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Effect of spraying with full green fertilizer, GA3 and NAA on some vegetative and rooting growth characteristics of almond seedlings (*Prunus amigdalus*)

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Abstract

This study was conducted in University of Duhok's nursery of horticulture department, college of Agriculture Engineering Sciences, in Kurdistan region of Iraq, during growing season (2022–2023). One-year-old almond seedlings were getting from college nursery. and sprayed two times: first spray was on 1st April and second spray was on 1st May. Randomized complete block design (RCBD) as factorial experiment was used, including three factors (Full green fertilizer (0, 4, 8) gm. L^{-1}, GA3 (0, 50, 100) mg. L^{-1}, and NAA (0, 750, 1250) mg. L^{-1} (3*3*3*3), with three seedlings for each experiment unit. Statistical analysis was performed by SAS program Results were compared according to Duncan's multiple range tests at 5%. Results showed that full green significantly increased (stem length (90.11cm), shoot number (9.22), leave area (47.48 cm^2), shoot dry weight (5.58gm)) at 8 mg/L^{-1}, GA3 significantly affected on (stem length (89.11cm), leave area (47.08cm^2), shoot fresh weight (9.05gm), shoot dry weight (5.92gm) , root fresh weight (6.50gm), and root dry weight (3.85gm)) at 100mg/L^{-1} ,and NAA increased stem length (90.85cm) and shoot fresh weight (8.73gm) at 1250mg/L-1, while shoot number (9.59) and leave area (46.12cm^2) at 750mg/L^{-1} NAA.

Key words**:** Full green Fertilizer, Plant growth regulators GA3, NAA, Almond seedlings.
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Introduction

Almonds are one of world's oldest commercial nut crops; they originated in West and Middle Asia and have since expanded to the Middle East, China, the Mediterranean region, and America [1]. One of the oldest tree nut varieties, almonds (*Prunus amygdalus*) are produced in greater quantities in Iran [2]. than in any other country in the world. The fertilizer led to the improvement of vegetative growth characteristics. Since all fertilizers have a variety of roles in the life of plants, giving them the nutrients they need to grow in an equilibrium shape can help to improve vegetative growth and tree production [3]. In addition to their ability to accelerate plant growth, plant growth regulators are known to improve the source-sink relationship and promote the translocation of photoassimilates, which helps in better retention of flowers and fruits. Growth regulators and promoters, such as GA3 and NAA, are responsible for initiating cell division in the cambium and stimulating vegetative growth. The primary function of auxin growth regulators is to regulate the development and expansion of roots. They are well known for their capacity to promote cell enlargement, which in turn promotes fruit growth in peaches and citrus [4]. Auxins also modify the ripening process of fruit and inhibit the typical cell wall deterioration that occurs during cold storage [5]. Through their influence on photosynthetic enzymes, leaf-area index, light interception, and improved nutrient use efficiency, they are known to increase the photosynthetic efficiency of plants. They also play a significant role in modulating a variety of processes throughout plant development. Gibberellic acid (GA3)-induced integrated mechanisms increase sink strength and redistribute photosynthesis to improve source potential [6]. Furthermore, GA increases phloem loading by influencing hormone concentration, apoplast pH, and cell turgor [7]. [8]. investigated how the fig cultivar 'Poona' reacted to varying GA3 concentrations and time intervals. Fig plants treated with three sprays of GA3 at a concentration of 60 mg L^{-1}, spaced 15 days apart, beginning from bud initiation, showed a notable increase in shoot length and the quantity of functional leaves. Stem elongation and protein synthesis are regulated by gibberellic acid (GA3). Actually, the Gibberella fujikuroi, which causes stem elongation, recovers GA3 as a metabolic byproduct. It is an extremely strong hormone that governs plant development and is found naturally in plants. [9]. showed that, plant height, fresh and dry weights of leaves and roots were increasing highly significantly with 3 g/l of potassium nitrate graduated by 2 g/l urea and 5 g/l ammonium sulfate respectively at both seasons on date palm. Balance fertilization of NPK showed that had significant affected on leave area, diameter, height, and lateral branches of apple cultivars [10]. [11]. found that GA3 affected on chlorophyll content on anna apple tree. [12]. found that GA3 was most effective on stem height, leaf area, stem diameter, root fresh weight, root dry weight, shoot fresh and dry weights of both almond species. [13] indicated that spraying of GA3 and NAA on seedling sour orange with treatment singular and together caused a significant increasing in the rate of length, diameter, leaf area, and chlorophyll. [14]. studied that NAA and GA3 treatments recorded significantly maximum length of seedling, diameter, leaf area, chlorophyll content, fresh weight of seedling and dry weight of custard apple seedling.
[15]. was found that GA3 has significant effect on vegetative growth of almond transplants such as (diameter, number of shoots, leaf area, and chlorophyll content).

