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Production indicators and secondary metabolites of dill varieties at arginine spray concentrations and stages

Thamer Hussein Ibrahim[1] Akeel Nagime Abood[2] Imad Khalaf Khader[3]

[٣-١]Field Crops Department, College of Agriculture, Tikrit University, Tikrit, Iraq.

[1] *Corresponding author: E-mail*: thameralkisyppp@gmail.com

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ABSTRACT
A field experiment was carried out during winter seasons 2021-2022 and 2022-2023 on 5/11/2020 in Experimental field belonging to the Department of Field Crops at College of Agriculture at Tikrit University. It included three concentrations of arginine (0, 50, and 100) mg. liter and two spraying stages, branching and flowering, and six varieties of dill (Lot, Shynshal, Super Dukak, Backsha, Gribivisky, and Viola- Balady). Experiment was applied according to a Randomized Complete Block Design and in a split-plot arrangement twice. Results showed following
Super Dukak variety excelled in traits of number of inflorescences per plant (24,389 inflorescences per plant) and number of seeds per plant (744.43 seeds). Plant-1 and seed yield (483.07) kg ha^{-1}. Concentration exceeds 100 mg. Liters: Number of inflorescences per plant is (25,833) inflorescences per plant and number of seeds per plant is (716.3) seeds. Plant and seed yield (445.73) kg ha^{-1} (carvone 61.93) ppm and lemonene (20.16) ppm. Spraying stage during the flowering period was superior in number of inflorescences per plant ((23,389 inflorescences per plant) and seed yield (404.83) kg ha-1. The spraying stage during the branching period was superior in increasing compounds of carvone (60,774) ppm and lemonene (19,438) ppm

المؤشرات الإنتاجية ومركبي الايض الثانوي لأصناف من الشبنت عند تراكيز رش الارجنين ومراحله

ثامر حسين إبراهيم * عقيل نجم عبودالمحمدي عماد خلف خضر القيسي

قسم المحاصيل الحقلية، كلية الزراعة، جامعة تكريت

الخلاصة

نفذت تجربة حقلية خلال الموسمين الشتويين ٢٠٢١- 2022 و٢٠٢٢- 2023 في 2020/11/5 في حقل التجارب العائد لقسم المحاصيل الحقلية في كلية الزراعة في جامعة تكريت، وتضمنت ثلاثة تراكيز من الارجنيين وهي (٠ و٥٠و١٠٠) ملغم. لتر ومرحلتي الرش التفرعات و التزهير وستة أصناف من الشبنت وهي (Lot و Shynshalو Super Dukak و Backsha و Gribivisky وViola- Balady), وطبقت التجربة وفق تصميم القطاعات العشوائية الكاملة وبترتيب الالواح المنشقة مرتين اظهرت النتائج مايلي: تفوق الصنف Super Dukak في صفات عدد النورات في النبات (24.389) نورة نبات$^{-1}$ وعدد البذور في النبات (٧٤٤.٤٣) بذرة. نبات$^{-1}$ وحاصل البذور (٤٨٣.٠٧) كغم هـ$^{-1}$. تفوق التركيز ١٠٠ملغم. لتر في عدد النورات في النبات (25.833) نورة نبات$^{-1}$ وعدد البذور في النبات (٧١٦.٣) بذرة. نبات وحاصل البذور (445.73) كغم هـ$^{-1}$ (ppm(٦١.٩٣carvone و ppm(٢٠.١٦)Limonene . تفوقت مرحلة الرش في فترة التزهير في عدد النورات في النبات (23.389) نورة نبات$^{-1}$ وحاصل البذور (٤٠٤.٨٣) كغم هـ$^{-1}$ تفوقت مرحلة الرش في فترة التفرعات في زيادة مركب carvone (٦٠.٧٧٤) ppm و Limonene(١٩.٤٣٨) ppm

كلمات مفتاحية: الشبنت، الارجنين، مرحلة الرش، الاصناف

INTRODUCTION

At present time, interest in medicinal herbs and plants is increasing in most countries of the world, to point that their circulation has become a great influence in them, and that they are truly a call to nature and to nature that God Almighty created and subjected to mankind. closest thing to which man can be comforted and resorted to for treatment is plants before anything else, and since beginning of creation man has dealt with them. With the species and types of plants around him to take the good and useful from them and exclude harmful and destructive for sake of continuing a happy life and physical and psychological well-being (Al-Khatib, 2018).

. Dill dill, whose scientific name is Anethum graveolens L., is one of important medicinal plants and belongs to Apiaceae family, which consists of 3750 species under 300 genera. It is native to Egypt, Iran and Turkey and is found in the eastern and western Mediterranean (Boras et al., 2006). The active parts of it are fresh and dried leaves. Seeds and roots are consumed fresh or cooked and used as a spice and in manufacture of foodstuffs and cosmetics. Plant has a high nutritional value and is rich in vitamins. Its fruits contain essential oils, including Carvon by 30-60% and Limonene by 33% and 20.61% (Stavri and Gibbons, 2005). It is used as a treatment for blood pressure, improves the functioning of heart and lungs, calmsnerves, stimulates appetite, treats indigestion, is an anti-convulsant, anti-vomiting in children, and a diuretic in mothers. Kaur and Arora, (2010)

