

## Response of Beet Plant to Water Soluble Extracts Spraying of Five Different Seeds

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**Abstract:** Field experiment was carried out in Horticulture and Landscape Department, College of Agriculture, University of Baghdad, Al-Jadriah during fall 2017 to study effect of five water soluble extracts of different seeds (black cumin T1, fenugreek T2, cumin T3, anise T4 and coriander T5) as well as the control treatment T0 in the growth and yield of beet plant. The experiment implemented with RCBD in three replicates. The means compared under 5% probability. The results revealed the significant superiority of T2 treatment in number of leaves and leaves dry weight (15.50 leaf.p<sup>-1</sup>, 15.13g). Moreover, T1 treatment gave the highest numbers in leaf area (39.48 dsm<sup>2</sup>), total chlorophyll leaves content (83.71mg .100g<sup>-1</sup> fresh weight), root size (156.66 cm<sup>3</sup>) and root diameter (5.58cm). Also T4 treatment showed significant results in root weight average, yield, beetroot TSS and sucrose (132.83g, 44.24 ton h<sup>-1</sup>, 11.78% and 65.98 μmol.L<sup>-1</sup>) successively. In compare with control treatment which showed the lowest means in experiment parameters. The highest value of beet root content of anthocyanin found in T4 treatment (30.10 mg .100g<sup>-1</sup> fresh weight) in compare with T2.

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### I. Introduction

The current environmental issues have entered in new area of debate that falls within the need to balance the benefits, risks of pollution and the effects of pollution. The growing interest at the end of the last century has led to protests against many products and practices, but some products and processes are still in dispute. Although it offers many benefits to community. The excessive use of chemical fertilizers has caused significant damage in public health and the environment and led to emergence of contaminated agricultural products that harm human health ( Alrubaie, I. I. J. 2009). In order to get products that are free from the residual effect of chemicals and a healthy environment and to maintain ecological balance, researchers studied alternatives to this chemical fertilizer such as organic agriculture and use of plant extract, where it is highly effective in plant nutrition as it is a non-toxic and easy to decompose in the environment. Many scientific researches and studies have confirmed that plant extracts contain many chemical compounds that vary according to the types and plant parts taken from them. These compounds promote vegetative and flowering growth, thus increasing the plant yield (Imran, W. H. H. 2004 and Malik, I.L.2001).

( Abdel-Hussein,2016) found that when used eight types of seeds extracts of cumin seeds gave the highest average of plumule length and dry weight of the radical. Also the treatment of coriander gave the highest average of seedling strength and radical length dry weight. The treatments of cumin and coriander were significantly in germination rate and germination speed and the highest length of radical compared to the treatments of the water extract of the fenugreek and the black Cumin, which led to the inhibition of all the qualities in the plant. (ALShammari,2015) refers to the mixture of black seeds and sweet fennel extracts showed significant superiority in length of seedling, stem diameter, number of leaves, number of nodes and length of root in pepper seedlings which treated with these plant extracts.

(Ismail and Nasrallah, 2012) showed that the spray treatments with growth regulator and fenugreek extract showed a significant decrease in plant height, number of branches, wet weight and dry weight of chamomile. (Hammad, et al., 2009) showed that the effect of soaking and spraying with plant extracts (Black Cumin, Sweet fennel and fenugreek) showed significant differences in the vegetative growth characteristics of eggplant (plant length, number of branches, number of leaves, leaf area and wet weight) compared to the treatment of soaking or spray treatment only. It was reported by (Imran, 2004) that the effect of the fenugreek extract on cucumber plants was significant in the number of branches, stem diameter and the total number of leaves per plant.

The red beet (*Beta vulgaris*) is one of the most important vegetables of the Chenopodiaceae family and is grown for its roots, which are eaten boiled or cooked or in the preparation of the salad or in pickles for pink color. It is a vegetable rich in nutrients and good proportion of dry materials in the roots which reached 15-19%,

sugars reached 9-12% mostly sucrose as well as a percentage of glucose and fructose reached 1-1.65% as well as contain the nitrogen by 2% and amino acids which are necessary for growth body and a group of vitamins including V,C. vitamins B1, B2, B3, B5 and B6, as well as (P) and folic acid. Red beet roots are rich in mineral salts and organic acids such as malic acid, Lactic acid, Citric acid, citric acid and linoleic acid (Boras, et al., 2011). The research objective was to study the effect of extracts of Black Cumin, Sweet fennel and fenugreek, coriander and anise in the growth and yield of red beet.