Material and Methods

This study was carried out during growing season (2022-2023) in the nursery of horticulture department, college of Agriculture Engineering Sciences, University of Duhok, Kurdistan region, Iraq. Almond seedlings one-year-old are taken from college nursery, planting in plastic pots (26cm diameter) capacity with 10kg soil. Randomized complete block design (RCBD) as factorial experiment was used, including three factors (Full green fertilizer (NPK) (0, 4, 8) gm. L^{-1}, GA3 (0, 500, 1000) mg. L^{-1}, and NAA (0, 750, 1250) mg. L^{-1} with three levels (3*3*3*3) with three seedlings for each experiment unit. Statistical analysis was performed by SAS program [16].

Results were compared according to Duncan's multiple range tests at 5% [17].

In the end of study, the measurements were measured:

1. Stem length (cm) by tap
2. Stem diameter (mm) by digital Verner device
3. Leave area (cm^2) by image program
4. Number of branches
5. Total chlorophyll content by SPAD-502 device
6. Shoot fresh weight (gm)
7. Shoot dry weight (gm)
8. Root fresh weight (gm)
9. Root dry weight (gm)

Results

Table (1) showed that spraying of full green fertilizer gave significant effect on length (90.11 cm) at 8 gm/l^{-1} compared with control, while GA3 gave not significant effect on length parameter, however, spraying of seedlings with NAA increased (90.85 cm) the length of it at 1250mg/l^{-1} which compared to other levels.

The triple interaction gave significant differences between data, the longest seedling (98.33 cm) was in 4gm/l^{-1} full green with 50 gm/l^{-1} GA3 from untreated seedlings of NAA which compared with other treatments.

Table (1): Effect of full green fertilizer, Ga3, and NAA on stem length (cm) of almond seedlings.

Full green fertilizer (gm/l^{-1})	GA3 (mg/l^{-1})	NAA (mg/l^{-1}) 0	750	1250	Full green F. * GA3	Full green F.
0	0	88.67c-i	82.00i-l	90.67b-g	87.11c	86.07b
	50	77.00l	93.67a-d	78.00kl	82.89d	
	100	85.67e-j	83.67g-l	95.33abc	88.22bc	
4	0	84.33f-k	90.00b-h	86.00e-j	86.78c	89.22a
	50	98.33a	84.00f-k	91.33a-f	91.22ab	
	100	95.33abc	79.67jkl	94.00a-d	89.67abc	
8	0	85.67e-j	82.67h-l	96.00abc	88.11bc	90.11a
	50	90.00b-h	96.33ab	92.00a-e	92.78a	
	100	87.67d-i	86.33e-j	94.33a-d	89.44abc	
Mean of NAA		88.07b	86.48b	90.85a		
Full green F. * NAA	0	83.78d	86.44cd	88.00bc	Mean of GA3	
	4	92.67ba	84.56cd	90.44ab		
	8	87.78bc	88.44bc	94.11a		
GA3 * NAA	0	86.22d-f	84.89ef	90.89abc	0	87.33a
	50	88.44b-e	91.33ab	87.11c-f	50	88.96a
	100	89.56bcd	83.22f	94.56a	100	89.11a

In table (2) found that each single factor (full green fertilizer, GA3, and NAA) had not significant effect on stem diameter. Triple interaction between (full green fertilizer*GA3*NAA) gave significant decrease in stem diameter, the best diameter (5.81 mm) at untreated seedlings of full green, GA3 with 1250 mg/l^{-1} NAA.

