RESPONSE OF GROWTH, FLOWERING, CORM PRODUCTIVITY ANDCHEMICAL CONSTITUENTS OF*FREESIA REFRACTA* CV. "RED LION" TO SOME NATURAL EXTRACTS

[1]EL-SAYED, A. , SAFIA H. EL-HANAFY[1], A. NABIH[2] and D. I. ATOWA[2]

1. *Faculty of Agriculture – Cairo University – Giza – Egypt*
2. *Horticulture Research Institute – ARC –Giza – Egypt*

Abstract

This experimental trial was consummated on *Freesia refracta*cv. "Red Lion" throughout two successive seasons (2009/2010 and 2010/2011) at the nursery of Horticulture Research Institute, Giza and Faculty of Agriculture, Cairo University, Egypt. It intended to study the response of the plant to two natural extracts (garlic extract at 250 and 500 ml/l and active dry yeast at 2.5 and 5 g/l) for improving plant quality and chemical constituents. The results indicated the prevalence of using yeast extract at 2.5 g/l for improving vegetative growth, most of flower parameters, corms and cormlet productivity. Meanwhile, using garlic extract at 500ml/l occupied the second rank in elevating number of cormlets/plot (cormlets yield) and fresh weight of cormlets. Treating plants with yeast extract at 5 g/l was the best for raising chlorophyll (aand b) in leaves. All treatments tended to increase carotenoids accumulation. Great influence was detected on chlorophyll (a) and carotenoids in leaves due to applying garlic extract at 500 ml/l, whereas using garlic extract at 250 ml/l or yeast 2.5g/l was the best for raising total carbohydrate content. N, P and K contents in the leaves also increased as a result of applying yeast extract at 2.5 g/l. Meantime, total carbohydrate accumulation in the new formed corms increased due to using the different treatments. However, applying yeast extract at 2.5 g/l raised N and P% content in the leaves. Also, K% content in the new corms increased as a result of using garlic extract at either 250 or 500 ml/l. From the aforementioned results it could be recommended to use the low level of yeast extract (2.5 g/l) as well as the high one of garlic extract (500 ml/l) for improving *Freesia refracta* cv. "Red Lion" quality and chemical constituents.

Key words:*Freesia refracta* cv. Red Lion, Natural extracts, garlic, yeast.

INTRODUCTION

Freesia (family, Iridaceae) is a corms plant discovered and put in cultivation since more than 200 years (Bailey, 1963). It is among the important cut flowers in European countries, U.S.A and Japan. Also, it occupies a considerable place among cut flowers in the Netherlands, besides roses, carnation and chrysanthemum. Freesia flowers are popular in the European markets and could be easily transported since they are light in weight. However, the cultivation of freesia was limited until the beginning of this century because flowers were of few colours. After the introduction

of new species and the establishment of many hybrids having a wide variety of colours, freesia has become an important ornamental plant.

The use of extracts of certain plants referred to as biostimulants, botanical activators or botanicals, such as garlic and yeast (though a fungus) in improving the growth of agriculture crops specially ornamental plants, is highly recommended as environment friendly and safe approach to get better plants without being forced to use chemical nutrients or synthetic growth regulators that may harm the environment. Yeast and garlic extracts may be considered superior in their beneficial effect.

In this connection, the effect of juices or extracts of certain plants as biostimulants was tried successfully by a lot of scientists to have positive influence on many plant traits. Concerning garlic extract Gomma *et al* (2005) stated that garlic extract levels (25, 50 and 100%) as a foliar spray caused significant increase in plant height, flowering percentage, flower stalk length, fresh weight of flower, bulbs and bulblets of *Narcissus tazetta* cv. Geranium plants. El-Shayeb (2009) stated that all concentrations of garlic extracts increased fresh and dry weight of leaves, stems and flowers and number of flowers of *Oenothe rabiennis*. The best response resulted from the highest concentration of garlic (75%). Saadawy *et al* (2009) on *Euonymus japonicus* reported that using garlic extract resulted in the highest values of all shoot and root characters and the highest values of all chemicals characters. Emam (2010) on *Polianthes tuberosa* concluded that applying garlic extract at 5 ml/l raised number of bulbs/plant and number of bulblets/plant. He found also that garlic extract at 3 ml/l increased P% in the new clump. Bazaraa *et al* (2012) on Gladiolus cv. "Novalux" reported that applying garlic extract at 500 ml/l proved its great effect in increasing all vegetative growth parameters as well as corms and cormlets traits. Also, it was most effective for raising total carbohydrates accumulation and P content in the new formed corms. Meanwhile, using garlic extract at 250 ml/l proved its effect in increasing N and K content in the same organ.

