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Response *Nigella sativa* L. For spraying with Glycine, lysine and Iron and its effect on growth and yield

Mohammed Hussein Mohammed Al-Qadi[1] **Akeel Nagime Abood ALmohammedi**[2]
1Ministry of Water Resources, Baghdad, Iraq
2College of Agriculture, University of, Tikrit, Iraq
*:*E-mail: moh79hus39@gmail.com E-mail: akeel.Nagime@tu.edu

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ABSTRACT
The field experiment was carried out in the winter season (2021-2022) and(2022 - 2023) at the University of Tikrit – Faculty of Agriculture – Field Crops Department Research Statio,which is characterized by its gypsum soil, studying the effect of spraying with glycine and lysine acid and the element of iron and the overlap between them in some growth and yield characteristics and the active substance of Nigella sativa L. The experiment was designed according to the design of the complete randomized sectors (RCBD) with a working experiment (with three repetitions and each repetition 18 transactions, as it included combinations of glycine and lysine with iron, and analyzed the data of the two seasons collectively to find out the effect of amino acids, iron, coefficients and seasons and their overlaps except for the active compounds. It was analyzed for the first season and for only one repetition. The results of the statistical analysis of the data showed that there were significant differences in all the characteristics studied. The treatment of amino acids glycine exceeded 100 mg.L-1 + lysine100 mg.L-1 in each of the vegetative growth qualities represented by the height of the plant with an average of The number of branches of the plant as well as the qualities of the crop and its components represented by the number of Capsules in the plant and the number of seeds in the Capsules and the weight of 1000 seeds and the total seed yield, the treatment of iron spraying with 100 mg L -1 morally exceeded in each of the vegetative growth qualities represented by the height of the plant and the number of branches of the plant with an average of as well as the qualities of the crop and its components represented by the number of Capsules in the plant and the number of seeds in the Capsulesand the weight of 1000 seeds and the total seed yield. As for the seasons, the second season has morally exceeded the number of Capsules in the plant and the number of seeds in the Capsules and the weight of 1000seed seedsand the total seed yield.

استجابة نبات حبة البركة *Nigella sativa* L للرش بالكلايسين واللايسين والحديد واثره في النمو والحاصل .

محمد حسين محمد القاضي[1] **عقيل نجم عبود المحمدي[2]**
1وزارة الموارد المائية، بغداد، العراق
2 كلية الزراعة، جامعة تكريت، العراق

الخلاصة
نفذت التجربة الحقلية في الموسم الشتوي (٢٠٢١-٢٠٢٢) و(٢٠٢٢-٢٠٢٣) في جامعة تكريت – كلية الزراعة – محطة ابحاث قسم المحاصيل الحقلية والتي تتصف بتربها الجبسية دراسة تأثير الرش بحامضي الكلايسين و اللايسين وعنصر الحديد والتداخل بينها في بعض صفات النمو والحاصل والمادة الفعالة لنبات حبة البركة Nigella sativa L. صممت التجربة وفق تصميم القطاعات العشوائية الكاملة (RCBD) بتجربة عاملية (وبثلاث مكررات وكل مكرر ١٨ معاملة , اذ تضمنت توليفات من الكلايسين واللايسين مع الحديد، وحللت بيانات الموسمين تجميعيا لمعرفة تأثير الاحماض الامينية والحديد والمعاملات والمواسم وتداخلاتها بأستثناء المركبات الفعالة فقد حللت للموسم الاول ولمكرر واحد فقط, واظهرت نتائج التحليل الاحصائي للبيانات وجود فروق معنوية في جميع الصفات المدروسة ، تفوقت معاملة الاحماض الامينية الكلايسين ١٠٠ ملغم لتر-١ + اللايسين ١٠٠ ملغم لتر-١ في كل من صفات النمو الخضري المتمثلة بارتفاع النبات بمتوسط وعدد الافرع للنبات بمتوسط كذلك لصفات الحاصل ومكوناته المتمثلة بعدد العلب بالنبات وعدد البذور في العلب ووزن ١٠٠٠ بذرة وحاصل البذور الكلي ، تفوقت معاملة الرش بالحديد ١٠٠ ملغم لتر-١ معنويا في كل من صفات النمو الخضري المتمثلة بارتفاع النبات بمتوسط وعدد الافرع للنبات بمتوسط كذلك لصفات الحاصل ومكوناته المتمثلة بعدد العلب بالنبات وعدد البذور في العلب ووزن ١٠٠٠ بذرة وحاصل البذور الكلي اما بخصوص المواسم فقد تفوق الموسم الثاني معنويا في كل من عدد العلب بالنبات وعدد البذور في العلب ووزن ١٠٠٠ بذرة وحاصل البذور الكلي.

الكلمات المفتاحية: حبة البركة ، الجلايسين ، اللايسين ، الحديد ، النمو ، الحاصل

INTRODUCTION

Nigella sativa L. is a widely used medicinal plant around the world belonging to the fraternal family (Ranunculaceae) that is very popular in many traditional medicine systems. Our Prophet Muhammad (peace be upon him) mentioned Nigella sativa and urged its use. He said the black seed is a cure for every disease except poisonous. That is, death (steam) (Al-Bagha,1987), seeds and oil have a long history of use In different drug and food systems, black seed seeds have been widely used in the treatment of various diseases and illnesses. Studies have indicated the medical importance of this plant in the treatment of many inflammatory diseases, rheumatism and diabetes, as well as improving the functions of the liver and kidneys and increasing the activity of immune cells within the human body. Black seed and its components, including some active compounds, are potential sources of treatments for various types of diseases such as antioxidants, anti-inflammatories, antibacterial, antifungals, parasites, antivirals, anti-cancer, nerves, digestive system and heart. They also have beneficial effects on the reproductive, pulmonary and immune systems, as well as diabetes, fertility, breast cancer, skin complications, dehydration, indigestion, etc. (Begum andMannan,2020). These traditional uses of black seed seeds are attributed to a wide range of medicinal properties, including antioxidants, anti-inflammatories, immunomodulatory, anti-cancer, neuroprotection, antimicrobials, antihypertensive, prevention of heart disease, antimicrobials, prevention of kidney disease, and their liver-protective properties. Black seed seeds, especially essential oil, are important because its seeds contain a lot of therapeutically effective compounds such as phenols in volatile oil and alkaloids, as well as containing glycosides, tannins, amino acids, vitamins, minerals and antioxidants, as well as containing 20% protein and 30-35% fixed oil, which are mostly responsible for their pharmacological effects and therapeutic benefits. (Hannan et al,2021) . The modern trend in the cultivation and production of medicinal plants is directed to resort to modern and safe methods and technologies to reduce the risks of pollution through the use of traditional methods in agriculture. Amino acids have an important role in many vital processes and promote protein contents, cell division, plant dyes and natural hormones such as IAA, GA3 and ethylene (Ahmed and Abd El-Hameed ,2003). Glycine acid plays an important role in vegetative growth and chlorophyll formation in plants. It also has a chelating effect on some micronutrients such as iron, zinc, manganese and copper by facilitating the absorption and transport of plants (Ghasemi et al,2013). One of the sources of nitrogen for plants due to the low percentage of carbon to (Näsholm et al,2009) N , as well as lysine acid, which is an essential amino acid in