.Said-ALAhi, Omer (2016) noticed, when they studied eight varieties of dill, that there were significant differences between the varieties of study, as Common variety had the highest average of active compound limonine, reaching 42.70 ppm

Muhammad and Al-Zarfi (2016) showed in their study on the Datura stramonium L plant that spraying amino acids, including arginine, at a concentration of 4 cm3 liter-1 had a significant effect on number of seeds in fruit, as it produced the highest averages of 118.97 fruits, compared to lowest averages in comparison plants. 118.38

Al-Kubaisi (2021) confirmed in his study on fenugreek plant, Trigonella foenum-graecum L., that spraying arginine at four concentrations (0, 100, 200, and 300) mg. liter in three batches during vegetative growth and flowering stage and beginning of pod formation led to a significant increase in yield characteristics, as concentration exceeded 300 mg liter in traits of number of seeds per pod and total seed yield with highest averages, which amounted to 16,730 seeds. Qarna and 1080.7 kg. E-1) compared to the control treatment, which gave lowest averages of (15.38 pod seeds and 906.00 kg. ha), respectively. Al-Hadithi (2022) indicated in his experiment on fenugreek plant, Trigonella foenum-graecum L., by spraying it with the amino acid arginine, that there were significant differences, as te combination of 50 mg arginine + 50 mg glutamic gave the highest rate of total seed yield trait, amounting to 2257.25 kg ha-1, and compared with the control treatment that It gave the lowest average of 595.34 kg ha^{-1}.Al-Samarrai (2023) pointed out in a study in which genotypes of the sweet bean (Foeniculum vulgare Mill) were used) that there were significant differences between the genotypes in yield characteristics, as the C4 genotype had the highest average in its class, the number of inflorescences, which amounted to 56,729 inflorescences per plant, and the total fruit yield, which amounted to 1,324.42. kg ha-1, compared to the genotype (C1), which gave the lowest values, amounting to 51.376 plant inflorescences-1 and 1200.38 kg ha-1, respectively. This study aimed to know the production indicators and secondary metabolic components of several dill varieties under the influence of arginine and its stages

MATERIALS AND METHODS

A field experiment was conducted in winter seasons 2021-2022 and 2022-2023 on 11/5/2020 in field experiments field belonging to department of Field Crops - College of Agriculture - Tikrit University. land was divided according to experiment plan and included 108 experimental units distributed in three replicates of 36 units. Experimental for one replicate), Experimental land was plowed in two perpendicular plows using a disc plow, then leveling and smoothing operations were carried out on it in order to create a suitable bed for seeds, and plants were harvested on 6/18 After determining location of experiment, soil samples were taken from it at a depth of (0-30) cm before planting and were analyzed to reveal physical and chemical characteristics as shown in Table No. (1)

Table No. (1) Some physical and chemical traits of experimental soil before plantin

Traits	Unit	Measuring Unit
soil reaction degree (PH)	٧.٦	/
Electrical conductivity (EC)	٢.٤	$DS.m^{-1}$
Organic Matter (OM)	١.٢١	$g.kg^{-1}$ soil
(N) available nitrogen	24.33	$Mg.kg^{-1}$soil
Phosphorous (P) available	8.4	
Potassium (K) available	82.38	
Soil texture	Sandy loam	

fertilized field soil by adding 90 kg.ha Nitrogen fertilizer in form of urea 46% and 80 kg. E-1 Phosphate fertilizer in form of triple superphosphate P2O5 (Al-Samarrai, 2001). Phosphate fertilizer was added sprinkled before planting to soil in one batch, and nitrogen fertilizer was added in two batches. Half of quantity was added at planting and other half a month after planting. Seeds of six varieties of dill were planted. In two years dated (November 5 for the years 2021 and 2202) in lines, distance between one line and another was (50) cm and between one plant and another (50) cm, and

number of plants in one line was 6 plants, thus number of plants in experimental unit became 18 plants. Three seeds were placed in seedling at a depth of 2-3 cm, then experiment was irrigated using a drip irrigation system. After t emergence of seedlings, process of patching absent seedlings was carried out, after which seedlings were thinned out to leave one plant for each seedling. Arginine acid was sprayed at elongation stage (plant height) of 15 cm. It was also sprayed at flowering stage according to concentrations used in experiment. A 16-liter hand sprayer was used to carry out spraying process, which was sprayed in early morning until plants were completely wet. Experimental units were watered. Well one or two days before spraying to increase efficiency of plants in absorbing spray material (Al-Sahhaf, 1989). The comparison treatment was sprayed with distilled water only. Experiment was applied in field according to a Randomized Complete Block Design (R.C.B.D), a split-plot system twice, as arginine spraying concentrations were distributed in main plots to control spraying process, and types and spraying stages were distributed in secondary plots, where levels of factors studied were as follows: First factor: - Different concentrations of arginine (100.50.0) mg. $Liter^{-1}$ second work: - spraying stage (arginine). third factor: - Varieties The following traits were studied: number of inflorescences, number of seeds, seed yield, and carvone and limonene compounds

