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Comparative Study on the Effect of Organic, Bio, Chemical Fertilization and Natural Extracts On *Hymenocallis Speciosa* Response to Salinity Tolerance

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ABSTRACT

This experiment aimed to study the positive effect of different types of fertilization on reducing the harmful effect of salinity stress on growth and chemical constituents under study. The planted bulbs received irrigation treatments of the different salinity levels (0, 1000, 2000 and 4000 ppm) and different fertilization treatments (Chicken manure, yeast, moringa extracts and kristalon) the main results could be briefed as follows: Salinity treatments caused inhibitor effect of all plant traits in most cases. On the other side, the different fertilizer treatments considerably differed in their effect on the different morphological parameters and to some extent on chemical constituents of the newly formed plants. So, and from the aforementioned results it could be recommended that in the case of cultivation under the conditions of salinity at the rate of 1000 ppm, it is preferable to add Kristalon or the Moringa extract in the second category in this respect.

Keywords: Hymenocallis speciosa, yeast, Moringa, Kristalon, Chicken manure, salinity stress.

1. Introduction

Hymenocallis, Family Amaryllidaceae is a spider flower, basket flower, summer daffodil. There are 30 – 40 species in the genus, all native to the tropical and subtropical Americas, from South United States to the warmer beaches of the Andes (John, 2002).

Hymenocallis speciosa, Salisb (a local variety), bulb globular, 3 – 4in. diam. leaves 20 or less, large (often 2 ft long) oblanceolate oblong and acute, narrowed into a channeled petiole: scape mostly shorter than the foliage, glaucous, flowers 18 – 20 cm., on very short pedicles, the bracts or spathe values 3-4 in. long, tube of perianth greenish, 3-4 in. long, the segments often twice longer (entirce flower often 9 in. long), cup about in. long, toothed, the free parts of the filaments little longer than the sup. The bulb improves with age if care is taken in growing and repotting. The leaves are evergreen and handsome. Flower very fragrant, and retaining their scent even when dried. Blooms are in summer (Bailey, 1963).

The use of extracts of certain plants referred to as bio-stimulants, botanical activators or botanicals, such as yeast (though the later is a fungus) in improving the growth of agricultural crops especially ornamental plants is highly recommended as an environment friendly and safe approach to get better plant without being forced to use chemical nutrients or synthetic growth regulators that may harm the environment. They proved other mastery in most cases for improving most plant traits compared with that gained from other extracts of the different plant species.

Leaves of moringa are rich in zeatin, it can be used as a natural source of cytokinin (Fuglie, 1999). In addition, Moringa leaves are also rich in ascorbates, carotenoids, phenols, potassium and calcium which affect plant growth as an enhance (Foidle *et al*, 2001). Antioxidants such as ascorbic acid and

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glutathione, are found at high concentrations in moringa chloroplasts and other cellular compartments, are crucial for plant defense against oxidative stress (Noctor and Foger, 1998).
Moringa containc proteins, fiber, calcium, phosphorus, potassium, sulpher, iron, ascorbic acid, carotene, choline thiamin, riboflavin, nicotinic acid and complete amino acid profile in a sufficient amount (Bau *et al*, 1994).

The chicken manure is a naturally nourishing fertilizer for plants. Rich in nutrients such as nitrogen, phosphorus, calcium, potassium and magnesium, it is known for a long time for its excellent properties for promoting plant growth (Kidinda *et al*., 2015). Furthermore, chicken manure is preferred amongst other animal wastes because of its high concentration of macro-nutrients (Warman, 1986; Duncan, 2005). The acidity due to chicken manure addition severely affects the availability of nutrients to plants, so if applied correctly chicken manure acts as a good soil amendment and/or fertilizer (e.g. provides N, P and K) and can also increase the soil and foliage of plants N, P, K Ca, and Mg concentrations (Duncan, 2005; Agbede *et al*., 2008).

2. Materials and Methods

The present experiment was consummated at the nursery of Horticulture Research Institute, Agriculture Research Center, Giza, Egypt throughout two successive seasons (2016/2017 and 2017/2018). The aim was to this study to find out the individual as well as the combined effect of different salinity levels and different types of fertilization on growth behavior productivity and some chemical constituents of *Hymenocallis speciosa* plant.

Bulbs of 15-16 cm. circumferences were selected after lifting date March 15th in both seasons. After examining and cleaning, bulbs of 15-16 cm. circumference were selected and planted on April 28th after the bulbs had been divided into four groups to study the effect of different salinity levels. Besides, every type of salinity group was redivided again into another four groups, for studying the effect of the different fertilization treatments, with every salinity level (control), chicken manure, yeast, moringa and kristalon

A pure salt of NaCl was mixed well with a pure one of CaCl2 at the ratio of 1:1 by weight. Thereafter, saline water was prepared from the salt mixture at the levels of 0, 1000, 2000, 4000 ppm. The bulbs were planted in 30 cm diameter plastic pots filled with a mixture of sand/ clay (1:1, v/v) as one bulb per pot.

The plants received irrigation treatments of the different salinity levels (0, 1000, 2000 and 4000 ppm) commencing from planting date (April 28th) till the end of the experiment. Every pot received 250 cm^3 from water by the different salinity treatments. They were irrigated every three days till the end of flowering stage. On other hand, the plants received the different fertilization treatments as follows; chicken manure was added as a soil dressing at 7 g/pot, yeast at 3 g/pot moringa extract at 5% and kristalon at 2 g/pot were applied as a foliar spray.
Regular agricultural practices such as watering, weeding … etc were carried out wherever needed.

2.1. Growth characters

Plant height (cm.), fresh weight of vegetative growth (g.), dry weight of vegetative growth (g.), and No. of leaves/plant, number of days from planting to flowering, flower diameter, spike length, Root length (cm.), number of flowers/plant, bulb circumference (cm.), fresh weight of bulb (g.), dry weight of bulb (g.), number of the new bulbs/plant (bulbs yield), No. of bulblets/pot (bulblets yield), fresh weight of bulblets (g.), fresh weight of roots (g.) and fresh weight of clump (g).

2.2. Chemical compostion

Chlorophyll (a and b) and total carotenoides content (mg/g fresh weight) were determined in the plant fresh leaves of the different treatments according to Wettstein (1957).
Nitrogen, phosphorus and potassium (%) in new bulbs: Nitrogen was determined by micro-Kjeldahle apparatus (Blake, 1965), phosphorus was colorimetrically determined in the acid digested using ascorbic acid methods (John, 1970). Potassium was determined using the flame-photometer (Dewis and Freitas, 1970).

Free proline content in the newly formed bulbs (mg/100 g. d.w.) was determined according to Bates *et al* (1973) and total carbohydrates % in bulbs (Smith et al 1956).