plants , is considered of great nutritional importance in human foods and animal feed. It can act as a regulator of interaction with the environment and as a regulator of plant growth, increasing the vegetative total, growth and early maturity of the crop (Stepansky et al,2006), and has a role in stimulating flowering in the plant even in a nitrogen-free medium (Tanaka et al,1997). Iron is one of the elements necessary for plant growth, as it needs it in small quantities and has an impact on increasing the quantity and quality of various agricultural crops. Iron enters into the structure of some enzymes such as catalase,. It also enters into the structure of cytochromes, which act as a carrier of oxygen in breathing and carbon representation (Imtiaz et al,2010) .

MATERIALS AND METHODS

The field experiment was carried out in the winter season (2021-2022) and (2022 - 2023) at the University of Tikrit - Faculty of Agriculture – Field Crops Department Research Station) to study the effect of spraying with glycine acid, lysine and iron element and the overlap between them in some of the growth qualities of Nigella sativa L. After determining the location of the experiment, soil samples were taken from it at a depth of (30 cm) before planting and were analyzed to detect its physical and chemical qualities in the central laboratory of the Department of Life Sciences/Faculty of Science/University of Baghdad and as shown in Table (1).

Table (1) Some physical and chemical characteristics of the experimental soil for the seasons before planting

C	Title	Value		Unit
		Season 2021	Season 2022	
1-	Degree of soil reaction (pH))	6.٩	7.0	/
2-	Electrical Conductivity (Ec)	47.53	50.3	Desi Siemens.E-1
5-	Organic Matter (O.M.)	6.1	6.87	%
6.	Gypsum	0.54	0.56	%
7-	Ready nitrogen (N)	45.21	44.3	ppm
8-	Ready phosphorus (P)	1.96	2.1	ppm
9.	Ready Potassium (K)	87	101	ppm
10.	Sulphates ($SO_4^{=}$)	1.49	1.59	%
11.	Calcium (Ca^{++})	0.20	0.22	%
12.	Sodium (Na^{+})	858	865	ppm
13.	Chloride (CI-)	0.19	0.20	%
14.	Sand	46.87	48.44	%
15-	Alluvium	29.21	31.56	%
16.	Clay	18.89	20.0	%
17.	Soil texture	Sandy loam		

The experimental land was ploughed with two orthogonal using the disc plough and then leveling and smoothing operations were carried out on it with the aim of creating a suitable seed shrine. The land was divided according to the field plan of the experiment, which included 54 experimental units distributed in three iterations by 18 experimental units per repeater and the area of the

experimental unit 2 × 2 m with an area of 4 m2. The soil of the field was fertilized by adding 60 kg. h-1 Nitrogen fertilizer in the form of urea (40% N), and45 kg.h-1 Phosphate fertilizer in the form of superphosphate triple P2O5 46%(Sultana et al,2019), as the phosphate fertilizer was added before planting to the soil in one batch and nitrogen fertilizer was added in two batches, as half of the amount was added when planting and the other half a month after planting .

The factors studied and their levels :

A-The first factor: Spraying with The first factor is 0, 50 and 100 mg each of glycine and lysine, and 100 + 100 mg of glycine and lysine.

B. The second Factor r is 0, 50 and 100 mg of iron .The seeds of the local nigella seed were planted in two years on 4/11/2021 and 2022 in lines, and the distance between one line and another was 40 cm and between one plant and another 20 cm. The number of plants in one line was 8 plants, so the number of plants in the experimental unit became 40 plants, as three seeds were placed in the pit and at a depth of 2-3 cm and then the experiment was narrated using a drip irrigation system. After the emergence of the seeds, the grafting process was carried out for the absent pits, after which the seedlings were reduced to the survival of one plant for each pit. Glycine and lysine, as well as iron, were sprayed when the plant reached the stage of 3-4 leaves. According to the concentrations used in the experiment, the 16-liter hand sprayer was used in the spraying process, which was sprayed early in the morning until the plants were completely wet, taking into account the separation of the plates with pieces of carton during the spraying to ensure that the spray did not volatilize between adjacent transactions. Plants must be thirsty for two or three days before spraying to increase the efficiency of the plants in absorbing the spray material (Al-Sahaf,1989). The comparison treatment was sprayed with distilled water only. Harvesting took place on 25/5/2022 for the first season, and on 23/5/2023 for the second season.

. The qualities studied:
1- plant height (cm)
2-number of branches (branch. Plant $^{-1}$)
3-Number of Capsules in the plant (Cap plant $^{-1}$)
4- The number of seeds in the box (seed Cap^{-1}).
5- Weight of 1000 seeds (g)
6. Total quotient (kg. h^{-1}).
Statistical analysis

After collecting and classifying the data, it was statistically determined as a factor experiment in designing the complete randomized sectors (R.C.BD) each season separately, then the significant differences between the averages were compared with a multi-term variant at the level of (0.05) .