RESULTS AND DISCUSSION

1. Number of inflorescences per plant (inflorescence. plant-1)

Results of table (2) indicate that there are significant differences between two growing seasons, as second season was significantly superior with an average of 23,863 (inflorescences - 1 plant) compared to first season, which gave lowest average of (21,130) inflorescences. Plant-1, as for arginine concentrations, it outperformed concentration by giving it highest average of (25.833) inflorescences. Plant-1 compared to control treatment, which gave the lowest average of (19,852) inflorescences. Plant-1: As for two spraying stages, there are significant differences, as the spraying stage outperformed flowering by giving highest average of (23.389) inflorescences. Plant-1, while branching spraying stage had lowest average of 21.603 (inflorescences. Plant-1). This is due to role of arginine in increasing the process of photosynthesis, and this is reflected in flower stalks and number of inflorescences

As for effect of varieties, results indicate that there are significant differences between trait averages, as the variety V3 excelled, which gave highest values, reaching (24.389) inflorescences. Plant-1, while it did not differ significantly from the rest of the varieties V2, V4, V5, and V6, which gave values that reached (23.15, 23.85, and 22.18). and 22.46 inflorescences, plant-1, respectively, while the variety (V1) obtained lowest values, amounting to (18,933) inflorescences, $plant^{-1}$ Four-way interaction between the second season, concentration C2, the spraying stage S1, and V6 variety obtained the highest average, amounting to 33.26, while two-way interaction occurred between seasons and spraying stages, where second season and spraying stage, S2, obtained the lowest average, amounting to 24.64

Table (2) Effect of spraying with arginine, its two stages, and varieties and their interactions on number of inflorescences on plant (inflorescence. Plant-1) for two seasons of experiment

S × V		Y2		Y1		Y × S× V	C3		C2		C1		C ×S× V
S2	S1	S2	S1	S2	S1		S2	S1	S2	S1	S2	S1	
22.42 a-d	18.39 e	21.96 a-f	21.8 b-f	20.66 c-g	16.76 g	V1	18.46 ijk	18.66 h-k	22.5 c-k	20 g-k	19.73 g-k	17.15 k	V1
23.03 abc	23.16 abc	21.73 b-f	18.23 fg	19.4 efg	20.13 d-g	V2	19.6 g-k	19.48 g-k	22.53 c-k	21.8 d-k	20.73 f-k	17.56 jk	V2
21.35 b-e	21.24 cde	22.36 a-f	22.23 a-f	23.93 a-e	24.33 a-e	V3	21 e-k	20.18 g-k	22.61 c-k	22.38 c-k	21.91 d-k	18.45 ijk	V3
23.88 abc	19.47 ed	24.11 a-e	24.53 a-d	24.17 a-e	20.02 d-g	V4	22.35 c-k	23.38 b-k	23.65 b-j	23.5 b-j	22.7 b-k	19.51 g-k	V4
24.67 ab	25.61 a	26.04 ab	20.71 c-g	23.31 a-e	22.35 a-f	V5	24.6 b-i	24.88 b-h	24 b-i	27.11 a-e	25.61 b-g	19.58 g-k	V5
23.57 abc	23.11 abc	24.77 a-d	24 a-e	25.42 abc	26.88 a	V6	28.76 ab	26.48 a-f	27.85 a-d	31.53 a	28.23 abc	21.33 e-k	V6
23.38 a				21.60 b		Average S	25.83 a		21.80 b		19.85 b		Average C
Y2	Y1	Y x S	C3	C2	C1	Y × C	C3		C2		C1		C × S
22.13 b	20.12 c	S1	25.08 ab	20.47 cd	17.83 d	Y1	21.09 cd		20.28 cd		19.41 d		S1
24.64 a	23.08 ab	S2	26.58 a	23.13 bc	21.87 c	Y2	27.36 a		24.30 b		22.51 bc		S2
Y2	Y1	Average Y		Y2			Y1						Y ×C × S
				C3	C2	C1	C3		C2		C1		
				26.23 ab	23.93 bc	21.76 cd	19.18 def		18.41 ef		17.25 f		S1
23.86 a	21.13 b			28.5 a	24.66 bc	23.26 bc	23 bc		22.15 cd		21.58 cde		S2
Average V	C× V			Y × V		Y2			Y1				Y ×C× V
	C3	C2	C1	Y2	Y1	C3	C2	C1	C3	C2	C1		
18.93 b	20.9 ef	20.23 ef	17.35 f	21.2 bc	17.5 d	15.9 lm	17.75 klm	21 d-l	19.3 h-m	18.2 i-m	14.85 m		V1
23.15 a	19.03 ef	19.07 ef	22.51 cde	22.95 abc	23.06 abc	20.65 e-m	21 d-l	22.1 b-k	21.65 c-l	19.55 g-m	17.9 j-m		V2
24.38 a	22.94 b-e	22.30 cde	18.98 ef	20.88 bc	21.18 bc	26.1 a-e	24.8 a-h	25.75 a-g	28.25 ab	25.85 a-f	19.75 f-m		V3
23.85 a	21.67 de	21.78 de	23.13 b-e	25.11 a	20.36 cd	22.16 b-k	20.4 d-m	24.03 c-j	22.5 c-k	22.26 b-k	19.86 e-m		V4
22.18 a	29.32 a	26.92 ab	20.45 ef	24.76 a	25.71 a	22.7 b-k	22.56 b-k	24.16 b-i	24.23 b-i	25.06 a-h	20.06 e-m		V5
22.46 a	26.68 ab	25.68 a-d	25.92 abc	24.04 ab	23.17 abc	27.26 abc	26.56 a-d	26.1 a-e	30.4 a	28 ab	21.16 c-l		V6
Y2						Y1							Y × C × S× V
C3		C2		C1		C3		C2		C1			
S2	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	S1		
17 i-l	17.9 h-l	21 c-l	20.6 d-l	18.8 g-l	15.2 jkl	14.8 kl	17.6 h-l	21 c-l	18 h-l	17.6 h-l	14.5 l		V1
21.9 b-l	23.9 b-k	23.1 b-l	22.6 b-l	20.2 e-l	18.9 f-l	19.4 e-l	18.1 h-l	21.1 c-l	20.7 c-l	18.9 f-l	16.9 i-l		V2
28.2 a-e	24.9 a-i	27.7 a-g	29.8 abc	26.2 a-h	20.6 e-l	24 b-j	24.7 a-i	23.8 b-k	26.7 a-h	25.5 a-i	18.9 f-l		V3
22.2 b-l	21.06 c-l	24.06 b-j	23 b-l	22.66 b-l	19.93 e-l	22.13 b-l	19.73 e-l	24 b-j	22 b-l	21.86 b-l	19.8 e-l		V4
22.8 b-l	22.86 b-l	24.2 b-j	24.4 b-i	25.2 a-i	20.13 e-l	22.6 b-l	22.26 b-l	24.13 b-j	24.06 c-j	24.93 a-i	20 e-l		V5
29.33 a-d	28.06 a-e	28 a-f	33.26 a	30.26 ab	22.06 b-l	25.2 a-i	25.06 a-i	24.2 b-j	27.53 a-g	25.73 a-i	20.26 d-l		V6