2.3. Statistical analysis

A factorial experiment type in randomized complete design (RCD) with three replicates was employed in both seasons. Every treatment contained 15 bulbs, and replicated three times (5 bulbs per replicate) for every experiment unit.

Data were then tabulated and statistically analyzed using SAS program (1994) and means were compared by L.S.D. method according to Snedecor and Cochran (1980).

3. Results

3.1. Vegetative growth parameters

3.1.1. Plant height

Plant height, was differed according to the different applied treatments, where the values were progressively decreased by increasing salinity level in the two seasons, as shown in Table (1). Meanwhile, the highest values resulted by applying kristalon treatment, followed in the second category by using moringa extract, whereas, the least scores were resulted from control plants (untreated), in the two seasons. On the other side, the interaction indicated the superiority of all untreated plants with tap water (control) and 1000 ppm saline treated with Moringa extract and kristalon as gave the longest plant.

3.1.2. Fresh weight of vegetative growth

Fresh weight of vegetative growth was gradually decreased by increasing salinity level in both seasons, and reached to the minimum values by reaching the maximum of salinity level (4000 ppm), as shown in Table (1). As for the effect of fertilizer treatments it could be concluded that kristalon and moringa extract increased fresh weight in compared to control in the two seasons. The interaction, on the other side cleared the superiority of receiving plants which were didn't receive saline water and received kristalon gave high fresh weight in the two seasons.

3.1.3. Number of leaves/plant:

Number of leaves/plant showed a gradual decrement in both seasons resulting from increasing salinity level, as shown in Table (1). Meanwhile, all different fertilizer treatments produced the highest values of number of leaves/plant in the two in compare to control. As for the interaction, untreated plants with saline water (control) fertilized with chicken manure, Yeast, moringa extract or kristalon produced the highest leaf number/plant in the two seasons.

3.2. Flower parameters

3.2.1. Number of days from planting to flowering

As shown from data registered in Table (2) the different salinity levels succeeded to induce precocity of flowering comparing with that gained from plants untreated with saline water (control) in the two seasons, as the earliest flowering was obtained due to applying the highest level of saline water (4000 ppm). The different fertilizer treatments, on the other hand, tended to extend the flowering season in the two seasons. Concerning the interaction, plants which received the highest salinity level (4000 ppm) without any fertilization (control) were the best treatment for accelerating flowering date in the two seasons.

3.2.2. Flower diameter

Flower diameter in both seasons was progressively decreased by increasing salinity level, as shown in Table (2). Kristalon or moringa extract proved their mastery in improving flower diameter in both seasons and occupied the first rank in this concern. The interactions show clearly the superiority of untreated control plants with saline water and received kristalon or moringa extract in producing the best flower diameter in the two seasons occupying the first rank in this regard.

3.2.3. Spike length

Obviously, spike length progressively decreased by increasing salinity level in the two seasons, Table (3). Nonsignificant different between fertilization treatment were obtained. The interactions on

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Table 1: Effect of different levels of salinity and types of fertilization on plant height (cm.), fresh weight of vegetative growth (g.) and number of leaves/plant of *Hymenocallis speciosa* during the two seasons (2016/2017 and 2017/2018)

	Plant height (cm.)					Fresh weight of vegetative growth (g.)					Number of leaves/plant				
	Salinity (A)														
Treatments (B)	**Control**	**1000**	**2000**	**4000**	**Mean**	**Control**	**1000**	**2000**	**4000**	**Mean**	**Control**	**1000**	**2000**	**4000**	**Mean**
								1st season							
Control	49.58	46.08	45.18	44.32	46.29	60.87	56.53	52.32	46.27	54.00	12.63	11.28	9.63	7.58	10.28
Chicken manure	51.33	46.78	45.69	44.68	47.12	66.69	60.66	54.20	47.48	57.26	14.53	11.78	10.17	7.85	11.08
Yeast	52.83	48.09	46.05	45.01	48.00	77.03	66.19	56.39	48.98	62.15	15.35	12.18	10.63	8.17	11.58
Moringa extract	54.58	49.37	46.79	45.33	49.02	86.59	70.72	58.61	50.18	66.53	15.97	12.52	10.97	8.51	12.00
Kristalon	56.17	51.57	47.98	45.85	50.39	94.51	75.24	62.09	52.41	71.06	16.53	12.80	11.22	8.87	12.36
Means	52.90	48.38	46.33	45.04		77.14	65.87	56.73	49.06		15.00	12.11	10.52	8.19	
LSD at 0.05															
A= 3.366						**A** = 7.065					**A**= 1.267				
B= 4.294						**B** = 8.565					**B**= 1.616				
A×B= 6.733						**A×B** = 16.230					**A×B**= 2.098				
								2nd season							
Control	50.23	47.10	46.05	45.17	47.14	61.05	57.46	52.90	46.87	54.57	12.89	11.67	10.11	8.13	10.70
Chicken manure	52.12	47.58	46.47	45.35	47.88	68.23	62.34	56.15	49.41	59.03	15.25	12.00	11.08	9.12	11.86
Yeast	53.46	49.11	47.10	46.00	48.92	78.12	68.21	58.40	50.36	63.77	16.09	13.05	11.59	9.31	12.51
Moringa extract	55.24	50.26	47.80	46.22	49.88	88.24	72.16	60.29	52.22	68.23	16.78	13.89	12.17	9.77	13.15
Kristalon	57.09	52.35	48.33	46.62	51.10	96.31	77.30	64.10	54.51	73.06	17.21	14.10	12.89	10.20	13.60
Means	53.63	49.28	47.15	45.87		78.39	67.50	58.37	50.67		15.64	12.94	11.57	9.31	
LSD at 0.05															
A= 4.891						**A** = 8.123					**A**= 1.563				
B= 5.031						**B** = 9.624					**B**= 1.832				
A×B= 7.399						**A×B** = 17.089					**A×B**= 2.401				

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Table 2: Effect of different levels of salinity and types of fertilization on number of days from planting to flowering and flower diameter (cm.) of *Hymenocallis speciosa* during the two seasons (2016/2017 and 2017/2018)