## II. Materials and methods

This study was conducted in the vegetable field of the Horticulture and Garden Engineering Department, college of Agriculture, University of Baghdad, AlJadriya in fall season 2017-2018 to study effect of extracts of five types of seeds: Black Cumin, Sweet fennel and fenugreek, coriander and anise on the growth and yield of red beet. The soil was prepared and divided into three rows. Each row was a replicate and the distance between the row and the other 1 m. Each row was divided into 6 experimental units, with length reached 1.5 m with a distance of 0.5 m between the experimental units. Every experimental unit consists of two lines for planting the red beet with 30 cm between the lines because the planting was on one side of the line (Boras, et al., 2011). The experiment was conducted according to Randomized Complete Block Design (RCBD) with three replicates. The treatments were as follows:

1. Control treatment which was without spraying and its symbol (T0).
2. Treatment of black cumin seeds extract with a concentration of 0.05 gl<sup>-1</sup> and its symbol (T1).
3. Treatment of the fenugreek seeds extract with a concentration of 0.05 gl<sup>-1</sup> and its symbol (T2).
4. Treatment of cumin seeds extract with a concentration of 0.05 gl<sup>-1</sup> and its symbol (T3).
5. Treatment of anise seeds extract with a concentration of 0.05 gl<sup>-1</sup> and its symbol (T4).
6. Treatment of Coriander seeds extract with a concentration of 0.05 gl<sup>-1</sup> and its symbol (T5).

Red beet seeds were planted (Detroit Hybrid) that produced by Top Harvest on 11/10/2017 with distance reached 10 cm between plants. The plant extracts were prepared by grinding 50 gm of seeds from each of the five plant species: Black Cumin seeds with chemical content that shown Table (1), fenugreek seeds (2), cumin seeds table (3), anise seeds table (4) and coriander seeds Table (5) and each type was added to (1) liter of the distilled water and placed on the vibrator for (15) minutes and then filtered and take the water extract, so we have five plant extracts each of them with 0.05 concentration ( Abdel-Hussein, 2016, ALShammari, 2015, Alrubaie, 2009 and Hammad, 2009).

**Table 1: chemical content of Black cumin seeds (100g) (ALShammari, 2015 and Alrubaie, 2009)**

Thimole	Hydrothymoquinene	Nigellone	Gotathione	Thmoquinene	Dithymoquinene
g 3.06	g1.71	g 4.01	g 3.17	g 2.22	g 1.89
Starch	fibers	Cyamene	Dicstrene	Superene	Lignene
10.11g	g14.63	g 4.78	g20.13	g 3.55	g 2.96
In addition different amino acids, Proteins, Vitamins, Soluble minerals and sugars					

**Table 2: chemical content of fenugreek seeds (Mohammed and Abdulilah, 2009)**

Amino acids					Minerals (ppm)				
Proline	Valine	Tryptophan	Glycine	Alanine	Ba	Li	K	Na	Ca
0.46	0.68	0.81	0.43	0.56	0.72	2.1	31.2	77.1	291.5
Rare elements ( ppm)									
Mn	Ni	Se	Cu	Al	Co	Zn	Fe	Mg	
0.018	0.07	0.22	0.261	0.357	1.3	4.72	16.513	39.5	
Alkaloids		Glycoside		Volatile oils			Saponins		
%0.93		%1.92		%2.45			%6.2		

**Table 3: chemical content of cumin seeds (2g) (Al-Snafi, 2016)**

Ash	Total fat	Dietary fiber	Carbohydrates	Protein
0.16 g	0.44 g	0.22 g	0.88 g	0.36 g
niacin	Thiamin	β- carotene	α-carotenoid	V.A
0.10 mg	0.02 mg	15.24 μg	2.54 (RE)	2.54 (RE)
manganese	magnesium	iron	copper	calcium
0.06 mg	7.32 mg	1.32 mg	0.02 mg	18.62 mg
Zinc	sodium	selenium	potassium	phosphorus
0.10 mg	3.36 mg	0.10 μg	35.76 mg	9.98 mg
Omega 6 fatty acids		Linoleic acid	oleic	Palmitic acid
0.06 g		0.06 g	0.28 g	0.02 g

