

**EFFECT OF SOME GROWTH SUBSTANCES ON
PARASTIC RELATIONSHIP BETWEEN *Vicia faba* L. AND
Orobanche crenata Forssk.**

**2- Effect of Morphactin, TIBA and Ethephon on Anatomical
characteristics of infected faba bean plants
with *Orobanche crenata***

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ABSTRACT

A pot experiment was conducted at Department of Agricultural Botany, Faculty of Agriculture, Kafr El-Sheikh Tanta University, Egypt, during 2000/2001 season to investigate the response of *Orobanche crenata* infected faba bean plants to application of three growth regulators (morphactin, TIBA and ethephon). The application of growth regulators were at 45 days from sowing and the samples were taken after 15 days from application.

Results showed that application of morphactin at 25, 50 or 100 ppm and TIBA at 75, 150 or 300 ppm as well as ethephon at 125, 250 or 500 ppm significantly increased diameter of infected faba bean root and thickness of vascular cylinder. The treatments also increased stem diameter, thickness of cortex, number of vascular bundles and thickness of xylem as well as vessel diameter, that compared with infected-untreated faba bean plants.

INTRODUCTION

The parasitic plants of the genus *Orobanche* (broomrape) are important pathogens of numerous agricultural crops throughout the world (Foy *et al.*, 1989). *Orobanche crenata* is one of the most important widespread parasitic weed in Egypt.

Hassan *et al.* (1991) mentioned that growth regulators could overcome or mitigate harmful effects of the parasite by stimulating the growth of the host rather than preventing parasite germination or growth.

The effect of growth regulators on anatomical structure was mentioned by many authors. Bradley (1969) mentioned that the

increase in thickness of xylem vessel as a result of treating apricot with 100 ppm ethrel, might be due to the stimulation of cambial activity. The aim of this investigation was to study the effect of some growth regulators (morphactin, TIBA and ethephon) on the anatomical structure of infected faba bean plants with broomrape.

MATERIALS AND METHODS

This investigation was conducted at the Agricultural Botany Department, Faculty of Agriculture, Kafr El-Sheikh, Tanta University during 2000/2001 season.

Faba bean seeds var. Giza 461 were obtained from the legume division ARC Egypt and *Orobanche crenata* Forssk seeds were obtained from the Weed Division, Agricultural Res. Station, Sakha, Kafr El-Sheikh.

Plastic pots used in this investigation (35 cm in diameter), each pot was filled provided with 9 kg loamy soil and artificially infested with pure *Orobanche crenata* seeds, 0.2 gram per pot. Five seeds of faba bean with *Orobanche* seeds were placed 3 cm below the soil surface. The sowing date was at 18/11/2000, three weeks after planting the faba bean seedlings were thinned to three plants per pot. Each pot received: 2 gm superphosphate (15.5% P₂O₅) before planting; 1 gm ammonium sulphate (20.5% N) with the first irrigation and 1 gm potassium sulphate (48% K₂O) after flowering.

The experiment was made in a complete randomized design with three replicates. At each replicate, three pots were taken at random.

Growth substances: Morphactin (2, chloro-9-hydroxy flouren-9-carboxylic acid) at (25, 50 or 100 ppm) was foliar sprayed to infected faba bean plants 45 days after sowing.

TIBA (2, 3, 5 triiodobenzoic acid) at (75, 150 or 300 ppm) was foliar sprayed to infected faba bean plants 45 days after sowing.

Ethephon (2, chloroethy phosphoric acid) at 125, 250 or 500 ppm was foliar sprayed to infected faba bean plants 45 days after sowing.

Sampling date:

The samples were taken at 60 days from sowing date and after 15 days from the spraying of growth substances.

The effect of growth substances, morphactin, TIBA and ethephon on the anatomical structure of leaves (lamina), stems and roots of infected faba bean plants with broomrape was studied. Specimens of 1 cm length were taken from the fifth internode from stem tip and the fifth leaf from the same internode including the midrib. Concerning the roots of faba bean, samples were taken from connection between faba bean root and *Orobanche crenata*.

The specimens were kept for killing and fixation in F.A.A. solution. The fixed materials were dehydrated in ethyl alcohol series, and finally embedded in paraffin wax of 56-58° c.m.p.

Sections of 20 μ thick were cut and mounted in Canada balsam (El-Ghmrawy and Zaher, 1953). The prepared sections were microscopically examined.