RESULTS AND DISCUSSION

The results in Table 2 showed that there were significant differences in the studied transactions regarding the impact of the seasons. The results indicated that there were no significant differences between the two agricultural seasons. As for the treatment of amino acid combinations, the results showed that there are significant differences between the means of the trait, as the combination gave glycine 100 mg.L-1 + lysine 100 mg.L-1 the highest value of 41.94 cm plant-1, while the comparison treatment gave the lowest values among the transactions and amounted to 28.51 cm plant-1. The plant's superiority in plant height is attributed to its response to the concentration of

amino acids (gLycine and lysine), which contribute to the activation of vital processes and the process of division and cellular expansion, and stimulate the activity of enzymes that contribute to the decomposition of organic compounds, and the production of oxines is stimulated and the length of the plant is increased by nitrogen released from amino acids. Nitrogen contributes to the activation of the process of division and cellular expansion, and stimulates the activity of enzymes that contribute to the decomposition of organic compounds. Nitrogen also plays a key role in building proteins and energy processing, increasing the plant's ability to absorb water and nutrients, and forming the chlorophyll molecule. and stimulate the plant to produce plant hormones such as oxins and gibrilins, and this leads to an increase in the growth rate and activation of vital processes in the plant, including stimulating division and elongation of cells and the activity of enzymes responsible for the decomposition of organic compounds. In addition, it contributed to increasing the production of gibrilins and affecting the elasticity and elongation of the walls of plant cells. In addition , the nitrogen supplied to the plant in the form of amino acids, which is a necessary element in all biological pathways that occur in the plant to build the enzymatic and hormonal system and all cellular organisms, as well as its entry into the structure of chlorophyll Increasing the content of Table (12, 13and 14) in the plant, which leads to significant physiological activity in the plant as a result of the increase in the rates of carbonation and the accumulation of its products of materials necessary for growth and cell division, which causes significant vegetative growth and increase the height of the plant. As for the coefficients of spraying with iron, the results showed that there were significant differences between the averages of the trait, as the spraying with iron exceeded 100mg.L-1, which gave the highest values and amounted to 39.62 cm plant-1, compared to the comparison treatment that gave an average of 33.08. Plant poison -1.. The bilateral overlap between amino acid combinations and seasons achieved significant differences between the averages of the trait, as the treatment of calcine surpassed 100 mg L-1+ lysine 100 mg L-1 in the second season and gave the best value of 42.8 cm plant-1 compared to the comparison treatment in the first season, which gave an average of 26.71 cm plant-1. As for the overlap between the treatment of iron spraying and the seasons, I noticed that there were significant differences between the averages of the trait, as iron spraying was given 100mg.L-1 in the second season, the highest value was 40.81 cm plant-1, while the lowest average was 32.03 cm plant-1 for plants of the comparative treatment of iron in the first season. The results of the statistical analysis of the experiment data for bilateral interference, represented by the treatment of amino acids with iron spraying , showed that there were significant differences between the averages of the trait, as the combination of gLycine surpassed 100 mg.l-1+ lysine100 mg.l-1and iron spraying 100 mg.l-1, which gave the highest value of 45.81 cm plant-1,when compared with the comparison treatment, which gave the lowest average of 27.38 cm plant-1, and did not differ significantly with the overlap between the comparison treatment of acidosis with the concentration of mg.L-1 iron with an average of 28.42 cm plant-1. The results of Table 10 of the triple overlap between amino acid combinations, iron spraying and seasons indicate that there are significant differences between the means of the trait. The results indicated that the combination of glycine 100 mg.L-1 + lysine 100 mg.L-1 and iron spraying 100mg.L-1 in the second season, as the

Table (4) The effect of glycine, lysine, iron, seasons and their overlaps on the Plant height (plant cm -1 (

Amino Acids / Iron	Season 1			Season 2			Acid Averages	Acid and season overlap	
	0	50	100	0	50	100		Season 1	Season 2
0 mg l^{-1}	26 u	26.53 U	27.6 stu	32.1 n-r	36.4 i-m	38.33 d-k	28.51 d	26.71 g	35.61 de
Glycine 50 mg .$^{Liter-1}$	29.83 q-t	36.1 j-m	37.1 h-l	34.97 k-o	40.3 d-i	41.73 b-f	36.82 c	34.34 e	39 bc
Lysine 50 mg .$^{Liter-1}$	33.53 l-q	39.17 d-j	40.97 b-h	35.77 j-n	42.7 b-e	44.8 abc	35.83 c	37.89 c	41.09 ab
Glycine 100 mg .$^{Liter-1}$	28.77 r-u	30.3 Pqr	31.87 o-r	34.03 l-p	39.5 d-j	40.57 d-h	39.63 b	30.31 f	39.03c
Lysine 100 mg .$^{Liter-1}$	32.9 l-q	38.8 d-k	40.23 d-i	36.53 i-m	41.23 b-g	43.03 bcd	38.67 b	37.31 f	40.27 b
Glycine100mgl^{-1} +lysine100mgL^{-1}	35 k-o	41 b-h	42.33 b--f	37.47 g-l	44.1 abc	46.83 a	41.94 a	39.44 bc	42.8 a

Overlap of iron and acids	0	50	100	Overlap of iron and the seasons	Season 1	Season 2
0 mg l^{-1}	27.38 n	28.42 N	29.73 mn	0	32.03 e	34.12 d
Glycine 50 mg .$^{Liter-1}$	33.07 kl	37.95 f-i	39.45 d-g	50	36.87 c	39.16 b
Lysine 50 mg .$^{Liter-1}$	31.37 lm	37.45 ghi	38.67 e-h	100	38.42 b	40.81 a
Glycine 100 mg .$^{Liter-1}$	35.75 ij	40.77 cde	42.38 bc	Season averages	35.77 a	38.03 a
Lysine 100 mg .$^{Liter-1}$	34.27 jk	40.08 cef	41.65 bcd			
Glycine100mgl^{-1} +lysine100mgL^{-1}	36.62 hi	43.4 B	45.81 a			
Iron averages	33.08 c	38.01 b	39.62 a			

Similar letters within one column There are no significant differences at the 5% probability level according to the Duncan test

highest value was given and amounted to 46.83 cm plant-1, while the comparison treatment of acids and non-spraying with iron in the first season gave an average of 26 cm plant-1, which did not differ morally from the comparison treatment of acids and iron spraying 50mg.L-1 in the first season with an average of 26.53 cm plant-1 .