Table (2): Effect of full green fertilizer, Ga3, and NAA on stem diameter (mm) of almond seedlings.

Full green fertilizer (gm/l^{-1})	GA3(mg/l^{-1})	NAA (mg/l^{-1})			Full green F. * GA3	Full green F.
		0	750	1250		
0	0	4.33c-f	5.70ab	5.81a	5.28a	4.75a
	50	3.86def	4.51c-f	5.03abc	4.47bc	
	100	4.39c-f	4.41c-f	4.72b-e	4.51bc	
4	0	4.48c-f	3.62f	4.07c-f	4.06c	4.49a
	50	4.99abc	4.19c-f	4.78b-e	4.65b	
	100	5.03abc	4.45c-f	4.84a-d	4.77b	
8	0	5.07abc	4.41c-f	4.66cde	4.71b	4.61a
	50	4.70b-e	4.75b-e	4.42c-f	4.62b	
	100	3.75ef	4.86a-d	4.82a-d	4.48c	
Mean of NAA		4.51a	4.54a	4.80a		
Full green F.* NAA	0	4.19cd	4.87ab	5.19a	Mean of GA3	
	4	4.83ab	4.09d	4.56bcd		
	8	4.51bcd	4.68abc	4.64bcd		
GA3 * NAA	0	4.62a	4.58a	4.85a	0	4.68a
	50	4.52a	4.48a	4.75a	50	4.58a
	100	4.39a	4.57a	4.80a	100	4.59a

Table (3) illustrated that full green fertilizer meaningfully increased shoot number (9.22) at $8gm/l^{-1}$ compared to other treatments, while, GA3 found no significant effect at three levels on number of branches, in addition, NAA had significant effect (9.59) at $750mg/l^{-1}$. Triple interaction between three factors had no significant effect on number of branches, the highest value was (13.33) from (untreated plants) control of each treatment

Table (3): Effect of full green fertilizer, Ga3, and NAA on shoot number of almond seedlings.

Full green fertilizer(gm/l^{-1})	GA3(mg/l^{-1})	NAA (mg/l^{-1})			Full green F. * GA3	Full green F.
		0	750	1250		
0	0	13.33a	9.67b-e	6.67efg	9.89ab	8.96a
	50	6.67efg	11.33ab	9.33b-f	9.11abc	
	100	8.00c-g	8.00c-g	7.67d-g	7.89cd	
4	0	7.67d-g	10.33bcd	10.33bcd	9.44abc	8.04b
	50	6.33fg	11.00abc	6.33fg	7.89cd	
	100	6.33fg	7.67d-g	6.33fg	6.78d	
8	0	9.33b-f	9.33b-f	6.00g	8.22cd	9.22a
	50	10.33bcd	7.33d-g	8.67b-g	8.78bc	
	100	11.33ab	11.67ab	9.00b-g	10.67a	
Mean of NAA		8.81a	9.59a	7.81b		
Full green F. * NAA	0	9.33ab	9.67a	7.89bc	Mean of GA3	
	4	6.78c	9.67a	7.67c		
	8	10.33a	9.44ab	7.89bc		
GA3 * NAA	0	10.11a	9.78a	7.67b	0	9.19a
	50	7.78b	9.89a	8.11b	50	8.59a
	100	8.56ab	9.11ab	7.67b	100	8.44a

Table (4) show us the full green fertilizer significantly increased leave area (47.48cm^2) at 8gm/l^{-1}, also, GA3 had significant difference on leave area (47.08cm^2) at 100mg/l^{-1} in addition, NAA also gave significant effect (46.12cm^2) at 750 mg/l^{-1}. Tri interaction gave significant difference (50.50cm^2) from 8gm/l^{-1} full green fertilizer with 100mg/l^{-1} GA3 and 750mg/l^{-1} NAA compared to other data.

