RESPONSE MAIZE CULTIVARS (*Zea mays* L) TO FOLIAR APPLICATION OF KINETIN

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ABSTRACT
This study aimed to investigate effect of foliar application of Kinetin on growth, yield, yield components and antioxidant affectivity of maize. A field experiment was conducted during the spring season of 2023 at the Alhamidia Research Station, College of Agriculture, University of Anbar. A randomized complete block design with split-plot arrangement with three replications was used in this study. The main plots contained the levels of kinetin (0, 25, 50, and 75 mg L-1), and the subplots contained the cultivars (Baghdad 3, Fajr 1, and Almaha). The results indicated that the maize cultivars significantly differed in most of the studied traits. The Baghdad 3 cultivar showed a significant superiority in most of the studied traits, such as leaf area (5473 cm^2), highest average crop growth per unit area, and the highest grain yield (3.75 t ha^{-1}) and biological yield. The Al-Maha cultivar showed superiority most active antioxidant enzymes, catalase and superoxide dismutase(CAT, SOD). Foliar application of kinetin improved growth traits, antioxidant enzyme activity, yield, and quality. The concentration of 75 mg L^{-1} recorded the best results,

Keywords: Grain yield, antioxidants, growth regulators. Superoxide dismutase
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استجابة عدة اصناف من الذرة الصفراء (*Zea mays* L) للرش بالكاينتين

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المستخلص:
نفذت تجربة حقلية خلال الموسم الربيعي لعام 2023 في محطة أبحاث الحامضية العائدة إلى كلية الزراعة –جامعة الأنبار الواقعة على خط طول 43.39 ودائرتي عرض 33.44 . لدراسة تأثير التغذية الورقية بالكاينتين في نمو وفعالية الانزيمات المضادة للاكسدة وحاصل ونوعية ثلاثة اصناف من الذرة الصفراء. استعمل تصميم RCBD ضمن ترتيب الألواح المنشقة وبثلاثة مكررات. إذ تضمَّنت الألواح الرئيسة مستويات الكاينتين (0 ، 25 ، 50 ، 75) ملغم لتر$^{-1}$ ، وتضمَّنت الألواح الثانوية الأصناف (بغداد 3 ، فجر1 ، المها). وتشير النتائج الى اختلفت أصناف الذرة الصفراء معنوياً في أغلب الصفات المدروسة, إذ سجل الصنف تفوقا معنويا في اغلب الصفات المدروسة كالمساحة الورقية (5473 سم2) أعلى متوسط لنمو المحصول في وحدة المساحة وكذلك تفوقه في حاصل الحبوب (3.75) طن هـ$^{-1}$ وأعلى حاصل بايلوجي, فيما تفوق الصنف المها بأعلى فعالية للانزيمات المضادة للاكسدة (CAT, SOD). أدَّى رش الكاينتين الى تحسين صفات النمو وفعالية مضادات الاكسدة الانزيمية والحاصل ومكوناته والنوعية

الكلمات المفتاحية: حاصل الحبوب, مضادات الاكسدة, SOD , منظمات النمو

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INTRODUCTION

Maize (*Zea mays* L.) is a cereal crop belonging to the Poaceae family. It is an important food and industrial crop in many countries of the world, ranking third globally after wheat and rice in terms of production (17, 38). It is also used in recent years in the production of biofuels (18). In Iraq, the production of maize in 2020 for the spring and fall seasons was 419.3 thousand tons, with a cultivated area of approximately 101.35 thousand hectare, a decrease of 27.425 thousand hectare from the previous season (21). Due to the increasing population in Iraq and the world, and the corresponding decreases in the productivity of strategic crops as a result of rising temperatures and drought. Maize, like other cereal crops, is exposed to biotic and abiotic stresses, including drought stress, heat stress, and water stress (16). All these factors have contributed to the low production of field crops. Therefore, it is necessary to focus on vertical expansion by increasing productivity per unit area (11, 12), in addition to the role of plant breeders who contribute effectively by developing and improving superior varieties and strains with low water requirements and resistance to environmental stress conditions (3, 8, 17). The decline in grain yield rates calls for us to search for all possible means to increase production through the use of modern agricultural methods to improve the production status by selecting high-yielding varieties that are tolerant to environmental stresses and adapted to several environments, as well as improving their quality traits. The control of environmentally safe materials contributes to increasing production, including plant growth regulators that play an important role in increasing the plant's ability to tolerate environmental stresses and increases and improve yield. Among the most important of these regulators are cytokinins in general and kinetin in particular. It works on the emergence of seeds, cell division, and encouraging its expansion, in addition to its role in the formation of some enzymes involved in the process of carbon fixation (10, 30) and delaying leaf senescence retain chlorophyll activity a longer period, which leads to keeping the leaves effective in providing the plant with nutrients, leading to improved productivity (29). This study aimed to investigate effect of foliar application of Kinetin on growth, yield, yield components and antioxidant affectivity of maize.

