Effect of shading, glycine, and α-tocopherol spray on the growth of Yemeni pomegranate transplants.

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Abstract

The experiment was conducted in a governorate nursery belonging to Diyala Agriculture directorate during 2023 growing season to study the effect of shading, spraying with glycine and α-tocopherol on some growth traits of one-year-old pomegranate transplants.

A factorial experiment according to RCBD using the NESTED system with three factorsshading(0,50%) glycine(0,250% mg\L^{-1}), and α-tocopherol spray(0,75,125,225 mg\L^{-1}) with three replicates and 3 transplants per experimental unit was used Shading treatment exceeds 50% has a superiority in most of the growth studied traits (Increment in stem diametermain stem length, leaves content of chlorophyll, and fresh weight of shoots, while did not differ significantly from the non-shading treatment in weight the root system, leaves proline, and protein content.

The glycine spray treatment exceeds 250 mg\L^{-1} acid glycine led to obtaining the highest values in vegetative growth characteristics (average increase in main stem diameter, main stem length, leaves chlorophyll content, shoot fresh weight, roots fresh weight).

Spraying Alpha tocopherol spray at 225 mg L^{-1} gave the highest values in main stem length increase, leaves chlorophyll content, while the spraying at 125 mg L^{-1} gave the highest values in the average increase in main stem diameter, and the fresh weight of vegetative system.

Introduction

Pomegranate belongs to the family Punicaceae and the genus Punica the best fruit was found in Carthage (1). It is a subtropical fruit tree crop cultivated in sub-temperate ,temperate , tropical ,and subtropical areas throughout the world (2). Shading was adopted because it is a crucial and essential factor in protecting the fruit from sunburn and reducing light and heat intensity. The use of a Shading net, influences fruit production, back flowering, and motivation flower Shading was adopted because it is an important and essential factor in protecting the fruit from sunburn .Shading works primarily to modify the quantity and quality of light underneath ,as reducing the intensity of heat and light leads to an increase in the leaf area ,the length of the branches ,and the fresh weight of the Vegetative system, as it increases with the increases with the increase in the percentage of total shading .affecting fruit production , flower development and flowering stimulation((3) subjected olive seedlings (*Olea europaea*) to three levels of shading (0, 25, and 50%), and he found that the 50% shading level had a significant effect on growth traits by giving the highest rate of shoots length, leaf area, and dry matter percentage of the shoot system(4)

Glycine is a biological amino acid in cells. It can facilitate the absorption and transfer of

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nutrients in plants,(5)Glycine plays an important role in plant growth and chlorophyll synthesis and has an effective role in improving plant pigments and reducing the negative effects of water stress (6). (7) reported that glycine spray at 500,1000 mg L^{-1} to five-years-old *Psidium guajava* trees enhanced growth traits (stem length, stem diameter, leaves chlorophyll, N, P, and K content compared to untreated plants during the 2020-2021 growing seasons.

α-Tocopherol (Vitamin E) is a non-enzymatic antioxidant, which, if applied to leaves, promotes the growth and yield of plants, especially under stress conditions 8). (9) investigated a foliar spray of 500 mg L^{-1} α-Toc and showed significant increases in root and shoot dry weights in soybeans grown under salt stress conditions.other functions of tocopherols in plants have been recently described,including their involvement in photosynthesis transduction ,carbohydrate metabolism ,cellular signaling and plant response to biotic and abiotic stresses(10)

Given the recent commencated of Yemeni pomegranates into Diyala Governorate and the less of studies related to the growth of its seedlling and its tolerance to environmental conditions in Iraq ,this study was conducted with the amio of knowing the effect of using saran mulch and spraying with both glycine and alpha-tocopherol on the growth of yameni pomegranate seedllings under the conditions of Diyala Governorate

Materials and Methods

The experiment was carried out in the nursery of the Directorate of Agriculture in Diyala governorate during the 2023 growing season for the period from 15\04\2023 to 1\11\2023 to study the effect of shading, spraying glycine and Alpha-tocopherol on some growth characteristics of one- year old Yemeni pomegranate transplants. A three –factor factorial experiment was implemented according to a randomized complete block design (R.C.B.D) using a three –factor nested design The experiment included three factors, shading with saran green nets at two levels(0, and 50%), Glycine spray at two conc.(0, and 250 mgL^{-1}) (11), and alpha-tocopherol spray at four conc.(0, 75, 125, and 225 mgL^{-1}) (12) Glycine and a-tocopherol were sprayed three times each, with 30-day intervals starting from 1 May.