	Number of days from planting to flowering					Flower diameter (cm.)				
	Salinity (A)									
Treatments (B)	**Control**	**1000**	**2000**	**4000**	**Mean**	**Control**	**1000**	**2000**	**4000**	**Mean**
					1st season					
Control	100.00	94.00	91.00	82.33	91.84	20.14	19.08	17.75	16.10	18.27
Chicken manure	101.67	95.33	92.33	83.67	93.25	20.42	19.30	17.98	16.42	18.53
Yeast	103.33	97.33	94.00	85.00	94.92	20.75	19.53	18.32	16.62	18.79
Moringa extract	105.33	98.67	95.67	86.67	96.59	20.97	19.75	18.55	16.90	19.04
Kristalon	106.33	100.33	97.35	89.00	98.25	21.30	20.08	18.75	17.12	19.31
Means	103.33	97.13	94.07	85.33		20.72	19.55	18.27	16.63	
LSD at 0.05										
A= 0.543						**A=** 0.198				
B= 0.692						**B=** 0.253				
A×B= 1.209						**A×B=** 0.478				
					2nd season					
Control	102.30	96.05	92.03	84.25	93.66	20.78	19.58	18.15	16.74	18.81
Chicken manure	103.25	97.27	94.45	85.40	95.09	21.32	19.89	18.43	17.09	19.18
Yeast	105.21	100.18	96.35	87.11	97.22	21.68	20.37	19.08	17.54	19.67
Moringa extract	107.15	101.30	97.43	88.27	98.20	21.86	20.88	19.46	18.04	20.11
Kristalon	108.18	102.54	100.20	93.09	101.00	22.07	20.95	19.78	18.33	20.23
Means	105.22	99.47	96.09	87.62		21.46	20.33	18.98	17.55	
LSD at 0.05										
A= 0.354						**A=** 0.285				
B= 0.408						**B=** 0.344				
A×B= 1.085						**A×B=** 0.625				

Table 3: Effect of different levels of salinity and types of fertilization on spike length (cm.) and No. of flowers/spike of *Hymenocallis speciosa* during the two seasons (2016/2017 and 2017/2018)

	Spike length (cm.)					No. of flowers/spike				
	Salinity (A)									
Treatments (B)	**Control**	**1000**	**2000**	**4000**	**Mean**	**Control**	**1000**	**2000**	**4000**	**Mean**
					1st season					
Control	21.07	20.63	20.42	18.21	20.08	9.63	8.49	8.27	7.52	8.48
Chicken manure	21.28	20.87	20.61	18.45	20.30	9.78	8.65	8.41	7.68	8.63
Yeast	21.71	21.20	20.86	18.70	20.62	9.96	8.85	8.59	7.87	8.82
Moringa extract	21.92	21.48	21.10	18.92	20.86	10.10	9.01	8.77	8.07	8.98
Kristalon	22.11	21.73	21.40	19.11	21.09	10.25	9.11	8.95	8.19	9.13
Means	21.62	21.18	20.88	18.68		9.94	8.82	8.60	7.86	
LSD at 0.05										
A= N.S						**A=** 0.260				
B= N.S						**B=** 0.332				
A×B= N.S						**A×B=** 0.805				
					2nd season					
Control	21.89	21.00	20.78	19.11	20.70	10.52	8.90	8.76	8.10	9.07
Chicken manure	22.32	21.43	21.20	19.52	21.12	10.39	9.27	9.02	8.28	9.24
Yeast	22.53	22.12	21.19	19.75	21.40	10.57	9.46	9.18	8.46	9.42
Moringa extract	23.07	22.65	21.88	20.05	21.92	10.71	9.60	9.36	8.66	9.58
Kristalon	23.80	22.96	21.47	20.19	22.11	10.96	9.72	9.54	9.78	10.00
Means	22.72	22.03	21.30	19.72		10.63	9.39	9.17	8.66	
LSD at 0.05										
A= N.S						**A=** 0.419				
B= N.S						**B=** 0.507				
A×B= N.S						**A×B=** 0.975				

the other side indicated the great influence of untreated plants with saline water and treated with either moringa extract or kristalon treatments in producing the best spike length in both seasons.

3.2.4. No. of flowers/spike:

No. of flowers/spike showed a gradual decrement in both seasons accompanied by the gradual increase in salinity level, Table (3). On the other hand, the different fertilizer treatments showed a slight effect in increasing number of flowers/spike in the two seasons, with kristalon treatment occupying the first rank in this regard. The interaction clearly reveals the superiority of plants which received either kristalon or moringa extract with water tap (control) in both seasons.

3.3. Bulbs and bulblets productivity

3.3.1. Bulb fresh weight

Data executed in Table (4) indicated that bulb fresh weight was progressively decreased by increasing salinity level in the two seasons, giving the least score with the highest salinity level (4000 ppm). Meanwhile, treating plants with the either kristalon or with moringa extract gave the highest values of bulb fresh weight in both seasons. The interaction revealed the great influence of untreated with saline water with kristalon and moringa extract treatments in the two seasons.

3.3.2. Bulb circumference

Bulbs which received saline water of the level of 1000 ppm or the untreated ones scored the highest values of bulb circumference in the two seasons as shown in Table (4). However, bulbs which received fertilization treatments (kristalon, moringa extract, yeast or chicken manure) enhanced bulb circumference scores in the two seasons. Moreover, the interactions, showed the superiority of untreated bulbs with saline water or those which received the lowest salinity level (1000 ppm) with either moringa extract or kristalon treatments in producing the widest bulb circumference in the two seasons.

3.3.3. Number of bulbs/plant (bulbs yield)

With insignificant effects in the two seasons, data presented in Table (4) exerted a gradual decrement in number of bulbs/plant (bulbs yield) in the two seasons by increasing salinity level. Meanwhile, data showed also the prevalence of using either moringa extract or kristalon treatment in increasing number of bulbs/plant (bulbs yield) in the two seasons. The interactions indicated the superiority of untreated bulbs with saline water with either moringa extract or kristalon treatments in raising number of bulbs/plant (bulbs yield) in the two seasons.

3.3.4. Bulblet fresh weight

It is evident from data exhibited in Table (5) that bulblets fresh weight progressively decreased due to increasing salinity level, as the least record was a result of using the highest salinity level (4000 ppm) in the two seasons. On the other side, the different fertilizer treatments caused an increase on such parameter, with the mastery of applying kristalon treatment in the two seasons. nonsignificant effect the interaction was attained on the same trait due to treating the bulbs untreated with salinity with kristalon , moringa extract, yeast or chicken manure treatments in the two seasons.

3.3.5. Number of bulblets/plant (bulblets yield)

With insignificant effects in the two seasons, data exhibited in Table (5) showed that No. of bulblets/plant (bulblets yield) was gradually decreased by the gradual increase in salinity level. Moreover, moringa extract and kristalon treatments were the best treatment in enhance bulblets yield (number of bulblets/plant) in the two seasons. Additionally the interaction indicated the prevalence of plants untreated with saline water and kristalon treatment in the two seasons.