MATERIALS AND METHODS

A field experiment was conducted during the spring season of 2023 at the experimental field of Alhamidia Research Station - College of Agriculture - University of Anbar, located at latitude 33.44 North and longitude 43.39 East, on the banks of the Euphrates River. The objective was to determine the effect of foliar application of kinetin on the physiological, productive, and qualitative characteristics of maize crops. A randomized complete block design within split-plot arrangement with three replications was used in this study. The levels of kinetin (0, 25, 50, and 75 mg $L^{-}1$) allocated to the main plots, and maize cultivars (Baghdad 3, Fajr 1, and Almaha) allocated to the subplots. The field operations (plowing, smoothing, and leveling) were carried out, and the furrows and channels were made. Samples were taken from field soil at a depth of 30 cm to determine the chemical and physical properties of the soil, as shown in Table (1).

Table 1. Chemical and physical characteristics of soil field

Characters	Value	Unit
Electrical conductivity (EC)	2.1	dS m^{-1}
pH	7.7	-
Clay	257	g kg^{-1} soil
Sand	508	g kg^{-1} soil
Silt	235	g kg^{-1} soil
Soil texture	Silty loam	
Available nitrogen (N)	19.5	mg kg^{-1} soil
Available phosphorus (P)	12.6	mg kg^{-1} soil
Available potassium (K)	190	mg kg^{-1} soil
Organic matter	0.72	%

The soil sample was analyzed in the laboratories of the Desert Studies Center - Anbar University, and the nitrogen in the laboratories of the Anbar Agriculture

Directorate Then, the field was divided into three replicates, the distance between replicates was 1.5 m, the number of experimental units was 36 units, the distances between experimental units was 1 m, and each unit contained four furrows (3 m long), the distance between furrows was 75 cm, and the distance between each hole were 25 cm. Planting was done on March 31, 2023, by placing 2-3 seeds in each hole. The thinning of the plants was carried out two weeks after emergence, leaving one plant in each hole to ensure the required plant density of 53,333.33 plants ha^{-1}. The irrigation process for the field was carried out immediately after planting, and irrigations was repeated based on the plant's needs. The experimental field was fertilized with a one-time application of DAP fertilizer (46% phosphorus and 18% nitrogen) at a rate of 200 kg per hectare. Nitrogen (100 kg ha^{-1} as urea) was applied in three timed doses: two weeks after emergence, at 60 cm height, and during flowering (6). The control of the corn stem borer (*Sesamia cretica*) was carried out preventively by spraying the plants with the pesticide Super Cerin in two doses. The first dose was applied when the plant reached a height of about 25 cm, and the second dose was applied 20 days after the first treatment. Kinetin, prepared at the Desert Studies Center laboratories, was added to the plants through foliar applications according to the concentrations specified in the study. This was done in two applications: the first after 40 days from emergence and the second at the beginning of flowering in the morning, using a 16-liter backpack sprayer until complete leaf wetting. A spreading agent (Adhesive) was added at a rate of 10 cm^3 per 100 liters of water. Weeding of the weed plants was carried out as needed. Harvesting took place when signs of maturity appeared, such as yellowing of leaves, stems, grain hardening, and the appearance of the black scar indicating complete grain filling and the cessation of nutrient translocation for each cultivar of the crop.

