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Influence of genotypes, spraying glutamic with potassium on the growth traits of the *Hibiscus sabdarriffa* L.

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ABSTRACT
The experiment was conducted in the summer season of 2023 in the Hawija Directorate / Kirkuk governorate to study the effect of genotypes (black hit, red hit, Arab, Sudanese 3) and spraying with different concentrations of acid(zero and glutamic 250 mg bit+1, potassium element 600 mg bit+1 and glutamic 250 mg bit+1 +potassium 600 mg bit+1) in the growth, substance of the genotypes of randomization complete block design with three repetitions, each contains 16 experimental units, the area of each experimental unit is 2 * 2 m with a total of 48 experimental units, the results of statistical analysis showed significant differences in all studied traits. The genotype of black hit exceeded most of the growth characteristics, including plant height (169) cm, number of branches (28.16) plant-1, leaf area (23061.04) cm2 leaf area and leaf directory (9.23) and chlorophyll a +b content in leaves (28.81) mg-1. The combination of glutamic 250 MML+1 +potassium element 600 MML+1 was significantly superior in all growth qualities, including the number of days from planting to 50% flowering (184.57%) days recipe number of days from planting to full maturity (214.86)days recipe plant height (180.66)CM recipe number of branches (29.54)branch leaf area recipe (23728.78)cm2 and leaf area guide recipe (9.48) cm2 Recipe sheet content of chlorophyll WA+B (22.49)mg-1. As for the interference of the genotype and the synthesis of clotamic acid and the potassium element, the combination of the genotype (hit black) with clotamic acid and the potassium element (250+600mg per liter+1) exceeded in most of the characteristics of growth and genotype (arabib with the clotamic combination 250mg per liter+1 +potassium element 600mg per liter+1) in the character of chlorophylla content, the genotype (sudan3 with synthesis of glutamic 250mg per liter+1 +element potassium 600mg per liter+1) in the character of plant height.

تأثير التركيب الوراثي والرش بحامض الكلوتاميك والبوتاسيوم في صفات النمو لنبات الكجرات

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الخلاصة

نفذت تجربة عاملية في الموسم الصيفي ٢٠٢٣ في قضاء الحويجة / محافظة كركوك لدراسة تأثير التراكيب الوراثية لنبات الكجرات (هيت أسود ، هيت أحمر ، عريب ، سودان٣) والرش بالتراكيز مختلفة من حامض(صفرو الكلوتاميك ٢٥٠ملغم بالتر+١ و عنصر البوتاسيوم ٦٠٠ملغم بالتر+١ وكلوتاميك ٢٥٠ملغم بالتر+١ +بوتاسيوم ٦٠٠ملغم بالتر+١) في النمو والحاصل والمادة الفعالة لتراكيب الوراثية لنبات الكجرات، استخدم تصميم القطاعات العشوائية الكاملة بثلاث تكررات كل مكرر يحتوي على ١٦ وحدة تجريبية مساحة كل وحدة تجريبية X2٢م بمجموع ٤٨ وحدة تجريبية، وقد حللت البيانات لمعرفة تأثير التراكيب الوراثية وتركيز الحامض الاميني الكلوتاميك وعنصر البوتاسيوم والتداخل بينهم حيث اظهرت نتائج التحليل الاحصائي وجود فروق معنوية في جميع الصفات المدروسة: تفوق التركيب الوراثي هيت أسود في اغلب صفات النمو ومنها ارتفاع النبات (١٦٩)سم وعدد الافرع (٢٨.١٦) فرع نبات-١ والمساحة الورقية (٢٣٠٦١.٠٤) سم٢ ورقة ودليل المساحة الورقية (٩.٢٣) ومحتوى الكلوروفيل a+ b في الاوراق (٢٨.٨١) ملغم غم-١. تفوقت توليفة الكلوتاميك ٢٥٠ملم بالتر+١ +عنصر البوتاسيوم ٦٠٠ملم بالتر+١ معنويا في جميع صفات النمو منها عدد الايام من الزراعة حتى ٥٠%تزهير (١٨٤.٥٧)% يوما وصفة عدد الايام من الزراعة حتى النضج التام (٢١٤.٨٦)يوما وصفة ارتفاع النبات (١٨٠.٦٦)سم وصفة عدد الافرع (٢٩.٥٤)فرع نبات وصفة المساحة الورقية (٢٣٧٢٨.٧٨)سم٢ و صفة دليل المساحة الورقية (٩.٤٨) سم٢ ورقة وصفة محتوى كلوروفيل و22.49) a+b)ملغم غم-١. اما بالنسبة للتداخل التركيب الوراثي وتوليفة حامض الكلوتامك وعنصر البوتاسيوم فقد تفوق توليفة التركيب الوراثي (هيت اسود) مع حامض الكلوتامك وعنصر البوتاسيوم (٢٥٠+٦٠٠ملغم بالتر+١) في معظم صفات النمو والتركيب الوراثي (عريب مع التوليفة الكلوتاميك ٢٥٠ملغم بالتر+١ +عنصر البوتاسيوم ٦٠٠ملغم بالتر+١) في صفة محتوى الكلوروفيلa، والتركيب الوراثي (سودان٣ مع توليفة الكلوتاميك ٢٥٠ملغم بالتر+١ +عنصر البوتاسيوم ٦٠٠ملغم بالتر+١) في صفة ارتفاع النبات،