3.4. Root parameters

3.4.1. Root length

It is evident from data illustrated in Table (6), that root length was progressively decreased by increasing salinity level in both seasons, registering the least scores, when the plants received the highest salinity level (4000 ppm). On the other hand, all fertilization types increased to some extent root length comparing with that obtained from untreated control plants. In the matter of the interaction, the highest

Table 4: Effect of different levels of salinity and types of fertilization on bulbs fresh weight (g.), bulb circumference (cm.) and number of bulbs/plant of *Hymenocallis speciosa* during the two seasons (2016/2017 and 2017/2018)

	Bulbs fresh weight (g.)					Bulb circumference (cm.)					Number of bulbs/plant				
	Salinity (A)														
Treatments (B)	**Control**	**1000**	**2000**	**4000**	**Mean**	**Control**	**1000**	**2000**	**4000**	**Mean**	**Control**	**1000**	**2000**	**4000**	**Mean**
								1st season							
Control	63.73	20.09	33.12	25.32	43.07	15.78	15.85	14.88	14.25	15.50	0.95	0.93	0.90	0.82	0.90
Chicken manure	65.42	53.81	33.82	26.05	44.78	16.00	16.21	15.08	14.63	15.76	1.07	0.97	0.94	0.85	0.96
Yeast	68.28	57.47	34.88	26.68	46.83	16.45	16.38	15.43	15.00	16.09	1.15	1.04	0.97	0.88	1.01
Moringa extract	72.08	59.64	35.96	28.48	49.04	16.83	16.65	15.78	15.23	16.42	1.25	1.08	0.99	0.92	1.06
Kristalon	73.88	61.33	36.52	29.60	50.33	17.08	16.88	16.12	15.55	16.69	1.42	1.19	1.07	0.97	1.16
Means	68.68	56.47	34.86	27.22		16.42	16.40	15.46	14.94		1.17	1.04	0.97	0.89	
LSD at 0.05															
A= 2.163						**A** = 0.823					**A**= N.S				
B= 2.759						**B** = 1.035					**B**= N.S				
A×B= 4.326						**A×B** = 1.542					**A×B**= N.S				
								2nd season							
Control	65.23	50.45	33.78	25.89	43.84	16.52	16.23	15.08	14.62	15.51	1.08	1.05	1.02	0.90	1.01
Chicken manure	67.35	54.21	34.15	26.95	45.67	16.80	17.05	15.22	14.89	16.00	1.35	1.20	1.16	0.93	1.16
Yeast	71.09	58.24	35.29	27.31	47.98	17.23	17.20	15.72	15.34	16.37	1.54	1.38	1.20	0.98	1.28
Moringa extract	72.89	60.22	36.43	29.12	49.67	17.54	17.42	16.07	15.65	16.67	1.78	1.41	1.23	1.04	1.37
Kristalon	74.11	62.51	37.24	30.20	51.02	17.95	17.78	16.38	15.80	16.98	2.08	1.62	1.35	1.20	1.56
Means	70.13	57.13	35.38	27.89		17.20	17.14	15.69	15.26		1.57	1.33	1.19	1.01	
LSD at 0.05															
A= 3.250						**A** = 0.908					**A**= N.S				
B= 4.098						**B** = 1.405					**B**= N.S				
A×B= 6.521						**A×B** = 1.870					**A×B**= N.S				

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Table 5: Effect of different levels of salinity and types of fertilization on bulblets fresh weight (g.) and number of bulblets/plant of *Hymenocallis speciosa* during the two seasons (2016/2017 and 2017/2018)

Treatments (B)	Bulblets fresh weight (g.)					Number of bulblets/plant				
	Salinity (A)									
	Control	1000	2000	4000	Mean	Control	1000	2000	4000	Mean
	1st season									
Control	11.43	10.28	10.08	8.65	10.11	0.95	0.90	0.75	0.60	0.80
Chicken manure	12.13	11.53	10.75	9.00	10.85	1.35	1.13	0.87	0.88	1.06
Yeast	13.08	12.19	10.87	9.31	11.36	1.72	1.28	1.15	1.27	1.36
Moringa extract	14.00	12.61	10.98	9.79	11.84	2.13	1.53	1.48	1.55	1.68
Kristalon	14.54	13.05	11.11	10.10	12.20	2.75	1.98	2.00	1.77	2.13
Means	13.04	11.93	10.76	9.37		1.78	1.37	1.26	1.21	
LSD at 0.05										
A= N.S						**A=** N.S				
B= N.S						**B=** N.S				
A×B= N.S						**A×B=** N.S				
	2nd season									
Control	12.23	10.77	10.42	9.12	10.64	1.07	1.02	0.92	0.81	0.95
Chicken manure	13.09	12.32	11.20	9.75	11.59	1.62	1.40	1.00	1.01	1.26
Yeast	14.00	12.89	11.42	10.07	12.10	1.91	1.59	1.46	1.52	1.62
Moringa extract	14.89	13.25	11.63	10.31	12.52	2.30	1.76	1.70	1.69	1.86
Kristalon	15.11	13.87	12.08	11.05	13.03	2.90	2.18	2.30	1.95	2.33
Means	13.86	12.62	11.35	10.06		1.96	1.59	1.48	1.39	
LSD at 0.05										
A= N.S						**A=** N.S				
B= N.S						**B=** N.S				
A×B= N.S						**A×B=** N.S				

Table 6: Effect of different levels of salinity and types of fertilization on root length (cm.) and root fresh weight (g.) of *Hymenocallis speciosa* during the two seasons (2016/2017 and 2017/2018).

Treatments (B)	Root length (cm.)					Root fresh weight (g.)				
	Salinity (A)									
	Control	1000	2000	4000	Mean	Control	1000	2000	4000	Mean
					1st season					
Control	34.50	32.85	29.85	28.75	32.40	107.25	103.13	95.25	90.22	101.90
Chicken manure	35.38	33.08	30.15	30.00	32.87	108.79	106.05	95.93	91.43	103.60
Yeast	35.58	33.55	30.92	30.50	33.35	111.14	109.07	97.90	92.58	106.00
Moringa extract	36.13	34.05	31.45	30.91	33.88	113.53	109.25	98.75	93.29	107.20
Kristalon	37.03	35.25	32.08	31.67	34.79	116.17	110.08	99.85	94.24	108.70
Means	35.73	33.76	30.89	30.37		111.40	107.50	97.54	92.35	
LSD at 0.05										
A= 1.667						**A=** 1.326				
B= 2.127						**B=** 1.809				
A×B= 3.684						**A×B=** 3.082				
					2nd season					
Control	35.23	33.18	30.25	29.42	32.02	110.32	107.05	99.30	94.12	102.70
Chicken manure	36.11	34.20	31.23	31.14	33.17	112.25	110.12	100.28	95.32	104.49
Yeast	36.33	34.40	31.42	31.21	33.34	115.03	113.15	102.30	96.43	106.73
Moringa extract	37.08	35.11	32.34	31.45	34.00	117.23	113.82	103.41	97.18	107.91
Kristalon	38.12	36.28	33.09	32.39	34.97	120.19	114.21	104.22	98.30	109.23
Means	36.57	34.63	31.67	31.12		115.00	111.67	101.90	96.27	
LSD at 0.05										
A= 1.917						**A=** 1.505				
B= 3.522						**B=** 1.982				
A×B= 4.208						**A×B=** 3.511				

values were recorded due to plants which received tap water (control) with chicken manure, yeast, moringa or kristalon or plants irrigated with 1000 ppm saline water fertilized with moringa extract or kristalon treatment in the two seasons. The opposite was right when plants received the highest level of salinity in irrigation without any addition of fertilization.