RESUITS AND DISCUSSION

Number of days from planting to 75% tasseling (days): The results indicate a significant effect of cultivars on the trait of the number of days from planting to 75% male flowering (Table 2). Baghdad3 required the shortest duration to reach the 75% male flowering stage, which was 71.50 days. This significantly differed from the other two cultivars. On the other hand, Fajr1 required the longest duration to reach 75% male flowering, which was 73.58 days. This difference may be attributed to the genetic nature of the cultivars and their sensitivity to the surrounding environmental conditions. These results align with the findings of Dar et al. (20), who observed significant differences among cultivars in the trait of male flowering in maize plants.The results revealed that the duration to reach 75% male flowering decreased with an increase in kinetin concentrations. The treatment with a concentration of 75 mg $liter^{-1}$ recorded the shortest duration to reach this stage, which was 70.78 days, and it significantly differed from the other treatments. In comparison, the control treatment (distilled water only) recorded the longest duration to 75% male flowering (74.44 days). This could be attributed to the significant role played by kinetin in stimulating biological reactions, increasing manufactured material, and consequently transitioning the plant from the vegetative growth stage to the reproductive growth stage. The results are consistent with the findings of Chattha (19).

Table 2. Effect of kinetin and maize cultivars and their interaction on day to 75% tasseling

Cultivars	Kinetin concentration (mg $liter^{-1}$)				Cultivar mean
	0	25	50	75	
Baghdad3	73.00	72.00	71.00	70.00	71.50
Fajr 1	74.00	72.00	71.67	70.67	72.08
Almaha	76.00	73.33	73.00	71.67	73.58
L.S.D 0.05		N.S			0.841
Mean	74.44	72.44	71.89	70.78	
L.S.D 0.05		1.070			

Number of days from planting to 75% silking (days): Results of Table (3) shows that plants of the Baghdad 3 cultivar needed fewer days from planting to silking 75.75 days, while Almaha cultivar took the longest time to reach this stage, reaching 77.67 days, which did not different significantly from the Fajr 1 cultivar, which took 77.17 days. The reason for this could be due to the differences in the genetic nature of the cultivars and their ability to benefit from the prevailing environmental conditions, including temperature and photoperiod. These results agreed with the results of Sharif and AL-Rawi (37), which showed significant differences between maize cultivars in silking dates. The results showed that plants sprayed with a concentration of 75 mg liter^{-1} needed the least time silking stage, (74.78 days), while the control treatment recorded the longest time to reach the flowering stage, (78.11 days). This could be due to the fact that spraying kinetin led to an increase in the biological reactions in plants, the formation of floral buds and reducing the time to silking stage. This result is consistent with what was reported by Hamad *et al.*, (26).

Table 3. Effect of kinetin and maize cultivars and their interaction on day to 75% silking

Cultivars	Kinetin concentration (mg liter^{-1})				Cultivar mean
	0	25	50	75	
Baghdad3	76.00	76.33	76.33	74.33	75.75
Fajr 1	79.33	77.00	77.00	75.33	77.17
Almaha	79.00	79.00	78.00	74.67	77.67
L.S.D 0.05		N.S			1.14
Mean	78.11	77.44	77.11	74.78	
L.S.D 0.05		1.035			

Plant height (cm)

The results indicate the superiority of Almaha cultivar plants, exhibiting the highest average plant height of 195.62 cm. This represents an increase of 10.88% and 2.38% compared to Baghdad3 and Fajr1 cultivars, respectively. In contrast, Baghdad3 cultivar recorded the lowest average plant height of 174.33 cm. The superior performance of Almaha cultivar in plant height could be attributed to the variability in cell elongation and division capabilities, as well as the length and number of internodes. These factors positively influenced the plant height of the Almaha cultivar. This result aligns with other researchers who identified a significant cultivar effect on plant height (5). The results also indicate a significant effect of kinetin concentrations on the plant height. Plant height increased linearly with increasing kinetin concentrations, with the concentration of 75 mg L^{-1} achieving the highest average height of 199.72 cm. This concentration showed a significant differences with other concentrations, exhibiting an increase of 12.65%, 8.14%, and 4.75% compared to concentrations of 0, 25, and 50 mg L^{-1}, respectively. The control treatment recorded the lowest average height of 174.44 cm. This could be attributed to the role of kinetin in enhancing cell division, differentiation, expansion, and the production of stimulating enzymes (25). These results are consistent with the findings of Al Faiad (7).

Table 4. Effect of kinetin and maize cultivars and their interaction on plant height (cm).

