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EFFECT OF DIFFERENT IRRIGATION PERIODS AND CHEMICAL FERTILIZATION ON GROWTH, FLOWERING, BULB PRODUCTION AND CHEMICAL CONSTITUENTS OF *Ornithogalum thyrsoides*, Jacq.

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ABSTRACT

In a trial to improve flower yield and quality as well as bulb production of *Ornithogalum thyrsoides*, Jacq. under Egyptian conditions this investigation was performed throughout three successive seasons (2001/2002, 2002/2003 and 2003/2004).The individual and the combined effect of the different irrigation periods (at1, 3, 5, 7 and 9 day intervals) and different types of chemical fertilization (The mixture of N,P and K of a ratio 1:2:1 and the commercial fertilizer of Multi, 13:3:43) on growth, flowering and bulb productivity were investigated. The results emphasized that using the shortest irrigation period (at daily interval) proved its superiority in improving most plant parameters (expressed by vegetative growth height, number of leaves/plant, spike stem length, spike stem diameter, length of spike, number of flowers/plant, fresh weight of cut spike, number of bulbs/plot (bulb yield), fresh weight of bulb, bulb circumference, number of bulblets/plot (bulblet yield) and total carbohydrates and nitrogen content in the new bulbs. Whereas, the time required from planting to flowering was decreased by increasing the irrigation period. Meanwhile, a gradual decrement on most plant parameters was detected by increasing irrigation period in most cases.

Chemical fertilization treatments in most cases revealed insignificant effect on plant parameters. However, it could be mentioned that a slight increment on vegetative growth height and fresh weight of cut spike was noticed by using the two types of chemical fertilization. Moreover, nitrogen content in the new bulbs was increased by using the mixture of N, P and K at the shortest irrigation period at daily interval. Also, a slight increment on phosphorus content in the new bulbs resulted from applying the two types of chemical fertilization for plants irrigated at three day interval.

The interactions revealed the great influence of irrigation treatment at daily interval with using the commercial fertilizer of multi for increasing spike stem length and the number of flowers/plant. Whereas, applying the mixture of N,P and K for plants that irrigated at daily interval increased the number of bulblets/plant. Meanwhile, applying the two types of chemical fertilization for the plants irrigated at daily interval increased bulb circumference.

From the aforementioned results it could be recommended to use the shortest irrigation periods (at daily or at three day interval) with applying either the mixture of N,P and K or the commercial fertilizer of Multi.

***Key words**: chemical fertilization , irrigation periods , Ornithogalum thyrsoides.*

1. INTRODUCTION

Ornithogalum thyrsoides Jacq. belongs to family Liliaceae. It is planted in the fall (September and October) and harvested in June; the origin of the species is South Africa. *O. thyrsoides* can be used outdoors in the garden, as cut flowers and potted plants (Meyer *et al.*, 1990). The long season of *Ornithogalum* required a good nutrient supply over a long period for both vegetative and bulb growth (Classens, 1990).

Little information is available for the effect of chemical fertilization and irrigation on *Ornithogalum thyrsoides* Jacq. plants. So, the literature on other bulbs is indispensable.

Claassens (1990) on *Ornithogalum thyrsoides* Jacq. mentioned that, the long season of *Ornithogalum* required a good nutrient supply with some organic matter over a long period of both vegetative and

bulb growth. Khalafalla *et al.*, (2000) on the same plant concluded that, using NPK at the high rate (20gm / plant) for plants grown in composted leaf medium or its mixture with sand showed maximum beneficial effect on the vegetative growth, flowering, bulb and bulblet productivity. However, these treatments increased also the soluble and insoluble sugars in bulbs and N,P and K in both leaves and bulbs. Also, Badawy *et al.*, (2002), on the above mentioned plant reported that, applying chemical fertilization in different dates (growing vegetative and visible of flower spike stages) showed different trends. Receiving chemical fertilization at the visible of flower spike stage was the best in this respect.

On other bulbs and corms many trials were performed in this concern. El-Ashry *et al.*, (1998a) on amaryllis cv. Apple Blossom, reported that NPK fertilization (2:1:1) at three levels (2,3,and 4 gm./plant) applied four times appreciably increased the fresh weight of the new bulbs. They added that 2:1:1 NPK fertilization at the same rates appreciably increased bulb content of carbohydrate and nitrogen. Moreover, Ibrahim *et al.*, (1999) on the same cultivar stated that, NPK treatment improved flower quality to a certain extent. Arafa *et al.*, (2002) on *Freesia refracta* cv. Aurora concluded that, chemical fertilization used twice with different application rates of NPK 1:2:1 (0,2 and 4 gm./plant) in every fertilization at the growing vegetative stage and at the visible of flower spikes revealed that applying chemical fertilization at visible of flower spikes induced to some extent flowering date and increased total carbohydrate and nitrogen contents in the new corms. Talukader *et al.*, (2003) on *Polianthes tuberosa* Linn. cv. Single reported that the number of florets per spike, flowering duration, yield of spikes and the number of bulbs per clump were the highest with the application of 80:40:80 gm NPK/m^2. Moreover, Singh *et al.*, (2004) on *Polianthes tuberosa* cv. Double concluded that the length of spikes and the number of spikes per clumb were the highest with NPK treatment over the control. Also, Desai *et al.*, (2005) on the same plant stated that 250 kg each of N, P and K /ha was optimum for the growth of the plant and bulb qualities. Pal and Biswas (2005) on tuberose cv. Calcutta found that, application of 20 gm. each of N, P and K/m^2 recorded the best growth and flowering characteristics.

Evapotranspiration of a crop is the sum of transpiration by the crop and evaporation from the soil surface during the plant life (Doorenbos

and Pruitt, 1984). Various workers on different plants, Eakes *et al.*, (1991 a&b) on *Salvia splendens*, Serpe and Matthews (1994) on begonias, El-Ashry *et al.*, (1998b) on *Strelitzia reginae* and Ali *et al.*, (1998) on rose and Moftah and Al- Humaid (2004) on *Polianthes tuberosa* cv. Double concluded that water consumption use (evapo-transpiration rates), vegetative growth and flowering of the plants were increased as water soil stress level decreased. Holding soil water caused steady decrease in relative water content in the plants (plant water potential). Such decline in water potential would probably decrease all internal plant processes as net photosynthesis, cell division and enlargement and reduction of epidermal cell turgor, Eakes *et al.*, (1991 a&b) on *Salvia splendens* and Kiehl *et al.*, (1992) on chrysanthemum. Bastide *et al.*, (1993) and Serpe and Mathews (1994) on Begonia, and Moftah and Al-Humaid (2004) on tuberose.