Dealing with yeast extract, Ali (2001) on *Calendula officinalis* proved a significant effect of yeast on vegetative growth and flowering characters of the plant as well as an increase in the leaf content of N and P as the concentration of the yeast increased in the solution. Desouky (2004) on *Strelitziareginae* stated that a combination of NPK at 100, 60, 20 g/plant with active dry yeast at 2 g/plant greatly increased plant height, leaf number/plant, petiole length, leaf area, flower spike number/plant, spike stalk length, stalk diameter as well as foliage and spike fresh and dry weight of plant. Total carbohydrate and element content of N, P, K, Ca, Mg, Fe, Mn, Zn and Cu in vegetative parts also increased. Mohamed *et al* (2005) on *Liliumlongiflorum* found that a spray solution with 3 g dry yeast/l significantly

increased leaf number/plant, flower diameter, dry weight and the carbohydrates content of flowers compared to the control. Abass (2008) subjected *Narcissus tazetta*plants to a spray of active dry yeast solution at the rate of 6 g/l. The results indicated that using yeast solution led to significant reduction in time required to flowering stage compared to the control as well as significant increase in N and P content in the leaf and bulb. Emam (2010) on *Polianthes tuberosa* stated that significant increase in rachis length was observed when treating plants with yeast at 7 ml/l, whereas using yeast at the lowest level (1 ml/l) caused a clear increment in the time from planting to flowering. Bazaara*et al* (2012) on Gladiolus cv. "Novalux" found that applying yeast at 5 g/l proved its effect in increasing all vegetative growth parameters as well as corms and cormlets traits.

Therefore, the current research aims to identifying the effect of either garlic or yeast extracts with different levels on growth, flowering, corms and cormlets productivity and chemical constituents of *Freesia refracta* cv. "Red Lion" for giving plants of high quality without being forced to use of chemical nutrients or synthetic growth regulators that may harm the environment.

MATERIAL AND METHODS

The experiment was consummated throughout two successive seasons (2009/2010 and 2010/2011) at the nursery of Horticulture Research Institute, Giza and Faculty of Agriculture, Cairo University, Egypt. The second season was an exact repetition for the first one. It intended to find out the response of *Freesia refracta* cv. "Red Lion" (fam: Iridaceae) to different types of natural extract treatments (garlic and active dry yeast) for improving the different plant traits.

1. Plant materials

a. Locally produced corms of 5–6 cm circumference were selected to study their response to the different natural extract treatments

b. Clay loamy soil was used in the two seasons. The chemical profile of soil Table (a) was determinted at Soil and Water Research Institute, Agricultural Research Center, Giza.

Table a. Chemical profile of soil medium according to Blake, (1965)

pH	EC dSm^{-1}	Cations (meq/l)			Anions (meq/l)			
		Ca++	Mg++	Na+	K+	HCO_3^-	Cl^-	SO_4^{--}
7.40	1.40	2.8	1.21	3.73	2.30	3.50	4.73	2.16
N(ppm)	P(ppm)	K(ppm)	Fe(ppm)	Zn(ppm)	Mn(ppm)	Cu(ppm)		
2.32	25.02	580.00	7.48	5.66	2.92	7.18		

2. Natural extracts were prepared as follows

a. Garlic (*Allium sativum*): 500 g of meshed garlic cloves were soaked in 100 ml ethyl alcohol (95%) and 400 ml of water for 3 hours before filteration and adjusted to 1 liter (as a stock)

b. Yeast (*Saccharomyces cerevisiae*): 2.50 or 5 g. dry yeast plus 1ml molasses+ 2ml water were mixed in a warm place (24 h)and adjusted with water to 1liter. Chemical constituents of garlic and yeast are present in Tables (b, c and d).

Table b. The main constituents of garlic bulbs , ppm (Duke, James, 1992)

Arginine	Ascorbic acid	Aspartic acid	Beta carotene	Biotin	Coffeic acid	Carbohydrates
6.340	100.0	4.890	0.17	6.0	2.0	274.0

Table c. The main constituents of garlic oil, percentage (AbouHadid*et al.* , 1998)

Constituents	%	Constituents	%	Constituents	%
Methyl allyl sulfide	4.70	Diallyl sulfide	2	Dimethyl trisulfide	0.8
Allyl sulfide	2.30	Diallyltrisulfide	1.06	Diallyl– disulfide	16
Di-n-propyl sulfide	0.70	di-n-Butyl sulfide	8.06	Hixanol	0.23
Tert. Butyl mercaptime	Trac	Methyl propenyl disulfide	0.04	Methyl allyltrisulfide	6
Unidentified compounds	3.50				

Table d. Chemical constituents of the active dry yeast.

