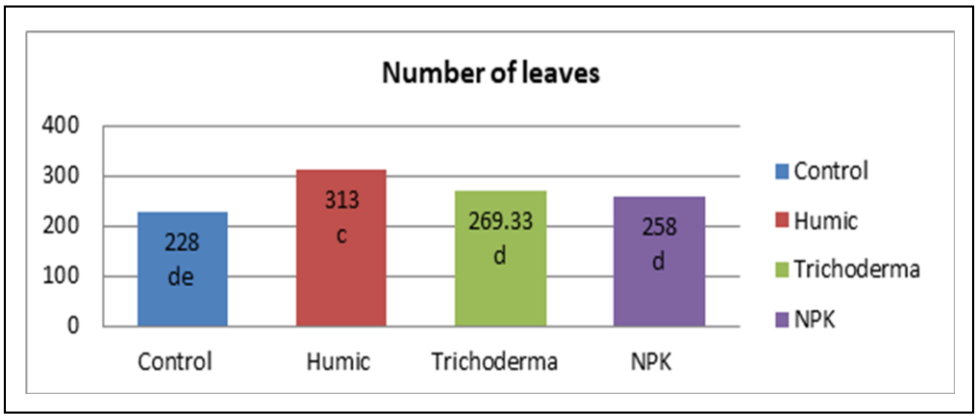

Figure 8. The effect of fertilization type on average number of leaves in panicium plants after 30 days of fertilization.

Figure (9) also showed the presence of significant differences in the average number of leaves per plant after 40 days of fertilization, as it showed the superiority of humic fertilizer over the rest of the fertilizers, and the highest average for this trait was recorded at 453.33 (leaf-plant $^{-1}$), with an increase of 40.78%. Fertilization by Trichoderma and NPK recorded an average of 389.00 and 351.90 (leaf-plant^{-1}), respectively, compared to the Control treatment, which recorded the lowest average of 322.00 (leaf-plant $^{-1}$). The reason for the superiority of humic acid is due to its role in encouraging cell division and increasing their number, which is reflected in the increase of vegetative growth of the plant and thus an increase in the number of leaves. Also, the organic matter has an important role in improving the chemical and physical properties of the soil, and increasing the activity of microorganisms in it, which increases readiness. The nutrients in them lead to an increase in plant growth [13]. Leaves area (cm^2): Figure (10) indicates that there were no significant differences between the averages for

the characteristic of leaf area of plants after 20 days of fertilization.

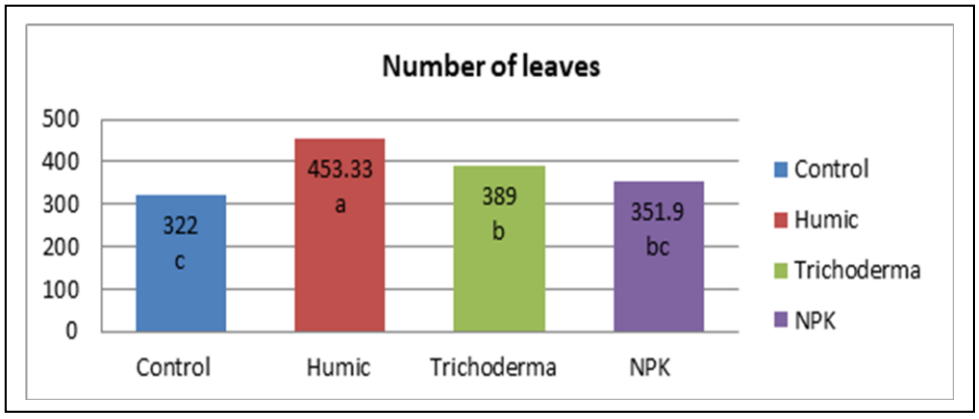

Figure 9. The effect of the type of fertilization on the average number of leaves in panicum plants after 40 days of fertilization.