Cultivars	Kinetin concentration (mg liter^{-1})				Cultivar mean
	0	25	50	75	
Baghdad3	163.67	168.90	179.67	185.07	174.33
Fajr 1	181.80	186.20	191.60	204.20	190.95
Almaha	177.87	195.27	199.43	209.90	195.62
L.S.D 0.05		N.S			4.313
Mean	174.44	183.46	190.23	199.72	
L.S.D 0.05		3.982			

Leaf area (cm^2)

The results illustrate the superiority of the Fajr1 cultivar, providing the highest average leaf area of 5473.00 cm^2 (Table 5), followed by Fajr1 with an average of 5421.00 cm^2. While, Baghdad3 recorded the lowest average leaf area of 4793.00 cm^2. This variability among cultivars could be attributed to genetic composition and their ability to utilize growth requirements, impacting this trait (32). These

findings agreed with the results of Abood and Salih (4). The results also reveal significant effects of kinetin concentrations (Table 5), with the concentration of 75 mg L^{-1} achieving the highest average leaf area of 6242.00 cm². This concentration showed a significant differences with other concentrations, exhibiting an increase of 28.62%, 22.01%, and 14.29% compared to concentrations of 0, 25, and 50 mg L^{-1}, respectively. The control treatment recorded the lowest average leaf area of 4455.00 cm². The reason for this could be attributed to kinetin's role in stimulating cell division and elongation, delaying leaf aging, thereby increasing leaf expansion and surface area. Additionally, kinetin plays a crucial role in increasing leaf area by promoting the growth of green plastids. These results are consistent with the findings of Al Faiad (7), who highlighted the significant impact of kinetin on this trait.

Table 5. Effect of kinetin and maize cultivars and their interaction on leaf area (cm^2).

Cultivars	Kinetin concentration (mg $liter^{-1}$)				Cultivar
	0	25	50	75	Mean
Baghdad3	4080	4418.	5008	5666.	4793
Fajr 1	4722	5265	5548	6358	5473
Almaha	4564	4922	5494	6703	5421
L.S.D 0.05		N.S			229.9
Mean	4455	4868	5350	6242	
L.S.D 0.05		320.1			

Crop Growth Rate (g m^{-2} day^{-1})

The results reveal significant differences among cultivars (Table 6), with Fajr1 plants surpassing others with the highest average for the crop growth rate, reaching 9.43 g m^{-2} day^{-1}. In contrast, Baghdad3 cultivar recorded the lowest average at 8.58 g m^{-2} day^{-1}. The genetic variances differed among cultivars. These findings align with the results of Abood and Salih (4). The results also indicate a significant impact of Kinetin concentrations, with concentrations of 50 and 75 mg L^{-1} achieving the highest average for the trait at 9.68 g m^{-2} day^{-1} for both concentrations. The control treatment recorded the lowest average for the trait at 7.88 g m^{-2} day^{-1}. The positive role of the spray solution in increasing plant height and leaf area (Tables 4 and 5) could be contribute to the increased crop growth rate with higher Kinetin levels, as suggested by Mohammed and Ahmed (33). The interaction between the two study factors also showed a significant effect on this trait. Fajr1 cultivar sprayed with a concentration of 50 mg L^{-1} exhibited the highest average crop growth rate at 10.35 g m^{-2} day^{-1}, while Baghdad3 cultivar sprayed with water only recorded the lowest average for the trait at 7.15 g m^{-2} day^{-1}.

Table 6. Effect of kinetin and maize cultivars and their interaction on Crop Growth Rate (g m^{-2} day^{-1})

Cultivars	Kinetin concentration (mg $liter^{-1}$)				Cultivar
	0	25	50	75	mean
Baghdad3	7.15	8.77	9.05	9.34	8.58
Fajr 1	8.63	8.68	10.35	10.08	9.43
Almaha	7.85	8.21	9.64	9.62	8.83
L.S.D 0.05		0.56			0.25
Mean	7.88	8.55	9.68	9.68	
L.S.D 0.05		0.44			