3.4.2. Root fresh weight:

Obviously, data registered in Table (6) indicate that roots fresh weight was progressively decreased with increasing salinity level and reached the minimum value when the plants were irrigated with the highest salinity level (4000 ppm) in both seasons.

With respect to the effect of the different fertilizer treatments, on the same trait, data indicated the prevalence of treating plants with either moringa extract or kristalon the highest root fresh weight in both seasons. As for the interaction, treated plants with either moringa extract or kristalon Irrigated with tap water gave the highest values of root fresh weight in the two seasons, whereas, the opposite was right for plants which received the highest salinity level as gave the lowest root fresh weight values.

3.5. Chemical constituents of the newly formed plant:

3.5.1. Pigment contents

3.5.1.1. Chlorophyll a

Obviously, data exhibited in Figure (1) exert that chlorophyll (a) content in leaves was increased comparing with that resulting from treating plants with salinity at the levels of (2000 ppm) in both seasons. On the other side, the different fertilizer treatments improved chlorophyll (a) content in leaves in both seasons, with the superiority of using either Moringa extract of kristalon treatments in the two seasons. The interaction, on the other side, cleared the superiority of treating plants which received salinity at 2000 ppm with either Moringa extract of kristalon treatments in the two seasons.

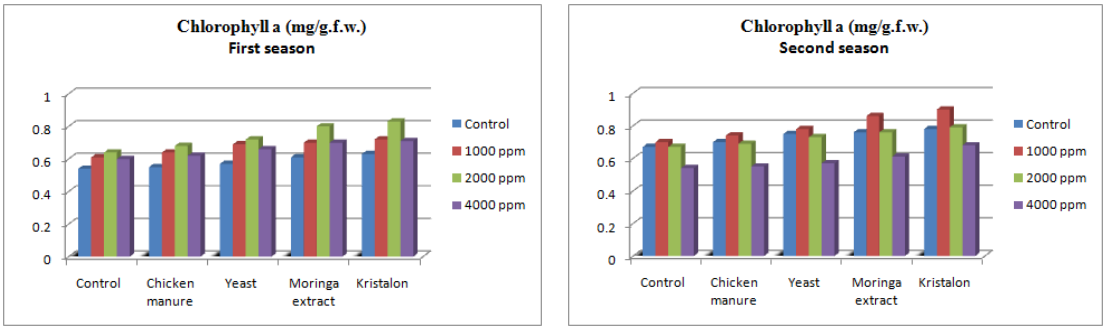

Fig. 1: Effect of different levels of salinity and types of fertilization on Chlorophyll a (mg/g.f.w.) of *Hymenocallis speciosa* during the two seasons (2016/2017 and 2017/2018).

3.5.1.2. Chlorophyll b

Data presented in Figure (2) proved the prevalence of treating plants with 2000 ppm saline water in the first season and at 1000 ppm in the second one in increasing chlorophyll (b) content, respectively. Moreover, treating plants with kristalon in both seasons was the best fertilizer treatments for improving chlorophyll (b) content in the two seasons.The interaction, on the other side, proved the mastery of plant which received salinity levels on either 1000 or 2000 ppm with kristalon treatment in both seasons.

3.5.1.3. Carotenoids

The recorded data in Figure (3) show that treating plants with saline water at 2000 ppm gave the highest values of carotenoids content in the two seasons. However, salinity level at 4000 ppm in the first season and 2000 ppm salinity in the second one proved also the superiority in increasing carotenoids content in the leaves. On the other side, negligible differences were noticed as carotenoids content resulted from using the different types of fertilization in the two seasons.

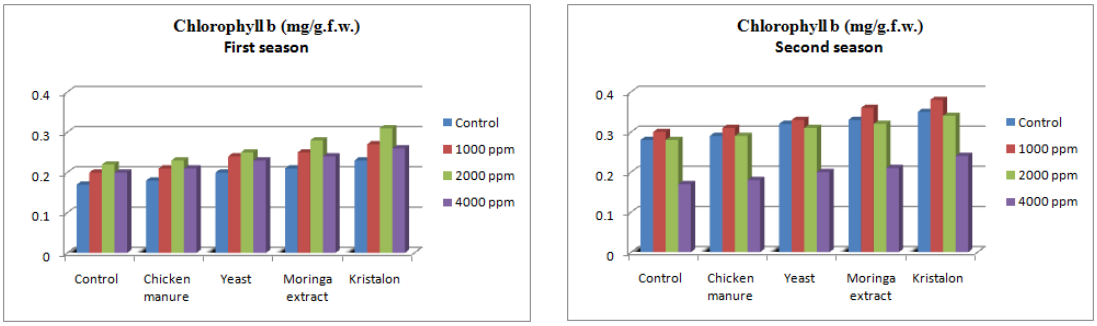

Fig. 2: Effect of different levels of salinity and types of fertilization on Chlorophyll b (mg/g.f.w.) of *Hymenocallis speciosa* during the two seasons (2016/2017 and 2017/2018)

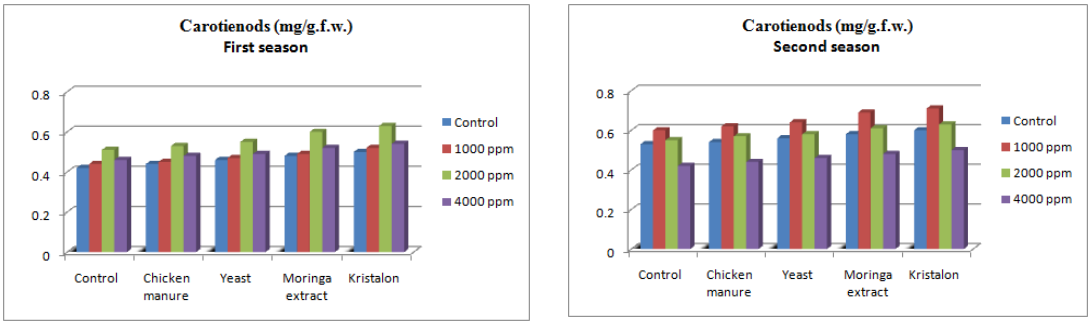

Fig. 3: Effect of different levels of salinity and types of fertilization on Carotenoids (mg/g.f.w.) of *Hymenocallis speciosa* during the two seasons (2016/2017 and 2017/2018)

3.5.1.4. Proline

Data registered in Figure (4) indicate that proline content in bulbs progressively increased by raising salinity level giving the utmost highest value by receiving plants saline water at 4000 ppm in both seasons. On the other side treating plants with kristalon gave the highest value of proline in bulbs in both seasons. Meanwhile, the interaction indicated that plants which received saline water at 2000 ppm and treated with kristalon scored the highest value of proline in the two seasons, whereas, the lowest value resulted from untreated control plants with saline water and untreated with fertilization.