Data of anatomical characteristics were tested by analysis of variance. Duncan's multiple range test was used for comparisons among treatments means (Duncan, 1955).

RESULTS AND DISCUSSION

1. Root structure:

a. Effect of *Orobanche* parasitism:

The cross sections illustrated in Fig. (1) and data in Table (1) show that the infection of faba bean plants with *Orobanche* significantly decreased diameter of root and thickness of vascular cylinder when compared with control plants. These results are in agreement with those obtained by Attia (1992) and Abou-Elela (1999).

b. Effect of morphactin:

The cross sections illustrated in Fig. (1) and data in Table (1) show that morphactin at 50 and 100 ppm increased the diameter of infeced faba bean root and thickness of vascular cylinder as well as number of xylem vessel and diameter of xylem vessel when compared with infected-untreated plants. The same results were obtained by Mahmoud (1987) on tomato and El-Nady (1994) on eggplant.

c. Effect of TIBA:

The cross sections illustrated in Fig. (1) and data in Table (1) show that TIBA at 300 ppm increased root diameter, thickness of cortex and diameter of vascular cylinder, but the diameter of xylem vessel was not significantly affected compared to infected-untreated plants.

d. Effect of ethephon:

The cross sections illustrated in Fig. (1) and data in Table (1) show that, ethephon at 500 ppm increased the diameter of root and thickness of vascular cylinder as well as vessel diameter compared to infected-untreated plants. These results are in accordance with those obtained by Mostafa *et al.* (1984) on *Datura innoxai* and Ateya (2001) on soybean. In this respect, it can be suggested that the increase in diameter of xylem vessels may enhance more absorption of nutrients and water.

Table (1): Effect of infection with *Orobanche crenata* Forssk and application of some growth substances on root structure of *Vicia faba* L. (faba bean) plants.

Treatments		Diameter of root (μ)	Thickness of cortex (μ)	Thickness of vascular cylinder (μ)	Diameter of xylem vessel (μ)
Morphactin	25	7198.33 e	641.67 b	6041.67 d	53.33 ab
Morphactin	50	8091.67 b	688.33 ab	6758.33 b	55.00 ab
Morphactin	100	8258.33 b	700.00 ab	7059.33 a	58.33 a
TIBA	75	7816.67 c	666.67 b	6483.33 c	51.67 b
TIBA	150	8150.00 b	683.33 ab	6886.67 b	48.33 b
TIBA	300	8550.00 a	725.00 a	7200.00 a	50.00 b
Ethephon	125	8083.33 b	641.33 b	6750.00 b	51.67 b
Ethephon	250	8091.67 b	658.67 ab	6775.00 b	53.33 ab
Ethephon	500	8565.67 a	691.00 ab	7183.33 a	58.33 a
Infected-untreated plant		6850.00 f	650.00 b	5506.67 e	48.33 b
Control		7416.67 d	658.00 b	6116.67 d	50.00 b
L.S.D. 5%		189.30	52.05	147.15	6.13
L.S.D. 1%		258.21	70.99	200.73	8.36

Means followed by a common letter are not significantly different at the 5% level by DMRT.

2. Stem structure:

a. Effect of *Orobanche* parasitism:

The cross sections illustrated in Fig. (2) and data in Table (2) show that *Orobanche* parasitism decreased diameter of stem,

thickness of vascular cylinder, number of vascular bundles as well as thickness of cortex and xylem that compared with control plants. The same results were obtained by Attia (1992) and Abou-Elela (1999) on faba bean plants.