Cocozza (1971) on gladiolus recorded that high flower quality could be maintained by irrigation, whenever, the soil moisture tension at the deepest part of the root zone reached 2 atm. Brouwer *et al.*, (1971) on freesia added that extra irrigation appeared to reduce rather than enhance development of the plant. Nabih *et al.*, (1992) and Nada *et al.*, (1992) on freesia and iris reported that the irrigation periods were not a limiting factor under the condition of loamy clay soil on growth, flowering and corms or bulbs productivity, even when the irrigation period was increased to reach 4 weeks. On *Polianthes tuberosa* Nabih *et al.*, (1992) reported that, irrigation treatments of 7 and 12 day intervals increased flower quality; they had almost similar effects on the different morphological traits studied. Whereas, prolonging irrigation period to 17 or 22 days showed a decline effect on flower quality and flower and bulb yield. Neeraja *et al.*, (1999) studied the effect of four levels of irrigations on growth, and yield attributes of rabi onion (*Allium cepa* L.) in sandy loamy soil. They found that the higher level of irrigation resulted in maximum plant height, more number of leaves per plant, maximum bulb length, bulb diameter, bulb weight and bulb yield. Mohamed and Gomie (2000) studied the effects of irrigation on onion cultivars. They noticed that the total marketable yields and average bulb weight significantly increased, while total soluble solids (TSS) declined with increasing available soil moisture. Lal *et al.*, (2002) studied the effects of irrigation levels on the growth and yield of onion cv. Hisar-2. They reported that plant height, number of leaves per plant, bulb size and

bulb yield increased with increasing the rates of irrigation.

El-Shakhs *et al.*, (2002) on *Dahlia pinnata*, reported that increasing both potassium levels and quantities of water improved plant height, number of branches/plant, leaves number/plant, flower diameter, flower stem length, dry weight of the cut flower, tuberous roots yield, as well as the percentage of carbohydrates, N,P,K in the leaves, flowers and tuberous roots.

The present experimental trial was conducted to determine the best chemical fertilization treatment and irrigation period on growth, flowering and bulb production of *Ornithogalum thyrsoides*, Jacq.

2. MATERIALS AND METHODS

The experimental trial was performed throughout three experimental seasons (2001/2002, 2002/2003 and 2003/2004) at the nursery of Qubba Botanical Garden, Qubba Palace and Ornamental Horticulture Department, Fac. of Agric. Cairo Univ.. It was intended to find out the individual as well as the combined effect of different irrigation periods and types of chemical fertilization on growth, flowering, bulb productivity and chemical constituents of the produced bulbs of *Ornithogalum thyrsoides*, Jacq.

2.1. Plant materials

Bulbs of 6-7 cm. circumference were selected to study their response to the different irrigation periods and chemical fertilization types as well as the interaction of both.

Table (a): Chemical analysis of clay loamy soil medium according to Soil and Water Research Institute, Agricultural Research Center, Ministry of Agriculture.

pH	EC Mmhos/ cm	Anions (meq/l)			Cations (meq/l)			
		Hco_3^-	Cl^-	$So4^{--}$	Ca^+	Mg^{++}	Na^+	K^{++}
7.40	1.40	3.50	4.73	2.16	2.8	1.21	3.73	2. 30
N (ppm)	P (ppm)	K (ppm)	Fe (ppm)	Zn (ppm)	Mn (ppm)	Cu (ppm)		
232.40	25.05	580.00	7.48	5.66	2.92	7.18		

2.2. Soil medium

Clay loamy soil was used over the three successive seasons. The chemical analyses of the soil were determined at the Soil and Water

Research Institute, Agricultural Research Center, Table (a).

2.3. Chemical fertilization

- N, P and K mixture: the fertilizers used to form the mixture of NPK were ammonium sulphate (20.6% N), calcium super phosphate (15.5% P_2O_5) and potassium sulphate (48% K_2O). They were usec at the ratio of 1:2:1 and mathematically calculated according to the percentage of the effective nutrient elements of the commercial fertilizer.
- Commercial fertilizer of Multi (13:3:43 N, P, K. respectively).

2.4. Procedure

Locally produced bulbs were lifted on June 1st,. After examining and cleaning, the bulbs were kept at room temperature (28 ± 3°C) till planting date (October 1st). Bulbs of 6-7 cm. circumference were selected and planted on October 1st, in the three seasons in 20 cm. clay pots filled with loamy clay soil (two bulbs were planted in each pot). In the first season, the pots were divided into four groups to study the effect of the different irrigation periods (each 3, 5, 7 and 9 days). Whereas, the pots were divided into five groups in the second and third seasons to study the abovementioned periods as well as the effect of irrigation period at daily interval. (15 pots) were used for every irrigation period .

The pots for every irrigation period were re-divided into three groups to study the effect of chemical fertilization treatments. The mixture of NPK was applied in five equal side dressing at monthly interval commencing from December 21st, at the rate of 2gm./plant in every fertilization. Meanwhile, Multi was applied at the rate of 1gm./plant in every fertilization at the abovementioned dates of applying the mixture of NPK (*i.e.* five dates at monthly interval). Thus, every plant of the groups treated with NPK mixture received 10gm./plant of the mixture, whereas, the groups treated with Multi received 5gm./plant of the multi fertilizer. Every pot received 15% of its volume water *i.e.*, 300ml./pot (mathematically calculated) in every irrigation.

The pots were distributed in split plot design in the three seasons. The main plot represented irrigation periods, whereas, the sub plots represented the different chemical fertilization treatments. Every

treatment contained 30 bulbs, replicated three times (10 bulbs for each experimental unit).

Regular agricultural practices such as weeding .....etc. were carried out whenever necessary.

2.5. The following data were recorded

2.5.1.Vegetative growth

- Vegetative growth height at flowering time referred to as plant height (cm.).
- Number of leaves/plant at flowering.

2.5.2.Flowering characteristics

- Number of days from planting to the first flower bud opening (flowering date).
- Spike axis length (cm.).
- Spike axis diameter (mm.).
- Length of spike (cm.).
- Number of flowers /plot (flowers yield).
- Fresh weight of cut spike (gm.).

2.5.3.Bulbs and bulblets production

- Number of bulbs / plot (bulb yield).
- Fresh weight of bulb (gm.).
- Bulb circumference (cm.)
- Number of bulblets / plot (bulblet yield).
- Fresh weight of bulblet (gm.).

Data were statistically analyzed and means were compared by L.S.D. method according to the method described by Snedecor and Cochran (1968).

2.6. Chemical analysis of the produced corms

The effects of the different irrigation periods and chemical fertilization treatments on the chemical constituents of the produced bulbs at the end of the third season were estimated as follows:

- Total carbohydrates were determined by using colorimetric method given by Smith *et al.*, (1956). Nitrogen content was determined by distillation in microkjeldahl apparatus (Black, 1956). Phosphorus content was colorimetrically determined in the acid digested using ascorbic acid method (John, 1970). Potassium content was determined using the flame photometer (Dewis and Freitas, 1970).