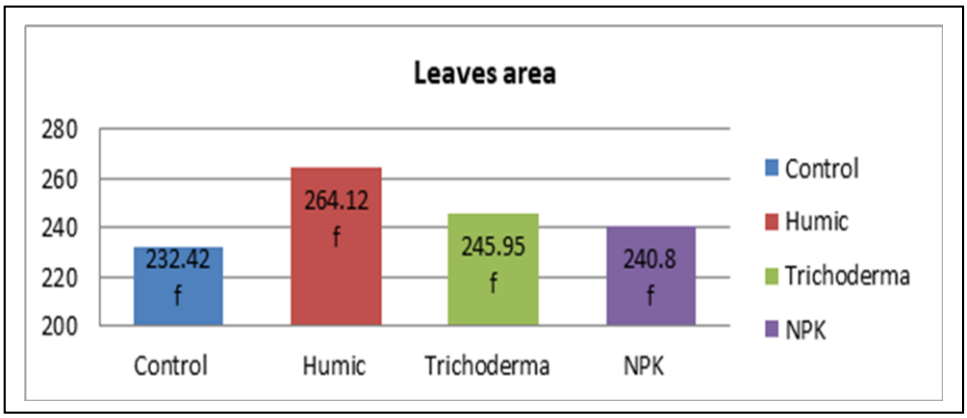

Figure 10. Effect of fertilization type on average leaves area in panicum plants after 20 days of fertilization.

Also, figure (11) shows the absence of significant differences after 30 days of fertilization. humic fertilizer outperformed the rest of the fertilizers and recorded the highest average for this characteristic as it reached 457.55 cm^2 with an increase of 20.91% compared to the Control treatment. Fertilization by Trichoderma and NPK recorded an average of 414.22 and 408.50 cm^2 of leaf area, respectively, compared to the Control treatment, which recorded the lowest mean of 378.42 cm^2.

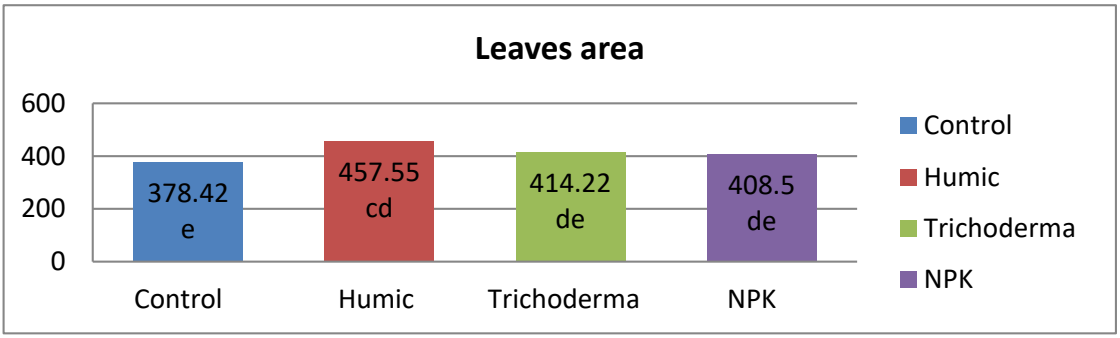

Figure 11. The effect of fertilization type on average leaves area in panicum plants after 30 days of fertilization.

While figure (12) showed that there were no significant differences between the averages after 40 days of fertilization, humic fertilizer outperformed the rest of the fertilizers and recorded the highest average for this characteristic of 572.80 cm^2, with a percentage increase of 16.95% compared to the Control treatment. Fertilization by Trichoderma and NPK recorded an average of 537.57 and 553.55 cm^2 of leaf area, respectively, compared to the Control treatment, which recorded the lowest average of 489.75 cm^2.