There were no significant differences at the 5% probability level V varieties S Spraying stages C arginine concentrations Y seasons

2. Number of seeds in main inflorescence

We review from results of table No. (3) the presence of significant differences between two planting seasons, as second season was significantly superior with an average of 627.91 seeds. Plant-1 compared to first season, which gave lowest average of 542.3 seeds. Plant-1 due to the superiority of the second season in environmental conditions such as ideal temperatures, amounts of rain, and more hours of sunshine. As for concentrations of arginine, concentration (C3) was superior, giving it the highest average of 716.3 seeds. Plant-1 compared to the control treatment (C1), which gave lowest average of 469.5 seeds. Plant-1 reason for increase in number of seeds in inflorescence is that spraying arginine on dill plant led to an increase in efficiency of carbon assimilation process in leaves and thus increased its outputs of carbohydrates, proteins, processed foodstuffs and transportation. These products range from their places of production in leaves (source) to their places of storage in reproductive parts of inflorescences and formed seeds. As for spraying stages, there were no significant differences between spraying stages

As for effect of varieties, results showed that there were significant differences between averages of trait, as variety (V3) had highest values, reaching 744.58 seeds. Plant-1, while variety (V1) obtained lowest values, amounting to 445.68 seeds. Plant-1. The reason is due to efficiency of this. L variety converts products of photosynthesis into useful nutrients and transfers them from leaves to the seeds formed in inflorescence, thus leading to an increase in the number of seeds in inflorescence. The four-way interaction between second season, concentration C2, the spraying stage S1, and variety V6 gave highest average, amounting to 961.7, while two-way interaction occurred between seasons and spraying stages, where second season and spraying stage, S2, obtained lowest average, amounting to 659.55

Table (3) effect of spraying with arginine, its stages, varieties, and their interactions on average number of seeds in main inflorescence for two seasons of experiment.

S × V		Y2		Y1		Y × S× V	C3		C2		C1		C ×S× V
S2	S1	S2	S1	S2	S1		S2	S1	S2	S1	S2	S1	
585.31 bcd	420.98 e	577.7 cd	613.54 bcd	601.35 bcd	308.81 f	V1	410.6 gh	440.3 fgh	432.5 fgh	612.5 b-h	425.1 fgh	363.3 h	V1
556.25 cde	711.7 ab	620.86 bcd	361.04 ef	525.6 cde	458.59 def	V2	482.6 d-h	458.9 fgh	477.9 e-h	647.3 a-g	472.5 e-h	410.4 gh	V2
518 cde	539.36 cde	603.99 bcd	535.35 cde	611.58 bcd	689.23 abc	V3	507.9 d-h	489.6 d-h	551.2 c-h	692.2 a-f	583.7 b-h	414.2 gh	V3
614.77 bcd	470.37 de	534.81 cde	809.85 ab	569.26 cd	533.16 cde	V4	587.8 b-h	593 b-h	589.5 b-h	787.2 abc	594.2 b-h	443.6 fgh	V4
604.59 bcd	777.46 a	608.67 bcd	579.69 cd	510.4 cde	620.12 bcd	V5	635.5 b-g	688.1 a-f	685 a-f	830.4 ab	747.1 a-d	485.4 d-h	V5
603.37 bcd	619.13 bc	602.76 bcd	702.9 abc	597.59 cd	865.69 a	V6	739.7 a-e	805.5 abc	746.4 a-d	897.9 a	777.6 abc	557.1 c-h	V6
614.95 a				555.27 a		Average S	716.30 a		569.52 b		469.50 c		Average C
Y2	Y1	Y x S	C3	C2	C1	Y × C	C3		C2		C1		C × S
570.34 ab	514.27 b	S1	684.17 ab	538.38 c	404.36 d	Y1	539.82 cd		491.60cd		447.41 d		S1
659.55 a	596.27 ab	S2	748.43 a	600.65 bc	534.64 c	Y2	754.03 a		678.57 ab		599.21 bc		S2