الكلمات المفتاحية : الكجرات، التراكيب الوراثية، صفات النمو، الكلوتاميك.

INTRODUCTION

Hibiscus sabdariffa L. is a shrub plant one of the plants of the Malvaceae Marshmallow family that is important medically and economically, as its cultivation is widespread in tropical and subtropical regions, including India, Australia, Indonesia and Africa (Rabo et al., 2015.(

Its medicinal importance is complemented by the fact that its goblet leaves contain high levels of hibiscin glycoside , and the Hibiscus plant also contains (hipsin glycoside), which plays a major role in reducing blood viscosity, strengthening the heartbeat and calming the nerves(Saad, 1988). Genotypes are one of the important factors that have a direct impact on the growth, productivity and quality traits, the reason for this is their adaptability to various environmental conditions . many recent scientific studies and researches have proved that the interaction between environmental conditions, genotype and balanced nutrient management has a significant impact on improving production quantity and quality (Maes and Dudareva, 2016.(Glutamic acid is one of the amino acids that contribute to the construction of proteins in the plant, as when spraying glutamic acid on the plant, it leads to a decrease in the content of

glutamic is also considered a buffer regulating solution for equalizing the cytoplasm of cells, which improves the process of opening and closing stomata and a source of carbon and affects the construction and composition of the chlorophyll molecule, which affects increasing the rate of carbon metabolism of the plant and thus increasing the construction of carbohydrates, as well as it helps maintain the required osmotic pressure in cells and plant protection in case of increased concentration of salts and reduce plant stress (Haroun et al., 2010). Genotypes are one of the important factors that have a direct impact on productivity and quality, and the reason for this is their adaptability to various environmental conditions . Many recent scientific studies and researches have proved that the interaction between environmental conditions, genotypes and balanced nutrient management has a significant impact on improving production quantity and quality (Maes and Dudareva, 2016.(

Potassium is one of the essential nutrients that has a vital role in promoting the growth of plants and improving the content of active substances, in the hibiscin plant. Potassium spraying shows a multiple positive effect on the active substance content, which enhances the nutritional value and medicinal uses of the plant. potassium spraying may contribute to increasing the content of active substances, including polyphenols and flavonoids, which are expressed by compounds with antioxidant properties. an increase in these compounds enhances the health benefits. potassium also has an important role in the efficiency of photosynthesis by enhancing the transport processes inside plants, which helps increase productivity and increase the content of active substances Khan (2015).

Determination of the best genotype in the growth, yield and chemical content, the possibility of increasing the yield of the plant and the content of active compounds using potassium and glutamic, as well as determining the optimal level of it, and to find out the best combination of genotype (potassium and glutamic) that gives the best growth, yield and active substance of the plant of the corms .

MATERIALS AND METHODS

The experiment was conducted during the summer season 2023 with the aim of studying the effect of spraying with different concentrations of potassium and glutamic in the growth, yield and active substance of four genotype of hibiscus , namely (Black hit, Red hit, Areb, sudan3), which was obtained from the department of field crops at the college of Agriculture, Tikrit University, the second factor spraying with potassium and glutamic as follows: The first (control) treatment is distilled water, the third treatment (spraying with potassium 600mg L), the third treatment (spraying with glutamic 250mg L) and the fourth treatment (spraying with potassium 600mg L +spraying with glutamic 250mg L) the spraying process was carried out when the plant reached the age of four leaves or a height of 10 cm in the early morning and was prepared and equipped the experiment after two perpendicular plowing and leveling the experiment and smoothing where the experiment was divided into three replicate and each contains (16) experimental unit, where the area of each experimental one is x22 m and a total of 48 experimental unit, each experimental one contains four lines, where the length of one line is 2 m and where the distance is between the line and the last 50 cm and the distance between the plant and the last 50 cm. The number of plants in each experimental unit is(16) plants, that is, the number of plants per square meter is (4)plants and the number of plants per hectare is (40,000)plants. The experiment was fertilized according to the recommendations, urea fertilizer (46% N) was added in an amount of 160 kg.h-1 in the form of two equal batches (the first at planting and the second 45 days after germination of the seedlings (Ali. 2012).Phosphate fertilizer was added in the form of triple superphosphate and an average of 120 kg.h-1 at once before planting after the completion of the preparation of the land (Matar,2010). And adding potassium fertilizer 42%K2O in an amount of 120 kg h-1 in one batch after tillage and before softening (Nasrallah.2012) .