Number of branches of the plant (plant branch -1)

The results shown in Table (3) indicated that there is no significant difference between the seasons. The combination of lysine 100 mg.L-1 + lysine 100 mg.L-1 achieved the highest significant value in the average number of branches by 8.21 branches of the plant-1, compared to the rest of the coefficients, which gave the comparison treatment the lowest average of 5.94 branches of the plant-1. The reason for the superiority of the trait is that amino acids (glycine and lysine) play an important role in stimulating physiological and biochemical processes in plants. These two factors

are involved in building proteins and making carbohydrates, including building chlorophyll, improving plant growth and stimulating the process of carbonization and the production of growth-stimulating hormones such as cytokines. The effect of increasing amino acids on increasing the number of branches can be the result of increasing cell division and stimulating the production of lateral shoots. This can happen by increasing the absorption of nutrients and minerals water and proteins needed to increase growth. In addition, glycine and lysine play a role in providing free nitrogen to the plant, which encourages an increase in the rate of vegetative root growth of plants and an increase in various proteins, for its positive role in the process of protoplasmic construction of cells and stimulating the activity of shoots through its direct impact on the biosynthesis of plant growth regulators such as oxine. The increase in nitrogen leads to an increase in the level of oxen in the plant and thus works to reduce the peripheral apical supremacy by causing an imbalance in hormonal balance and then encouraging the lateral shoots to grow. The reason is also due to the importance of nitrogen in stimulating growth as a result of to increase the diverse proteins responsible for this and for its positive role in increasing the processes of protoplasmic construction of cells, which leads to an increase in the number of branches of the plant. Iron spraying significantly affected the average number of branches of the black seed plant with an average of 7.81 g plant branch -1 at a concentration of 100mg liters -1 compared to non-sprinkled plants, which gave the lowest average of 6.63 g plant branch -11.The reason for the increase in the trait may be attributed to the important role of iron in the process of building chlorophyll, which leads to an increase in processed foodstuffs, which in turn has contributed to an increase in the number of branches. In addition, the vital role of iron in activating the vital pathway for building chlorophyll, because it enters into the composition of enzymes that stimulate this vital pathway, which leads to raising the efficiency of the process of carbonic representation and increasing its outputs of substances necessary for growth, regulating hormonal content and enzymatic activity, which in turn leads to an increase in processed foodstuffs, which in turn has contributed to increasing plant growth and increasing the number of branches. This may be due to the role of iron in limiting the action of oxen that cause the supremacy of the apical tip of the plant, as iron is necessary for the enzymatic oxidation of oxidases (IAA oxidase), reducing the apical sovereignty and activating the side shoots on growth, and thus forming new branches. Table (3) shows that the bilateral overlap between the spraying of amino acids andiron had a positive effect on the means of the trait. The combination of glycine 100 mg.L-1 + lysine 100 mg L-1 with the treatment of iron spraying 100 mg.L-1 has the highest significant value compared to the rest of the transactions with an average of 9.00 plant branches -1, compared to the lowest averages recorded by the comparative treatment of amino acids with plants not sprayed with iron, which gave an average of 5.77 plant branches -1 and did not differ significantly from the overlap between the comparative coefficients of amino acids with iron at a concentration of 50 and 100mg.L-1, which gave each of an average of 5.90 and6.15 plant branches -1, respectively. With regard to the bilateral overlap between the treatment of amino acids and seasons, the overlap between the combination of glycine 100 mg.L-1 + lysine 100mg.L-1 in the second season exceeded all overlaps with an extended average 8.58 plant branches -1compared with the overlap between the comparative treatment of amino acids and the first season, which recorded the lowest value of 5.93 plant branches -1..

Table (3) The effect of glycine, lysine, iron, seasons and their overlaps on the number of branches of the plant (branch of a plant-1)
branches of the plant (branch of a plant^{-1})

Amino Acids	Season 1			Season 2			Acid Averages	Acid and season overlap	
	0	50	100	0	50	100		Season 1	Season 2
0 mg l^{-1}	5.8 no	5.97 mno	6.03 mno	6.8 h-m	7.1 f-k	7.43 e-j	5.94 e	5.93 f	7.11 d
Glycine 50 mg Liter^{-1}.	6.07 l-o	6.8 h-m	7.3 e-j	6.53 j-o	7.87 c-f	8.07 cde	7.26 c	6.72 e	7.49 bcd
Lysine 50 mg Liter^{-1}.	7.1 f-k	7.77 c-g	7.87 c-f	6.63 i-n	8.37 bcd	8.53 bc	6.94 d	7.58 bcd	7.84 bc
Glycine 100 mg Liter^{-1}.	5.73 o	5.83 no	6.27 k-o	6.93 g-l	7.47 e-i	7.83 c-g	7.72 b	5.94 f	7.41 cd
Lysine 100 mg Liter^{-1}.	6.6 i-o	7.27 e-j	7.63 d-h	7.1 f-k	8.1 cde	8.67 abc	7.71 b	7.17 ed	7.96 b
Glycine100mgl^{-1}	7.03 f-k	7.9 c-f	8.6 bc	7.27 e-j	9.00 ab	9.47 a	8.21 a	7.84 b	8.58 a

Overlap of iron and acids	0	50	100	Overlap of Iron and Seasons	Season 1	Season 2
0 mg l^{-1}	5.77 j	5.90 j	6.15 j	**0**	6.49 c	6.78 c
Glycine 50 mg Liter^{-1}.	6.87 ghi	7.28 e-h	7.63 def	**50**	7.31 b	7.59 b
Lysine 50 mg Liter^{-1}.	6.33 ij	7.03 gh	7.47 d-g	**100**	7.54 b	8.08 a
Glycine 100 mg Liter^{-1}.	6.82 hi	7.98 cd	8.37 bc	**Season averages**	7.11 a	7.48 a
Lysine 100 mg Liter^{-1}.	7.07 fgh	7.83 cde	8.23 bc			
Glycine100mgl^{-1} +lysine100mgL^{-1}	6.95 gh	8.68 ab	9.00 a			
Iron averages	6.63	7.45	7.81			

Similar letters within one column There are no significant differences at the 5% probability level according to the Duncan test.