Y2	Y1	Average Y	Y2			Y1			Y ×C × S
			C3	C2	C1	C3	C2	C1	
			713.58 ab	654.75 abc	572.55 bcd	504.21 cde	424.89 de	383.84 e	S1
627.91 a	b٥٤٢.٣٠		794.47 a	702.39 ab	625.86 abc	575.43 bcd	558.31 bcd	510.97 cde	S2

Average V	C× V			Y × V		Y2			Y1			Y ×C× V
	C3	C2	C1	Y2	Y1	C3	C2	C1	C3	C2	C1	
445.68 c	629.87 b-f	448.83 gh	386.85 h	611.11 bc	334.92 d	448 e-j	374.4 hij	451.4 e-j	499.7 d-j	376.4 hij	276.2 j	V1
600.04 b	446.62 gh	449.63 gh	455.23 fgh	594.64 bc	651.39 b	572.3 b-i	445.9 f-j	615.8 b-h	645 b-g	625.8 b-h	325.4 ij	V2
744.58 a	739.7 abc	588.97 b-g	428.92 gh	564.8 bc	496.97 c	674 a-f	670.6 a-g	716.7 a-e	809.5 abc	831.1 ab	403.2 g-j	V3
580.42 b	547.86 d-h	541.31 d-h	570.34 c-g	588.97 bc	556.43 bc	445.2 f-j	524.8 d-j	459.1 e-j	760 a-d	521.2 d-j	497.5 d-j	V4
579.24 b	864.15 a	762.31 ab	521.26 e-h	566.2 bc	837.77 a	523.4 d-j	636.7 b-h	524.8 d-j	834.4 ab	552.1 c-i	532.5 d-j	V5
560.69 b	687.59 b-e	746.79 ab	715.7 a-d	556.58 bc	661.51 b	701.2 a-f	823 ab	714.7 a-f	918.9 a	693.6 a-f	639.4 b-h	V6

Y2						Y1						Y × C × S× V
C3		C2		C1		C3		C2		C1		
S2	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	S1	
466 d-o	386.8 i-o	464.8 d-o	526.6 b-o	402.7 g-o	302.5 no	430.1 f-o	362.1 k-o	437.9 e-o	472.8 d-o	350.2 l-o	250 o	V1
648.4 a-n	458.2 d-o	649.5 a-n	707 a-l	627.4 a-o	344.8 l-o	496.3 b-o	433.5 f-o	582.2 a-o	583 a-o	624.3 a-o	306 mno	V2
697.7 a-m	761.1 a-j	720.4 a-l	834.1 a-d	832.5 a-d	435.8 f-o	650.4 a-n	580.1 a-o	713 a-l	784.8 a-g	829.6 a-e	370.5 j-o	V3
499.3 b-o	531 b-o	491 b-o	767.9 a-i	542.4 b-o	518.2 b-o	391.1 h-o	518.6 b-o	427.2 f-o	752.2 a-k	500.1 b-o	476.7 c-o	V4
527.2 b-o	727.8 a-l	529.4 b-o	867.4 abc	561 b-o	542.4 b-o	519.5 b-o	545.7 b-o	520.3 b-o	801.4 a-f	543.2 b-o	522.5 b-o	V5
781.7 a-h	849.9 a-d	772.4 a-i	961.7 a	722.6 a-l	678.5 a-n	620.6 a-o	796.1 a-f	657 a-n	876 ab	664.5 a-n	600.3 a-o	V6

There were no significant differences at the 5% probability level V varieties S Spraying stages C arginine concentrations Y seasons

3. Seed yield (kg. ha-1)

results of table (4) indicate that there are no significant differences between averages of trait during two growing seasons. As for arginine concentrations, concentration (C3) outperformed, giving it highest average of 445.73 kg.e-1 compared to comparison treatment (C1), which gave lowest average of 323.38 kg.ha.The reason may be attributed to role of amino acid arginine in stimulating effectiveness of a number of enzymes responsible for manufacturing protein and carbohydrates and improving energy sources, which causes an increase in amount of manufactured materials and their transfer to their final destination in plant, which is number of inflorescences and number of seeds in inflorescence, thus increasing total yield For seeds.