Proteins	47.0%	Niacin	300 – 500 m/g
Carbohydrates	33.0%	Pyrodoxin	28.0 m/g
Minerals	8.0%	Pantathenate	70.0 m/g
Nucleic acids	8.0%	Bioton	1.3 m/g
Lipids	4.0%	Cholin	40.0 m/g
Thiamine	60 – 100 m/g	Folic acid	5.13 m/g
Riboflavin	35 – 50 m/g	Vit.B12	0.001 m/g
Minerals (mg/g)			
Na	0.12	Cu	8.0
Ca	0.75	Se	0.1
Fe	0.02	Mn	0.02
Mg	1.65	Cr	2.2
K	21.0	Ni	3.0
P	13.5	Va	0.04
S	3.9	Mo	0.4
Zn	0.17	Sn	3.0
Si	0.03	Li	0.17

3. Procedure

Locally produced corms were taken from soil on May 15th, in every season . After examining and cleaning,corms were kept at room temperature (28 ± 3° C) till planting date. Corms of 5 – 6 cm. circumference were selected and planted on September 29th in 20cm diameter clay pots filled with 2.5 kg clay loamy soil (one corm each) under open field conditions. Garlic and yeast extracts were applied separately as a soil drench for each (250 and 500 ml/l for garlic and 2.5 and 5 g/l for yeast), commencing from December 15th to February 15th at 15 days intervals, i.e. plants were treated by the different natural extract treatments 5 times.

The layout of the experiment was randomized complete block design (RCBD) with three replicates. Every treatment contained 18 corms and every experimental unit contained 6 corms in both seasons.

Regular agricultural practices such as weeding, watering.....etc were carried out whenever necessary. Kristalon was sprayed three times (1g/l) at 30 day interval commencing from November 15th as a regular care in both seasons.

3. The following parameters were recorded

a. Vegetative growth: Vegetative growth height at flowering time (cm) andnumber of leaves / plant at the beginning of flowering stage

b. Flowering characteristics: Number of days from planting to the first flower bud opening(flowering date), spike stem length (cm), spike stem diameter (mm), length of the main spike (cm), number of flowers on the main spike, number of cut spikes / plant, total number of flowers/plant, fresh weight of cut spike (g), corms and cormlets productivity,number of the produced corms/plot (corms yield), corm fresh weight (g), corm circumference (cm), number of the produced cormlets/plot (cormlets yield), cormlets fresh weight (g).

Data were statistically analyzed using SAS 1994 Computer Program and means were compared by L.S.D test according to Snedecor and Cochran (1980).

d. Chemical analysis:

The following determinations were carried out in the second season

1. **Pigments content:**Determinations of chrolophyll a, b and carotenoids in fresh leaves were carried out according to Wettstein (1957).
2. **Total carbohydrates content in leaves and new corms:**Total carbohydrates in leaves and new corms were determined using colorimetric method described by Smith *et al.* (1956)
3. **Nitrogen, phosphorus and potassium percentage in leaves and new corms:** Nitrogen was determind by micro-kjeldahle apparatus (Blake,1965). Phosphorus was colorimetrically determined in the acid disgest using ascorbic acid

method (John, 1970). Potassium was determined using the flamephotometer (Dewis and Freitas, 1970).

RESULTS AND DISCUSSION

a. Effect of yeast and garlic extracts on vegetative growth parameters:

Data registered in Table (1) indicate the prevalence of supplying plants with the lowest level of yeast (2.5 g/l) in raising vegetative growth height, as it elevated the scored value to the utmost with significant difference compared with control and

Table 1: Effect of yeast and garlic extracts on vegetative growth height and number of leaves/plant at flowering time of freesia plant during 2009/2010 and 2010/2011 seasons.

Natural Extract	Vegetative growth height (cm)		Number of leaves/plant	
	1st Season	2nd Season	1st Season	2nd Season
Control	25.00	27.11	8.60	8.04
Yeast 2.5g/l	28.80	31.17	9.00	9.44
Yeast 5g/l	25.30	26.00	7.50	8.33
Garlic 250ml/l	26.00	28.80	8.20	8.17
Garlic 500ml/l	25.00	24.56	8.60	8.22
L.S.D at 0.05	2.477	2.243	N.S	N.S

other treatments in both seasons. In contrast, the least scores were confined to plants treated with garlic extract at 500 ml/l in the two seasons. Number of leaves/plant was not significantly affected by the different treatments in both seasons.