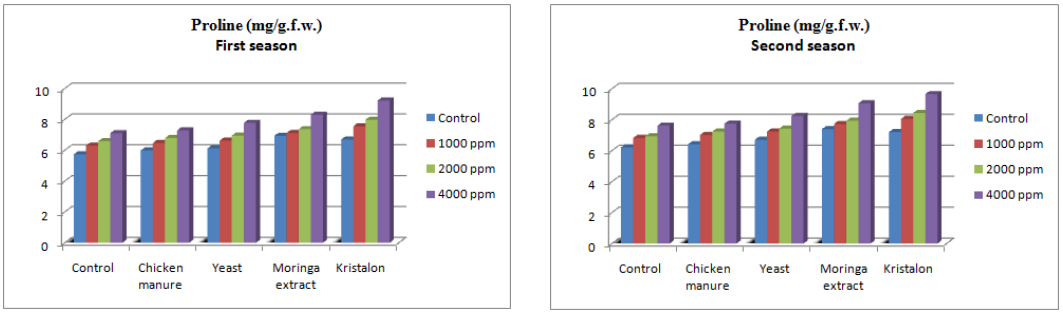

Fig. 4: Effect of different levels of salinity and types of fertilization on proline (mg/g.f.w.) of *Hymenocallis speciosa* during the two seasons (2016/2017 and 2017/2018)

3.5.1.5. Total carbohydrates%

As indicated in Figure (5), raising salinity level to 2000 ppm in the two seasons gave the highest score of total carbohydrates in bulbs. On the other side, receiving plants Moringa extract succeeded to produce the highest value of the same content in the two seasons. Meanwhile, the interactions, indicated the prevalence of treating plants with salinity at 2000 ppm level with receiving plants yeast extract in giving the utmost highest values of total carbohydrates in leaves in the two seasons.

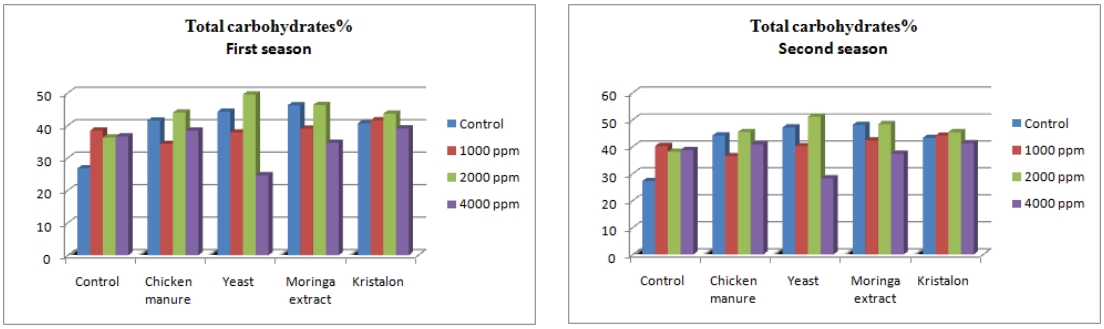

Fig. 5: Effect of different levels of salinity and types of fertilization on total carbohydrates% of *Hymenocallis speciosa* during the two seasons (2016/2017 and 2017/2018)

3.6. Minerals content

3.6.1. Nitrogen%

Data exhibited in Figure (6) exert the beneficial effect of raising salinity level to 2000 ppm in both seasons in raising Nitrogen% in bulbs over than that gained from the other salinity level used. On the other hand, giving the plants Moringa extract indicated its superiority in raising N% in the leaves. The interactions, on the other side, revealed the prevalence in raising N% in the leaves due to supplying the plants which treated with salinity level at either 1000 or 2000 ppm, with kristalon treatment in both seasons.

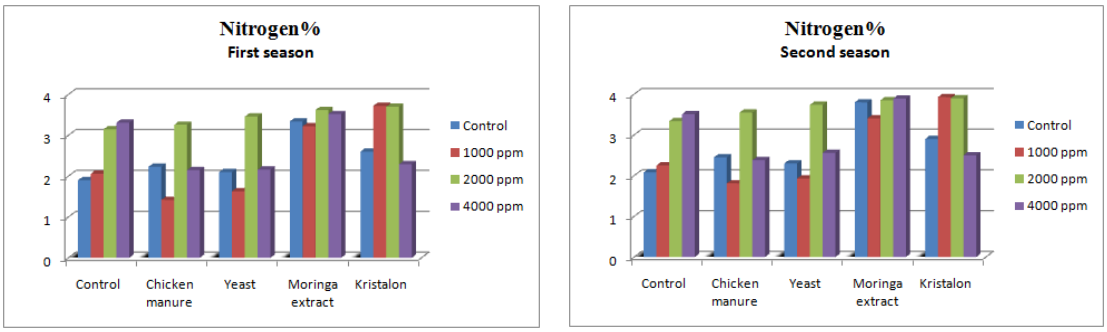

Fig. 6: Effect of different levels of salinity and types of fertilization on nitrogen% of *Hymenocallis speciosa* during the two seasons (2016/2017 and 2017/2018)

3.6.2. Phosphorus%

Data scored in Figure (7) indicated that increasing salinity level to the maximum values (2000 and 4000 ppm) caused a decrement in phosphorus% in newly formed bulbs in both seasons. However, receiving plants the lowest level of saline water (1000 ppm) gave rise to the utmost high values of phosphorus% in bulbs in both seasons.