3. RESULTS AND DISCUSSION

3.1. Vegetative growth height

Great influence was recorded on the height of vegetative growth resulting from the plants irrigated at daily interval. However, using irrigation treatment at 3 day interval also showed a favourable effect in this connection. Whereas, prolonging the duration to either 7 or 9 days was on the account of the obtained values in the three experimental trials as indicated in Table (1). The decrement on the height of vegetative growth resulting from prolonging irrigation period was also found by Nada *et al.*, (1992) on Iris and Nabih *et al.*, (1992) on *Polianthes tuberosa*. Moreover, Lal, *et al.*, (2002) studied the effects of the irrigation levels on the growth of onion cv. Hisar and reported that, plant height increased with increasing the rates of irrigation. However, the increasing on plant height could be explained by either increasing the number of cell layers in the cell expanding zone and the cambial zone or as a result of water availability that increased cell enlargement over cell division (Abe and Nakai, 1999).

Insignificant increment on vegetative growth height resulted from applying the mixture of N, P and K as well the irrigation trials in the three experimental seasons. Singh *et al.*, (2004) recorded the same result on tuberose cv. Double.

3.2. Number of leaves / plant

Data in Table (2) reveal the increment in the number of leaves / plant due to applying the shortest irrigation periods (every one or three days). However, the best treatment was a result of receiving the plant irrigation treatment at daily interval. Whereas, using the longest durations at 7 or 9 day interval decreased the values in the three experimental trials. The decrement in the leaf number as a result of prolonging irrigation period was in accordance with Nada *et al.*, (1992) on Iris. Also, Neeraja *et al.*, (1999) found that higher levels of irrigation resulted in more number of leaves per plant of *Allium cepa* L. in sandy loamy soil. However, Lal *et al.*, (2002) confirmed the previous result on onion cv. Hisar-2.

Insignificant effect was recorded on the obtained values as a result of applying chemical fertilization treatments or its combination with the different irrigation treatments. The same result was recorded on tuberose by Singh *et al.*, (2004).

Table (1): Effect of irrigation periods, chemical fertilization and their interaction on vegetative growth height(cm) of *Ornithogalum thyrsoides* during 2001/2002, 2002/2003 and 2003/2004 seasons.

	2001/2002 Season				2002/2003 Season				2003/2004 Season			
	Cont	Multi	N.P.K	Mean	Cont	Multi	N.P.K	Mean	Cont	Multi	N.P.K	Mean
Daily	—	—	—	—	32.58	35.71	35.81	34.70	31.58	34.71	34.81	33.70
3days	25.81	26.57	26.02	26.13	30.84	31.63	31.47	31.31	28.94	29.09	30.03	29.35
5 days	25.86	24.61	25.12	25.19	25.21	23.55	24.86	24.54	23.21	21.55	22.86	22.54
7days	27.62	28.68	26.31	27.53	20.36	22.40	24.30	22.36	18.36	20.40	22.30	20.36
9days	21.56	22.36	24.14	22.69	24.65	19.73	23.53	22.64	21.55	17.73	21.57	20.28
Mean	25.21	25.55	25.39		26.73	26.60	27.99		24.73	24.70	26.32	
	Irr.	Fert.	rr.xFert.		Irr.	Fert.	Irr.xFert.		Irr.	Fert.	Irr.xFert.	
L.S.D. 0.05	3.46	N.S.	N.S.		2.00	N.S.	N.S.		2.21	N.S.	N.S.	
L.S.D. 0.01	2.55	—	—		2.70	—	—		2.99	--	—	

Cont.=Control; Irr.=Irrigation; Fert.=Fertilizer

Table (2): Effect of irrigation periods, chemical fertilization and their interaction on the number of leaves/ plant of *Ornithogalum thyrsoides* during 2001/2002, 2002/2003 and 2003/2004 seasons.

	2001/2002 Season				2002/2003 Season				2003/2004 Season			
	Cont	Multi	N.P.K	Mean	Cont	Multi	N.P.K	Mean	Cont	Multi	N.P.K	Mean
Daily	—	—	—	—	6.92	7.63	7.03	7.19	5.92	6.63	6.03	6.19
3days	5.73	5.58	5.83	5.71	6.85	7.20	7.05	7.03	5.66	6.08	6.03	5.92
5 days	5.35	4.99	5.29	5.21	6.75	6.23	6.86	6.61	5.75	5.23	5.86	5.61
7days	5.08	5.26	5.11	5.15	6.18	5.63	6.18	6.00	5.18	4.63	5.18	5.00
9days	4.82	4.89	4.94	4.88	6.56	6.06	6.67	6.43	5.24	5.06	5.62	5.30
Mean	5.24	5.18	5.30		6.65	6.55	6.76		5.55	5.52	5.74	
	Irr.	Fert.	Irr.xFert.		Irr.	Fert.	Irr.xFert.		Irr.	Fert.	Irr.xFert.	
L.S.D. 0.05	0.45	N.S.	N.S.		0.53	N.S.	N.S.		0.56	N.S	N.S.	
L.S.D. 0.01	0.33	—	--		0.72	—	—		0.75	—	—	

Cont.=Control; Irr.=Irrigation; Fert.=Fertilizer

3.3. Number of days to flowering

It is obvious from the tabulated data the gradual decrement on the time required for flowering as a result of increasing the irrigation period in the last two seasons. The values reached to only 218.65 and 216.65 days compared with 223.95 and 221.48 days resulted from plants received the shortest period (at daily interval), in the second and third seasons, respectively. However, in this concern, it could be concluded that, the different irrigation treatments caused a pronounced prolongation of the flowering season as can be seen in Table (3).

On the other hand, negligible and insignificant differences were recorded on the obtained values due to the effect of the different fertilization treatments in the three seasons. In this connection, Hetman *et al.*, (1985), Abou Dahab *et al.*, (1987) and Nabih *et al.*, (1992) on freesia recorded the same effect.

The interaction also showed insignificant effect on the time required for flowering.

3.4. Spike axis length

It is clear from the tabulated data that there is a decrement in the length of spike axis by prolonging irrigation period. In this respect, spike axis length reached 25.94 and 22.78cm. for the plants irrigated at daily interval against to 13.00 and 11.00cm. resulted from the plants received irrigation treatment at 9 days interval in the last two seasons, respectively as shown in Table (4). The differences reached to the level of significance in most cases. However, the decrement on spike axis length due to prolonging irrigation period was in parallel line with Nabih *et al.* (1992) on *Polianthes tuberosa.*

All types of chemical fertilization revealed insignificant effect on spike axis length in the three experimental trials. Also, Nabih *et al.*, (1987) and Nada *et al.*, (1992) on iris, Khalafalla *et al.*, (2000) on *Ornithogalum thyrsoides* and Arafa *et al.*, (2002) on freesia recorded the same effect.

The interactions revealed the great influence of treating the plants with the commercial product of Multi for that irrigated at daily interval followed by that treated with the same chemical fertilization and irrigated every 3 days in the three seasons.

Table (3): Effect of irrigation periods, chemical fertilization and their interaction on flowering date of *Ornithogalum thyrsoides* during 2001/2002, 2002/2003 and 2003/2004 seasons.