The previous result of the great influence of yeast extract in elevating vegetative growth height are in conformity with that attained by a lot of workers. Khedr and Farid (2000) on tomato cv. "Fakulta". Wanas (2002) on *Viciafaba*cv. "Giza" 461, Abdel-Latif (2006) on *Salvia officinals*, Abdel-Wahed (2007) on *Brassaiaarboricolla*, Saadawy*et al* (2009) on *Brassaiaactinophylla* and Bazaraa*et al* (2012) on Gladiolus cv. "Novalux."

b. Effect of yeast and garlic extracts on flowering parameters:

Negligible differences on the time required from planting corms to flowering were observed in most cases when applying the two biostimulants (garlic and yeast extracts) treatments in both seasons, Tables (2, 3 and 4). However, the only significant effect was noticed due to treating plants with yeast at 2.5g/l in the second season, which caused significant increment in such duration compared with that obtained from other treatments. Such result is in harmony with that gained by Emam (2010) on *Polianthestuberosa*. He concluded that using yeast at the lowest level (1 ml/l) caused an obvious increment in the time required from planting to flowering.

Data exhibited in Table(2) clear that the longest spike stem was obtained as a result of treating plants with yeast extract at the lowest level (2.5 g/l). Meanwhile, the second rank for elevating such trait belonged to plants supplied with garlic extract at 250 ml/l. Meanwhile, the great influence of using yeast at 2.5 g/l was extended to spike stem diameter as it gave the highest recorded values in both seasons. In contrast, the least scores of spike stem length and spike stem diameter were a result of treating plants with the highest level of yeast or garlic extract (5g/l and 500 ml/l, respectively) in both seasons.

In this connection the prevalence of active dry yeast in improving flower traits (spike stem length and diameter) was also noticed by Desouky (2004) on *Strelitizia reginae,* El-Sayed *et al* (2010) on *Spathiphyllum wallisii* and Emam (2010) on *Polianthes tuberosa.*

Table 2: Effect of yeast and garlic extracts on number of days from planting to the first flower bud opening (flowering date), spike stem length and spike stem diameter of freesia plant during 2009/2010 and 2010/2011 seasons.

Natural extract	No. of days from planting to flowering		Spike stem length (cm)		Spike stem diameter (mm.)	
	1st Season	2nd Season	1st Season	2nd Season	1st Season	2nd Season
Control	160.00	178.00	17.60	20.11	4.50	2.72
Yeast 2.5g/l	159.67	183.33	22.00	22.33	4.70	3.00
Yeast 5g/l	156.00	178.33	17.20	16.94	4.12	2.67
Garlic 250ml/l	156.67	178.67	18.60	20.17	4.50	2.90
Garlic 500ml/l	157.00	179.78	17.50	19.78	4.32	2.60
L.S.D at 0.05	N.S	3.160	2.216	2.026	0.494	N.S

Dealing with the effect of the different biostimulant treatments on length of the main spike, number of flowers on the main spike and fresh weight of cut spike insignificant effects were observed on such traits due to applying the different treatments in both seasons (Tables 3 & 4). Meanwhile, number of spikes/plant as well as total number of flowers/plant revealed a great response to yeast extract at 2.5g/l as such treatment gave the utmost high values in both seasons(Table 4). However, the great influence of yeast extract in raising both number of spikes/plant and total number of flowers/plant is in conformity with Desouky (2004) who stated that a combination of NPK at 100: 60: 20 gm/plant + active dry yeast as 2 gm/plant greatly increased flower spike numbers and affects number/plant of *Strelitizia reginae* plant. Also, Abass (2008) added that using yeast solution led to significant increases in number of flowers/spike of *Narcissus tazetta.*

Table 3: Effect of yeast and garlic extracts on length of the main spike and number of flowers on the main spike of freesia plant during 2009/2010 and 2010/2011 seasons.

Natural Extract	Length of the main spike (cm)		No. of flowers on the main spike	
	1st Season	2nd Season	1st Season	2nd Season
Control	5.80	4.78	9.00	7.89
Yeast 2.5g/l	6.00	4.92	9.10	7.27
Yeast 5g/l	5.40	4.17	9.23	8.33
Garlic 250ml/l	5.70	4.58	8.70	7.67
Garlic 500ml/l	5.65	4.55	8.87	7.78
L.S.D at 0.05	N.S	N.S	N.S	N.S

In this connection, the prevalence of applying yeast extract for improving some plant traits was reported by Skoog and Mitler (1957) They reported that the active dry yeast proved high beneficial effect on plant parameters as it contains cytokinins which effectively promot plant growth and delay leaf aging. Moreover, the positive effect of applying yeast to plant can be attributed to its high nutrient contents, high protein, large amount of vitamin b and natural plant growth regulators such as cytokinins (Ahmed, 2002). Likewise, the beneficial effect of garlic extract in some instances was attributedby many scientists to its various contents. Wanas*et al* (1998),investigated the different effects of garlic as a natural extract on the endogenous phytohormones levels and the histologlical feature in squash (*Cucurbitapepo*) plants grown from treated seeds. They noticed that garlic extract significantly increased the levels of endogenous auxins, gibberellins and cytokinins in the leaves of treated plants. Aqil*et al* (2006) stated that extract of *Allium sativum* showed promising antioxidant and free radical scavenging activity.