Catalase Enzyme (CAT) Activity

The results indicate significant variations among cultivars in Catalase enzyme (CAT) activity (Table 7). The Almaha cultivar exhibited the highest antioxidant enzyme activity, recording the highest average at 11.92 absorption units (Table 7), while the Baghdad3 cultivar showed the lowest CAT enzyme activity with an average of 9.78 absorption units. Studies suggest that exposure to any stress leads to an increase in the activity of antioxidant enzymes as a response to neutralize the harmful effects of that stress. These results align with the findings of Saddiqe *et al.* (35). The results showed a significant impact of Kinetin concentrations on reducing CAT enzyme concentrations. The control treatment recorded the lowest average

for the trait at 8.10 absorption units (AU), while the Almaha cultivar showed a significant increases with higher concentrations, reaching an average of 11.92 absorption units. The effectiveness of this enzyme highlights the contribution of Kinetin in enhancing the plant's defense system against unfavorable conditions (32), this results consistent with the results of Al-Zuwaini (13).The interaction between factors also showed a significant effects on Catalase enzyme activity. The combination of the Almaha cultivar with a concentration of 75 mg L^{-1} recorded the highest average at 15.03 AU while the combination of Baghdad3 cultivar with the control treatment recorded the lowest average at 7.62 AU.

Table 7. Effect of kinetin and maize cultivars and their interaction on Catalase Enzyme (CAT) Activity (AU)

Cultivars	Kinetin concentration (mg liter^{-1})				Cultivar mean
	0	25	50	75	
Baghdad3	7.62	11.32	10.24	10.29	9.87
Fajr 1	8.17	10.66	11.00	10.41	10.06
Almaha	8.51	14.02	10.14	15.03	11.92
L.S.D 0.05		0.55			0.26
Mean	8.10	12.00	10.46	11.91	
L.S.D 0.05		0.40			

Superoxide Dismutase (SOD) Enzyme Activity

The results reveal significant differences among the studied cultivars in their Superoxide Dismutase (SOD) content (Table 8). The Almaha cultivar demonstrated significantly higher enzyme activity at 35.72 AU, surpassing the other two cultivars. In contrast, Baghdad3 cultivar exhibited the lowest enzyme activity at 25.87 AU. The variability among cultivars could be attributed to genetic differences, where each cultivar's ability to trigger defense mechanisms, represented by antioxidant enzymes, plays a role. These results agreed with the findings of Markab (32). Moreover, the result indicates that the application of Kinetin to the plants contributed to an increase in the antioxidant enzyme SOD activity, reaching the highest average at 49.56 AU at the higher concentration. This value differed significantly from the other treatments, with the control treatment recording the lowest enzyme activity at 10.77 AU. The increase of the activity of antioxidant enzymes with higher Kinetin concentrations may be attributed to the role of this substance in enhancing enzymatic antioxidants to preserve the plant from deterioration due to environmental stress (14). These findings are consistent with the results reported by Markab (32). The interaction between factors also showed a significant effects on SOD enzyme activity. The combination of the Almaha cultivar with a concentration of 75 mg L^{-1} recorded the highest average at 60.69 AU, while the combination of Baghdad3 cultivar with the control treatment recorded the lowest average at 8.65 AU.

Table 8. Effect of kinetin and maize cultivars and their interaction on Superoxide Dismutase (SOD) Enzyme Activity (AU).

Cultivars	Kinetin concentration (mg liter^{-1})				Cultivar mean
	0	25	50	75	
Baghdad3	8.65	13.72	35.62	45.48	25.87
Fajr 1	10.16	15.75	37.93	42.50	26.58
Almaha	13.50	17.72	50.96	60.69	35.72
L.S.D 0.05		0.81			0.39
Mean	10.77	15.73	41.50	49.56	
L.S.D 0.05		0.60			

Number of grains per ear (Grains ear^{-1})

The results in Table 9 demonstrate the apparent superiority of the Almaha cultivar in grain count per ear, with an average of 460.2 grains ear^{-1}, surpassing the other cultivars. In contrast, the Baghdad3 cultivar recorded the lowest average at 432.9 grains ear^{-1}. The variation among cultivars in this trait could be attributed to genetic differences or the ability of each cultivar to provide nutritional

requirements for successful fertilization, positively impacting the grain count per ear. These findings align with the results reported by Jagla (28).The results indicate that the concentration of 75 mg L^{-1} of kinetin outperformed the other concentrations (Table 9), recording the highest average for the trait at 503.4 grains ear^{-1}. In comparison, the control treatment with a concentration of (0) recorded the lowest average at 353.3 grains ear^{-1}. This could be attributed to the role of Kinetin in increasing nutrient and water absorption, facilitating the transport of essential nutrients to the required sites, positively influencing the fertilization rate and subsequently increasing the grains count per ear. These results are consistent with the findings of Chatta *et al*. (19). The interaction between factors also showed significant effects on grains count, with plants of the Almaha cultivar sprayed with a concentration of 25 mg L^{-1} recording the highest average at 542.4 grains ear^{-1}, while, plants of the Baghdad3 cultivar sprayed with water only recorded the lowest average at 339.7 grains ear^{-1}.