The bilateral overlap between iron spraying and seasons recorded significant differences in the average of the trait, where the treatment of spraying with 100mg liters-1 in the second season recorded the highest moral value of the trait studied with an average of 8.08branches of the plant-1 compared to the lowest value of plants not sprayed in the first season, which averaged 6.49 branches of the plant -1

As for the coefficient of triple interference between the treatment of amino acids and iron spraying and seasons, it was given with the combination of glycine 100 mg.L-1 + lysine 100 mg.L-1 with the treatment of iron spraying 100mg.L-1 , in the second mousse the highest average number of branches of the nigella plant with an average of 9.47 branches of the nigella plant-1, while the triple interference between plants not sprayed with the treatment of amino acids in the first season gave an average of 5.8 branches of the nigella plant-1. Number of Capsules in the plant (can. Plant-1) :

The results shown in Table (4) showed that there were significant differences between the seasons, as the second season morally exceeded the first season by an average of 27.46 capsules Plant-1, compared to the first season which gave an average of 21.46 capsules plant-1. The combination (glycine 100 mg.L-1 + lysine 100 mg.L-1) had the highest significant value in the average trait of 28.37 Capsules. Plant-1, compared to the rest of the transactions, which gave the comparison transaction the lowest average of 21.86 Capsules. Plant-1, The reason for the increase in the number of Capsules in the plant may be attributed to the role of amino acids in increasing the activity of various physiological and biochemical activities in the plant as a result of their role in increasing the readiness of nutrients and the formation of chlorophyll, which leads to increasing the efficiency of carbon representation in the plant, as well as contributing to increasing respiration, which leads to the production of energy compounds (ATP), which benefit the plant during growth, in addition to stimulating the processes associated with building protein and stimulating the production of plant hormones such as oxines, Ghibellines and cytokines, because amino acids are a source of nitrogen, which is mainly involved in building cells and the composition of nucleic acids, which works to increase the rate of physiological traits and thus increase vegetative growth by increasing the height of the plant and the number of branches, and this is reflected positively in increasing the number of Capsules in the plant. Iron spraying significantly affected the average duration of the dry substance of the nigella plant with an average of 26.23 Capsules. Plant-1 at a concentration of 100mg.L-1compared to plants not sprinkled which gave the lowest average of 22.6 Capsules. Plant-1. The increase in the average of this trait may be due to the positive role of the iron element in improving the vegetative growth qualities such as the height of the plant and the number of branches, table (2 and 3) , and improving and increasing its content of chlorophyll and nutrients. This improves the efficiency of the leaves in intercepting solar energy and representing carbon dioxide gas, which leads to an increase in the rate of carbonization, which is reflected positively in the increase in the number of Capsules formed on the plant. The effect of the bilateral overlap between iron spraying and amino acids morally in the means of the trait, where the treatment of iron spraying (100 mg.L-1) with a combination of (glycine 100 mg.L-1 + lysine 100 mg.L-1) recorded the highest significant value compared to the rest of the transactions with an average of 33.53 Capsules . Plant-1compared with the lowest average recorded by plants not sprinkled with the comparative treatment of amino acids, which gave an average of 21.47 Capsules of plant-1. Regarding the bilateral overlap between the treatment of amino acids and seasons, the overlap between the combination (glycine 100 mg.L-1 + lysine 100mg.L-1) in the second season exceeded all overlaps by an average of 31.37 Capsules. Plant-1compared with the overlap between the comparative treatment of amino acids and the first season, which recorded the lowest value of 18.86 Capsules. Plant-1. The bilateral overlap between iron spraying and seasons recorded significant differences in the average of the trait, where the treatment of spraying with 100 mg liters-1 in the first season recorded the highest moral value of the trait studied with an average of 29.23 Capsules. plant-1 compared to the lowest value of a non-sprinkled plant agent in the first season, which averaged19.6 Capsules. Plant-1. As for the coefficient of triple interference between iron spraying and treatment of amino acids and seasons, the blinds gave iron spraying with the combination of glycine 100 mg.L-1 + lysine 100 mg.L-1 with the second mousse the highest average duration of dry matter production with an average of 36.53 Capsules. Plant-1, while the triple overlap between non-sprinkled plants with amino acid treatment in the first season gave an average low of18.47 Capsules Plant-1.

Table (4) The effect of glycine, lysine, iron and seasons and their overlaps in the number of Capsules in the plant(can . plant-1).

Amino Acids / Iron	Season 1			Season 2			Acid Averages	Acid and season overlap	
	0	50	100	0	50	100		Season 1	Season 2
0 mg l^{-1}	18.47 p	18.9 O	19.2 nop	19.63 nop	20.73 m-p	21.23 l-o	21.86 d	18.86 i	20.53 gh
Glycine 50 mg L^{-1}	19.37 nop	20.47 m-p	20.87 m-p	20.07 m-p	22.3 klm	24.17 ijk	23.53 c	20.23 h	22.18 f
Lysine 50 mg .L^{-1}	19.77 nop	21.57 lmn	23.4 jkl	20.3 m-p	25.27 f-j	30.53 b	23.23 c	21.58	25.37 de
Glycine 100 mg L^{-1}	24.47 h-k	24.9 g-i	25.2 f-j	25.63 f-j	26.73 e-h	27.23 d-g	25.18 b	24.86 e	26.53 cd
Lysine 100 mg L^{-1}	25.37 f-j	26.47 e-i	26.87 e-h	26.07 e-i	28.3 cde	30.17 bc	24.58 b	26.23 d	28.18 b
Glycine100mgL^{-1}+lysine100mgL^{-1}	25.77 f-j	27.57 def	29.4 bcd	26.3 e-i	31.27 b	36.53 a	28.37 a	27.5 bc	31.37 a

Overlap of iron and acids	0	50	100	Overlap of iron and the seasons	Season 1	Season 2
0 mg l^{-1}	21.47 j	21.9 Ij	22.2 hij	**0**	19.6 f	25.6 c
Glycine 50 mg L^{-1}	22.63 g-j	23.73 e-h	24.23 efg	**50**	21.54 e	27.54 b
Lysine 50 mg L^{-1}	22.37 hij	23.47 f-i	23.87 e-h	**100**	23.23 d	29.23 a
Glycine 100 mg .L^{-1}	23.07 f-j	25.3 De	27.17 bc	**Season averages**	21.46 b	27.46 a
Lysine 100 mg L^{-1}	22.77 g-j	24.57 ef	26.4 cd			
Glycine100mgL^{-1}+lysine100mgL^{-1}	23.3 f-i	28.27 B	33.53 a			
Iron averages	22.6 c	24.54 b	26.23 a			

Similar letters within one column There are no significant differences at the 5% probability level according to the Dunca

Number of seeds in the can (can seed -1))