Table 4: Effect of yeast and garlic extracts on number of spikes/plant, total number of flowers/ plant and fresh weight of cut spike of freesia plant during 2009/2010 and 2010/2011 seasons.

Natural Extract	No. of spikes / plant		Total No. of flowers / plant		Fresh weight of cut spike (gm.)	
	1st Season	2nd Season	1st Season	2nd Season	1st Season	2nd Season
Control	3.20	2.33	23.10	16.78	8.70	7.36
Yeast 2.5g/l	4.00	3.00	27.00	20.50	10.25	8.44
Yeast 5g/l	3.50	2.33	23.90	15.34	8.50	6.70
Garlic250ml/l	3.90	2.67	24.30	17.17	8.00	7.00
Garlic500ml/l	3.70	2.33	22.53	16.33	7.50	6.39
L.S.D at 0.05	0.436	N.S	2.917	2.670	N.S	N.S

c. Effect of yeast and garlic extracts on corms and cormlets productivity:

Clear response was observed on corms and cormlets productivity due to supplying plants with the low yeast level (2.5 g/l) in both seasons. In this connection the utmost high values of corms yield and fresh weight of cormlets were registered in both seasons. Also, it was found that plants treated with 500 ml/l garlic extract came in the second rank for improving both cormlets yield and fresh weight of cormlets. Meanwhile, corm circumference was not significantly affected by the different biostimulant treatments in both seasons, Table (5 and 6).

The aforementioned results revealed the prevalence of yeast treatment in improving corms and cormlets productivity. In this concern, the beneficial effect of yeast extract on the performance of many plants was studied by many scientists. Ahmed (1998) used dry yeast on marjoram as a foliar fertilizer and found that, it enhanced growth and plant nutritional status. Ahmed (2002) on *Leuconenàlecucocephala*concluded that the positive effects of applying yeast to plant is attributed to its high nutrient contents, high protein, large amount of vitamin B and natural plant growth regulators such as cytokinins.

Table 5: Effect of yeast and garlic extracts on number of the produced corms/ plot , corm fresh weight and corm circumference of freesia plant during 2009/2010 and 2010/2011 seasons.

Natural Extract	No.of the produced corms / plot		Corm fresh weight (gm.)		Corm circumference (cm.)	
	1st Season	2nd Season	1st Season	2nd Season	1st Season	2nd Season
Control	2.70	3.33	3.31	2.74	5.70	5.50
Yeast 2.5g/l	3.30	5.00	3.80	3.27	6.30	6.00
Yeast 5g/l	2.20	3.00	3.60	1.96	6.12	5.76
Garlic 250ml/l	2.85	4.50	2.50	1.90	6.10	5.15
Garlic 500ml/l	2.78	4.30	2.70	2.59	5.87	5.30
L.S.D at 0.05	N.S	1.64	1.30	1.43	N.S	N.S

Table 6 : Effect of yeast and garlic extracts on number of the produced cormlets / plot and cormlets fresh weight of freesia plant during 2009/2010 and 2010/2011 seasons

Natural extract	No.of the produced cormlets/plot		Cormlets fresh weight (gm.)	
	1st Season	2nd Season	1st Season	2nd Season
Control	2.30	3.33	0.32	0.22
Yeast 2.5g/l	7.30	5.00	0.67	0.47
Yeast 5g/l	3.00	3.00	0.30	0.23
Garlic 250ml/l	4.30	3.00	0.42	0.29
Garlic 500ml/l	5.70	4.50	0.58	0.31
L.S.D at 0.05	2.046	1.838	0.331	0.216

d. Effect of yeast and garlic extracts on chemical constituents of leaves:

d.1Pigments content in leaves:

Highest chlorophyll (a) accumulation in leaves was concomitant to plants treated with 5 g/l yeast extract or those received garlic as 500 ml/l. Meanwhile, the highest chlorophyll (b) content in leaves was scored in plants treated also with 5 g/l yeast in both seasons. Values for plants treated with garlic as 500 ml/l occupied the second position, Table (7).

The previous results show the superiority of either yeast or garlic application in raising chlorophyll a and b accumulation in leaves. However, many scientists confirmed these results on certain plant species El-Ghamriny *et al* (1999) on tomato, Amer (2004) on *Phaseolus vulgaris*, Heikal (2005) on *Thymus vulgaris*, Abdel-Wahed (2007) on *Brassaiaarboricolla*, Abass (2008) on *Narcissus tazetta*, Saadawy *et al* (2009) on *Brassaiaactinophylla* and *Euonymus japonicus* and Emam (2010) on *Polianthestuberosa*.