As for spraying stages, it was found that there were significant differences between spraying stages, as the spraying stage (S2) excelled by giving it the highest average of 404.83 kg. ha while spraying stage (S1) obtained lowest value, amounting to 359.8 kg. E-1 Spraying arginine during the flowering period leads to an increase innumber, size and weight of flowers, which leads to an increase in crop productivity

As for effect of varieties, results showed that there were significant differences between averages of trait, as variety (V3) excelled, which gave highest values and amounted to 483.07 kg. ha-1, while variety (V1) obtained lowest values and amounted to 295.01 kg.ha. The reason for superiority may be due to Some of varieties with this characteristic led to variation in ability and efficiency of genetic varieties in benefiting from products of photosynthesis, which was reflected in l variation in most of their traits, including trait of grain yield

. The four-way interaction between second season, concentration C2, spraying stage S1, and variety V3 achieved highest average, amounting to 683.3, while two-way interaction occurred between seasons and spraying stages, where second season and spraying stage S2 obtained lowest average, amounting to 466.01

Table (4): effect of spraying with arginine, its stages, varieties, and their interactions on average Seed yield (kg.ha-1) for two seasons of experiment

V × S		Y2		Y1		V× S × Y	C3		C2		C1		V× S ×C
S2	S1	S2	S1	S2	S1		S2	S1	S2	S1	S2	S1	
332.05 cde	282 e	313.89 d-h	394.78 a-g	246.11 gh	287.22 e-h	V1	309.15 d-g	336.38 c-g	278.63 d-g	383.83 b-g	271.81 efg	237.12 g	V1
348.55 cde	455.2 ab	285.56 e-h	301.67 d-h	202.22 h	316.67 d-h	V2	334.52 d-g	385.28 c-g	350.4 c-g	421.28 b-g	316.92 d-g	255.23 fg	V2
343.57 cde	397.4 bcd	254.11 gh	324.44 c-h	421.67 a-f	474.44 abc	V3	356.2 c-g	411.5 c-g	364.27 c-g	448.71 b-f	338.09 c-g	292.17 d-g	V3
360.72 b-e	308.02 de	383.2 b-g	515.63 ab	417.98 a-f	276.78 fgh	V4	361.11 c-g	433.3 c-g	391.92 c-g	473.57 a-d	352.56 c-g	310.53 d-g	V4
436.85 abc	510.94 a	435.88 a-e	314.37 d-h	484.93 ab	478.14 ab	V5	365.38 c-g	444.33 b-f	402.74 b-g	533.07 abc	386.23 b-g	316.72 d-g	V5
384.31 b-e	428.14 abc	514.51 ab	531.84 ab	452.04 a-d	547.43 a	V6	457.31 b-e	465.84 a-e	568.23 ab	637.97 a	412.69 b-g	358.29 c-g	V6
404.83 a				٣٥٩.٨٠ b		S Average	445.73 a		377.83 b		323.38 b		C Average
Y2	Y1	S x Y	C3	C2	C1	C × Y	C3		C2		C1		S × C
٣٤٣.٦٥ b	٢٩٣.٤٨ c	S1	386.33 bc	305.31 cd	264.06 d	Y1	368.49 bc		343.94 cd		٣٠٢.٨٢ d		S1
466.01 a	426.11 a	S2	505.13 a	450.35 ab	382.7 bc	Y2	483.39 a		408.08 b		387.17 bc		S2
Y2	Y1	Y Average	Y2				Y1						S × C ×Y
			C3	C2	C1		C3		C2		C1		
			438.17 bc	334.5 de	309.78 ef		300.83 ef		283 ef		245.11 f		S1
٤٤٦.٠٦ a	318.56 a		528.61 a	481.66 ab	464.55 ab		436.14 bc		404.88 bcd		360.53 cde		S2
V Average	V× C		V × Y		Y2				Y1				V× C ×Y
	C3	C2	C1	Y2	Y1	C3	C2	C1	C3	C2	C1		
295.01 c	402.55 b-e	294.37 ef	246.18 f	265.83 e	294.44 de	181.83 m	300.33 i-m	286.67 i-m	324.67 i-m	214.17 lm	276.67 j-m		V1
346.38 bc	321.83 def	360.83 b-f	314.52 ef	367.78 cd	434.61 abc	219.67 klm	314.67 i-m	340.83 e-m	387.5 b-k	275.83 j-m	293.33 i-m		V2
483.07 a	461.14 bc	345.33 c-f	301.35 ef	228.17 e	320.56 de	283 i-m	346.67 e-m	475.83 b-i	591.67 a	307.5 i-m	313.33 i-m		V3
٣٩٢.٧b	358.65 b-f	422.4 b-e	378.1 b-f	426.93 bc	295.57 de	461.83 b-j	421.33 b-j	342.37 e-m	480.44 b-h	374.56 e-m	215.68 lm		V4
412.77 b	585.52 a	399.46 b-e	337.5 c-f	417.62 bc	531.53 a	497.64 a-e	530.14 a—e	415.36 b-k	534.77 a-e	414.82 b-k	309.37 i-m		V5
363.94 b	411.34 b-e	455.08 bcd	485.49 ab	499.72 ab	504.99 ab	539.69 a-d	563.5 cab	495.14 a-e	579.37 ab	491.42 a-e	361.67 e-m		V6
Y2						Y1							V× S × C × Y
C3		C2		C1		C3		C2		C1			
S2	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	S1		
198 mno	301.7 d-o	323.3 b-o	343.3 b-o	245 h-o	286.7 e-o	165.7 o	299 d-o	250 h-o	306 c-o	183.3 no	266.7 g-o		V1
221.3 j-o	315.7 b-o	346.7 b-o	396.7 b-o	278.3 g-o	300 d-o	218 k-o	313.7 b-o	335 b-o	378.3 b-o	273.3 g-o	286.7 e-o		V2
343 b-o	356 b-o	595 ab	683.3 a	333.3 b-o	318.3 b-o	223 i-o	337.3 b-o	356.7 b-o	500 a-k	281.7 g-o	308.3 b-o		V3
471 a-m	468.9 a-n	377.5 b-o	499.2 a-k	388.8 b-o	223.8 i-o	452.6 a-o	373.8 b-o	307.3 c-o	461.7 a-o	360.3 b-o	207.6 l-o		V4
500.9 a-k	550.9 a-g	437.2 a-o	550.5 a-g	426.8 a-o	321.1 b-o	494.4 a-l	509.3 a-i	393.5 b-o	519.1 a-h	402.9 a-o	297.7 d-o		V5
571.6 a-e	575.7 a-d	541.5 a-g	592.6 abc	492 a-l	398.2 b-o	507.8 a-j	551.3 a-g	448.8 a-o	566.1 a-f	490.8 a-l	325.1 b-o		V6