	2001/2002 Season				2002/2003 Season				2003/2004 Season			
	Cont	Multi	N.P.K	Mean	Cont	Multi	N.P.K	Mean	Cont	Multi	N.P.K	Mean
Daily	—	—	—	—	223.28	224.31	224.26	223.95	219.89	222.31	222.26	221.48
3days	192.03	193.07	193.97	193.02	220.69	221.92	220.25	220.95	218.69	219.92	218.25	218.95
5 days	193.33	193.70	193.48	193.51	218.16	219.92	220.38	219.39	216.16	217.92	218.08	217.39
7days	192.82	193.23	194.03	193.36	220.81	219.79	217.40	219.33	218.81	217.79	215.40	217.33
9days	197.30	197.03	195.05	196.46	217.90	219.75	218.29	218.65	215.90	217.75	216.29	216.65
Mean	193.87	194.26	194.13		220.17	221.14	220.06		217.89	219.14	218.06	
	Irr.	Fert.	Irr.xFert.		Irr.	Fert.	Irr.xFert.		Irr.	Fert.	Irr.xFert.	
L.S.D. 0.05	1.83	N.S.	N.S.		1.45	N.S.	N.S.		1.54	N.S.	N.S.	
L.S.D. 0.01	2.48	—	—		1.96	—	—		2.08	—	—	

Cont.=Control; Irr.=Irrigation; Fert.=Fertilizer

Table (4): Effect of irrigation periods, chemical fertilization and their interaction on spike axis length (cm.) of *Ornithogalum thyrsoides* during 2001/2002, 2002/2003 and 2003/2004 seasons.

	2001/2002 Season				2002/2003 Season				2003/2004 Season			
	Cont	Multi	N.P.K	Mean	Cont	Multi	N.P.K	Mean	Cont	Multi	N.P.K	Mean
Daily	—	—	—	—	24.28	27.08	26.45	25.94	21.12	23.96	23.27	22.78
3days	31.92	33.89	31.48	32.43	20.56	21.29	20.39	20.75	17.69	17.79	17.04	17.51
5 days	28.32	27.18	26.62	27.38	17.59	16.83	16.36	16.93	15.59	14.83	14.36	14.93
7days	26.04	27.16	24.50	25.90	12.19	13.74	13.78	13.24	10.19	11.74	11.78	11.24
9days	20.74	17.96	22.87	20.52	13.41	12.05	13.54	13.00	11.41	10.05	11.54	11.00
Mean	26.75	26.55	26.37		17.61	18.20	18.11		15.20	15.68	15.60	
	Irr.	Fert.	Irr.xFert.		Irr.	Fert.	Irr.xFert.		Irr.	Fert.	Irr.xFert.	
L.S.D. 0.05	1.19	N.S.	N.S.		1.17	N.S.	N.S.		4.31	N.S.	7.47	
L.S.D. 0.01	1.60	—	—		1.58	—	—		3.17	—	5.50	

Cont.=Control; Irr.=Irrigation; Fert.=Fertilizer

3.5. Spike axis diameter

A gradual decrement on spike axis diameter was detected due to increasing irrigation period in the three experimental trials, Table (5). However, in the third season irrigation treatment at either 7 or 9 day interval gave about the same effect in this concern. The decrement on spike axis diameter resulting from increasing irrigation period might be due to the reduction of vegetative growth resulted from the long irrigation period. The previous effect was also noticed by Nabih *et al.*, (1992) on *Polianthes tuberosa*.

On the other hand, negligible and insignificant effect on spike axis diameter was detected from using the different chemical fertilization treatments in the three seasons. In this connection, Hetman *et al.*, (1985), Abou Dahab *et al.*, (1987), Nabih *et al.*, (1992) and Arafa *et al.*, (2002) on freesia and Nabih *et al.*, (1987) and Nada *et al.*, (1992) on iris and Badawy *et al.*, (2002) on *Ornithogalum thyrsoides* agreed that chemical fertilization treatments had no effect on spike axis diameter.

The interactions, in all cases showed insignificant effect on the obtained values in the three experimental trials.

3.6. Length of spike

Data in Table (6) show the superiority of irrigation treatments at either 1 or 3 day interval for increasing the length of spike in the three seasons. The contrary action was a result of using the longest irrigation periods of either 7 or 9 days in the three experimental trials. In this connection, Nabih *et al* ., (1992) on freesia concluded that the length of the spike slightly reduced resulting from prolonging irrigation periods to 4 weeks.

Chemical fertilization treatment as well as their interactions with the different irrigation treatments had no significant effect on the length of spike in the three experimental seasons. At this concern, Satyavir *et al.* (2005) on tuberose recorded that, the minimum spike length was observed under N and P fertilization.

3.7. Number of flowers /plant

It is evident from the tabulated data the decrement in the number of flowers/plant due to increasing irrigation period. Such effect reached its maximum when the plants irrigated at 7 or 9 day interval. The differences reached to the level of significance in most cases.

Table (5): Effect of irrigation periods, chemical fertilization and their interaction on spike axis diameter (mm.) of *Ornithogalum thyrsoides* during 2001/2002, 2002/2003 and 2003/2004 seasons.

	2001/2002 Season				2002/2003 Season				2003/2004 Season			
	Cont	Multi	N.P.K	Mean	Cont	Multi	N.P.K	Mean	Cont	Multi	N.P.K	Mean
Daily	—	—	—	—	6.32	6.56	6.43	6.44	5.82	6.06	5.96	5.94
3days	5.57	5.67	5.45	5.56	5.81	5.77	5.92	5.84	5.36	5.27	5.42	5.35
5 days	5.27	4.85	4.93	5.02	5.16	4.96	5.17	5.10	4.69	4.48	4.67	4.61
7days	4.63	4.65	4.35	4.54	4.27	4.52	4.83	4.54	3.77	4.02	4.33	4.04
9days	4.03	3.60	4.25	3.96	4.96	4.33	4.64	4.64	4.46	3.83	4.18	4.16
Mean	4.87	4.69	4.75		5.31	5.23	5.40		4.82	4.73	4.91	
	Irr.	Fert.	Irr.xFert.		Irr.	Fert.	Irr.xFert.		Irr.	Fert.	Irr.xFert.	
L.S.D. 0.05	0.75	N.S.	N.S.		0.31	N.S.	N.S.		0.32	N.S.	N.S.	
L.S.D. 0.01	0.55	—	—		0.42	—	—		0.43	—	—	

Cont.=Control; Irr.=Irrigation; Fert.=Fertilizer

Table (6): Effect of irrigation periods, chemical fertilization and their interaction on length of spike (cm.) of *Ornithogalum thyrsoides* during 2001/2002, 2002/2003 and 2003/2004 seasons.