Table 9. Effect of kinetin and maize cultivars and their interaction on number of grain per ear (Grains ear^{-1})

Cultivars	Kinetin concentration (mg $liter^{-1}$)				Cultivar mean
	0	25	50	75	
Baghdad3	339.0	448.2	467.0	477.5	432.9
Fajr 1	361.7	470.4	486.9	505.6	456.15
Almaha	359.1	411.4	542.4	527.7	460.2
L.S.D 0.05		103.51			N.S
Mean	353.3	443.3	482.1	503.4	
L.S.D 0.05		88.18			

Weight of 300 Grains (grams)

Data in Table 10 indicates significant differences among cultivars, with the Fajr1 cultivar recording the highest average of 300 grains at 61.9 grams. It showed a significant differences from the other two cultivars, which did not differed significantly from each other. The Almaha cultivar recorded the lowest average at 58.6 grams. The reason for this differences could be attributed to the Fajr1 cultivar possessing genetic and physiological components that contribute to its increased efficiency in converting the products of the photosynthetic process into economic yield. These results align with Mahmood *et al*. (31). The results also indicate that Kinetin concentrations had significant effects on this trait. The concentration of 75 mg L^{-1} recorded the highest average at 63.8 grams compared to concentrations of (0, 25, and 50) mg L^{-1}, which recorded lower averages of 56.6, 60.2, and 59.6 grams, respectively. The role of Kinetin in increasing grain weight by accelerating the transfer of nutrients from leaves to grains may explain these results, consistent with the findings of El-Nasharty *et al*. (22). The interaction between study factors also had a significant effect on this trait. Plants of the Fajr1 cultivar sprayed with a concentration of 75 mg L^{-1} recorded the highest average weight of 300 grains at 65.5 grams, while plants of the Almaha cultivar sprayed with distilled water recorded the lowest average at 49.2 grams.

Table 10. Effect of kinetin and maize cultivars and their interaction on Weight of 300 Grains (grams).

Cultivars	Kinetin concentration (mg $liter^{-1}$)				Cultivar mean
	0	25	50	75	
Baghdad3	54.8	56.9	60.3	62.4	58.6
Fajr 1	55.8	59.2	63.6	65.9	61.0
Almaha	49.2	59.1	61.9	62.5	58.1
L.S.D 0.05		4.74			2.36
Mean	56.9	58.4	61.83	63.6	
L.S.D 0.05		3.88			

Grains Yield (ton ha^{-1})

The results indicate significant differences among cultivars in the trait of grains yield (Table 11). Plants of the Fajr1 cultivar excelled by recording the highest average for the trait at 3.75 ton ha^{-1}. This did not differ

significantly from the Almaha cultivar, which recorded 3.40 75 ton ha^{-1}. In contrast, plants of the Baghdad3 cultivar recorded the lowest average for the trait at 3.08 ton ha^{-1}. The superiority of the Fajr1 cultivar could be attributed to its excellence in the trait of weight of 300 grains (Table 10). This result is consistent with the findings of Abdulhamed *et al.* (2), and Abood et al. (5), they observed a significant effect of cultivars on the grains yield of maize. The results also illustrate the significant superiority of the concentration of 75 mg L^{-1} of kinetin, with the highest average at 4.42 75 ton ha^{-1}. It outperformed other concentrations significantly. The concentrations of 50 and 25 mg L^{-1} did not differed significantly from each other in this trait but differed significantly from the control treatment, which recorded the lowest average at 2.35 ton ha^{-1}. The reason for the superiority of the 75 mg L^{-1} treatment lies in its excellence in the traits of the number of grains per ear and the weight of 300 grains (Tables 9 and 10). This result aligns with the findings of Saif *et al.* (36). The interaction between the study factors had a significant effects on this trait. Plants of the Almaha cultivar sprayed with a concentration of 75 mg L^{-1} Kinetin recorded the highest average at 4.92 75 ton ha^{-1}. This did not differed significantly from plants of the Fajr1 cultivar sprayed with the same concentration, which differed significantly from the other treatments. In contrast, plants of the Baghdad3 cultivar sprayed with distilled water recorded the lowest average for the trait at 2.30 ton ha^{-1}.