RESULT AND DISCUSSION

Number of days from planting to maturity (day).

The results of table(1) indicate that there are significant differences in the genotypes and the concentration of glutamic amino acid and potassium element in the average of this trait and the interaction between glutamic amino acid and potassium element and the genetic genotype, where the results showed the genotype of sudan3 to reach full maturity and needed fewer days to reach that stage reached (201.81)days, compared to the black hit genotype, which gave the longest time to reach this stage (210.88) days, The reason for the variation of genotype in early maturity is due to genetic factors controlling and even influencing factors to the trait and the increased speed of growth as a result of cell division (Elayan et al, 2015) .These results are consistent with (Basszinew and Bizuayeh, 2016). The addition of glutamic amino acid and potassium in different concentrations led to significant differences in this trait, as the control treatment gave spraying with water only the least number of days to reach that stage and an average of (198.00) days, compared to the fourth treatment spraying with glutamic amino acid and potassium element, which gave the highest average of (214.86) days, the reason for the superiority of the fourth treatment spraying with glutamic and potassium element may be due to its superiority in increasing the duration of planting to 50% flowering, and these results are consistent with(Saget, 2021). As for the interaction between glutamic amino acid and potassium element and genotype, there are significant differences in this trait, as the genotype of Sudan 3 sprayed with water recorded the lowest number of days from planting to full maturity, reaching (195.75) days, while the genotype of plants gave black hit with the fourth coefficient spraying with glutamic amino acid and potassium element the longest time to reach this stage reached (220.17.(

Table (1) the effect of genotype and spraying with different concentrations of potassium and glutamic in the number of days from planting to maturity (day).

genotypes	Black heat	Sudan3	Red heat	Red heat	Average

Concentrations					
Comparison	201.01g	195.75h	198.01h	197.25h	198.00 d
potassium600mg/L+1	212.33c	204.11ef	209.99h	207.13d	208.34 b
Clotamic250mg/L+1	210.03c	202.27Fg	206.99d	205.19de	206.12 c
potassium600mg/L+1 +Glutamic250mg/L+1	220.17a	205.11de	219.83a	214.33b	214.86a
Average	210.88a	201.81d	208.70b	205.97c	

* Similar characters there are no significant differences at Level 5%

plant height (plant cm).

The results of table (2) showed that there are significant differences between the averages of this trait due to the influence of genotype, glutamic amino acid, potassium element and their concentrations, and the bilateral interaction between glutamic amino acid, potassium element and genotype, it is noted that the genotypes of black hit has significantly exceeded the highest average for the plant height, reaching (169.86) cm, compared to the plants genotype sudan3, which gave the lowest average for the trait, reaching (161.85) plant poison, the difference in plant height between genotype may be due to their different genetic nature and differences in the extent of their response to environmental conditions and the amount of benefit from them, this is reflected in the variation in the qualities of These results also agreed with Ali and (Babbas 2011) and Gessese) and (Wachamo, 2022). As for the effect of spraying with glutamic acid and potassium element in the plant height trait, it led to the appearance of a moral superiority in the highest averages in the plant height, reaching (180.66) cm compared with the lowest averages when treating the control that was sprayed with water, reaching (149.92) cm, perhaps the reason for this increase in spraying glutamic acid and potassium element on an enzyme that has a major role in the analysis of organic compounds in addition to the nitrogen released from the amino acid, which has a role in protein building, energy processing and increasing the viability of potassium also plays a role in increasing the efficiency of carbon metabolism through its role in increasing the activity of cell division and elongation, which was positively reflected on the plant's height (Rabo, 2015) and(Al-nimrawi, 2021). But interaction presence of a significant between glutamic acid and potassium element and genotype as the Areb genotype with the fourth treatment recorded spraying with glutamic acid and potassium element the highest average, reaching (195.66) cm, while the genotype Sudan 3 sprayed with water recorded the lowest average plant height, reaching (147.01) cm.