Also, it is evident from data outlined in Table (7) that, all natural extracts levels caused increment in carotenoids accumulation in leaves over the control in both seasons with the mastery of garlic at the level of 500 ml/l. Meanwhile, plants which received 2.5 and 5 g/l yeast occupied the second and third position, respectively, in this regard.

In this connection, the prevalence of yeast extract in supporting carotenoids accumulation in leaves was also reported by El-Ghamriny*et al* (1999) on tomato, Heikal (2005) on *Thymus vulgaris*, Abdel-Wahed *et al* (2006) on *Euonymus japonicas*. The favourable effect of garlic extract on the same constituent was also recorded by Saadawy *et al* (2009) on *Brassaiaactinophylla* and *Euonymus japonicus*

Table 7: Effect of yeast and garlic extracts on chlorophyll (a) , chlorophyll (b) and carotenoids content in the leaves of freesia plant during 2009/2010 and 2010/2011 seasons

Natural extract	Chlorophyll (a) (mg/g.f.w)		Chlorophyll (b) (mg/g.f.w)		Carotenoids (mg/g.f.w)	
	1st Season	2nd Season	1st Season	2nd Season	1st Season	2nd Season
Control	0.73	0.96	0.20	0.25	0.52	0.62
Yeast 2.5 g/l	0.75	0.97	0.21	0.29	0.63	0.80
Yeast 5 g/l	0.92	1.06	0.34	0.47	0.77	0.85
Garlic250 ml/l	0.71	0.70	0.18	0.21	0.62	0.78
Garlic500 ml/l	0.98	1.11	0.26	0.34	0.78	0.87

d.2Total carbohydrates percentage in leaves:

Different trends on total carbohydrate accumulation in leaves were observed due to applying the two natural extracts levels. Treating plants with garlic at 250 ml/l slightly increased the scored values over the control in both seasons. The other treatments decreased to some extent the recorded values compared to those scored for untreated plants (control), Table (8).

In this respect, the favourable effect of garlic extract for increasing total carbohydrate content in leaves is in accordance with the finding of Saadawy *et al* (2009) who concluded that garlic extract application caused an increment in shoot and root contents of total carbohydrates in*Brassaiaactinophylla*and *Euonymus japonicus.*

d.3Minerals percentage in leaves:

Using garlic as 250 ml/l proved its mastery in increasing N% in leaves in both seasons. Leaves nitrogen percentage in plants treated with 2.5 g/l yeast belonged to the second position. Meanwhile, applying yeast at 5 g/l gave means closely near to control values in both seasons, Table (8).

The different natural extract levels differed in their effects on P% in leaves. Treating plants with yeast at the level of 2.5 and 5 g/l slightly increased P% in leaves over control to occupy the first and second positions, respectively. Plants which received garlic at 250 and 500 g/l showed lower values, especially with garlic at 500 ml/l, compared to control in both seasons.

Table 8: Effect of yeast and garlic extracts on total carbohydrates content and (N, P and K%) in leaves of freesia plant during 2009/2010 and 2010/2011 seasons.

Natural Extract	Total carbohydrates %		N%		P%		K%	
	1st Season	2nd Season	1st Season	2nd Season	1st Season	2nd Season	1st Season	2nd Season
Control	41.93	42.32	2.000	2.470	0.710	0.859	1.354	1.323
Yeast 2.5g/l	37.24	37.65	2.890	3.930	0.975	0.989	1.552	1.495
Yeast 5g/l	39.42	39.68	1.690	2.510	0.930	0.870	1.380	1.409
Garlic250ml/l	42.87	42.64	4.320	5.210	0.613	0.812	1.236	1.208
Garlic500ml/l	39.29	39.43	1.520	1.640	0.481	0.596	1.437	1.466

Slight effects were noticed in potassium percentage in leaves due to applying the different natural extracts levels. Yeast treatment at 2.5 g/l followed by garlic at 500 ml/l increased to some extent K% in leaves, compared to the control in both seasons. Meantime treating plants with garlic at 250 g/l slightly decreased the

corresponding values than control in the two seasons. The other treatment (yeast at 5 g/l) gave values closely near to the control ones, especially in the first season.