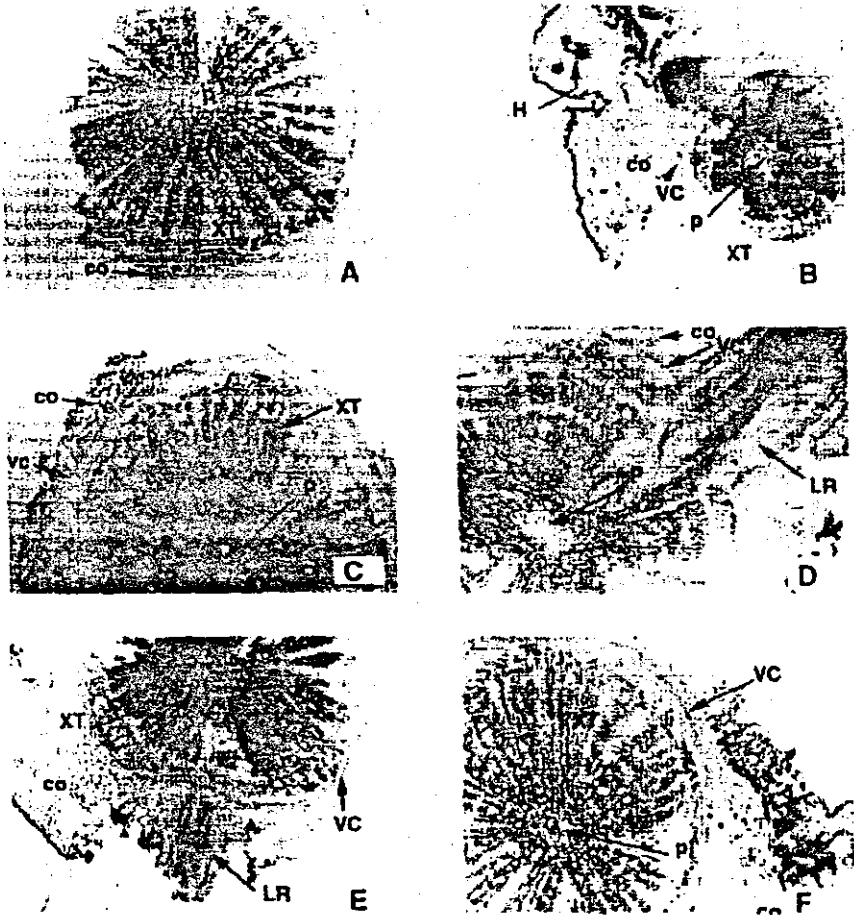


Fig. (1): Cross sections illustrating the effect of some growth regulators on root structure of broomrape infected faba bean plants (X = 100).

- A. Control free.
 - B. Control infected
 - C. Morphactin 50 ppm
 - D. Morphactin 100 ppm
 - E. TIBA 300 ppm
 - F. Ethephon 500 ppm
- CO = Cortex, PhT = Phloem tissue, XT = Xylem tissue, H = Houstonorium, LR = Lateral root, P = Pith.

Table (2): Effect of infection with *Orobanche crenata* Forssk and application of some growth substances on stem structure of *Vicia faba* L. (faba bean) plants.

Treatments	Diameter of stem (μ)	Thickness of cortex (μ)	Thickness of vascular cylinder (μ)	Number of vascular bundles (μ)	Thickness of xylem (μ)	Diameter of xylem vessel
Morphactin 25 ppm	5386.67 cde	213.33 abc	4866.67 ab	23.33 cde	275.00 bc	33.33 abc
Morphactin 50 ppm	5525.00 ab	196.67 cd	5041.67 ab	25.0 abc	291.67 abc	30.0 cd
Morphactin 100 ppm	5660.00 a	223.33 ab	5116.67 ab	25.33 ab	316.67 a	31.67 bcd
TIBA 75 ppm	5551.67 ab	213.33 abc	5041.67 ab	23.00 de	283.33 abc	31.67 bcd
TIBA 150 ppm	5415.00 b-e	226.67 a	4875.00 ab	23.0 de	300.0 ab	31.67 bcd
TIBA 300 ppm	5483.33 a-d	226.33 a	5116.67 ab	24.67 a-d	308.633 ab	36.67 ab
Ethephon 125 ppm	5416.67 b-e	203.33 bcd	5006.67 ab	24.33 bc	275.00 bc	35.00 abc
Ethephon 250 ppm	5545.00 abc	196.67 cd	5058.33 ab	23.67 b-e	283.33 abc	33.3 abc
Ethephon 500 ppm	5606.67 ab	203.33 bcd	5100.0 ab	26.33 a	300.0 ab	38.33 a
Infected-untreated plants	5130.0 f	183.33 d	4650.0 b	22.67 e	258.33 c	26.67 d
Control	5280.0 ef	213.33 abc	4766.67 b	23.33 cde	283.33 abc	30.0 cd
L.S.D. 5%	172.13	21.56	782.12	1.72	33.15	5.97
L.S.D. 1%	234.80	29.42	1066.85	2.34	45.22	8.14

Means followed by a common letter are not significantly different at the 5% level by DMRT.

b. Effect of morphactin:

The cross sections illustrated in Fig. (2) and data in Table (2) show that morphactin at 50 and 100 ppm increased the diameter of infected faba bean stem, thickness of vascular cylinder and diameter of xylem vessel compared to infected-untreated faba bean plants. These results are in line with those obtained by Mahmoud (1987) on tomato and El-Nady (1994) on eggplant.

c. Effect of TIBA:

The cross sections illustrated in Fig. (2) and data in Table (2) show that TIBA at the rate of 300 ppm increased infected faba bean stem diameter, thickness of cortex, number of vascular bundles, thickness of xylem as well as diameter of vessel compared to infected-untreated faba bean plants.

d. Effect of ethephon:

The cross sections illustrated in Fig. (2) and data in Table (2) revealed that ethephon at 500 ppm resulted in increasing infected faba bean stem diameter. This effect may be induce as a result of increase in thickness of cortex and vascular cylinder as well as number of vascular bundles that compare to infected-untreated faba bean plants. The same results were obtained by Ibrahim *et al.* (1990) on *Lupinus termis* L. and Ateya (2001) on soybean.

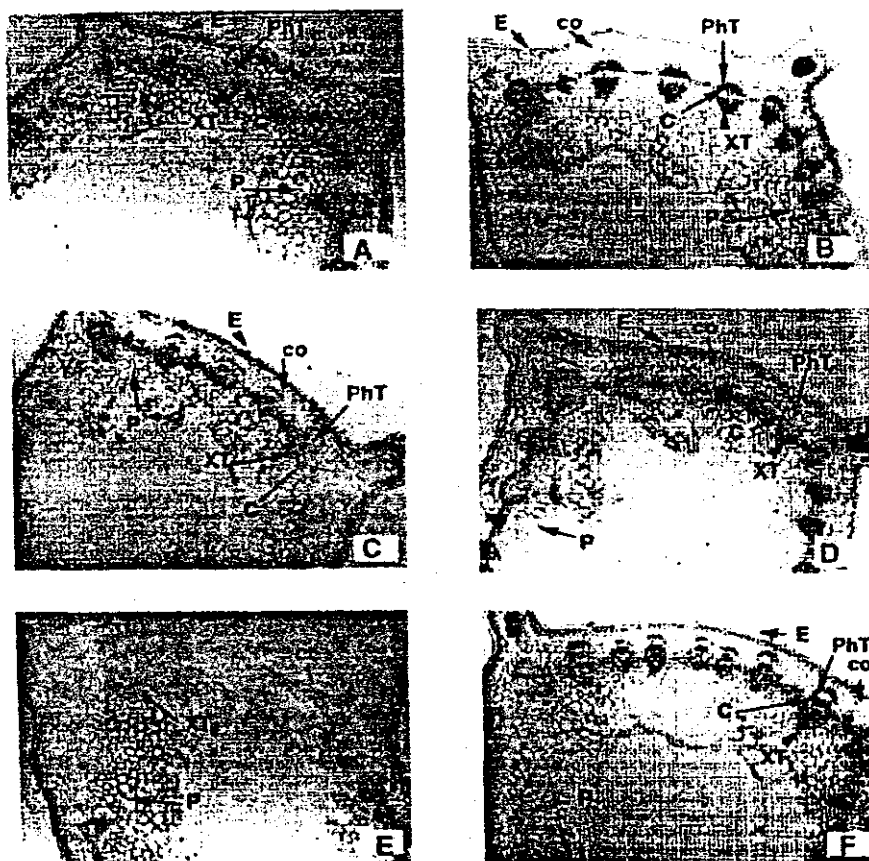


Fig. (2): Cross sections illustrating the effect of some growth regulators on stem structure of broomrape infected faba bean plants, (X = 100).

A. Control free.

B. Control infected

C. Morphactin 50 ppm

D. Morphactin 100 ppm

E. TIBA 300 ppm

F. Ethephon 500 ppm

E = Epidermis, CO = Cortex, PhT = Phloem tissue, XT = Xylem tissue, CT = Cambium tissue, P = Pith.