Table (4) Effect of full green fertilizer, Ga3, and NAA on leaf area (cm^2) of almond seedlings.

Full green fertilizer (gm/l^{-1})	GA3 (mg/l^{-1})	NAA (mg/l^{-1})			Full green F. * GA3	Full green F.
		0	750	1250		
0	0	43.84d-h	41.27hi	45.79b-g	43.63d	44.32b
	50	46.21a-g	43.90d-h	41.31hi	43.81cd	
	100	43.93d-h	45.78b-g	46.82a-f	45.51bcd	
4	0	43.46e-i	47.59a-e	45.87b-g	45.64bcd	43.83b
	50	39.48ij	42.79f-i	37.01j	39.76e	
	100	47.00a-f	45.46c-h	45.78b-g	46.08bc	
8	0	46.64a-g	49.68abc	47.07a-f	47.80ab	47.48a
	50	44.50d-h	48.13a-d	42.29ghi	44.97cd	
	100	50.21ab	50.50a	48.27a-d	49.66a	
Mean of NAA		45.03ab	46.12a	44.47b		
Full green F. * NAA	0	44.66cd	43.65cd	44.64cd	Mean of GA3	
	4	43.31d	45.28bcd	42.89d		
	8	47.12b	49.44a	45.88bc		
GA3 * NAA	0	44.65bc	46.18ab	46.24ab	0	45.69b
	50	43.40c	44.94abc	40.20d	50	42.85c
	100	47.05ab	47.25a	46.96ab	100	47.08a

Table (5) illustrated that the full green fertilizer, GA3, and NAA gave significant decrease on total chlorophyll (45.86%), (45.65%), and (46.45%) respectively on untreated seedlings. Triple interaction found that the higher level (62.08%) was in 8gm/l^{-1} full green fertilizer and from untreated seedlings of GA3 and NAA.

Table (5) Effect of full green fertilizer, Ga3, and NAA on leaf chlorophyll content (SPAD unit) of almond seedlings.

Full green fertilizer (gm/l^{-1})	GA3(mg/l^{-1})	NAA(mg/l^{-1})			Full green F. * GA3	Full green F.
		0	750	1250		
0	0	53.16b	40.30e-h	53.02b	48.83a	45.86a
	50	54.27b	36.50hij	37.43hij	42.73cd	
	100	42.62d-g	51.42b	44.07de	46.03b	
4	0	39.38f-i	38.88g-j	51.07b	43.11cd	41.05c
	50	42.90d-g	49.93bc	37.18hij	43.34cd	
	100	35.30ij	34.69j	40.08e-h	36.69e	
8	0	62.08a	37.71hij	35.28ij	45.02bc	44.30b
	50	46.18cd	40.24e-h	52.83b	46.42b	
	100	42.20d-g	38.70g-j	43.47def	41.46d	
Mean of NAA		46.45a	40.93c	43.83b		
Full green F. * NAA	0	50.02a	42.74bc	44.84b	Mean of GA3	
	4	39.19d	41.17cd	42.78bc		
	8	50.15a	38.88d	43.86b		
GA3 * NAA	0	51.54a	38.97e	46.45b	0	45.65a
	50	47.78b	42.22cd	42.48c	50	44.16b
	100	40.04de	41.60cd	42.54c	100	41.39c

Table (6) show us that full green fertilizer has significant decrease on shoot fresh weigh, the maximum value was (8.67g) from control, also, GA3 & NAA factors find best shoot fresh weight respectively (9.05g and 8.73g) from 100mg/l^{-1} GA3and 1250mg/l^{-1} NAA.Triple interaction explained that 8gm/l^{-1} full green fertilizer with 100mg/l^{-1} GA3 with 750mg/l^{-1} NAA gave best differences between data was (10.84g) compared to other data.