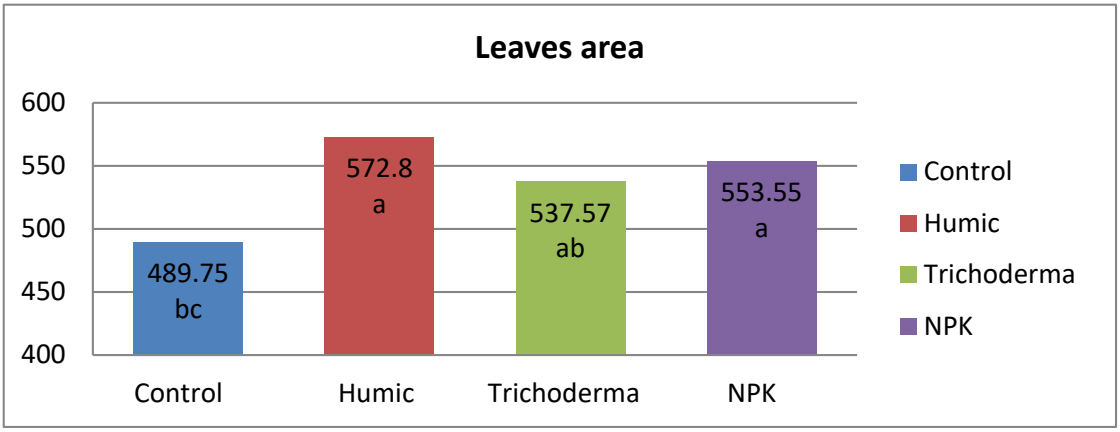

Figure 12. The effect of fertilization type on average leaves area in panicum plants after 40 days of fertilization.

The reason for this is that humic acid increases the permeability of cell membranes, and thus increases the process of absorption of nutrients and water, as humic acid increases the readiness of macronutrients and micronutrients, especially nitrogen, phosphorous and potassium that affect many vital processes that contributed to increasing the length and width the leaf that affected the increase in leaf area, as well as the humic acid increases the surface area of soil particles [15].

Leaf area index: Table (4) shows that there were no significant differences between the averages for the index characteristic of leaf area of plants after 20 days of fertilization.

Table 2. The effect of fertilization type on average leaf area index in panicum plant by different mulching periods.

Leaf area index			Fertilization
After 40 days of fertilization	After 30 days of fertilization	After 20 days of fertilization	treatments
19.58 bc	15.13 e	9.29 f	**Control**
22.91 a	18.30 cd	10.56 f	**Humic**
21.50 ab	16.56 de	9.83 f	**Trichoderma**
22.14 a	16.33 de	9.62 f	**NPK**

Also, Table (2) showed the presence of significant differences between the averages after 30 days of fertilization. Humic fertilizer outperformed the rest of the fertilizers and recorded the highest average for this characteristic as it reached 18.30, with an increase of 20.95% compared to the control treatment. Fertilization with Trichoderma and NPK scored an average of 16.56 and 16.33 for leaf area index, respectively, compared to the control treatment, which recorded the lowest average of 15.13.

While Table (2) indicates that there is a significant difference between the averages for the average characteristic of the index of leaf area, after 40 days of fertilization, the humic fertilization treatment recorded the highest average for the studied characteristic, with an average of 22.91 and an increase of 17.00% compared to the control treatment. While fertilization with NPK and Trichoderma recorded the mean for the index leaf area was 22.14 and 21.50, respectively, compared to the control treatment, which recorded the lowest average of 19.58.

The reason for this may be attributed to the fact that humic acid has the ability to improve the chemical, biological and physical properties of the soil and when it decomposes it gives carbonic acid, which is a weak acid that decomposes into ions (H^+) and ions ($Hco3^-$), and this contributes to changing the soil pH. It also helps in dissolving some of the insoluble mineral substances, which are not accessible to the plant, such as phosphorous, magnesium, potassium and calcium, as it increases the readiness of the trace elements due to the low pH of the soil solution so that they are easily absorbed by the plant [16].

Total green fodder yield (tons. H^{-1}): Table (3) showed that there were significant differences between humic fertilization and other types of fertilization after 20 days of fertilization. Humic fertilizer recorded a significant

superiority over the rest of the fertilizers, as it recorded the highest average for this characteristic of 49.61 tons. h^{-1}, with an increase of 28.12% compared to the control treatment, while fertilization with Trichoderma and NPK recorded an average of 40.27 and 39.56 tons.h^{-1} of green fodder. h^{-1}, respectively, compared to the control treatment, which recorded the lowest average of 38.72 tons. h^{-1}.