**Table 4: chemical content of anise seeds (Albadairi, 2017)**

terpenoids	flavonoids	Paramethoxy	Methyl chvicol	anisaldehyde
Coumarians	carotenoids	Poly phenolics	sulfides	Lignans
Phthalides		curcumins	Plant sterols	Saponins
Stable oil 30%		Anethol 80-90%	Aromatic oil 1-3%	

**Table 5: chemical content of Coriander seeds (Bhat, et al.2014 )**

Mg	Fe	Ca	Fiber	Carbohydrate	Total lipid	Protein	Energy	water
330 mg	mg16.32	709 mg	g 41.9	g54.99	g17.77	g12.37	kcal298	g8.86
Niacin	Riboflavin	Thiamin	V.C.	Zn	Na	K	p	
mg2.13	mg0.29	mg0.239	mg21.0	mg4.70	mg35	mg1267	mg409	
Fatty acids, total polyunsaturated			Fatty acids, total monounsaturated			Fatty acids ,total saturated		
g1.75			g13.58			g0.99		

The plants were sprayed with plant extracts three times during the season beginning on 29/11/2017 with 15 days between spraying and then 10 plants data were recorded from each experimental unit randomly at the end of the season. The studied characters were total number of leaves per the plant, the dry weight of the leaves after drying by electric oven with 70°C until weight is stable. The leaf area was estimated according (Watson, and Watson. 1953.) method while the leaves content of total chlorophyll was estimated according to (Goodwin, 1976) method as shown in the following equation:

$$\text{Total Chlorophyll (mg/L)} = 20.2 D(645) + 8.02 D(663)$$

Then it was converted into 100mg.g<sup>-1</sup> fresh weight. The weight of the root estimated by g.plant<sup>-1</sup> and root size by cm<sup>3</sup>, while the root length and its diameter (cm) was measured by Digital venire, and the total root yield was estimated by (ton h<sup>-1</sup>). The root content of the soluble solids (TSS%) was estimated as well as The content of Anthocyanin dye was calculated according method of (Ranganna, 1977). The roots content of the sucrose was estimated according to (Carruthers, and Oldfield , 1960) method. LSD test that used to compare the average was at 5% significance level.

### III. Results and discussion

The results shown in Table (6) show that most of the plant extracts were superior in vegetative growth and yield characters of the red beet plant. The treatment of fenugreek seeds extract gave the highest value of number of leaves and dry weight of leaves reached (15.50 leaf.plant<sup>-1</sup> and 15.13 g) respectively. Which did not differ significantly from the treatment of spraying with the black cumin and anise extract compared to the control treatment that gave the lowest values in the mentioned characters. The treatment of spraying with the black cumin seeds extract in both of leaf area and leaf content of total chlorophyll, which gave (39.48 dm<sup>2</sup> and 83.71 mg.100 g<sup>-1</sup>) respectively. Which did not differ significantly from the spray treatments with the seeds extract of the fenugreek and anise compared to the control treatment that gave the lowest values in these characters, and the anise extract treatment was superior without significant differences from the spray treatments with black cumin extract and the fenugreek treatment in productivity in the area unit, which gave (44.24 ton h.<sup>-1</sup>) compared to control treatment that gave (31.32 ton h.<sup>-1</sup>)

The reason of the three extracts superiority in the characteristics of red beet vegetative growth and the yield to the content of chemical compounds and nutrients that stimulate the plant growth, the seeds of the fenugreek contains amino acids, including Tryptophan, which is the initiator of the formation of plant Auxins and valine which affects the speed of the formation of roots and plant growth and the amino acid (Alanine) which affects the speed of plant growth and activation of the composition of chlorophyll as well as containing the calcium element, which is very important in the division and elongation and in the green plastids formation which are responsible Photosynthesis, and magnesium and iron which have important role in the formation of chlorophyll, which was reflected in the increased number of leaves and dry weight of shoots (Table 6) (Taiz and Zeiger , 2010).

The water extract of the black cumin seeds contains many compounds that lead to the speed of cellular divisions such as Nigellone and some antioxidants of amino acids and proteins such as Thymoquinone and anti-oxidation of carbohydrates such as Hydrothymoquinone all these substances lead to the growth of the vegetative parts of the plant and the increase of leaf area (Table 6) (ALShammari, 2015 , Alrubaie, 2009 and Sahan, 2005).

