EFFECT OF SALINTY TREATMENTS ON GROWTH, OIL YIELD AND CHEMICAL COMPOSITION OF *NIGELLA SATIVA* L.

SHADIA KOTB AND E. EL GAMAL

Horticultural Research Institute, Agricultural Research centre, Giza, Egypt.

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Abstract

Pot experiment was carried out during 1989 and 1990 to investigate the effect of saline soil (0, 1000, 2000, and 3000 p.p.m) on vegetative growth, oil yield, carbohydrates and chlorophyll of *Nigella sativa* L. The results , showed that increasing salinity levels to 0.3% singificantly decreased vegetative growth including , seed germination percent , plant height , number of branches , fresh and dry weight, number of fruits and seed weight. Photosynthetic pigments increased by increasing salinity levels up to 0.3% In contrast volatile oil, fixed oil and carbohydrates decreased by increasing soil salinity levels.

INTRODUCTION

Medicinal plants occupy a prominents economic position because of the continuous increasing demand for their medicinal products from the local and foreign markets. *Nigella sativa* L. (black cumin) plant belongs to family Ranunculaceae Its seeds are reputed and used by common people from many medicinal purposes, as antiasthmatic drug, liurecic, oasminatine, cough, as a flavouring agent to bread and spices in curry. In Egypt there at wide of saline areas which cause harmful effects on plant growth and oil production. Recently these is a reason able planning in Egypt to cultivate wide areas with medicinal plants by using different water sources such as the drainage water and in the last few decades a great interest has been pointed out to utilize the saline water in irrigation to meet the great need of water for expansion in the new areas and for using at period of water shortage.

The harmful effect of salinity on some medicinal plants were mentioned by Mandour *et al.,* (1979) on *Ammi majus* L., El sahhar and Zannati (1981) on *Matricaria chamomila* L.,

Therefore the present investifation was designed to study the salt tolerance of *Nigella sativa* plant to different levels of soil salinity.

MATERIALS AND METHODS

The study has been conducted in the Farm of Medicinal and Aromatic plant Research section at Dokki, Giza Egypt, during the two successive season 1988/1989-1989/1990. Seeds were sown on October 15th , in pots 35cm diameter, each pot was painted with three layers of bitumin to prevent direct contact between the soil medium and pot wall. Pots were filled with dry Nile clay soil (11 Kg. for each Pot) . The salinity treatments were 0.0, 0.1, 0.2 and 0.3% based on dried soil weight, chloride type of salinization was applied to the soil as described by Strogonve (1962). The componet of salt mixture were Mg So4 (10%) , Ca So4 (1%) Na 01 (78%) Mg Cl 2(2%) and Ca So3 (9%) .

The chemical composition of the soil before salinization is presented in Table 1. Where extraction of the soil was 1:5 calculated mg /1200 gm soil.

Fertiliztion was used at the rates of 0.13 and0.066 gm per pot of ammonium sulphate (20.6%) and calcium superphosphate (10.0%) respectively, they are added in 2 equal portions, the first was 45 days after planting and the second was added before flowering stage. All the plants received the same agricultural practices.

The following data were recorded, seed germination, plant height, number of branches, fresh and dry weight, number of fruits and seed weight per plant . Essential oil percentage was determined according to the method described by God *et al* . (1963). Plant pigments were extracted with 80% acetone using the method described by Wettstein , (1957) as mg/100g fresh weight. Soluble , non soluble sugars and total carboyhydrates in dried herb were determined according to the method described by Dubois *et al.,* (1956).

Table 1. Chemical analysis of the soil before saliniztion.

Season	T.S.S	PH 1.25	E-c mmoh/cm	Amionssmg .100 gm soil				Cation meg/100gm Soil				p.p. m	p.p. m
				Co_3	Hco_3	Cl	So_4	Ca	Mg	Na+	K+	N+	P+
1 St	0.102	7.4	0.32	-	0.52	0.38	0.72	0.87	0.12	0.45	0.18	28.70	11.53
2 St	0.200	7.3	0.59	-	1.15	1.40	4.00	3.19	1.51	1.25	0.60	36.2	11.14

The data were statistically analized using randomized complete blocks design according to Snedecor (1956).

RESULTS AND DISCUSSION

1. Effect of salinity on the growth of the plant:

Data in Table 2 indicate that germination percentage decreased as salinity increased. Plant height and branching were also significantly decreased by increasing salinity levels , Similar results were recorded by Ahmed (1988) on geranium. These harmfull effects could be attributed to the inhibitory effect of salinity on the merestimatic activity.