. There were no significant differences at the 5% probability level V varieties S Spraying stages C arginine concentrations Y seasons

4. Carvon content in volatile oil

Results of (5) indicate that there are significant differences in arginine concentrations. concentration was superior to (C3), giving it highest average of 61.93 ppm compared to comparison treatment (C1), which gave lowest average of 59.74 ppm. As for spraying stages, it was found that there are significant differences between spraying stages, as it was spraying stage (S1) gave highest average value of 60.77 ppm, while spraying stage (S2) obtained the lowest value of 60.61 ppm. As for the effect of varieties, results showed that there were significant differences between averages of trait, as the variety (V2) excelled, which gave highest values reached ppm 61.13, while the variety (V4) obtained the lowest values, reaching ppm 60.26

Table (5): effect of spraying with arginine, its stages, varieties, and their interactions on cavone content of volatile oil for two seasons of experiment

S2	S1	V× S	C3		C2		C1		V× S ×C
			S2	S1	S2	S1	S2	S1	
61.26 A	60.86 C	V1	59.693 tu	59.82 qrs	59.64 Uv	59.79 Rs	59.89 q	59.78 Rs	V1
60.27 H	60.58 F	V2	59.68 U	59.8 Sr	59.59 V	59.64 Uv	59.84 qrs	59.763 St	V2
60.68 E	60.99 B	V3	60.46 M	60.91 K	59.86 Qr	60.26 No	61.2 j	60.69 L	V3
61 B	60.68 E	V4	60.19 O	60.41 M	59.9 Q	60.01 P	60.7 l	60.3 N	V4
60.25 H	60.41 G	V5	61.89 F	62.26 C	61.31 I	61.69 G	62.69 a	62.11 D	V5
60.54 F	60.80 D	V6	61.75 G	62.21 C	61.26 Ij	61.59 H	62.46 b	61.99 E	V6

S2	S1	S × C	Average V	C3	C2	C1	V× C
59.71 F	59.76 E	C1	60.77 C	59.71 N	59.86 l	59.77 M	V1
60.25 D	60.56 C	C2	61.13 A	59.68 N	59.81 m	59.61 O	V2
61.87 B	61.99 A	C3	60.49 E	60.13 K	60.95 g	60.49 I	V3
			60.26 F	60.32 J	60.66 h	59.88 L	V4
			60.90 B	61.64 E	62.57 a	62.05 C	V5
			60.61 D	61.82 D	62.23 b	61.28 F	V6
60.61 B	60.77 A	S Average		61.93 A	60.40 b	59.74 C	C Average

There were no significant differences at the 5% probability level V varieties S Spraying stages C arginine concentrations Y seasons.

5. Limonene content in volatile oil

Results oftable (6) indicate that there are significant differences in arginine concentrations. Concentration (C3) was superior, giving it highest average of 20.16 ppm compared to comparison treatment (C1), which gave lowest average of 18.53 ppm .As for spraying stages, it was found that there were significant differences between spraying stages, as spraying stage (S1) excelled by giving it highest average of 19.43 ppm, while spraying stage (S2) obtained lowest value of 19.21 ppm. As for the effect of varieties, results showed that there was Significant differences between averages of tl trait, as variety (V2) excelled, which gave highest values, reaching 19.60 ppm while, the variety (V4), which gave t lowest values, reached 19.04 ppm.