Table 11. Effect of kinetin and maize cultivars and their interaction on grains yield (ton ha^{-1})

Cultivars	Kinetin concentration (mg liter^{-1})				Cultivar mean
	0	25	50	75	
Baghdad3	2.30	2.99	3.32	3.71	3.08
Fajr 1	2.32	3.40	3.64	4.62	3.75
Almaha	2.52	2.94	3.23	4.92	3.40
L.S.D 0.05		0.65			0.21
Mean	2.38	3.12	3.40	4.42	
L.S.D 0.05		0.53			

Biological Yield (ton ha^{-1})

The results revealed that the Almaha cultivar recorded the highest average for the biological yield at 15.97 75 ton ha^{-1} (Table 12), while the Baghdad3 cultivar recorded the lowest average at 13.14 75 ton ha^{-1}. The reason for this difference could be attributed to the variation in the genetic makeup of the cultivars; these results are consistent with the findings of Al-Janabi et al. (9). Similarly, the results indicated a significant effects of Kinetin on the biological yield. The concentration of 75 mg L^{-1} outperformed by providing the highest average at 18.23 75 ton ha^{-1} compared to the control treatment, which recorded the lowest average for the trait at 13.74 75 ton ha^{-1}. This could be attributed to the fact that spraying Kinetin at a concentration of 75 mg L^{-1} led to an increase in most vegetative growth traits of the plant, such as plant height (Table 4) and leaf area (Table 5), in addition to its superiority in grain yield (Table 11). This resulted in an increases in the biological yield, aligning with the findings of El-Nasharty *et al*. (22) The results also indicated the significant superiority of the interaction treatment (Fajr1 with a concentration of 75 mg L^{-1} Kinetin), recording the highest average at 19.79 75 ton ha^{-1}. In contrast, the interaction treatment (Baghdad3 with the control treatment) gave the lowest average at 10.98 75 ton ha^{-1}.

Table 12. Effect of kinetin and maize cultivars and their interaction on biological Yield (ton ha^{-1})

Cultivars	Kinetin concentration (mg liter^{-1})				Cultivar mean
	0	25	50	75	
Baghdad3	10.98	12.50	14.42	16.67	13.14
Fajr 1	13.24	14.08	16.43	19.79	15.89
Almaha	14.01	15.27	16.94	17.68	15.97
L.S.D 0.05		4.891			2.471
Mean	12.74	13.95	15.93	18.05	
L.S.D 0.05		3.393			

Oil Percentage in Grains (%)

The result indicates significant differences among cultivars in the oil percentage (Table 13). The Fajr1 cultivar recorded the highest oil percentage at 4.25%, differed significantly from the other two cultivars that did not differed significantly from each other. On the other hand, the Baghdad3 cultivar recorded the lowest oil percentage in grains at 3.81%. This variation can be attributed to the genetic differences among cultivars, aligning with the findings of Hussein (27). Moreover, the results show a significant impact of Kinetin concentrations on oil percentage. The highest concentration treatment (75 mg L^{-1}) recorded the highest oil percentage in grains, reaching 4.43%. This did not differed significantly from the treatment at 50 mg L^{-1}, while the control treatment (0 mg L^{-1}) recorded the lowest oil percentage at 3.41%. The increases in oil percentage in grains with higher Kinetin concentrations could be attributed to its role in promoting biochemical reactions within the plant. This, in turn, contributes to an increases in leaf area (Table 5), enhancing photosynthetic processes and the transfer of synthesized materials from source to sink.

Table 13. Effect of kinetin and maize cultivars and their interaction on biological Yield (ton ha^{-1}) for the spring season of 2023

Cultivars	Kinetin concentration (mg $liter^{-1}$)				Cultivar mean
	0	25	50	75	
Baghdad3	3.17	3.34	4.46	4.27	3.81
Fajr 1	3.62	3.95	4.62	4.81	4.25
Almaha	3.44	3.77	4.07	4.23	3.87
L.S.D 0.05		N.S			0.216
Mean	3.41	3.68	4.38	4.43	
L.S.D 0.05		0.190			

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