Table (2) the effect of genotype and spraying with different concentrations of potassium and glutamic in the plant height cm

genotypes / Concentrations	Black heat	Sudan3	Red heat	Red heat	Average
Comparison	153.01d	147.0i	150.68cd	149.01cd	149.92c
potassium600mg/L+1	176.07ab	165.13bd	169.42ad	162.26bd	168.22b
Clotamic250mg/L+1	170.14ad	163.21bd	165.80bd	160.17bd	164.82d
potassium600mg/L+1 +Glutamic250mg/L+1	180.23ab	172.06ad	174.72ad	195.66a	180.66a
Average	169.86a	161.85b	165.15a	166.77a	

* Similar characters there are no significant differences at Level5%

The number of main branches per plant

Table (3) showed the presence of a significant effect in increasing the average number of branches, in the genotypes, the Black hit genotype surpassed the highest average of the trait, reaching (27.16) plant-1, while the plants of the Areb genotype gave the lowest average, reaching (23.33) plant-1, the reason for the increase in the number of branches per plant may be due to the nature of genetic To the genetic nature of the variety and in response to nutrition and environmental conditions specific to the growth of (Atta et al, 2011).

As for the effect of the concentration of glutamic acid and the potassium element in the trait, it was significant when the concentration of and the potassium element gave the highest average for the number of branches reached (29.04) plant-1, as the non-addition coefficient gave the lowest average as it reached (18.00) glutamic amino plant branch and the potassium element in providing free nitrogen in the plant and reducing the activity of growth inhibitors and increasing the rates of vegetative growth of the plant this is due to an increase in the number of branches for the genotype and spraying of homo cysteine and potassium, which leads to stimulation of phagocytic processes and an increase in the rates of photosynthesis of during the increased construction of chlorophyll from what improves plant growth (EI-Ghamry et al (2009) and these results are consistent with the residue (Mukhlef, 2019).

The genotypic plants are black with the fourth treatment, spraying with glutamic acid and potassium recorded the highest average trait of (31.07) plant-1, while the genotypic of Arab and water treatment recorded the lowest average trait of the number of branches in the plant if it reached (17.01) plant-1.

Table (3) the effect of genotypes and spraying with different concentrations of glutamic and potassium in number of main branches in one plant –1

Genetic structures / Concentrations	Black heat	Sudan3	Red heat	Red heat	Average
Comparison	19.01 i	17.50ij	18.50ij	17.01j	18d
potassium600mg/L+1	30.63ab	27.43df	28.17ce	25.03gh	27.81b
Clotamic250mg/L+1	27.93cf	26.53fg	26.43fg	24.13h	26.25c
potassium600mg/L+1 +Glutamic250mg/L+1	31.07a	29.17bc	28.76cd	27.17df	29.04a
Average	27.16	25.15b	25.46b	23.33c	

* Similar characters there are no significant differences at Level5%

leaf area cm2

Table (4) indicate that there are significant differences between them, as the genotype surpassed Black hit with the highest average trait of (23061.1) cm2, as the genotype gave Areb the lowest average trait of (22062.1) cm2, that the reason for the variation of genotypes in the leaf area trait may be due to differences and interferences with the environmental conditions that are suitable for growth, this results in a variation in the process of photosynthesis and therefore the amount of accumulation of nutrients in the plant has an important role in growth, these results (Krem and Ehsan 2015).

The combination of glutamic acid and potassium gave the highest value to the trait of leaf area with an average of (23728.8) cm2 compared to the rest of the treatments, which gave the control treatment the lowest average of (21083.3) cm2, which clearly affected the leaf area that a source of nitrogen, which is one of the most important nutrients needed by the plant at various stages of growth, including leaf growth, amino acid has a positive role in a large number of vital and physiological processes such as cell division and increased absorption of water and nutrients and hence the increase in leaf area (Kakkar et al, 2000) and the results are consistent with (Mohammadi, 2018) and (Al-Jumaili, 2023).

As for the interaction, the genotype was black hit with the fourth treatment, spraying with glutamic acid and potassium element, as the highest average of the trait was recorded at (24273.6) cm2, while the genotype of Areb with control treatment recorded the lowest average at (20646.00) cm2.