	2001/2002 Season				2002/2003 Season				2003/2004 Season			
	Cont	Multi	N.P.K		Cont	Multi	N.P.K		Cont	Multi	N.P.K	
Daily	—	—	—	—	8.46	9.10	8.65	8.74	5.79	6.43	6.65	6.29
3days	7.78	8.25	7.90	7.98	8.52	7.69	7.58	7.93	6.52	5.69	5.58	5.93
5 days	7.10	6.76	6.45	6.77	6.29	6.32	6.72	6.44	4.29	4.32	4.72	4.44
7days	6.54	6.08	5.75	6.13	4.68	5.21	5.57	5.15	2.68	3.21	3.57	3.15
9days	5.04	4.17	5.34	4.85	5.44	4.89	5.88	5.40	3.44	2.89	3.88	3.40
	6.62	6.32	6.36		6.68	6.64	6.88		4.55	4.51	4.88	
	Irr.	Fert.	Irr.xFert.		Irr.	Fert.	Irr.xFert.		Irr.	Fert.	Irr.xFert.	
L.S.D. 0.05	1.40	N.S.	N.S.		0.65	N.S.	N.S.		0.65	N.S.	N.S.	
L.S.D. 0.01	1.03	—	—		0.88	—	—		0.87	—	—	

Cont.=Control; Irr.=Irrigation; Fert.=Fertilizer

Insignificant effects were obtained on the number of flowers/plant resulting from using the different types of chemical fertilization as indicated in Table (7). Also, Nabih (1991), Nabih *et al.*, (1992) and Ibrahim *et al.*, (1996) recorded the same result on freesia.

The interactions revealed considerable differences on the obtained values due to the different treatments. In this concern, irrigation of plants on a daily basis with applying the commercial product of Multi increased the value in the last experimental trials. They reached 38.77 and 36.77, respectively. The contrary action was a result of irrigation of plants at 7 day interval with applying the commercial product of Multi or untreated with the chemical fertilization in the last two seasons as seen in Table (7).

3.8. Fresh weight of cut spike

Data in Table (8) indicate the superiority of receiving the plants irrigation treatment at daily interval for increasing fresh weight of cut spike when compared with the effect of other treatments. However, using irrigation treatments at three day interval showed also a favourable effect in this concern. Whereas, prolonging irrigation period to 7 or 9 days was on the account of the obtained values in the three experimental field as seen in Table (8). The increment on fresh weight of cut spike due to the short irrigation period might be attributed to the effect of such treatment in increasing the values of spike stem length, spike stem diameter and length of spike. The previous treatment is in accordance with Nabih *et al.*, (1992) on *Polianthes tuberosa*.

Using either the mixture of N,P and K or the commercial product of Multi increased fresh weight of cut spike compared with the control in the last two seasons. However, the effect reached only to the level of significance by using the mixture of NPK in the third season. In this connection, Nabih (1991) on freesia, Khalafalla *et al.*, (2000) and Badawy *et al.*, (2002) on *Ornithogalum thyrsoides* recorded the increment on fresh weight of spike due to chemical fertilization. Moreover, Pal and Biswas (2005) on tuberose stated that, the application of NPK improved spike weight.

The interactions revealed insignificant effect on fresh weight of cut spike in the three experimental seasons as seen in Table (8).

Table (7): Effect of irrigation periods, chemical fertilization and their interaction on the number of flowers/plot of *Ornithogalum thyrsoides* during 2001/2002, 2002/2003 and 2003/2004 seasons.

	2001/2002 Season				2002/2003 Season				2003/2004 Season			
	Cont	Multi	N.P.K	Mean	Cont	Multi	N.P.K	Mean	Cont	Multi	N.P.K	Mean
Daily	—	—	—	—	35.97	38.77	36.19	36.98	34.29	36.77	34.19	35.08
3days	35.13	37.77	35.19	36.03	32.83	33.87	35.23	33.97	30.83	31.87	33.23	31.97
5 days	31.83	32.87	34.23	32.97	30.04	30.16	32.01	30.74	28.04	28.16	30.01	28.74
7days	29.04	29.16	31.01	29.74	22.54	23.55	28.56	24.88	20.54	21.55	26.56	22.88
9days	21.54	22.55	27.56	23.88	30.68	24.05	27.51	27.41	28.68	22.05	25.51	25.41
Mean	29.38	30.59	32.00		30.41	30.08	31.90		28.47	28.08	29.90	
	Irr.	Fert.	Irr.xFert.		Irr.	Fert.	Irr.xFert.		Irr.	Fert.	Irr.xFert.	
L.S.D. 0.05	2.09	N.S.	3.62		2.09	N.S.	3.62		2.14	N.S.	3.71	
L.S.D.0.01	2.82	—	4.88		2.82	—	4.88		2.89	—	5.00	

Cont.=Control; Irr.=Irrigation; Fert.=Fertilizer

Table (8): Effect of irrigation periods, chemical fertilization and their interaction on fresh weight of cut spike (gm.) of *Ornithogalum thyrsoides* during 2001/2002, 2002/2003 and 2003/2004 seasons.

	2001/2002 Season				2002/2003 Season				2003/2004 Season			
	Cont	Multi	N.P.K		Cont	Multi	N.P.K		Cont	Multi	N.P.K	
Daily	—	—	—	—	19.63	23.98	22.15	21.92	17.29	22.04	19.63	19.65
3days	14.68	15.81	14.20	14.90	15.66	15.51	16.39	15.85	13.49	13.68	14.22	13.80
5 days	11.91	10.33	10.48	10.91	10.59	10.01	11.39	10.67	9.12	8.46	9.94	9.18
7days	9.77	9.36	8.38	9.17	5.43	7.04	7.85	6.77	4.60	6.13	8.75	6.49
9days	6.16	4.84	7.55	6.18	7.53	6.74	8.22	7.49	7.52	6.74	7.77	7.34
	10.63	10.09	10.16		11.77	12.66	13.20		10.40	11.41	12.06	
	Irr.	Fert.	Irr.xFert.		Irr.	Fert.	Irr.xFert.		Irr.	Fert.	Irr.xFert.	
L.S.D. 0.05	3.00	N.S.	N.S.		1.56	N.S.	N.S.		1.80	1.40	N.S.	
L.S.D. 0.01	2.21	—	—		2.10	—	—		2.43	1.88	—	

Cont.=Control; Irr.=Irrigation; Fert.=Fertilizer

3.9. Number of bulbs/ plot (bulbs yield)

Obviously, the obtained values of Table (9) reveal the gradual decrement on the number of bulbs/plot (bulbs yield) due to increasing irrigation period in the three seasons. In this respect using the longest irrigation period (at 9 day interval) much decreased the values in the three seasons, to the extent that they reached only 9.44, 6.33 and 6.67 in the first, second and third seasons respectively. The decrement on bulb yield resulting from prolonging irrigation period was also found by Nabih *et al.*, (1992) on *Polianthes tuberosa*, Neeraja *et al.*, (1999) on *Allium cepa* and Lal *et al.*, (2002) on Onion cv. Hisar-2.