Table (3) also shows that there were significant differences between humic fertilization and other types of fertilization after 30 days of fertilization. Humic fertilizer was significantly superior to the rest of the fertilizers, as the highest average for this characteristic was recorded at 76.88 tons. h^{-1}, with an increase of 24.96% compared to the control treatment, while fertilization with Trichoderma and NPK recorded an average of 64.32 and 62.47 tons.h^{-1} of green fodder, respectively, compared to the control treatment, which recorded the lowest average of 61.52 tons. h^{-1}.

While the results of Table (3) indicated that there were no significant differences between the averages of fertilization treatments for the total yield characteristic of green fodder, after 40 days of fertilization.

Table 3. The effect of the type of fertilization on the average total yield of green fodder by the different mowing periods of the Panicum plant (ton.h^{-1})

Total yield of green fodder (tons. h-1)			Fertilization
After 40 days of fertilization	After 30 days of fertilization	After 20 days of fertilization	**treatments**
99.48 a	61.52 c	38.72 e	**Control**
109.31 a	76.88 b	49.61 d	**Humic**
100.07a	64.32 c	40.27 e	**Trichoderma**
99.59 a	62.47 c	39.56 e	**NPK**

This may be due to an increase in the rates of photosynthesis and food manufacturing processes, due to the positive effect of humic acid on plants [17].

Green yield (tons. h^{-1}): Table (4) showed that there was a significant difference between humic fertilization and other types of fertilization after 20 days of fertilization. Humic fertilizer outperformed the rest of the fertilizers, as it recorded the highest average for this characteristic of 10.07 tons. h^{-1}, with an increase of 18.89% compared to the control treatment, Fertilization by Trichoderma and NPK recorded an average of 8.62 and 8.57 tons. h^{-1}, respectively, compared to the control treatment, which recorded the lowest average of 8.47 tons. h^{-1}.

Table (4) shows that there were significant differences between some averages, after 30 days of fertilization, humic fertilizer was significantly superior to the rest of the fertilizers, as it recorded the highest average for this characteristic of 15.47 tons. h^{-1}, with an increase of 25.67% over the control treatment, While the fertilization with Trichoderma and NPK recorded an average of 12.92 and 12.68 tons. h^{-1}, respectively, compared to the control treatment, which recorded the lowest average of 12.31 tons. h^{-1}.

Table 4. The effect of the type of fertilization on the average hay yield on the different mulching periods of the panicum plant (tons. h^{-1}).

Green yield (tons. h^{-1})			Fertilization
After 40 days of fertilization	After 30 days of fertilization	After 20 days of fertilization	**treatment**
20.73 a	12.31 cd	8.47 e	**Control**
21.91 a	15.47 b	10.07 de	**Humic**
20.08 a	12.92 c	8.62 e	**Trichoderma**
20.34 a	12.68 c	8.57 e	**NPK**

However, Table (4) showed that there were no significant differences between the averages of fertilizer parameters for the hay yield characteristic, after 40 days of fertilization.

The reason is due to the oxidation sites on the humic acid molecule, which give the whole molecule a negative charge, enabling it to absorb positively charged nutrients, and hold them until the plant needs them [18].

4. Conclusion

The superiority of humic acid fertilizer in terms of plant height, branch number, leaf number, leaf area, total yield of green feed, and hay output after 40 days of fertilization. After 40 days of fertilization with Trichoderma, the weed stood out in terms of plant height, branch count, leaf count, leaf area, total yield of green feed, and hay yield. After 40 days of fertilization with NPK, the cut outpaced the weed in terms of plant height, branch count, leaf count, leaf area, total yield of green feed, and hay yield.

Supplementary Materials:

No Supplementary Materials.

Author Contributions:

N. A. Al-Zubaidy and N. Fl. Al-Mubarak; methodology, writing—original draft preparation, A. M. Ahmed; writing—review and editing, N. Fl. Al-Mubarak; paraphrasing. All authors have read and agreed to the published version of the manuscript.

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Informed Consent Statement:

No Informed Consent Statement.

Data Availability Statement:

No Data Availability Statement.

Conflicts of Interest:

The authors declare no conflict of interest.

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