Table (6) Effect of full green fertilizer, Ga3, and NAA on shoot fresh weight (gm) of almond seedlings.

Full Green fertilizer (gm/l^{-1})	GA3 (mg/l^{-1})	NAA(mg/l^{-1})			Full Green F. × GA3	Full Green F.
		0	750	1250		
0	0	7.88e-h	7.66fgh	9.21cd	8.25bc	8.67a
	50	8.75cde	7.27gh	10.42ab	8.81b	
	100	8.23d-g	8.36def	10.23ab	8.94ab	
4	0	6.95h	9.54bc	8.39def	8.29bc	8.10b
	50	7.71e-h	7.91e-h	7.13h	7.58c	
	100	8.25d-g	9.18cd	7.85e-h	8.43bc	
8	0	9.66bc	7.44fgh	8.35def	8.48bc	8.66a
	50	7.70e-h	7.89e-h	7.53fgh	7.71c	
	100	9.08cd	10.84a	9.45bc	9.79a	
Full Green F. * NAA	0	8.29bc	7.77c	9.95a		
	4	7.64c	8.88b	7.79c	Mean of GA3	
	8	8.81b	8.73b	8.44bc		
GA3* NAA	0	8.16bc	8.22bc	8.65abc	8.34b	
	50	8.05c	7.69c	8.36bc	8.03c	
	100	8.52abc	9.46a	9.18ab	9.05a	
Mean of NAA		8.25b	8.46ab	8.73a		

Table (7) illustrated that full green fertilizer significantly increased shoot dry weight (5.58g) at $8gm/l^{-1}$, while, GA3 meaningfully increased shoot dry weight (5.92g) at $100mg/l^{-1}$, otherwise, NAA has no significant effect on shoot dry weight. Triple interaction on almond seedlings found the best shoot dry weight (8.05g) from $8gm/l^{-1}$ full green fertilizer with $100mg/l^{-1}$ GA3 via $750mg/l^{-1}$ NAA compared to other data.

Table (7) Effect of full green fertilizer, Ga3, and NAA on shoot dry weight (gm) of almond seedlings.

Full green fertilizer (gm/l^{-1})	GA3(mg/l^{-1})	NAA(mg/l^{-1}) 0	750	1250	Full green F.× GA3	Full green F.
0	0	4.82f-j	4.74g-j	5.37d-j	4.98bc	5.53a
	50	5.72d-g	4.05j	7.69ab	5.82ab	
	100	5.15e-j	5.17e-j	7.07abc	5.80ab	
4	0	4.30hij	6.54bcd	5.48d-i	5.44bc	5.15b
	50	5.12e-j	5.16e-j	4.07j	4.78bc	
	100	4.89f-j	6.10c-f	4.70g-j	5.23bc	
8	0	6.62bcd	4.16ij	5.56d-h	5.45bc	5.58a
	50	4.59g-j	4.74g-j	4.36hij	4.56c	
	100	5.87c-g	8.05a	6.27cde	6.73a	
Full green F. * NAA	0	5.23bc	4.65c	6.71a		
	4	4.77c	5.93ab	4.75c	Mean of GA3	
	8	5.69bc	5.65bc	5.40bc		
GA3 *NAA	0	5.25abc	5.15bc	5.47abc	5.29b	
	50	5.14bc	4.65c	5.37abc	5.06b	
	100	5.30abc	6.44a	6.02ab	5.92a	
Mean of NAA		5.23a	5.41a	5.62a		

Table (8) show us the root fresh weight increased (6.37g) from untreated plant of full green fertilizer, while GA3 significantly differ (6.50g) in 100mg/l^{-1} from other level, otherwise, NAA had no significant effect on root fresh weight. Triple interaction (full green F.*GA3*NAA) factors produced best weight (7.40g) by 8gm/l^{-1} full green and control of each GA3 and NAA treatment.

Table (8) Effect of full green fertilizer, Ga3, and NAA on root fresh weight (gm) of almond seedlings.