Insignificant effect was recorded on the number of bulbs/plot (bulbs yield) due to using the different types of chemical fertilization treatments in the three seasons. Nada *et al* ., (1992) recorded the same result on Iris. However, Yadav *et al.*, (2005) on tuberose cv. Double recorded the maximum number of bulbs as a result of nitrogen fertilization.

The interactions revealed insignificant effect on bulb yield in the three seasons, as can be seen in Table (9).

3.10. Fresh weight of bulb

It is evident from the data of Table (10), the great influence of applying the shortest irrigation periods at 1 and 3 day interval for increasing fresh weight of bulb. Whereas, using the longest ones (7 and 9 day interval) was on the account of the previous parameter. Meanwhile, using irrigation treatment at 5 day interval gave an intermediate effect in this concern. The decrement on bulb weight resulted from the less level of irrigation was also found by Neeraja *et al.*, (1999) on *Allium cepa* and Mohamed and Gomie (2000) on onion cultivar.

Negligible and insignificant effects, on the other hand, were detected due to the effect of chemical fertilization treatments and their interactions with irrigation periods on bulb fresh weight in the three experimental trials as seen in Table (10). Nabih *et al.*, (1992) on freesia recorded the same result.

3.11. Bulb circumference

Great influence on bulb circumference was recorded as a result of using the shortest irrigation periods at 1 and 3 day interval for increasing bulb circumference as seen in Table (11). Whereas,

Table (9): Effect of irrigation periods, chemical fertilization and their interaction on the number of bulbs/plot of *Ornithogalum thyrsoides* during 2001/2002, 2002/2003 and 2003/2004 seasons.

	2001/2002 Season				2002/2003 Season				2003/2004 Season			
	Cont	Multi	N.P.K	Mean	Cont	Multi	N.P.K	Mean	Cont	Multi	N.P.K	Mean
Daily	—	—	—	—	16.33	10.00	15.00	13.78	12.33	11.67	13.67	**12.56**
3days	15.00	11.67	17.00	14.56	13.67	13.00	13.00	13.22	14.67	12.67	12.00	**13.11**
5 days	10.67	11.33	14.00	12.00	9.67	13.00	8.67	10.44	10.33	10.67	10.00	**10.33**
7days	10.67	10.67	11.33	10.89	8.33	9.00	9.33	8.89	7.67	7.67	8.67	**8.00**
9days	9.67	10.67	8.00	9.44	5.00	7.67	6.33	6.33	6.00	7.00	7.00	**6.67**
Mean	11.50	11.08	12.58		10.60	10.53	10.47		10.20	9.93	10.27	
	Irr.	Fert.	Irr.xFert.		Irr.	Fert.	Irr.xFert.		Irr.	Fert.	Irr.xFert.	
L.S.D. 0.05	4.06	N.S.	N.S.		2.74	N.S.	N.S.		1.69	N.S.	N.S.	
L.S.D. 0.01	2.98	—	—		3.69	—	—		2.28	—	—	

Cont.=Control; Irr.=Irrigation; Fert.=Fertilizer

Table (10): Effect of irrigation periods, chemical fertilization and their interaction on fresh weight of bulb (gm.) of *Ornithogalum thyrsoides* during 2001/2002, 2002/2003 and 2003/2004 seasons.

	2001/2002 Season				2002/2003 Season				2003/2004 Season			
	Cont	Multi	N.P.K	Mean	Cont	Multi	N.P.K	Mean	Cont	Multi	N.P.K	Mean
Daily	—	—	—	—	11.23	13.90	12.48	12.54	12.17	14.70	13.07	**13.32**
3days	7.14	7.68	7.18	7.34	10.36	10.81	12.04	11.07	10.81	12.77	12.41	**12.00**
5 days	6.55	5.89	6.32	6.25	7.20	5.66	8.84	7.23	6.52	6.34	7.90	**6.92**
7days	6.62	6.55	5.58	6.25	4.99	6.20	6.22	5.81	4.57	5.45	5.78	**5.27**
9days	3.61	3.83	3.86	3.77	7.21	5.20	6.39	6.27	5.42	5.03	5.50	**5.32**
Mean	5.98	5.99	5.74		8.20	8.36	9.19		7.90	8.86	8.93	
	Irr.	Fert.	Irr.xFert.		Irr.	Fert.	Irr.xFert.		Irr.	Fert.	Irr.xFert.	
L.S.D. 0.05	1.48	N.S.	N.S.		1.71	N.S.	N.S.		1.95	N.S.	N.S.	
L.S.D. 0.01	1.09	—	—		2.31	—	—		2.63	—	—	

Cont.=Control; Irr.=Irrigation; Fert.=Fertilizer

increasing irrigation periods to 5, 7 and 9 day interval decreased to some extent the values compared with that obtained from the previous treatments.

Negligible and insignificant effects were obtained due to using the different treatments of chemical fertilization. This finding was in accordance with Nabih *et al.*,(1992) on freesia and Nada *et al.*, (1992) on iris.

The interactions revealed an increment on bulb circumference as a result of the interaction between the two types of chemical fertilization treatments and the shortest irrigation period (at 1 day interval).

3.12. Number of bulblets / plot (bulblet yield)

Considerable and significant increment in the number of bulblets /plot (bulblet yield) was detected with maximum shortening of the irrigation period (at daily interval), in the last two seasons. Meanwhile, a reasonable effect on bulblet yield was observed resulting from applying irrigation treatment at 3 day interval in the three experimental seasons. Whereas, using the longest irrigation periods of either 7 or 9 day interval was on the account of the obtained values in all seasons. The great effect of the short irrigation period on bulb yield was in accordance with Neeraja *et al.*, (1999) on *Allium cepa* L.

Chemical fertilization treatments and their interaction with the different irrigation treatments revealed insignificant effect on bulblet yield in the three seasons as indicated in Table (12).

3.13. Fresh weight of bulblet

It is obvious from the tabulated data that prolonging irrigation period to 5, 7 and 9 day interval increased fresh weight of bulblet in the three seasons. However, the effect reached only the level of significance in the second season. On the contrary, applying the shortest irrigation periods (at daily or at 3 day interval) was on the account of fresh weight of bulblet as indicated in Table (13). Insignificant effect on bulblet fresh weight was obtained due to using chemical fertilization treatments and their interactions with the different irrigation treatments in the three seasons as seen in Table(13). On the contrary, Desai *et al.*, (2005) on *Polianthes tuberose* cv. Shringar found that weight of bulblets per clump

Table (11): Effect of irrigation periods, chemical fertilization and their interactions on bulb circumference (cm.) of *Ornithogalum thyrsoides* during 2001/2002, 2002/2003 and 2003/2004 seasons.