Table (4) the effect of genotypes and spraying with different concentrations of glutamic and potassium in the leaf area cm^2

Genotypes / Concentrations	Black heat	Sudan3	Red heat	Red heat	Average
Comparison	21556.2h	21024.1i	21109 i	20646d	21083.3c
potassium600mg/L+1	22860.8d	22378.7f	22686 e	22390f	22578.9b
Clotamic250mg/L+1	23553.4c	22390.1f	22468.1f	21727.5g	22534.6b
potassium600mg/L+1 +Glutamic250mg/L+1	24273.6a	23448.9c	23707.2b	23485c	23728.8a
Average	23061.1a	22310.5c	22492.5b	22062.1d	

* Similar characters there are no significant differences at Level5%

Chlorophyll content (a +b) in the leaves:

Table (5) showed that there are significant differences between the genotypes in total chlorophyll, as the genotype surpassed Black hit, giving the highest average trait of (28.81), while the genotype sudan3 gave the lowest average trait of (25.49) due to the increased content of leaves of chlorophyll to the genetic differences between the genotype plants, as the genotype plants surpassed Black hit in most of the growth traits, as in tables (1) (2) (3) these factors together led to an increase in the content of chlorophyll in the leaves.

Significant differences were also found in the trait of chlorophyll when the combining of glutamic acid and potassium reached (31.68), as the control treatment gave the lowest rate of (19.81) that glutamic acid and potassium have an important role in the process of photosynthesis, including these elements are considered one of the internal components, which is one of the important compounds in the construction of the chlorophyll molecule, and also contributes to the synthesis of chlorophyll and enzymes, which is reflected in the increased content of chlorophyll in the results are consistent with(Al-Halfi et al, 2017).

The effect of the interaction between glutamic acid and the potassium element and the genotype is significant in this trait, as the genotype recorded a Black hit with the fourth treatment of glutamic and potassium element, the highest value of the trait was (35.59), the opposite of the treatment of the interaction between the genotype sudan3 and the Red hit with control treatment, the lowest value reached (18.80) and(18.80).

Table (5) the effect of genotypes and spraying with different concentrations of glutamic and potassium in the content of chlorophyll (a+b) in the leaves .

Genotypes / **Concentrations**	**Black heat**	**Sudan3**	**Red heat**	**Red heat**	**Average**
Comparison	21556.2h	21024.1i	21109 i	20646d	21083.3c
potassium600mg/L+1	22860.8d	22378.7f	22686 e	22390f	22578.9b
Clotamic250mg/L+1	23553.4c	22390.1f	22468.1f	21727.5g	22534.6b
potassium600mg/L+1 **+Glutamic**250mg/L+1	24273.6a	23448.9c	23707.2b	23485c	23728.8a
Average	23061.1a	22310.5c	22492.5b	22062.1d	

* Similar characters there are no significant differences at Level5%

Dry weight of the vegetative total (g plant)

The results of Table (6) showed that the genotype of black hit has significantly outperformed the highest average trait (482.15) g plant-1, compared with the genotype of sudan3, which gave the lowest average trait (435.50) g plant-1, that the difference between varieties in the dry weight of the vegetative total is due to the effect of the genotype of the variety and the increase in the vegetative total of the variety what he came up with (al-Hassan et al., 2011).

Spraying with glutamic acid and potassium element led to a significant superiority in the highest average of (610.58) g plant-1 compared with the lowest average when the control treatment that was sprayed with water only reached (264.97)g plant-1, this can be attributed to the prominent role

of amino acid and potassium element in a direct impact on improving the qualities of vegetative growth, including plant height, number of branches and leaf area as in tables(3) (4) (5) results agreed with (Khan et al, 2003), noting that the accumulation of dry matter, yield and dry plant weight have been associated with rates of increase in the vegetative growth qualities of the plant .

The interaction between the genotypes, amino acid and potassium element is observed, the genotype surpassed the Red hit, recording the highest value of the trait reached (663.53) g plant-1, while the genotype Sudan3 with control treatment spraying with water only gave the lowest value of the trait reached (224.14) g plant

Table (6) the effect of genotypes and spraying with different concentrations of glutamic and potassium in the Dry weight of the vegetative total (g plant).

Genotypes / Concentrations	Black heat	Sudan3	Red heat	Red heat	Average
Comparison	293.60f	224.14h	276.94g	265.20g	264.97d
potassium600mg/L+1	561.18c	547.45c	551.70c	540.80c	550.28b
Clotamic250mg/L+1	410.30d	378.70e	389.81de	380.30e	389.77c
potassium600mg/L+1 +Glutamic250mg/L+1	663.53a	591.70b	597.80b	589.30b	610.58a
Average	482.15a	435.50c	454.06b	443.90c	

* Similar characters there are no significant differences at Level5%

CONCLUSIONS

The genotype of black hit exceeded the studied characteristics, including plant height, number of branches, leaf area, chlorophyll a +b content in leaves, number of days from planting to full maturity and dry weight of one plant. As for the combinations of glutamic 250mm BL+1 +element potassium 600mm BL+1 was significantly superior in all traits, as for the interaction the combination of genotype black and the combination of glutamic acid and element potassium (250+600mm BL+1) outperformed in most of the studied traits .

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