Studied attributes:

1 increment in stem diameter (mm).

The diameter of the stem was measured at a height of 5 cm above the soil surface at the beginning of the experiment using a Vernia and at the end of experiment.the difference between the two readings represents the increase in the diameter of the stem.

2- increment in main stem length (cm).

The length of main stem was measured using a measuring tape at the beginning f the experiment ,and after completing the experiment ,the plant height was measured, and the difference between the two readings represents the average increase.

3 – Leaves content of chlorophyll (mg .100 gm weight fresh)

Chlorophyll content was estimated in the laboratory of the College of Agriculture ,university of Diyala according to the Howrtiz method (13)

4- Leaves content of proline (mg.g-1).

Proline was estimated according to the method (14)

5- leaves content of Protein (%) .

The percentage of nitrogen in proteins was estimated at 16% so the percentage of protein was calculated through the equation mentioned in Al-Falih.(15)

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Percentage of protein =6.25×total nitrogen percentage.

6- Average fresh weight of shoot and root systems (gm plant - 1)

At the end of the experiment ,the plants and soil were extracted from the anvils, and the root system was separated from the shoots from the crown area using pruning shears .the roots were washed well with water and after the water dried they were weighed using a sensitive balance (16)

Results and Discussion

1-increment in main stem diameter (mm)

The results presented in Table (1) showed that shading led to a significant increase in the average stem diameter compared to the unshaded treatment, as the shading treatment gave the highest increase in stem diameter, compared to the unshaded treatment.

Glycine spray caused a significant increase in stem diameter, About the spraying treatments with α-Tocopherol, it is noted that the spraying treatment with 125 mg L^{-1} was significantly superior to the rest of the treatments by giving the highest increase in stem diameter, whereas spraying 225 mg L^{-1} treatment gave the lowest increase.

Table 1: Effect of shading, glycine, and α-Tocopherol spray, on main stem diameter increase (mm) of Yemeni pomegranate transplants.

Shading	a- tocopherol mg L^{-1}				Shading * Glycine
	glycine mg L^{-1}	0	75	125	225	
Un shaded	0	1.41 h	1.78 fg	2.11 def	1.79 fg	1.78 c
	250	2.10 cf	1.95 efg	2.26 cde	2.49 bc	2.20 b
Shaded	0	2.46 bcd	2.27 cde	2.80 ab	1.66 gh	2.30 b
	250	2.70 a-c	2.87 a	2.88 a	2.49 bc	2.73 a
			Shading*a-			Shading
Un shaded		1.76	1.86 b	2.19	2.14	1.99 B
Shaded		2.58	2.57	2.84	2.08	2.52 A
Glycine mgL^{-1}		Glycine*a-tocopherol				Glycine
0		1.94	2.03 b	2.46	1.73	2.04 B
250		2.40	2.41	2.57	2.49	2.47 A
Average a-tocopherol		2.17 B	2.22 B	2.51 A	2.11 B	

*Treatments that contain at least one similar letter do not differ significantly from each other at 0.05 level according to Duncan's multinomial test.

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2. increment in main stem length (cm)

Results in table 2 showed that shading treatment caused a significant increase in the average length of the main stem compared to the un-shaded one. as for the glycine spray treatments, we can notice that the treated transplants gave a significant increase in main stem length compared to untreated transplants. **α**-tocopherol spray at 225 mg L^{-1} gave the highest increase over the rest treatments, whereas untreated one gave the least increase

Table 2: Effect of shading, glycine, and α-tocopherol spray, on the average increase in main stem length (cm) of Yemeni pomegranate transplants

Shading	a- Tocopherol mg L-1					Shading * Glycine
	glycine mg L-1	0	75	125	225	
Un shaded	0	2.59 i	7.83 e f	6.11 f i	4.66 h i	5.30 C
	250	5.83 f i	4.22 i i	6.67 e i	9.75 c	6.62 B
shaded	0	6.78 e h	7.22 d g	13.66 b	9.61 c d	9.32 A
	250	5.00 g h i	7.33 d g	9.00 c d e	18.34 a	9.92 A
Shading* a-Tocopherol						Shading
Un shaded		4.21 h	6.03	6.39	7.21	5.96 B
Shaded		5.89	7.28	11.33 b	13.98	9.62 A
Glycine *a-toocopherol						Glycine
0		4.68	7.53	9.89 b	7.14 b	7.31 B
250		5.42	5.78 b	7.83	14.04	8.27 A
Average a-Tocopherol		5.05 D	6.65 C	8.86 B	10.59 A	

*Treatments that contain at least one similar letter do not differ significantly from each other at 0.05 level according to Duncan's multinomial test

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3-Chlorophyll content : (mg 100 g $^{-1}$ fresh weight)

The results presented in Table 3 showed that shading led to a significant increase in leaves' chlorophyll content compared to the unshaded ones. Glycine spray was significantly superior to unsprayed treatment. Spraying with a-tocopherol at 225 mg L^{-1} had a significant effect compared to the rest treatments, whereas untreated plants gave the lowest content.