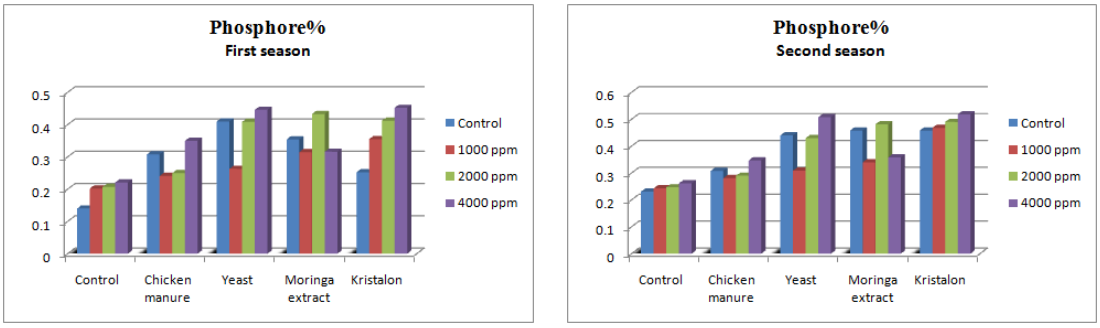

Fig. 4: Effect of different levels of salinity and types of fertilization on phosphore% of *Hymenocallis speciosa* during the two seasons (2016/2017 and 2017/2018)

3.6.3. Potassium%

Data outlined in Figure (8) indicated that potassium% in bulbs was progressively decreased as a result of increasing salinity level in both seasons. Moreover, all fertilization types caused an increment in potassium% comparing with that gained from untreated control plant. The interaction showed the superiority of using salinity level at 4000 ppm, but without any fertilization treatment in producing the highest value of potassium% in both seasons

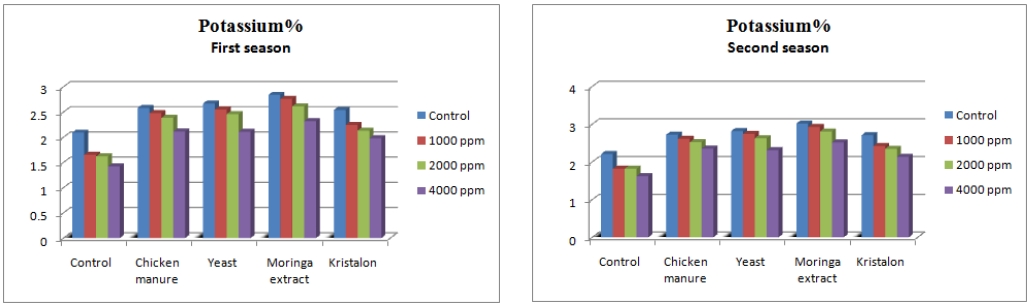

Fig. 4: Effect of different levels of salinity and types of fertilization on potassium% of *Hymenocallis speciosa* during the two seasons (2016/2017 and 2017/2018)

4. Discussion

Long term degradation of water quality from natural resources has led to the use of alternative water resources for irrigation that are saline. Saline water irrigation in floriculture for the production of nursery crops requires an understanding of plant response. Angeliki *et al* (2020) Overall results of different plant growth variables were consistent, showing a significant decrease at 100 and 200 mM NaCl. All lavender species showed signs of salinity stress that included chlorosis, followed by leaf and stem necrosis at NaCl concentrations greater than 50 mM. *L. dentate* var. *dentate* showed the greatest plant growth followed in a descending order by *L. dentate* var. *candicans*, *L. stoechas* and *L. angustifolia.* Hafiz *et al* (2020) It is concluded that roses production is negatively affected due to salinity but proper measures and uses of salt tolerant root stock can reduce some losses. Moreover, more salt tolerant rootstocks need to be identified and selected for cultivation in saline areas. Additionally, water and nutrient management may be used to alleviate some aspects of salt stress. El-Sayed *et al* (2020) reported that *Zygophyllum coccineumis* population had the maximum chlorophyll a content, superoxide dismutase and esterase activities under salinity compared to non-saline populations, but salinity had a non-significant effect on chlorophyll b between the three populations (0, 100, 200, 400 mM NaCl). Carotenoids were enhanced with the increase of salt levels in all populations. Mahbuba Rahman and Md. Azizul Hoque (2018) mentioned that almost all the studied parameters of tuberose in both cultivars were unfavorably affected by salinity. Considering the length and diameter of spike, number of spikes per plant, number of florets per spike, vase life, number of large sized underground bulbs and weight of bulb; both cultivars performed better in controlled condition (0 dS/m). Although, these parameters were unaffected by salinity up to 4dS/m, these got hampered from 6 dS/m and onwards. Both the single and double cultivars were adversely affected by the salinity of soil, but single cultivar was proven more sensitive to soil salinity than double cultivar.

Various workers agreed that chemical fertilization improved ornamental bulbs quality and yield Khalafalla *et al* (2000) on *Ornithogalum thrysoides* reported that, using the medium and high rates of NPK (3 and 4 g/pot significantly increased number spikes/ pot and florets/spike, spike stem diameter and fresh and dry weight of cut spike. El-Hanafy *et al* (2005) on *Freesia refracta* cv. Aurora mentioned that using the commercial product of multi feed (13: 13: 43) caused an increment in spike stem diameter and length of the main spike. Meanwhile, using the mixture of N, P and K delayed to some extent flowering date.

It is well known that N, P and K elements play a major role in growth and development of plant as nitrogen (N) is a main constituent of all proteins and nucleic acids, as well as, of both structure and non structural components of plant cells. Besides involving phosphorus (P) in energy transfer process and building of phospholipids and nucleic acids (Yeonhee *et al*, 2000). In addition, potassium (K) is a very effective macro-element on growth and development of the different plants. It is the factor

affecting many functions of plants, as stomatal movement, regulation of photosynthesis and respirators rate and activating many enzymes involved in the plant growth. It also enhances translocation of sugars and carbohydrates through plant organs, increases protein synthesis and the different metabolic processes as well as reducing respiration, hence energy losses (Csirzinsky, 1999).

Khalafalla *et al* (2000) on *Ornithogalum thrysoides* Jacq found that the rates of NPK fertilization (3 and 4 g/pot) significantly increased both fresh and dry weights of the produced bulbs. El-Hanafy *et al* (2005) on *Freesia refracta* cv. Aurora concluded that using the commercial product of multi feed (13: 13: 43) caused an increment in fresh weight of corm. Meanwhile, all chemical fertilization treatments (NPK at 2 g/plant, multi and super feed at 1 g/plant) increased number of corms/plot (corms yield) but caused a decrement in number of corms/plot (cormels yield).

Referring to the effect of chemical fertilization on chemical constituents of ornamental bulb plants a lot of scientists studied such treatments in details.

Meanwhile, using the mixture of N, P and K increased nitrogen in the same organ.

Heikal (2005) on *Thymus vulgaris* reported that foliar application of active dry yeast (20 and 40 gm/l) significantly increased plant height, number of leaves/plant, leaf/stem herb fresh and dry weight. Abdel-Latif (2006) mentioned that spraying *Salvia officinalis* with active dry yeast 4 times at 5 gm/l significantly increased plant height.

A lot of researches focused their experiment on the important role of *Moringa oleifera* extract increase in the content of carbohydrates and the leaves K content as salinity level decreased in irrigation water. She added that irrigation with saline water led to significant decrease in K content in the leaves and bulbs with a gradual increase in Na and Cl content. Similar observations were also attained by El-Auesni *et al* (2010) on *Schefflera arboricola* and Pandy (2011) on *Cassia fistula*.