The anise seeds, which are sweet and like Licorice flavor(Aldaraji, 2008) contain the terpenoids and phenolics, which are a source of plant pigments and chlorophyll, vitamins, enzymes, nitrogen bases and aromatic oils. They are also a source of plant hormones such as gibberellin, which promotes cell division and elongation, (Table 6) ( Alkhafaji, 2014). Flavonoid which are antioxidant play an important role in regulating the activity of the natural hormone IAA, which stimulates cell division and elongation in low concentrations

(Al-Naggar, 2003 and ALShammari, 2003) , as well as the content of anise seeds of poly phenolics, which works with binary phenols to stimulate growth.

**Table.6. effect of plants extract applied in vegetative growth and yield of beet plants**

Treatment	Number of leaves (leaf plant <sup>-1</sup> )	Leaf area (dcm <sup>2</sup> plant <sup>-1</sup> )	Dry weight of leaves (g plant <sup>-1</sup> )	Leaves content of chlorophyll ( mg 100g <sup>-1</sup> fresh weight)	Yield ton h. <sup>-1</sup>
T0	11.33	17.70	9.58	70.70	31.32
T1	14.33	39.48	14.19	83.71	43.04
T2	15.50	38.56	15.13	80.18	42.20
T3	11.50	23.13	11.08	76.62	33.92
T4	14.00	36.49	13.96	83.42	44.24
T5	12.00	30.58	13.02	79.33	41.48
LSD 5%	1.53	7.43	2.10	4.99	0.52

The results shown in Table 7 show that most of the spray treatments of plant extracts were superior in quality of red beet characteristics. The spray treatment of anise extract gave the highest root weight reached (132.83 g), which did not differ significantly from the treatment of the black cumin extract. The treatment of spraying with the black cumin seeds extract in both of root size and root diameter which gave (156.66 cm<sup>3</sup> and 5.58 cm) respectively, which did not differ significantly from the spray parameters of the fenugreek extract treatment and anise extract treatment in the root size, and the coriander extract, the fenugreek and the anise and the cumin in the root diameter compared with the control treatment which gave The lowest values in these studied characteristics, while the spraying treatments with plant extracts did not have a significant effect on root length.

We also note that the effect of the anise extract has a significant effect on the root content of (TSS) which gave (11.78%), which did not differ significantly from the treatment of fenugreek and the black cumin extract compared with the lowest content which obtained from control treatment. The same treatment was superior in the root content of the anthocyanin dye and gave (30.10 mg.100 gm<sup>-1</sup>), which did not differ significantly from the control treatment and the black cumin extract treatment and coriander extract treatment compared to the lowest value content of anthocyanin dye which obtained from the fenugreek extract treatment as well as this treatment affects root content of Sucrose that reached (65.98 µmol.L<sup>-1</sup>), which did not differ significantly from coriander extract treatment compared to the lowest content obtained from control treatment.

May be the reason of the superiority of anise seeds and black cumin extract treatments in the characteristics of the roots to their significant impact on the characters of vegetative growth, which was evident in increase of leaves number and leaf area and dry weight and leaves content of chlorophyll (Table 6), which increased the products of photosynthesis and then increase Sugars, Proteins and ATP compounds, all of which affect plant growth and size, which is reflected in the weight, size and diameter of roots (Table 7) (Martin, 2012). The increase in total vegetative growth and increase in photosynthesis product, which is soluble sugars, organic acids, soluble salts and increased rate of transfer from leaves to roots, increased the percentage of soluble solids, including sugars (Table 7) (Abdul Rasool, 2002).

**Table.7. effect of plants extract applied in root characteristics of beet plants**

Carecters Treatment	root weight (g)	root size (cm <sup>3</sup> )	root length (cm)	root diameter (cm)	root content of TSS %	root content of the anthocyanin (mg 100g <sup>-1</sup> fresh weight)	root content of Sucrose µmol.L <sup>-1</sup>
T0	94.04	100.00	6.33	4.83	11.05	30.08	37.10
T1	129.15	156.66	6.50	5.58	11.50	29.93	43.23
T2	126.71	153.33	6.41	5.50	11.61	9.87	45.11
T3	101.88	125.83	6.00	5.33	10.96	24.75	47.28
T4	132.83	153.33	6.93	5.50	11.78	30.10	65.98
T5	124.54	144.16	6.25	5.55	11.20	29.53	64.18
LSD 5%	6.32	9.31	N.S	0.34	0.39	4.00	4.58

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