Full green fertilizer (mg/l^{-1})	GA3(mg/l^{-1})	NAA(mg/l^{-1}) 0	750	1250	Full green F. × GA3	Full green F.
0	0	6.32d-g	6.04e-j	6.56c-f	6.30abc	6.37a
	50	6.28d-g	5.57g-j	7.10abc	6.32abc	
	100	6.22d-h	6.17d-i	7.05abc	6.48ab	
4	0	5.41ij	6.23d-h	5.50hij	5.71cd	5.82b
	50	5.46hij	5.88e-j	5.35j	5.57d	
	100	6.05e-j	6.64b-e	5.84f-j	6.17bcd	
8	0	7.40a	5.64g-j	5.51hij	6.18bcd	6.24a
	50	5.52hij	6.15d-i	5.47hij	5.71cd	
	100	6.81a-d	7.28ab	6.41c-f	6.83a	
Full green F. * NAA	0	6.27bcd	5.93cde	6.90a		
	4	5.64e	6.25bcd	5.56e	Mean of GA3	
	8	6.57ab	6.36bc	5.80de		
GA3 *NAA	0	6.38abc	5.97bc	5.86bc	6.07b	
	50	5.75c	5.87bc	5.97bc	5.86b	
	100	6.36abc	6.70a	6.43ab	6.50a	
Mean of NAA		6.16a	6.18a	6.09a		

Table (9) illustrated that full green significantly decreased at root dry weight (3.93g) from control, also, GA3 increased (3.85g) at 100mg/l^{-1}, otherwise, NAA does not significant difference. We found best results of root dry weight per almond seedling and significant differences during the triple interaction, the maximum value obtained (4.98g) from 8gm/l^{-1} full green and control each of GA3 and NAA.

Table (9) Effect of full green fertilizer, Ga3, and NAA on root dry weight (gm) of almond seedlings.

Full green fertilizer (gm/l^{-1})	GA3(mg/l^{-1})	NAA(mg/l^{-1})			Full green F. × GA3	Full green F.
		0	750	1250		
0	0	4.06b-f	3.84c-h	4.82ab	4.24a	3.93a
	50	3.78c-i	3.17f-j	4.26a-d	3.74abc	
	100	3.56d-j	3.60d-j	4.28a-d	3.81ab	
4	0	2.86j	3.88c-h	3.34e-j	3.36bc	3.52b
	50	3.72c-j	3.50d-j	3.01hij	3.41bc	
	100	3.88c-h	4.23a-e	3.22f-j	3.78ab	
8	0	4.98a	3.45d-j	3.26f-j	3.90ab	3.66b
	50	3.11g-j	3.32f-j	2.91ij	3.11c	
	100	3.93c-g	4.53abc	3.42d-j	3.96ab	
Full green F. * NAA	0	3.80b	3.53bc	4.45a		
	4	3.49bc	3.87b	3.19c	Mean of GA3	
	8	4.00ab	3.76b	3.20c		
GA3 *NAA	0	3.96ab	3.72ab	3.81ab	3.83a	
	50	3.54ab	3.33b	3.39b	3.42b	
	100	3.79ab	4.12a	3.64ab	3.85a	
Mean of NAA		3.76a	3.72a	3.61a		