3. Leaflet structure:

a. Effect of *Orobanche* parasitism:

The cross sections illustrated in Fig. (3) and data in Table (3) show that the infected faba bean plants with *Orobanche* decreased thickness of blade, spongy and palisade tissue as well as number of xylem vessels when compared with control plants.

b. Effect of morphactin:

The cross sections illustrated in Fig. (3) and data in Table (3) show that morphactin at the rate of 50 and 100 ppm increased thickness of faba bean palisade and spongy tissues. These results are in agreement with those obtained by Mahmoud (1987) on tomato., who stated that morphactin produced abnormal leaves and large cells of mesophyll. The number and diameter of xylem vessels/medvein as well as thickness of epidermal layer increased with morphactin at 100 ppm compared to infected-untreated plants. Similar results were obtained by El-Emary (1995) on okra plants.

Table (3): Effect of infection with *Orobanche crenata* Forssk and application of some growth substances on leaflet structure of *Vicia faba* L. (faba bean) plants.

Treatments	Thickness (μ) of					Xylem vessels of medvein	
	Epidermal layer	Blade	Spongy tissue	Palisade tissue	Xylem of medvein	Number	Diameter
Morphactin 25 ppm	44.33 bc	550.0 e	270.0 e	191.67 ab	201.67 ab	7.33 abc	28.33 a
Morphactin 50 ppm	46.67 abc	608.33 bc	316.67 ab	200.0 a	208.33 ab	7.65 ab	31.67 a
Morphactin 100 ppm	53.33 a	611.67 bc	325.0 a	201.67 a	220.0 a	8.00 a	31.67 a
TIBA 75 ppm	43.33 bc	598.33 bcd	308.33 abc	203.33 a	196.67 abc	7.33 abc	26.67 a
TIBA 150 ppm	40.00 c	600.00 bcd	313.33 abc	196.67 a	198.33 abc	7.00 abc	28.33 a
TIBA 300 ppm	46.67 abc	641.67 a	323.33 ab	196.67 a	220.0 a	7.67 ab	30.0 a
Ethephon 125 ppm	40.00 c	583.33 cd	298.3 cd	188.33 ab	193.33 bc	6.67 bc	28.33 a
Ethephon 250 ppm	46.67 abc	585.00 bcd	300.00 a-d	191.67 ab	205.09 b	7.33 abc	28.33 a
Ethephon 500 ppm	50.00 ab	578.33 d	290.0 cd	191.67 ab	216.67 ab	7.7 ab	31.67 a
Infected-untreated plants	43.33 bc	518.33 f	268.33 e	163.33 c	181.67 c	6.33 c	26.67 a
Control	43.33 bc	541.67 ef	282.0 de	196.00 a	193.33 bc	6.67 bc	28.33 a
L.S.D. 5%	8.12	24.76	22.77	17.72	20.83	0.94	4.71
L.S.D. 1%	11.07	33.78	31.06	24.17	28.42	1.29	6.43

Means followed by a common letter are not significantly different at the 5% level by DMRT.

c. Effect of TIBA:

The cross sections illustrated in Fig. (3) and data in Table (3) show that TIBA at 300 ppm increased thickness of infected faba bean epidermal layer, blade, spongy and palisade tissues as well as diameter of xylem vessel when compared with infected-untreated plants. On the other hand, Abou Shoba *et al.* (1991) revealed that no differences could be detected in the leaf tissues between treated and untreated maize plants. El-Kady *et al.* (1992) illustrated that no differences of the anatomical leaf structure were obtained between TIBA treated and untreated rice plant.