Table (6): effect of spraying with arginine, its stages, varieties, and their interactions on lemonne content of volatile oil for two seasons of experiment

S2	S1	V× S	C3		C2		C1		V× S ×C
			S2	S1	S2	S1	S2	S1	
19.72 A	19.50 C	V1	18.54 Z	18.58 Vw	18.49 B	18.51 A	18.59 V	18.56 Xy	V1
19.12 J	19.26 G	V2	18.49 B	18.55 Yz	18.45 D	18.47 C	18.57 Wx	18.52 A	V2
19.38 E	19.62 B	V3	19.31 P	19.71 K	18.91 T	19.16 R	19.88 I	19.48 N	V3
19.48 D	19.25 H	V4	19.11 S	19.41 O	18.78 U	18.91 T	19.54 M	19.26 Q	V4
18.96 L	19.05 K	V5	20.31 E	20.58 B	19.98 H	20.13 G	20.69 A	20.48 C	V5
19.16 I	19.37 F	V6	19.89 I	20.16 F	19.67 L	19.79 J	20.34 D	19.98 H	V6

S2	S1	S × C	Average V	C3	C2	C1	V× C
18.50 F	18.54 E	C1	19.38 C	18.49 Q	18.58 M	18.54 O	V1
19.16 D	19.40 C	C2	19.60 A	18.515 P	18.565 N	18.47 R	V2
19.97 B	20.36 A	C3	19.16 E	19.035 K	19.71 G	19.37 I	V3
			19.04 F	19.21 J	19.56 H	18.84 L	V4
			19.49 B	19.96 E	20.51 A	20.23 C	V5
			19.27 D	20.10 D	20.37 B	19.82 F	V6
19.21 B	19.43 A	S Average		20.16 A	19.38 B	18.53 C	C Average

There were no significant differences at the 5% probability level V varieties S Spraying stages C arginine concentrations Y seasons

The reason for superiority of variety (V2) over rest of other varieties is due to difference in genetic makeup and extent of its ability to benefit from products of photosynthesis, accumulation of dry materials in seeds, and control of genes to calculate synthesis of active substance and take advantage of available conditions

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As for spraying stage, above results show that branching stage of both compounds in dill plant is superior to flowering stage. The reason is that branching stage is in which lateral buds are formed, as plant needs large quantities of nutrients necessary to form active substances, which is a complex process that requires interaction of many Factors, including nutrients, growth hormones, and environmental conditions. During t ـbranching phase, these factors are available in high levels, leading to increased formation of active substances. As for superiority of concentration (C3) over rest of the other concentrations, it is due to the increased concentration of nutrients and growth hormones during the branching stage, which leads to an increase in formation of active substances, which leads to an increase in content of active substances in the plant

CONCLUSIONS

From the above results, it was shown that spraying arginine at a concentration of 100 mg/L on the dill plant led to an increase in plant's yield and the active substance .As for effect of varieties, the Super Dukak genotype excelled in most of the traits studied by giving it a significant increase in all traits under study, which indicates its suitability to conditions of experiment more than rest of other genotypes .

REFERENCES

Al-Hadithi, Munther Hikmat Shaker. (2022) The effect of inoculation with *Sinorhizobium meliloti*, arginine and glutamic bacteria on the growth traits and quotient and some secondary metabolic University of Tikrit

Al-Khatib, Obaida Muhammad Zahid. (2018) Application of the integrated system of diagnosis and recommendation of fertilizer in the growth and production of the pill Black Nigella sativa L. Within the conditions of Hama Governorate. Master's thesis, Faculty of Agriculture Engineering, University of Aleppo.

Al-Kubaisi, Wael Yahya Nasser, (2021). Improving the qualities of growth and yield and some effective compounds in the fenugreek plant by spraying Gabrielin and arginine, Master Thesis – Faculty of Agriculture – Anbar University.

Al-Muhammad, Maher Hamid Salman and Mushtaq Talib Hammadi Al-Zarfi (2016) The effect of spraying amino acids and urea on the growth and content of Datura stramonium leaves and seed of some alkaloid compounds. Al-Furat Journal of Agricultural Sciences/ Third Agricultural Conference. Al Qasim Green University. Republic of Iraq 167.

Al-Sahaf, Fadel Hussein Reda. 1989. plant nutrition Ministry of Higher Education and Scientific.

Al-Samarrai, Madiha Hamoudi Hussein. 2001. Effect of nitrogen and phosphate fertilization and planting date on growth and quantity Oil in the plant Anethum *graveolens L.* Master's Thesis - University of Baghdad - Faculty of Agriculture – Department of Horticulture.

Boras, Jatawi, Bassam Abu Turabi and Ibrahim Al-Basit. 2006. Production of vegetable crops. Theoretical part. Al Daoudi Press. Damascus University Publications. Syria

Kaur, G.J. and D. S. Arora (2010). Bioactive potential of *Anethum graveolens, Foeniculum vulgar* and *Trachys permumammi* belonging

to the family Umbelliferae. Current Status J. Med. Plants Res., 4(2):87-94.

Said-AL Ahl, H. A. H. and Omer, E. A. (2016). Impact of cultivar and harvest time on growth, production and essential oil of *Anethum graveolens* cultivated in Egypt. Int. J. Pharm. and Pharm. Sci. 8h 54m

Samarrai, Sattar Abdul Khalifa. 2023. The physiological and productive functioning, active substances, estimation of genetic parameters and gene expression of several genes in the sweet grain *Foeniculum vulgar* Mill. With the influence of organic fertilizer and phosphate PhD thesis of the Faculty of Agriculture, University of Tikrit.

Stavri, M., and S. Giboons. 2005 The ant mycobacterial constitutions of Dill (Anthem graveolens). Phytother.Res.19:938-941.