Discussion

The significant increasing of some studied parameters as a result to increase the levels of full green as in (length of stem, no. of branches, leave area, and shoot dry weight) Fertilizers have a significant impact on almond seedlings because they contain three essential elements for plant growth: potassium, which is important for stem and root growth and is involved in plant metabolism and protein synthesis, phosphorus, which is important for photosynthetic processes, respiration, energy storage, and cell division, and nitrogen, which promotes leaf growth, chlorophyll component, and vegetative growth and green coloration of foliage [18] [19]. According to, [20]. the primary macronutrients found in inorganic fertilizers are nitrogen, phosphorus, and potassium. These nutrients have an impact on the vegetative and reproductive phases of plant growth. Similar results were also reported by [21] on peach tree, **[**22] on Khaya senegalensis African Mahogny, and **[**23] on almond transplant. While, the most parameters were significant differences in 100 mg/l^{-1} GA3 as in (length of stem, leave area, shoot fresh weight, shoot dry weight, root fresh weight, and root dry weight). The reason might be attributed to the seedling's overall growth and increased rate of photosynthesis, which resulted in the seedling's overall assimilation and redistribution of photosynthesis. enhanced growth, which may be caused by GA3's rise in leaf length and width. Greater cell division and elongation finally resulted in an increase in vegetative growth. Similar results were also reported by [24] in custard apple, [25] on almond transplant. Also, NAA meaningfully increased some characteristics such as (length of stem, shoot fresh weight, number of branches, and leave area) respectively in 1250 and 750 mg/l^{-1}. NAA can also promote protein synthesis and RNA synthesis **[**26]**;** [27]**,** as well as stimulate carbohydrate and nitrogenous material hydrolysis and translocation at the seedling, resulting in increased cell division and improved rooting.

Conclusion

This conclusion explained according to the results that were obtained from the study that was conducted: the best level of full green 8gm/l^{-1} was the effect concentration on (stem length, no. of branches, leave area, and shoot dry weight), while, GA3 in 100mg/l^{-1} concentration obtained the best results on (stem length, leave area, shoot fresh weight, shoot dry weight, root fresh weight, root dry weight), more ever, but NAA at 750mg/l^{-1} effect on no. of branches and leave area, also, NAA at 1250mg/l^{-1} effect on almond seedlings in stem length and shoot fresh weight parameters. However, triple interaction significantly effects on all parameters in an excellent way.

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تأثير الرش بسماد **Full green** و **3GA** و **NAA** في بعض صفات النمو الخضري و الجذري لشتلات اللوز البذرية

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الخلاصة

أجريت هذه الدراسة في مشتل جامعة دهوك قسم البستنة كلية علوم الهندسة الزراعية في إقليم كردستان العراق خلال الموسم الزراعي (2022-2023). حصلنا شتلات اللوز البالغة من العمر عام واحد من مشتل الحرم الجامعي. وتم الرش مرتين: الرشة الأولى كانت في 1 نيسان والرشة الثانية في 1 ايار. تم استخدام تصميم القطاعات العشوائية الكاملة (RCBD) كتجربة عاملية، متضمنة ثلاثة عوامل (سمادNPK (Full green) 0، 4، 8) غم . لتر-1، 3GA(0 ، 50، 100) ملغم. لتر-1، و NAA 0 ، 750، 1250) ملغم. لتر-1،(3*3*3*3) بثلاثة شتلات لكل وحدة تجريبية. تم إجراء التحليل الإحصائي بواسطة برنامج SAS، وتمت مقارنة النتائج وفقا طبقاً لاختبارات دنكان المتعددة المدى بنسبة 5% ، أظهرت النتائج أن سماد Full green زاد معنوياً (طول الساق 90.11سم، عدد الأفرع9.22، مساحة الورقة 47.48سم^2، الوزن الجاف لمجموعه الخضرى5.58غم) عند 8 غم/لتر-1، كما زاد ال3GA معنوياً. تأثر على (طول الساق 89.11سم، مساحه الورقة 47.08سم2، الوزن الرطب للمجموع الخضري 9.05غم، الوزن الجاف للمجموع الخضري 5.92غم، الوزن الرطب للجذر 6.50غم، الوزن الجاف للجذر 3.85غم) عند 100 ملغم/لتر-1، بالإضافة إلى ذلك، زاد NAA طول الساق90.85سم والوزن الجاف للمجموع الخضرى 8.73غم عند 1250 ملغم/لتر-1 بينما بلغ عدد الفروع 9.59فروع ومساحة الأوراق 46.12سم^2 فى 750 ملغم/لتر-1 NAA.

الكلمات المفتاحية:سماد Full green ومنظمات النمو GA3,NAA،شتلات اللوز البذرية.