Table (5) shows that there are significant differences with regard to amino acids. The combination of 100 mg.L-1 + lysine 100 mg.L-1, recorded the highest value of 57.99 can seeds -1 , while the lowest value at the comparison treatment was 33.87 can seeds -1. The reason for the increase in the number of seeds in the can is that spraying the amino acids glycine and lysine on the vegetative sum of the black seed plant improved and increased the vegetative growth of the plant represented in Table (2 and 3). In addition, glycine and lysine stimulate the formation of amino acids necessary in the construction of green plastics and the formation of chlorophyll in the leaves, which increases the efficiency of the carbonization process in the leaves and thus increases their outputs of carbohydrates, proteins and processed foodstuffs. These products, necessary elements and dry

materials are transferred from the places of manufacture in the leaves (source) to the places of storage in the reproductive parts of the formed Capsules and seeds, in addition to the role of amino acids in stimulating the physiological processes in the flowering stage, which increases the amount of pollen and reduces the proportion of growth inhibitors affecting the reduction of growth and division of cells in the plant, causing an increase in the number of seeds formed in the can. As for the effect of iron, the results showed that there are significant differences between the coefficients. The treatment exceeded 50 mg.L-1 from the rest of the coefficients by giving it the highest value of 51.25 canned seeds -1, which did not differ significantly from the treatment of 100 mg.L-1 (50.59 canned seeds -1), while the comparison treatment gave the lowest value of the trait of 45.98 canned seeds -1. The reason may be due to the role of iron in encouraging the formation of fruits as it is necessary in the growth of reproductive organs and also helps in activating the roots with their vital functions, and it is involved in building protein and helps the work of more than 1,40 enzymes in their natural state, most of which are oxidation and reduction reactions, which results in an increase in the rate of accumulation of dry matter during the various stages of growth. The reason for the increase may be attributed to the role of iron in increasing physiological growth measures and thus increasing the number of seeds, in addition to the vital role of iron in activating various physiological processes because it is necessary in the process of carbonization, protein formation and activation of the enzymatic system in the plant. This leads to an increase in the manufacture of materials necessary for growth in a way that pushes the plant to significant vegetative growth in a way that improves the number of seeds in the box. The increase in the number of Capsules may be due to the role of iron in improving growth indicators, which was positively reflected in the formation of a large number of ovaries in the flower and their transformation into whole seeds in the box.In the bilateral overlap between amino acid combinations and seasons, significant differences were found between the mean of the trait, as the combination (gLycine 100 mg.L-1 + lysine 100 mg.L-1) in the second season outperformed the rest of the coefficients and gave the highest value of 70.07 can seeds -1 When compared to the comparison treatment in the first season, which gave the lowest value of the trait 20.61 can seeds -1.The results of the bilateral overlap between iron spraying and seasons showed significant differences between the averages of the trait, as the treatment of iron spraying exceeded 100mg.L-1 in the second season and gave the highest average trait of 65.09 can seeds -1, while plants not sprayed with iron in the first season gave the lowest value of the trait of 38.22 can seeds -1. The results of the bilateral overlap between amino acid combinations and iron spraying indicate that there are significant differences between the means of the trait, as the combination (all lysine 100 mg.L-1 + lysine 100 mg.L-1) and iron spraying 50mg.L-1 outperformed the rest of the transactions, as it recorded the highest value of 61.57 can seeds -1, when compared to the treatment of not spraying with amino acids and iron, which recorded the lowest value of 30.3 can seeds -1. The results of the triple overlap of amino acid combinations, iron spraying and seasons also showed that there were significant differences between the means of the trait, as the combination (all Yassin 100 mg.L-1 + lysine 100 mg.L-1) with iron spraying (100mg.L-1) in the second season, and gave the highest values of 78.23 can seeds -1,when compared to the comparison treatment in the first season, which amounted to 18.47 can seeds -1, and did not differ morally from the comparison overlap of acids with a concentration of 50 mg.L-1 iron in the first season with an average of 18.9 can seeds -1.

Table (5) The effect of glycine, lysine, iron, seasons and their overlaps on the quality of the number of seeds in the box (seed box-1).

Amino Acids / Iron	Season 1			Season 2			Acid Averages	Acid and season overlap	
	0	50	100	0	50	100		Season 1	Season 2
0 mg l^{-1}	18.47 y	18.9 y	24.47 x	31.1 w	32.8 vw	36.8 tuv	33.87 e	20.61 g	33.57 F

Glycine 50 mg L^{-1}	42.73 p-s	45.3 opq	34.93 uvw	42.17 p-s	43.5 pqr	40.13 rst	46.42 d	40.99 e	41.93 E
Lysine 50 mg .L^{-1}	48.6 mno	52.23 kml	38.8 stu	46.23 nop	50.17 lmn	41.33 qrs	49.43 c	46.54 d	45.91 D
Glycine 100mg.L^{-1}	42.13 p-s	48.77 mno	50.47 lmn	54.47 jkl	60.4 f-i	62.97 efg	53.29 b	47.12 d	59.28 C
Lysine 100 mg.L^{-1}	52.6 klm	59.83 f-i	61.17 fgh	57.8 hij	66.27 cde	69.9 bc	54.64 b	57.87 c	64.66 B
Glycine100mgl^{-1}+lysine100mgL^{-1}	56.47 ijk	63.9 def	67.83 cd	59 ghi	72.97 bc	78.23 a	57.99 a	62.73 b	70.07 A

Overlap of iron and acids	**0**	**50**	**100**	**Overlap of iron and the seasons**	**Season 1**	**Season 2**
0 mg l^{-1}	30.3 j	33.83 i	37.47 h	**0**	38.22 e	53.74 c
Glycine 50 mg L^{-1}	42.78 g	46.6 f	49.88 de	**50**	40.48 d	62.02 b
Lysine 50 mg L^{-1}	47.67 ef	52.57 cd	48.05 ef	**100**	36.08 f	65.09 a
Glycine100mg L^{-1}	49.98 de	54.88 c	55.02 c	**Season averages**	38.26 b	60.29 a
Lysine100 mg L^{-1}	52.53 cd	58.07 b	53.32 c			
Glycine100mgl^{-1}+lysine100mgL^{-1}	52.62 cd	61.57 a	59.78 ab			
Iron averages	45.98 b	51.25 a	50.59 a			

Similar letters within one column There are no significant differences at the 5% probability level according to the Duncan test.