In this connection, plant content of the major nutrients (N, P and K) was reported to be influenced by the application of biostimulants. El-Desouky*et al* (1988)soaked squash (*Cucurbitapepo*) seeds in garlic extract at 50 – 500 ml/l and found that all treatments significantly increased NPK content in plant organs. El-Gharminy*et al* (1999) claimed that spraying yeast at the rate of 10g/l was effective in enhancing N, P and K of tomato plant. Ahmed (2002) worked on *Leucaenaleucocephala* seedlings and found that the highest values of N, P and K were recorded with the highest level (6 g/l) of active dry yeast. Desouky (2004) worked on *Strelitziareginae* plants and found that a combination of NPK at 100: 60: 20 gm/plant + active dry yeast increased elements content in vegetative parts of the plant. El-Leithy*et al* (2007)on *Origanumsyriacum,* mentioned that when fertilizing the plants with active dry yeast at the concentrations of 0, 5 and 10 g/l, active dry yeast at 5 or10 g/l led to significant increment in N, P and K. Abass (2008) on *Narcissus tazetta* found that using the yeast solution (6 g/l) led to significant increase in N and P contents in the leaf and bulb. Saadawy*et al* (2009)stated that plants treated with yeast extract gave rise to the highest contents of root K of *Brassaiaactinophylla;* and shoot P and root K of *Euonymus japonicus*.

e. Effect of yeast and garlic extracts on chemical constituents of the new formed corms:

e.1Total carbohydrates percentage in the new formed corms:

Data outlined in Table (9) indicate that all yeast and garlic extract levels increased total carbohydrates accumulation in the new formed corms compared tocontrol in both seasons. Treating plants with 500 ml/l garlic extract proved its mastery in this respect. Meanwhile, values of the same constituents for plants received yeast at 2.5 and 5 g/l or those treated with garlic at 250 ml/l achieved the second, third and fourth position, respectively.

In this concern, the prevalence of garlic extract in raising total carbohydrates was observed bySaadawy*et al* (2009) on *Brassaiaactinophylla* and *Euonymus japonicus* and Bazaraa*et al* (2012) on Gladiolus cv. Novalux. The beneficial effect of yeast on the same constituent was also noticed by Wahba (2002) on *Oenotherabiennis*,Desouky (2004) on *Strelitziareginae*, Mohamed *et al* (2005) on*Liliumlongiflorum*, Heikal (2005) on *Thymus vulgaris*, Abdel-Wahed*et al* (2007) on *Brassaiaarboricolla* and El-Leithy*et al* (2007) on *Origanumsyriacum*.

e.2Mineral percentage of the new formed corms:

Data given in Table (9) reveal the superiority of applying yeast at 2.5 g/l in raising N% in the new corms compared with control, as the utmost high means were scored. The second rank was achieved with plants which received yeast at 5 g/l. Plants treated with garlic as 250 ml/l occupied the third rank. On the contrary, the lowest means were obtained with plants treated with garlic at 500 ml/l.

Table 9: Effect of yeast and garlic extracts on total carbohydrates contents and N, P and K % in the new corms of freesia plant during 2009/2010 and 2010/2011 seasons.

Natural extract	Total carbohydrate %		N%		P%		K%	
	1st Season	2nd Season	1st Season	2nd Season	1st Season	2nd Season	1st Season	2nd Season
Control	38.015	28.542	3.723	3.351	0.399	0.424	2.40	2.61
Yeast 2.5g/l	45.404	47.784	6.330	5.585	0.669	0.592	2.60	2.84
Yeast 5g/l	45.617	50.093	5.585	5.213	0.688	0.614	2.33	2.40
Garlic250ml/l	40.668	46.327	4.840	4.840	0.386	0.299	3.03	3.03
Garlic500ml/l	47.144	54.355	3.723	3.723	0.481	0.491	2.89	3.00

Other scientists confirmed the prevalence of yeast application in raising nitrogen content asAhmed (2002) on *Leucaenaleucocephala*, Wahba (2002) on *Oenotherabiennis*, Desouky (2004) on *Strelitiziareginae*, Heikal (2005) on *Thymus vulgaris*, El-Leithy*et al* (2007) on *Origanumsyriacum*, Abass (2008) on *Narcissus tazetta*,Saadawy*et al* (2009) on *Euonymus japonicas*and Emam (2010) on *Polianthestuberosa*. Also, garlic effect in raising N% was also observed by Saadawy*et al* (2009) on *Euonymus japonicas*, Emam (2010) on *Polianthestuberosa*and Bazaraa*et al* (2012) on Gladiolus cv. "Novalux".

The highest P content in the new corms was noticed in plants treated with yeast at 2.5 and 5 g/l, as they occupied the first and second ranks, respectively. Plants which received garlic at 500 ml/l achieved the third position. In contrast, treating plants with garlic at 250 ml/l tended to decrease the scored values than that gained by untreated plants (control) in both seasons.

The favourable effect of yeast application for increasing P% was recorded byWahba (2002) on *Oenotherabiennis*, Desouky (2004) on *Strelitiziareginae*, Heikal (2005) on *Thymus vulgaris*, El-Leithy *et al* (2007) on *Origanumsyriacum*, Saadawy*et al* (2009) on *Euonymus japonicas* and Emam (2010) on *Polianthestuberosa.* The prevalence of garlic extract was also found by Saadawy*et al* (2009) on *Euonymus japonicas* and Bazaraa*et al* (2012) on Gladiolus cv. "Novalux".