Ahmed (2002) on *Leucaena leucocephala* seedlings stated that highest values of stem length, stem diameter and fresh weight of aerial parts of plants were recorded with the highest level (6 g/l) of active dry yeast. Wahba (2002) on *Oenothera biennis* pointed out that the plant height, number of stalks/plant and fresh and dry weight of leaves were increased with increasing the concentration of active dry yeast (2.5, 5 and 7 g/l). Desouky (2004) on *Strelitizia reginae* reported that a combination of NPK at the rate of 100: 60: 20 g/plant + active dry yeast at 2 g/plant greatly increased plant height, leaf number/plant, leaf area as well as vegetative fresh and dry weight of the plant. Heikal (2005) on *Thymus vulgaris*, mentioned that foliar application of active dry yeast (20 and 40 g/l) significantly increased plant height, number of leaves/plant, leaf/ stem fresh weight ratio, herb fresh and dry weight. Mohamed *et al* (2005) on *Lilium longflorum*, mentioned that a spray solution with 3 g dry yeast/l significantly increased leaf number/plant compared to the control. Abdel-Latif (2006) stated that spraying *Salvia officinalis* with active dry yeast 4 times at 5 g/l significantly increased plant height. Abdel-Wahed *et al* (2006) reported that using yeast twice at the rate of 4 g/l plus 6 g NPK significantly increased plant height, fresh and dry weight of shoots of *Euonymus japonica* plant, while yeast alone led to an increment in No. of branches, stem diameter, root length and fresh and dry weight of roots. Abdel-Wahed (2007) on *Brassaia arboricola* mentioned that using yeast at 8 g/l as soil drench produced the tallest plants while the shortest ones were found at the concentration of 4 g/l. Similar results were obtained by Abdel-Fattah *et al* (2009) on Dracaena and Ruscus.

El-leithy *et al* (2007) on *Origanum syriacum* concluded that fertilizing plants with active dry yeast at the concentration of 0, 5 and 10 g/l led to significant increment in vegetative growth parameters, yeast at 5 g/l was the most effective treatment in most cases. Saadawy *et al* (2009) on *Brassaia actinophylla* mentioned that plants treated with yeast extracts had the highest values of plant height, root length and roots fresh and dry weight. El-Sayed *et al* (2010a) recommended to fertilizer one year old transplants of *Spathyophyllum wallisii* grown in 20 cm. diameter plastic pots (1:1:1, v/v/v) with 2 g NPK mixture as a soil drench plus 4 g active dry yeast as a foliar spray, five times at one month internal for obtaining the best growth and the highest quality.

Mohamed *et al* (2005) on *Lilium longflorum*, reported that a spray solution with 3 g dry yeast/l significant increased flower diameter and dry weight. Emam (2010) on *Polianthes tuberose* stated that, using yeast at the lowest level (1 ml/l) caused an obvious increment in time required from planting to flowering. Atowa (2012) on *Freesia refracta* cv. Red Lion concluded that using yeast extract at 2.5 g/l caused improving of flower diameter. Bazaraa *et al* (2014) on gladiolus cv. Novalux concluded that applying yeast extract at the level 3 g/l proved its effect on increasing flower diameter and No. of flowers.

On *Calendula officinals* Ali (2001) obtained an increment in the leaf content of N and P as the concentration of the yeast was increased in the solution. Ahmed (2002) worked on *Leucaena leucocephala* seedlings found that the highest contents of N, P and K were recorded with the highest level (6 g/l) of active dry yeast. Wahba (2002) on *Oenothera biennis* recorded that total carbohydrates as well as N, P and K contents were increased with increasing the concentration of active dry yeast (2.5, 5 and 7 g/l). Heikal (2005) stated that foliar application of active dry yeast (20 and 40 g/l) significantly increased chlorophyll a, b carotenoids, total carbohydrates, N and P of *Thymus vulgaris* plant. Mohamed *et al* (2005) pointed out that a spray solution with 3 g dry yeast/l significant by increased content of flowers of *Lilium longflorum* plants. Abdel-Wahed *et al* (2006) worked *Euonymus japonica* and mentioned that using yeast extract at the rate of 4 g/l led to an increment in carotenoids content in the leaves and K% in the roots. Abdel-Wahed (2007), studied the effect of yeast extract at the rate of 6 g/l (50 ml/pot) as soil drench on *Brassaia arboricola* plants and found that yeast treatment increased chlorophyll content, total carbohydrates content in the herbs and flower content of K.

El-leithy *et al* (2007) treated *Origanum syriacum* plants, with active dry yeast at the concentration of 0, 5 and 10 g/l. They found that dry yeast at either 5 or 10 g/l led to significant increment in chemical constituents (N, P, K and carbohydrates percentage). Abass (2008) on *Narcissus tazetta* subjected the plants to three levels of sea water irrigation (0, 4 and 8 dSm^{-1}), spray of the active dry yeast solution at the rate of 6 g/l under two types of soil (clayey and sandy). Results indicated that yeast solution led to significant increase in N and P contents in the leaf and bulb with the increase in chlorophyll accumulation in the leaves.

Emam (2010) on *Polianthes tuberose* concluded that treating plants with yeast at the highest level (11 ml/l) caused significant decrement in chlorophyll (SPAD) in leaves, whereas, using yeast at the moderate level (5 ml/l) proved its superiority in increasing N% in the clump. Atowa (2012) on *Freesia refracta* cv. Red Lion concluded that using yeast extract at 2.5 g/l caused improving in N, P and K in the leaves. Barsoom (2014) on *Hymenocallis speciosa* reported that using yeast extract at the lowest level (3 g/l) proved its mastery in increasing chlorophyll (a) in the leaves. Meanwhile, P% in the new bulbs was increased due to using yeast extract at the highest level (6 g/l).

Chicken manure plays an important role in plant growth and development, especially when used as a part from growing medium. In this connection, Abdel-Fattah *et al* (2008) on Brassaia (*Schefflera actinophylla* (Endl) Harms) the obtained results exhibited that the various used media significantly increased plant height (cm.), stem diameter (cm.), No. of leaves/plant and dry weight of leaves, stem and roots (g), with the superiority of the sand+ farmyard Chicken manure mixture (1:1, v/v) gave the highest values in the two seasons relative to the control and all other mixtures. Similary, were those results of pigments content (chlorophyll a, b and carotenoids, mg/g.f.w), the percentage of N, P and K as well as Fe, Mn and Zn ppm in the leaves, but the mastery in these constituents was ascribed to sand+ farmyard chicken manure+ chicken manure mixture. Thus, many researchers reported that soil application of chicken manure increased yield marketability and yield criteria of onion (Shaheen *et al*., 2007; Yoldas *et al*., 2011; Ali *et al*., 2018 and Yoldas *et al*., 2019).

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