The results in Table (6) showed that there were significant effects between the study factors and their bilateral and triangular combinations in the averages of the adjective of the weight of 1000 seeds of the black seed plant. The results showed that there were significant differences between the seasons. The averages of the second season had a positive impact on the adjective with an average of 3.5 g, superior to the first season, which recorded an average of 2.8g. The results indicated that there are significant differences between the coefficients of amino acid addition (glycine and lysine),as the combination of (gLycine 10 0 mg.L-1 + lysine 100 mg.L-1) recorded the highest significant value in the average characteristic of 3.49 g, compared to the rest of the coefficients, which gave the comparison treatment the lowest average of 2.56g . The reason for the increase in the weight of seeds is due to the impact of amino acids (glycine and lysine) in balancing nutritional functions and their positive impact on the black seed plant, by stimulating the division and elongation of cells and plant tissues, which stimulates the ability of the plant to stabilize nitrogen, increasing the absorption of water and nutrients , and the reflection of this on the vegetative growth qualities represented by the plant's height and the number of branches Table(2 and 3) , which leads to stimulating and increasing the physiological, biological and metabolic processes of the plant, such as carbon

representation, respiration and building proteins, which causes an increase in dry materials, minerals and organic acids and their accumulation in seeds, in addition to the role of amino acids in transporting the products of carbonate and mineral elem and mineral elements from roots and matured leaves to Capsules and then seeds, which is reflected in the end result in an increase in the weight of 1000 seeds that are the estuaries in which the products of carbon representation are collected. The treatment of iron spraying (100mg L-1) had a clear impact on the average trait and gave a higher average of 3.35 mg day-1 compared to non-sprayed plants, which gave a lower

average of 2.86 g . The increase in the weight of seeds may be due to the important role played by the element iron in stimulating physiological processes and raising their efficiency, such as the process of carbonization and activating the enzymatic system that participates in the processes of oxidation, reduction and electron transfer proteins, in addition to increasing the effectiveness of the hormonal system and the absorption of elements necessary for growth , which causes an increase in the accumulation of carbonic products from amino acids, dissolved mineral elements, dissolved sugars and other organic substances and their transfer to seeds and increase their weight. This may be due to the role of the two elements in improving the qualities of the paper space and increasing its content of chlorophyll, and mineral elements, which caused an increase in the growth rate of the plant, which was reflected positively in raising the efficiency of carbonation and respiration process and increasing the activity of the plant in absorbing water and nutrients, which increases the fullness of seeds, increases their weight and decreases the percentage of atrophic seeds, which led to the concentration of nutrients in seeds and increases the weight of 1000 seeds. As for the coefficient of bilateral overlap between the treatment of amino acids and iron spraying, it gave a combination (glycine 100 mg.L-1 + lysine 100 mg.L-1) with the treatment of iron spraying (100mg L-1) the highest significant value compared to the rest of the transactions with an average of 3.75 g compared to the lowest average treatment record for plants not sprayed with the comparative treatment of amino acids, which gave a minimum average of 2.38 g .The bilateral overlap between the combination (Glycine 100 mg L-1 + Lysine 100 mg.L-1) in the second season exceeded all overlaps in the trait with an average of 3.84 g compared to the overlap between the comparative treatment of amino acids and the first season, which recorded the lowest average of 2.21 g.

Table (6) The effect of glycine, lysine, iron, seasons and their overlaps in the characteristic of weighing 1000 seeds for pond bark (g).

Acids / Iron	Season 1			Season 2			Acid Averages	Acid and season overlap	
	0	50	100	0	50	100		Season First	Season 2
0 mg l^{-1}	2.03 w	2.27 v	2.33 Uv	2.53 st	2.87 op	3.03 mn	2.56 e	2.21 i	2.81 G
Glycine 50 mg L^{-1}	2.43 tu	2.8 pq	2.87 po	2.67 qrs	3.07 lmn	3.2 jkl	3.16 c	2.7 h	2.98 F
Lysine 50 mg .L^{-1}	2.63 rs	3.07 lmn	3.17 klm	2.77 pqr	3.27 h-k	3.4 fgh	3.05 d	2.96 f	3.14 E
Glycine 100 mg L^{-1}	2.73 pqr	2.97 no	3.03 mn	3.23 ijk	3.57 e	3.73 d	3.33 b	2.91 f	3.51 C
Lysine 100 mg .L^{-1}	3.13 klm	3.5 ef	3.57 E	3.37 f-i	3.77 cd	3.9 bc	3.31 b	3.4 d	3.68 B
Glycine100mgl^{-1}+lysine100mgL^{-1}	3.33 g-j	3.77 cd	3.87 bcd	3.47 efg	3.97 b	4.1 a	3.49 a	3.66 b	3.84 A

Overlap of iron and acids	0	50	100	Overlap of iron and the seasons	Season 1	Season 2
0 mg l^{-1}	2.38 j	2.62 i	2.68 i	**0**	2.51 f	3.21 c
Glycine 50 mg .L^{-1}	2.88 g	3.22 e	3.38 d	**50**	2.89 e	3.59 b
Lysine 50 mg .L^{-1}	2.78 h	3.15 e	3.22 e	**100**	(3. d	3.75 a
Glycine 100 mg .L^{-1}	3.02 f	3.42 d	3.55 c	**Season averages**	2.8 b	3.5 a

Lysine 100 mg .L^{-1}	2.98 f	58.07 b	3.52 c
Glycine100mgl^{-1}+lysine100mgL^{-1}	3.12 e	3.62 b	3.75 a
Iron averages	2.86 c	3.24 b	3.35 a

Similar letters within one column There are no significant differences at the 5% probability level according to the Duncan test.