The fresh and dry weights of plant organs were highly significant decreased by increasing salinity levels up to 0.3%, such decrease might be attributed, either to the decrease in plant height or the decrease in branching.

Saline might cause injury interfering with normal stomatal closure causing excessive water loss and leaf injury symptoms like those of drought. NaCl might particularly stop the synthesis of organic matter , resulting in poor growth. Similar results were found by Tawfik (1986) on lemon grass and Helaly (1977) on Egyption henbane.

Table 2 indicates also similar trend of Salinity level on the number of fruits and the seeds weight (yield) the two mentioned characters decreased by increasing salinity levels. Leopold and Willing (1984) mentioned that, salinity might induce damage to photosynthetic effectiveness through the disturbance of chloroplast membrances by production of lesions, also salinity depressed transpiration rate which might inhibit transpirational stream and nutrients up take . Such disturbance or inbalance of nutrients was considered a reasonable cause restricting growth.

It was clear that the first level of salinity (1000 p.p.m improved all the characterestic presented in Table 2 as compared to the control and the other levels of salinily.

These results might be due to that plants grown under low concentration of salinity initiate the ability of the plant to adsorb the soil elements and fertilization

Table 2. Germination percentage , plant height, brach number , frsh and dry weight , number of frutis, and seed weight (g) under an increasing levels of salinity on Nigella satia L. in 1988/1989 and 1989/ 1990

Treatment	Germantion %		Plant hight (cm)		Bruncly number		Feesh weight(g)		Dry weit (g)		Number of fruits		seed weight (g)	
	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd
Control	80.20	84.30	39.30	37.2	6.6	5.1	6.20	6.30	3.1	3.2	9.5	10.6	2.4	3.0
1000	91.60	91.60	43.00	40.30	7.30	5.50	7.30	7.30	3.7	3.6	11.03	11.30	2.70	3.60
2000	78.00	67.70	37.00	36.40	5.50	5.30	5.30	5.60	3.2	3.4	7.70	8.50	1.70	1.90
3000	70.10	63.90	37.30	32.30	3.40	3.20	3.20	2.60	2.2	1.8	26.50	6.80	1.00	1.00
L.S.D. (0.05)	3.10	2.10	3.75	2.53	1.7	1.23	30.63	0.86	0.41	0.54	0.93	0.72	0.28	0.40
(0.01)	4.60	3.20	5.70	3.82	2.5	1.9	0.97	1.30	0.62	0.81	1.40	2.7	0.45	0.59

subsequently which has correlated with the metabolism of the plant.

The lower levels of salinity acted as a normal sourse of nutrients , leading to more growth, which resulted from increasing anabolism activity.

2 . Chloropyhyll and caroteniodes percent:

Data presented in Table 3 indicate that chlorophyll a and b as well as caroteniodes (mg/100g fresh weight) in most cases were significantly increased by increasing salinity level up to 0.3%

These results are in agreement with those obtained by Mahdi *et al.,* (1984) on *Eucalyptus spp.*, and Moussa et al (1985) on Lupine plant. The increase in chlorophyll content might be due to the increase in chlorophyll anabolism than the chlorophyll catabolism , and or the reduction in leaf area.

3 . Carbohydrates as affected by salinity:

Data in table 4 show generally that soluble sugars, non soluble sugars and total carbohydrates significantly decreased by increasing salinity levels up to 0.3%

Several studies indicated that carbohydrate content was affected by different levels of salinity. Strogonov (1972) showed that , carbohydrate content was usually higher in plants grown in saline soils than those grown under normal conditions.

On the other hand, other investigators found that the salinity decreased carbohydrate contents in plant tissues.

These results in Table 4 were in agreement with El Mahdi *et al.,* (1984)on eucalyptus, who indicated that the salinity depressed total soluble sugar.

About the decrease in carbohydrates content Moursi *et al.,* (1976) concluded that , the depression in the content of total carbohydrates was suggested to be due to the production of relatively high energy by increasing respiration to overcome the relatively low availability of water and nutrtional elements in saline medium . The depressing effect of salinity also on the water content of leaves, thus usually resulted in a decrease in carbohydrate accumulation

Table 2. Effect of differnt levels of salinily on chlorophyll contents of *Nigella Sativa* L. (mg /100g fresh wt.), during the two seasons 1988/1989, 1989/ 1990