	2001/2002 Season				2002/2003 Season				2003/2004 Season			
	Cont	Multi	N.P.K	Mean	Cont	Multi	N.P.K	Mean	Cont	Multi	N.P.K	Mean
Daily	—	—	—	—	7.93	8.66	8.27	8.28	9.96	7.60	9.11	8.89
3days	7.59	7.42	7.46	7.49	8.03	7.83	8.15	8.00	7.32	8.03	8.83	8.06
5 days	7.26	6.97	7.09	7.11	7.19	6.54	7.73	7.15	6.70	8.02	6.77	7.16
7days	7.31	7.27	6.87	7.15	6.59	6.94	6.97	6.83	7.08	8.14	7.44	7.56
9days	5.86	6.14	6.00	6.00	7.32	6.71	6.83	6.95	6.09	7.47	6.22	6.59
Mean	7.00	6.95	6.85		7.41	7.34	7.59		7.43	7.85	7.67	
	Irr.	Fert.	Irr.xFert.		Irr.	Fert.	Irr.xFert.		Irr.	Fert.	Irr.xFert.	
L.S.D. 0.05	0.67	N.S.	N.S.		0.57	N.S.	N.S.		1.02	N.S.	1.77	
L.S.D. 0.01	0.49	—	—		0.77	—	—		1.38	—	2.39	

Cont.=Control; Irr.=Irrigation; Fert.=Fertilizer

Table (12): Effect of irrigation periods, chemical fertilization and their interactions on the number of bulblets/plot of *Ornithogalum thyrsoides* during 2001/2002, 2002/2003 and 2003/2004 seasons.

	2001/2002 Season				2002/2003 Season				2003/2004 Season			
	Cont	Multi	N.P.K	Mean	Cont	Multi	N.P.K	Mean	Cont	Multi	N.P.K	Mean
Daily	—	—	—	—	139.00	123.67	116.00	126.22	133.33	119.00	114.67	122.33
3days	11.33	26.67	28.67	22.22	29.33	46.00	25.00	33.44	33.00	44.00	24.33	33.78
5 days	1.67	3.00	2.67	2.44	14.67	7.67	7.67	10.00	18.33	10.00	9.33	12.56
7days	2.00	3.33	4.00	3.11	5.00	3.67	6.00	4.89	9.33	7.33	16.00	10.89
9days	1.67	4.00	2.67	2.78	1.00	4.00	5.33	3.44	2.33	8.67	10.33	7.11
Mean	4.17	9.25	9.50		37.80	37.00	32.00		39.27	37.80	34.93	
	Irr.	Fert.	Irr.xFert.		Irr.	Fert.	Irr.xFert.		Irr.	Fert.	Irr.xFert.	
L.S.D. 0.05	18.12	N.S.	N.S.		12.30	N.S.	N.S.		11.23	N.S.	N.S.	
L.S.D. 0.01	13.33	—	—		16.59	—	—		15.15	—	—	

Cont.=Control; Irr.=Irrigation; Fert.=Fertilizer

increased with NPK treatment.

3.14. Chemical composition of the produced bulbs

3.14.1. Total Carbohydrates

Different trends were recorded on the total carbohydrate content due to using the different treatments. Applying the two types of chemical fertilization for the plants received irrigation treatments at the lowest durations (at daily and at 3 day interval) increased the total carbohydrate content in the new bulbs compared with the control. However, the best treatments for increasing the values were a result of using both types of chemical fertilization with plants irrigated at daily interval. Whereas, the same fertilization treatments for plants received irrigation treatments at either 5 or 7 day interval decreased the accumulation rate of carbohydrates when compared with the control. Using the longest irrigation period at 9 day interval, increased the accumulation rate of carbohydrate content in the new bulbs due to using the commercial fertilizer of Multi when compared with the control. Whereas, applying the mixture of N,P and K with the previous irrigation treatment gave about the same effect compared with the control as seen in Table (14). In this connection, Nabih *et al.*, (1992) on *Polianthes tuberosa* recorded that soluble, non soluble and total sugar content were gradually decreased by prolonging irrigation periods. Whereas, the effect of chemical fertilization was noticed by Nabih and Aly (1988) found that freesia corms (5-6 cm circumference) required 2-3gm. NPK/plant in every fertilization to increase sugar content of the new corms.

Table (14): Effect of irrigation periods, chemical fertilization and their interactions on total carbohydrate percentage in the newly produced bulbs of *Ornithogalum thyrsoides* during 2003/2004 season.

	Daily	3Days	5 Days	7Days	Ddays	Mean
Cont	6.72	6.24	23.16	20.16	12.96	13.85
	19.20	10.56	10.56	12.96	20.64	14.78
N.P.K	21.12	15.84	10.08	12.48	12.58	14.42
Mean	15.68	10.88	14.60	15.20	15.39	

3.14.2. Nitrogen content

It is obvious from the data in Table (15) that the slight increment of nitrogen content in the produced bulbs resulted from the

plants irrigated at daily interval when compared with the other irrigation treatments in this concern. However, Haber (1968) on gladiolus concluded that the soil moisture content had a marked effect on the rate of absorption and quantity of absorbed NP_2O_5 and K_2O and also on the distribution of these nutrients in the plant. The previous finding was in accordance with Nabih *et al.,* (1992) on *Polianthes tuberosa.*

Referring to the effect of chemical fertilization it is clear from the tabulated data that, receiving the plants the mixture of N, P and K revealed its superiority for increasing nitrogen content in the produced bulbs under the condition of using irrigation treatment at the shortest duration (at daily interval). However, the great effect of chemical fertilization on nitrogen accumulation in corms or bulbs was also noticed by Nabih (1991) and Arafa *et al.,*(2002) on freesia, Ibrahim *et al.,*(1999) on amaryllis and Khalafalla *et al* ., (2000) and Badawy *et al.,* (2002) on *Ornithogalum thyrsoides.*

3.14.3. Phosphorus percentage

The data in Table (15) show that using irrigation at 3 day interval, proved the best treatment for increasing phosphorus accumulation in the produced bulbs compared with the other treatments in this concern. Similar effect had been obtained from the other treatments. In this concern, Haber (1968) on gladiolus concluded that, the soil moisture content had a marked effect of the rate of absorbed P and also of the distribution of this nutrient in gladiolus plant. Moreover, Nabih *et al.,*(1992) on *Polianthes tuberosa,* recorded that the shortest irrigation period resulted in a great effect on the accumulation rate of phosphorus in bulbs.

Negligible effect was obtained on phosphorus accumulation in the new bulbs due to the different types of chemical fertilization under the condition of different irrigation treatments, with the exception of the slight decrement on phosphorus content by the different fertilization treatments under irrigation treatment at 3 day interval. However, the negligible effect of chemical fertilization of N P K on phosphorus accumulation in the new bulbs was also noticed by Nabih *et al.,* (1992) on *Polianthes tuberosa.*

Table (13): Effect of irrigation periods, chemical fertilization and their interactions on fresh weight of bulblets (gm.) of *Ornithogalum thyrsoides* during 2001/2002, 2002/2003 and 2003/2004 seasons.