Table 3. Effect of shading, glycine and α-tocopherol spray on leaves chlorophyll content (mg 100 g $^{-1}$ fresh weight) of Yemeni pomegranate transplants.

Shading	a- Tocopherol mg L-1					Shading * Glycine
	glycine mg L-1	0	75	125	225	
Un shaded	0	1.35 h	1.14 i	1.81 cd	1.49 f-h	1.45 C
	250	1.35 h	1.46 f-h	1.57 efg	2.06 ab	1.61 B
shaded	0	1.62 ef	1.51 f-h	1.94 bc	1.84 cd	1.73 A
	250	1.41 gh	1.73 de	1.84 cd	2.15 a	1.78 A
Shading* a-toocopherol						Shading
Un shaded		1.35	1.30	1.69	1.77	1.53 B
Shading		1.51	1.62	1.89	2.00	1.76 A
Glycine *a-toocopherol						Glycine
0		1.49	1.33	1.88	1.67	1.59 B
250		1.38	1.60	1.71	2.11	1.70 A
a-tocopherol		1.43 C	1.46 C	1.79 B	1.89 A	

*Treatments that contain at least one similar letter do not differ significantly from each other at 0.05 level according to Duncan's multinomial test

4-Proline content : (mg.g-1)

Table 4 showed that treatments of each of the studied factors (shading, glycine spray, and) did not differ significantly between them individually.

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Table 4: Effect of shading, glycine and α-tocopherol spray on the proline content of leaves (mg g^{-1}) of Yemeni pomegranate seedlings

Shading	a- Tocopherol mg L-1				Shading * Glycine
	glycine mg L-1	0	75	125	225	
Un shaded	0	3.90 abc	4.20 a	4.30 a	4.00 abc	4.10 A
	250	3.90 abc	3.80 abc	4.10 ab	3.60 bc	3.80 B
shaded	0	4.00 abc	4.20 a	3.50 c	4.00 abc	3.90 Ab
	250	4.00 abc	3.80 abc	3.90 abc	4.10 abc	4.00 Ab
Shading* a-toocopherol						Shading
Un shaded		3.90 b	4.00 b	4.20 a	3.80 b	4.00 A
Shaded		4.00 b	4.00 b	3.70 b	4.00 b	3.90 A
Glycine *a-toocopherol						Glycine
0		3.90	4.20	3.90	4.00	4.00 A
250		3.90	3.80	4.00	3.90	3.90 A
a-tocopherol		3.90 A	4.00 A	4.00 A	3.90 A	

*Treatments that contain at least one similar letter do not differ significantly from each other at 0.05 level according to Duncan's multinomial test

5-Protein content : (%)

Table 5 reveals that the treatments of shading, glycine spray, spray, and a-tocopherol did not differ significantly between them individually.

Table 5: Effect of shading, glycine, and α-tocopherol spray on leaves protein content (%)of Yemeni pomegranate transplants.

Shading	a- Tocopherol mg L-1				Shading * Glycine
	glycine mg L-1	0	75	125	225	
Un shaded	0	7.42 a	7.13 abc	7.36 a	7.09 abc	7.25 A
	250	7.29 ab	7.23 abc	7.19 abc	6.98 abc	7.17 A
shading	0	7.10 abc	7.00 abc	6.70 c	6.77 bc	6.91 B
	250	6.75 bc	6.92 abc	6.98 abc	6.90 abc	6.89 B
Shading* a-toocopherol						Shading
Un shaded		7.35	7.18	7.27	7.04	7.21 A
Shading		6.93 b	6.96 b	6.87 b	6.83 b	6.90 A

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	Glycine *a-toocopherol				Glycine
0	7.26	7.06	7.05	6.93	7.08
250	7.02	7.07	6.93	6.94	7.03
a-tocopherol	7.14	7.07	7.07	6.94	

*Treatments that contain at least one similar letter do not differ significantly from each other at 0.05 level according to Duncan's multinomial test

6-Vegetative system Fresh weight (gm)

The results presented in Table 6 show that the shading treatment led to an increase in the vegetative system fresh compared to the unshaded one. Glycine spray caused a significant increase in fresh weight compared with untreated plants. Concerning the a-tocopherol spraying treatments, we can notice that a-tocopherol spray at125 ml L^{-1} gave the highest fresh weight, whereas untreated plants gave the least fresh weight.