First season

Character	0	1000	2000	3000	L.S.D. at 5%	L.S.D. at 1%
Chlorophyll a	38.50	53.90	72.70	83.70	3.10	4.80
Chlorophyll b	54.83	63.60	71.20	83.50	3.85	5.94
Carotenoides	49.50	67.00	72.10	77.8	3.85	5.9
Chlorophyll a + b	93.33	117.50	143.90	167.20		
Second season						
Clorophyll a	49.3	54.03	75.40	88.40	6.40	9.70
Chlorophyll b	53.10	66.50	75.30	93.7	5.50	8.90
Carotenoides	50.1	64.50	71.80	80.60	3.10	4.80
Chlorophyll a + b	102.40	120.53	150.70	182.10		

Table 4. Effect of salinity on Carbohydrates fractions percentage in herb of *Nigella sativa* L. in 1988-1989, 1989-1990

Carbohyrate salinity	Soluble		Nane - soluble		Total carbohydrates	
	1st season	2nd season	1st season	2nd season	1st season	2nd season
0.0	3.50	2.07	2.70	2.70	6.20	4.80
0.1	2.20	1.33	2.00	0.87	4.20	2.20
0.2	1.20	0.97	2.40	2.03	3.60	3.00
0.3	2.67	1.93	2.30	1.70	4.90	3.60
L.S.D. 5%	0.66	0.50	—	1.04	0.73	0.76
L.S.D. 1%	1.00	0.75	—	—	1.10	1.20

Oil Percentage and oil yield

Data in table 5 showed that the volatile oil precentage deceased by increasing salinity levels up to 0.3% , this decrease was significant in the First season, while it was insignificant in the second one. These results agree with Tawfik (1986) on lemongrass.

Oil yield also recorded similar trend, except the treatment of 1000 p.p.m, which resulted in the highest level, this might be due to the higher seed yield in this treatment Generally the differences among the treatments were significant .

Fixed oil was significantly decreared by increaseing salinity levels up to 0.3% in the two successive seasons.

Oil yield as affected by salinily treatments was significantly decreased in the two seasons, except in the second season, the treatment at 1000 p.p.m. resulted in the highest value.

Fixed oil was significantyly decreared by increaseing salinity levels up to 0.3 % in the two successive seasons

Oil yield as affected by salinity treatments was significantly decreased in the two seasons, except in the second season, the treatment at 1000 p.p.m resulted in the highest value.

Table 5. Effect of salinity on Carboydrates fractions percfntage in herb of Nigella sativa L. in 1988-1989, 1989/1990

Salinity %	Volatil oil			Foxed oil
	oil percentage	Oil yield	oil percentage	Oil yield
		First season		
0.0	1.30	3.13	14.9	35.68
0.1	1.26	3.38	11.70	31.12
0.2	1.00	1.73	13.00	22.51
0.3	0.99	0.99	13.90	13.82
L.S.D. %5	0.12	1.40	0.69	1.88
%1	0.17	2.11	1.04	3.83
		Second season		
0.0	1.09	3.25	13.90	41.35
0.1	1.20	4.33	13.30	47.84
0.2	1.03	1.92	12.60	23.49
0.3	0.89	0.89	11.90	11.90
L.S.D. %5	0.40	0.33	1.33	3.13
%1		0.50	2.04	4.72

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تأثير معاملات الملوحة علي النمو ومحصول الزيت والمستوي الكيماوي لحبه البركة

شاديه قطب أحمد السيد عبد الحميد الجمل

معهد بحوث البساتين – مركز البحوث الزراعية

أجري هذا البحث بمزرعه قسم بحوث النباتات الطبية والعطريه بالدقي في موسمي ١٩٨٨، ١٩٨٩، ١٩٨٩/١٩٩٠ وذلك لدراسة تأثير تركيزات مختلفه من الملوحة علي النمو ومحلول البذره والزيت في نبات حبه البركه لمعرفه مدي تحمله للمستويات المختلفه من الملوحة بهدف التوسع في زراعه بالاراضي الملحيه .

وقد زرعت التجربة في ١٥ اكتوبر في قصاري تحتوي علي تربه مملحة بكلوريد الصوديوم بترنيزات ١، ٢، ٣٪ (١٠٠٠، ٢٠٠٠، ٣٠٠٠ جزء من المليون)

وقد أوصت النتائج المتحصل عليها حدوث نقص في نسبه الانبات وارتفاع النبات وعدد الفروع والوزن الطازج والجاف ومحصول البذرة بزياده تركيز الملوحه بالتربه ، كما وجد أيضا زياده في محتوي النبات من الصبغات (كلورفيل أ ، كلورفيل ب ، وكاروتين) بزياده تركيز الملحوحه في حين نقص السكريات الكليه والذائبه وغير الذائبه والزيت الثابت والطيار بزياده تركيز الملوحه خلال موسمي التجربه.