	2001/2002 Season				2002/2003 Season				2003/2004 Season			
	Cont	Multi	N.P.K	Mean	Cont	Multi	N.P.K	Mean	Cont	Multi	N.P.K	Mean
Daily	—	—	—	—	0.31	0.37	0.41	0.36	0.32	0.38	0.41	0.37
3days	0.46	0.17	0.60	0.41	0.73	0.28	0.57	0.52	0.47	0.29	0.58	0.45
5 days	1.68	1.20	1.08	1.32	1.02	0.93	0.82	0.92	0.68	0.57	0.55	0.60
7days	1.21	1.16	1.16	1.18	1.33	1.28	1.34	1.32	0.59	0.58	0.49	0.55
9days	1.10	1.00	1.16	1.09	1.10	1.20	0.89	1.06	0.49	0.54	0.40	0.48
Mean	1.11	0.88	1.00		0.90	0.81	0.81		0.51	0.47	0.49	
	Irr.	Fert.	Irr.xFert.		Irr.	Fert.	Irr.xFert.		Irr.	Fert.	Irr.xFert.	
L.S.D. 0.05	0.46	N.S.	N.S.		0.44	N.S.	N.S.		N.S.	N.S.	N.S.	
L.S.D. 0.01	0.34	—	—		0.60	—	—		—	—	—	

Cont.=Control; Irr.=Irrigation; Fert.=Fertilizer

Table (15): Effect of irrigation periods, chemical fertilization and their interaction s on nitrogen, phosphorus and potassium percentages in the newly produced bulbs of *Ornithogalum thyrsoides* during 2003/2004 seasons.

	Nitrogen				Phosphorus				Potassium			
	Cont	Multi	N.P.K	Mean	Cont	Multi	N.P.K	Mean	Cont	Multi	N.P.K	Mean
Daily	1.76	1.68	2.50	1.98	0.81	0.85	0.76	0.81	0.75	0.72	0.69	0.72
3days	1.50	1.80	1.65	1.65	1.10	0.83	0.85	0.93	0.80	0.75	0.72	0.76
5 days	1.23	1.78	1.78	1.60	0.76	0.75	0.88	0.80	0.94	0.90	0.99	0.94
7days	1.66	1.50	1.76	1.64	0.91	0.81	0.85	0.86	1.00	0.94	0.87	0.94
9days	1.68	1.68	2.24	1.87	0.85	0.91	0.81	0.86	1.04	1.11	0.72	0.96
Mean	1.57	1.69	1.99		0.89	0.83	0.83		0.91	0.88	0.80	

3.14.4. Potassium percentage

The data in Table (15) show the slight increment of potassium content on the new bulbs resulting from increasing irrigation period. It reached 1.04 % as a result of irrigation treatment at 9 day interval, against 0.75 % resulted from using the shortest irrigation period (at daily interval). However, Nabih *et al.,* (1992) on *Polianthes tuberosa* noticed the increment of potassium content in the new bulbs due to receiving the plants irrigation treatment at 9 day interval.

Negligible effect on potassium accumulation on the new bulbs was noticed due to applying chemical fertilization treatments under the condition of the different irrigation treatments with the exception of applying N P K treatment for plants irrigated at 9 day interval. Such treatment decreased the value compared with the control (0.72% against 1.04% of the control). Also, the negligible effect of N P K fertilization on potassium content in the new bulbs was also detected by Nabih *et al.,* (1992) on *Polianthes tuberosa.*

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تأثير فترات الرى والتسميد الكيميائى على النمو والازهار وانتاج الابصال والمحتوى الكيميائى لأبصال الـ*Ornithogalum thyrsoids* Jacq

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ملخص

فى محاولة لتحسين محصول وصفات الازهار وكذا انتاج الابصال لنبات الاورنيثوجالم *Ornithogalum thyrsoides* Jacq عند زراعته فى الاصص تحت الظروف المصرية، اجرى هذا البحث خلال ثلاثة مواسم زراعية متعاقبة (٢٠٠١/ ٢٠٠٢ , ٢٠٠٢/٢٠٠٣ & ٢٠٠٣/٢٠٠٤). تم دراسة التأثير المنفرد والمتجمع لفترات رى متباينة (يوم, ثلاثة ايام, خمسة ايام, سبعةايام وتسعة ايام) وانماط متباينة من التسميد الكيميائى (خليط من النيتروجين والفوسفور والبوتاسيوم) بنسبة ١:٢:١ والسماد التجارى مالتى(١٣:٣:٤٣) على النمو والازهار وانتاج الابصال ومحتواها الكيميائى وقد اوضحت النتائج ما يلى:

أظهر استخدام اقصر فترة رى (يوميا) تفوقا واضحا على معظم خصائص النبات من حيث ارتفاع النمو الخضرى, عدد الاوراق للنبات, طول الحامل النورى, سمك الحامل النورى, طول النورة, عدد الازهار للنبات والوزن الطازج للحامل النورى ومحصول الابصال والبصيلات والوزن الطازج للبصلة ومحيطها ومحتوى الابصال من الكربوهيدرات الكلية والنيتروجين, هذا وقد تناقصت الفترة اللازمة من الزراعة حتى الازهار وذلك باطالة فترات الرى بينما ازداد وزن البصيلة نتيجة لاطالة فترة الرى

ان استخدام الرى على فترات كل ثلاثة ايام أدى الى تحسين معظم الصفات المدروسة بينما ظهر تناقص تدريجى لمعظم الصفات باطالة فترات الرى المستخدمة كل (٥, ٧, ٩ أيام).

كان للتسميد الكيميائى تأثيرات غير معنوية فى معظم الصفات النباتية التى تم دراستها وعلى أى حال فقد لوحظ زيادة بسيطة فى ارتفاع النمو الخضرى وكذا الوزن الطازج للحامل النورى باستخدام نمطى التسميد الكيميائى المستخدمان فى التجربة هذا بالاضافة الى حدوث زيادة فى محتوى الابصال من النيتروجين وذلك باستخدام المعاملة بمخلوط النيتروجين والفوسفور والبوتاسيوم للنباتات التى تم

ريها يوميا. حدثت كذلك زيادة بسيطة فى محتوى الابصال من الفوسفور باستخدام نمطى التسميد الكيميائى مع النباتات التى تم ريها كل ثلاثة ايام.

اظهرت التفاعلات تأثيرا عظيما بالنسبة لنباتات التى تم ريها كل يوم مع استخدام السماد التجارى مالتى وذلك فى زيادة طول الحامل النورى وعدد الازهار للنبات. بينما كان لاستخدام مخلوط النيتروجين والفوسفور والبوتاسيوم بالنسبة للنباتات التى تم ريها كل يوم أثرا فى زيادة محصول البصيلات، هذا وقد ازداد محيط الابصال نتيجة لاستخدام نمطى التسميد الكيميائى للنباتات التى تم ريها على فترات يومية.

يمكن من النتائج السابقة التوصية باستخدام الرى على فترات يومية اذا لزم الامر او كل ثلاثة ايام مع استخدام نمطى التسميد الكيميائى (مخلوط النيتروجين والفوسفور والبوتاسيوم أو السماد التجارى مالتى).

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