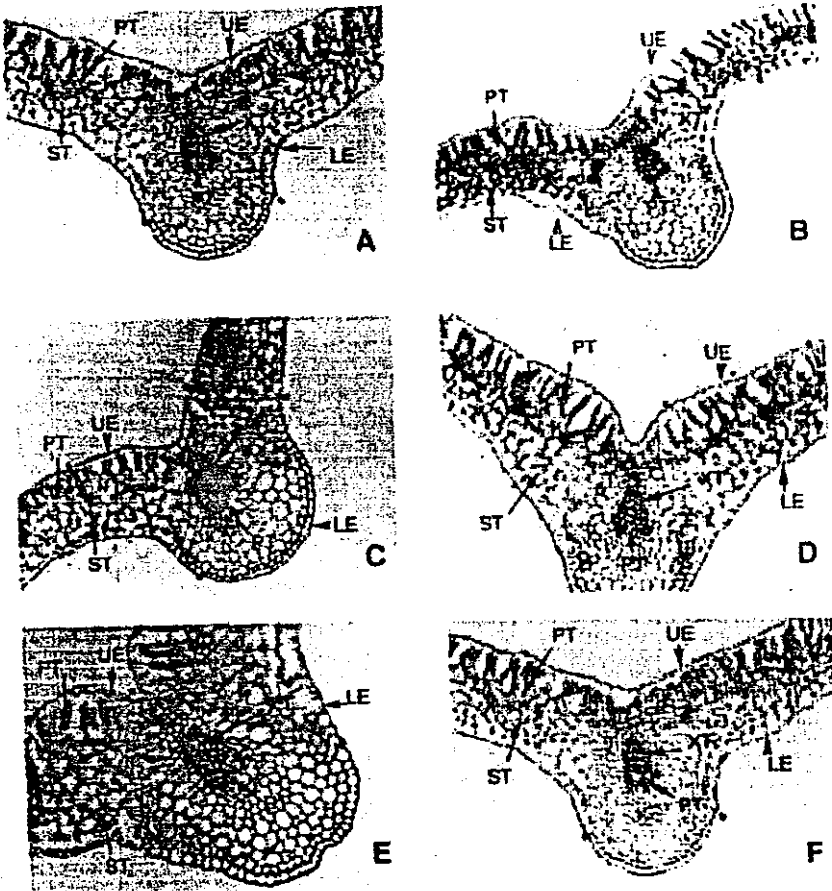


Fig. (3): Cross sections illustrating the effect of some growth regulators on leaflet structure of broomrape infected faba bean plant (X = 100).

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|----------------------|-----------------------|
| A. Control free. | B. Control infected |
| C. Morphactin 50 ppm | D. Morphactin 100 ppm |
| E. TIBA 300 ppm | F. Ethephon 500 ppm |

UE = Upper epidermis, LE = Lower epidermis, PT = Palisade tissue, ST = Spongy tissue, XT = Xylem tissue, PhT = Phloem tissue.

d. Effect of ethephon:

The cross sections illustrated in Fig. (3) and data in Table (3) show that ethephon (500 ppm) increased thickness of infected faba bean blade spongy and palisad tissues as well as thickness of xylem and diameter of xylem vessel when compared with infected-

untreated plants. These results are in accordance with those of Mostafa *et al.* (1984) on *Datura innoxia* and Ateya (2001) on soybean plants. The increment in diameter of xylem vessel may be due to the stimulation of cambial activity in the medvein as mentioned by Bradley *et al.* (1969) on apricot plants.

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تأثير بعض منظمات النمو على العلاقة التطفلية بين نبات الفول
والهالوك.

٣- تأثير المورفاكتين ، التيبيا والاثيفون على الصفات التشريحية
لنباتات الفول المصابة بالهالوك

انسيد زايد ، محمد العافرى ، سعيد حافظ عيسى ،

خالد عبد الدايم عبد العزيز

قسم النبات كلية الزراعة بكفر الشيخ جامعة طنطا - مصر

أجرى هذا البحث بقسم النبات الزراعى ، كلية الزراعة بكفر الشيخ
- جامعة طنطا خلال موسم ٢٠٠٠/٢٠٠١ لدراسة تأثير بعض منظمات
النمو (المورفاكتين بتركيزات ٢٥ ، ٥٠ ، ١٠٠ جزء فى المليون والتيبيا
بتركيزات ٧٥ ، ١٥٠ ، ٣٠٠ جزء فى المليون والاثيفون بتركيزات ١٢٥
، ٢٥٠ ، ٥٠٠ جزء فى المليون) على نباتات الفول المصابة بالهالوك.
تم الرش بمنظمات النمو بالتركيزات السابقة عند عمر ٤٥ يوم من
الزراعة وتم اخذ العينات عند عمر ٦٠ يوم اى بعد ١٥ يوم من الرش
بمنظمات النمو.

وقد اوضحت النتائج ما يلى:

أدت المعاملة بمنظمات النمو الثلاثة بجميع التركيزات المستخدمة
الى زيادة قطر الجذر وزيادة سمك القشرة وسمك الاسطوانة الوعائية
وقطر الوعاء الخشبى.

تميزت النباتات المعاملة ايضا بزيادة قطر المساق والاسطوانة
الوعائية وسمك القشرة وعدد الحزم الوعائية وزيادة سمك النصل
وسمك نسيج الخشب وقطر الوعاء وذلك فى نباتات الفول المصابة
بالهالوك والمعاملة بمنظمات النمو مقارنة بالنباتات المصابة والغير
معاملة.