Table 6: Effect of shading, glycine, and α-tocopherol spray on Vegetative system Fresh weight (gm)

Shading	a- Tocopherol mg L-1				Shading * Glycine
	glycine mg L-1	0	75	125	225
Un shaded	0	26.80	25.00	28.30	31.30	27.90
	250	31.00	27.00	43.70	36.40	34.50
shaded	0	42.30	47.00	61.70	39	47.50
	250	50.00	52.70	44.30	49.00	49.00
Shading* a-toocopherol						Shading
Un shaded		28.90	26.00	36.00	33.90	31.20
Shaded		46.20	49.80	53.00	44.00	48.20
Glycine *a-toocopherol						Glycine
0		34.60	36.00	45.00	35.20	37.70
250		40.50	39.80	44.00	42.70	41.80
a-tocopherol		37.50	37.90	44.50	38.90	

***Treatments that contain at least one similar letter do not differ significantly from each other at 0.05 level according to Duncan's multinomial test**

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7-Fresh weight of root system (gm)

No significant differences were obtained from shading treatment compared to unshaded one,(Table 7). Concerning the glycine spraying treatments we can notice that sprayed plants gave the highest fresh weight of the root system compared to untreated plants. On the other hand apha-tocopherol spray had no significant effects on root system fresh weight.

Table 7: Effect of shading, glycine, and α-tocopherol spray on roots system Fresh weight (gm)

Shading	a- Tocopherol mg L-1				Shading * Glycine
	glycine mg L-1	0	75	125	225
Un shaded	0	39.00 ab	39.30 ab	30.70 b	39.30 ab	37.10 B
	250	43.30 a	40.70 ab	43.50 a	50.30 a	44.50 A
shaded	0	41.30 ab	41.30 ab	44.00 a	41.30 ab	42.00 AB
	250	43.30 a	42.30 a	41.00 ab	40.30 ab	41.80 AB
Shading* a-toocopherol						shading
Un shaded		41.20	40.00	37.10	44.80	40.80 A
Shaded		42.30	41.80	42.50	40.80	41.90 A
Glycine *a-toocopherol						glycine
0		40.20 b	40.30 b	37.30 b	40.30 b	39.50 B
250		43.30 a	41.50 b	42.20 a	45.30 a	34.10 A
a-tocopherol		41.80 A	40.90 A	39.80 A	42.80 A	

*Treatments that contain at least one similar letter do not differ significantly from each other at 0.05 level according to Duncan's multinomial test

Discussion:

It is clear from this study that shading nets have a significant effect on most of the studied characteristics, this may be due to the positive effects on decreasing light intensity to suitable levels that enable plants to grow in suitable environment conditions, where low lighting increases cell division through enhancing auxin movement within cells and promoting cell division and enlargement(17)

Shading enables the plant to increase the exposure of its leaves to suitable light intensity which improves chlorophyll synthesis and subsequently increases photosynthesis and its product (18). This means an increase in most growth traits

Spraying glycine had a positive effect on vegetative growth traits, as the amino acids participate in plant growth through the synthesis of proteins, plant hormones, and other organic compounds such as enzymes, amines, alkaloids, and vitamins (19) This means that glycine works to increase Photosynthesis efficiency as a result of enhancing chlorophyll formation, (Table 3),

and vegetative growth, (Tables 6, 7). This is consistent with the founds by (13).(20) The use of a-tocopherol improved the growth characteristics of Yemeni pomegranate transplants, as it has an important role in alleviating the negative impact of stress on metabolic activities related to growth by increasing the efficiency of water absorption and use, protecting photosynthetic pigments and increasing IAA content, which enhances cell division and expansion this is consistent with the findings of.(21) The positive effects on plant growth resulting from the treatment with a-tocopherol may be due to the role of antioxidants in the activity of the plant's vital processes, increasing growth and encouraging root growth, and the role of them in protecting the plant from Damage from oxidation, which in turn leads to protection of the photosynthesis process and its role in increasing plant hormones (22).

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