Data given in Table (9) indicate that plants treated with garlic at either 250 or 500 ml/l were the highest in K% in new corms than control in the two seasons. Plants

which received garlic at 500 ml/l occupied to the second position. In contrast, treating plants with yeast at 5 g/l caused a slight decrement in both seasons.

The increment in K% due to applying garlic extract was also noticed bySaadawy *et al* (2009) on *Euonymus japonicus*, Emam (2010) on *Polianthestuberosa*and Bazaraa *et al* (2012) on Gladiolus cv. "Novalux".

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إستجابة النمووالإزهاروإنتاجالكورماتوالمحتوى الكيماوي لنبات الفريزيا (صنف Red lion) لبعض المستخلصات الطبيعية

عبدالغفورعوض السيد[1] – صفيةحمدي الحنفي[1] – علي نبيه فهمي[2] – ضياء إسلام عطوة[2]

[1]كليةالزراعة – جامعة القاهرة – جيزة – جمهورية مصرالعربية
[2]معهد بحوث البساتين – مركزالبحوث الزراعية – جيزة – جمهورية مصرالعربية

أجريت التجربة على نبات الفريزيا (*Freesia refracta*) صنف "Red Lion" خلال عامين متتاليين (٢٠٠٩ / ٢٠١٠ ، ٢٠١٠ / ٢٠١١) بمشتل معهد بحوث البساتين بالجيزة و كلية الزراعة جامعة القاهرة ، مصر. بهدف دراسة مدى إستجابة نبات الفريزيا لإثنين من المستخلصات الطبيعية تم إستخدامها بمستويات مختلفة (الثوم بتركيزات ٢٥٠ ، ٥٠٠ مل/لتر والخميرة ٢,٥ ، ٥ جم/لتر) لتحسين خصائص النبات و محتواه الكيماوي.

أوضحت النتائج التفوق الواضح لإستخدام مستخلص الخميرة بتركيز ٢,٥ جم/لتر في تحسين النمو الخضري ومعظم خصائص الأزهار مع زيادة إنتاجية الكورمات و الكوريمات. فينفسالوقت إحتل إستخدام مستخلص الثوم بتركيز ٥٠٠ مل/لتر المرتبة الثانية في زيادة محصول الكوريمات و الوزن الطازج للكوريمة، بينما كان لمعاملة النباتات بمستخلص الخميرة بتركيز ٥جم/لتر أثرا متفوقا في زيادة محتوى الأوراق من الكلوروفيل (أ،ب)، بينما أدت كافة المعاملات إلى زيادة محتوى الأوراق من الكاروتينيدات. في الوقت نفسه تم الحصول على تأثير جيد وبالنسبة لمحتوى الأوراق من الكلوروفيل (أ) و الكاروتينيدات نتيجة لإستخدام مستخلص الثوم بتركيز ٥٠٠ مل/لتر، بينما كان لإستخدام مستخلص الثوم بتركيز ٢٥٠ مل/لتر أثرا متفوقا في زيادة محتوى الأوراق من الكربوهيدرات الكلية. إزداد كذلك محتوى الأوراق من عناصرالنتروجينو الفوسفور والبوتاسيوم نتيجة لإستخدام الخميرة بتركيز ٢,٥ جم/لتر. في نفس الوقت كان لإستخدام مستخلص الثوم بتركيز ٢٥٠ ، ٥٠٠ مل/لتر أثرا متفوقا في زيادة محتوى الأوراق من عناصر النتروجين والبوتاسيوم كذلك إزداد محتوى الأوراق من عنصر الفوسفور نتيجة لإستخدام مستخلص الخميرة بتركيز ٥ جم/لتر. وقد إزداد محتوى الكورمات الجديدةمن الكربوهيدرات الكلية نتيجة لإستخدام المعاملات المختلفة، في نفس الوقت كان لإستخدام مستخلص الخميرة بتركيز ٢,٥ جم/لتر أثرامتفوقا في زيادة محتوى الكورمات من عناصر النتروجين و الفوسفور بينما إزداد محتوى الكورمات من عنصر البوتاسيوم كنتيجة لإستخدام مستخلص الثوم بتركيزات ٢٥٠ ، ٥٠٠ مل/لتر.

التوصية: من النتائج السابقة ينصح بإستخدام التركيز المنخفض من مستخلص الخميرة (٢,٥ جم/لتر) أو التركيز المرتفع من مستخلص الثوم (٥٠٠ مل/لتر) لتحسين صفات نبات الفريزيا (صنف Red Lion) و محتواه الكيماوي.

الكلمات الدالة : *Freesia refracta*cv. "Red Lion" ، المستخلصات الطبيعية، ثوم، خميرة.