Total seed yield (kg ha^{-1}) :

The results in Table (7) indicated that there were significant differences between the two agricultural seasons, as the second agricultural season gave the highest average of 760.6 kg ha^{-1}**,** while the first agricultural season gave the lowest average of 708.3 kg ha^{-1}. As for the treatment of amino acid combinations, the results showed that there were significant differences between the averages of the trait, as the combination (Glycine 100 mg.L^{-1} + lysine 100 mg.L^{-1}) gave the highest value of 1043.17 kg ha $^{-1}$, while the comparison treatment gave the lowest values among the transactions and amounted to 430.08 kg ha^{-1}. The reason may be that the foliar spraying of amino acids facilitates the process of absorption and use of nutrients directly in the vegetative growth stage and branches, which helps to increase the concentration of chlorophyll and obtain the highest degree of carbonization, which leads to an increase in the amount of dry matter. Amino acids (Glycine and lysine) stimulate the effectiveness of a number of enzymes responsible for the manufacture of protein, carbohydrates and dry matter and improve energy sources. They are a source of nitrogen and carbon necessary in the formation of chlorophyll and increase the content of leaves from it, and the formation of plastic granules, which causes a delay in the aging of leaves, as well as their role in increasing the surface area of leaves and building a root group characterized by high efficiency in the absorption of water and necessary nutrients, which positively affects the physiological activities such as improving the efficiency of carbon representation and respiration and its reflection in increasing the physiological qualities. The increase in rainfall and the moderation of the atmosphere in terms of temperatures led to prolong the period of maturation, and decrease in the rate of respiration, all this led to increase the manufactured materials and reduce their consumption and transfer from sources to effluents, which leads to increase the seed yield. As for the coefficients of spraying with iron , the results showed that there are significant differences between the averages ofof the trait, as the spraying with iron exceeded (100mg.L-1), which gave the highest values and amounted to 912 kg ha-1.Compared to the comparison treatment, which recorded the lowest values of 513.6 kg ha-1 , and may explain the increase in the seed yield to the vital role of the element iron and the speed of its absorption by the plant and its activation of many physiological processes, including stimulating the vital path of chlorophyll synthesis and the enzymatic system, and the important role it plays in delaying the aging of the leaves by inhibiting the vital path of ethylene synthesis, or perhaps for its role in reducing the activity of the peroxidase enzyme (Peroxidase), which is responsible for the decomposition and breakdown of endow acetic acid (IAA), all of which increases the efficiency of the carbonation process and its associated metabolic processes and the manufacture of proteins and respiration, which leads the plant to the formation of a large vegetative growth that increases the formation of a number of branches and leaves and a large surface area of leaves, which increases the biological processes of the plant and thus increases the height of the number of branches and the number of Capsules and the number of seeds in the box and the weight of 1000 seeds (tables 2, 3, 4, 5 and 6), which reflects positively on the increase of the total yield of seeds of the seed of the seed of the seed of the seed of the seed of the movement. The bilateral overlap between amino acid combinations and seasons achieved significant differences between the averages of the trait, as the treatment of calcine surpassed 100 mg.L-1 + lysine 100 mg.L-1 in the second season and gave the best value of 1076.22 kg ha-1, compared to the comparison treatment in the first season, which gave an average of 417.58 kg ha-1. As for the overlap between the treatment of iron spraying and the seasons, I noticed that there were

significant differences between the means of the trait, as the treatment of iron spraying (100mg.L-1) in the second season gave the highest value and amounted to 949.0 kg ha-1 while the lowest average was 501.1 kg ha -1 for plants of the comparative treatment of iron in the first season. As for the results of the statistical analysis of the experiment data for bilateral interference represented by the treatment of amino acids with iron spraying, the results showed that there were significant differences between the averages of the trait, as the combination (Glycine 100 mg.L-1 + lysine100 mg l-1) and iron spraying (100mg.L-1), which gave the highest value of 1394.0 kg ha-1 when compared to the comparison treatment, which gave an average value of 406.1 kg ha-1, and did not differ morally from the comparative treatment of amino acids with the treatment of iron spraying by 50 mg liters-1 with an average of 406.6 kg ha-1. The results of Table (7) of the triple overlap between amino acid combinations, iron spraying and seasons indicate that there are significant differences between the means of the trait. The results indicated the superiority of the combination (Glycine 100 mg.L-1 + Lysine 100 mg.L-1) and iron spraying (100mg.L-1) in the second season, as the highest value was given and amounted to 1438.23 kg ha-1 , while the comparison treatment of acids and non-spraying with iron in the first season gave an average of 394.1 kg ha-1, and it did not differ significantly from the comparison treatment of amino acids with iron at a concentration of 50 mg.L-1 in the first season with an average of 403.6 kg ha-1.

Table (7) The effect of glycine, lysine, iron and seasons and their overlaps in the total seed yield (kg ha^{-1}).

Acids / Iron	**Season 1**			**Season 2**			**Acid Averages**	**Acid and season overlap**	
	0	**50**	**100**	**0**	**50**	**100**		**Season 1**	**Season 2**
0 mg l^{-1}	394.1 y	403.6 y	455 wxy	503.4 t-w	648.97 op	740.9 mn	430.08 f	417.58 i	632.35 G
Glycine 50 mg L^{-1}	476.8 vwx	599.8 pq	699.3 no	543.1 q-u	904.7 hi	1022 ef	661.02 d	592.01 h	823.44 D
Lysine 50 mg L^{-1}	526.6 r-v	817.87 kl	982.13 fg	562.5 q-t	1117.9 d	1349.9 b	617.84 e	775.53 e	1010.1 B
Glycine 100 mg L^{-1}	419.1 xy	428.6 xy	480 u-y	528.47 r-u	707.3 no	836.9 jk	850.67 b	442.58 i	690.91 F
Lysine 100 mg L^{-1}	501.8 t-w	658.2 op	770.97 lm	568.1 qrs	958.03 gh	1107. d	804.14 c	643.68 g	877.89 C
Glycine100mgl^{-1}+lysine100mgL^{-1}	551.6 s	886.2 ij	1060.47 ef	587.5 qr	1202.93 c	1438.23 a	1043.1 a	832.76 d	1076.2 A

Overlap of iron and acids	**0**	**50**	**100**	**Overlap of iron and the seasons**	**Season 1**	**Season 2**
0 mg l^{-1}	406.1o	416.6 o	467.5 n	**0**	501.1 f	806.8 c
Glycine 50 mg L^{-1}	515.9 lm	678.13 i	788.97 g	**50**	526.11 e	874.9b
Lysine 50 mg L^{-1}	489.3 mn	629.0 j	735.1 h	**100**	748.8 d	949.0 a
Glycine100 mg L^{-1}	555.6 kl	931.3 e	1065 c	**Season averages**	708.3 b	760.6 A

Lysine 100 mg L^{-1}	539.1 kl	852 f	1021 d	
Glycine100mgl^{-1}+lysine100mgL^{-1}	575 k	1160 b	1394.0 a	
Iron averages	513.6 c	777.8 b	912 a	

Similar letters within one column There are no significant differences at the 5% probability level according to the Duncan test.

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