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Effect of Garlic and Onion Extracts on Bud Break, Growth, Yield, Berry Quality and Seasonal Changes of some Chemical Constituents of "Flam Seedless"and "Superior" Grapevines (*Vitis vinifera* L).

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THIS investigation was carried out during two successive seasons of 2006 and 2007 to investigate the effect of garlic and onion extracts on bud break, growth, yield ,berry quality and some chemical constituents of "Flam Seedless" and "Superior" grapevine cultivars. The trees were grown in loamy sand soil, sprayed with seven treatments (garlic extract at 10, 15 and 20%, onion extract at 10, 15 and 20% and control).Generally, it was found that all studied growth parameters *i.e.*, date of bud break ,percentage of bud break, number of cluster/vine, yield(kg)/vine, yield components (cluster weight, length and width, number of berries per cluster, weight of 100 berries, berries length and width), as well as seasonal changes in some chemical constituents of buds (water content %, total carbohydrates, total sugars and reducing sugars ,total free amino acids, total indoles and plant hormones (IAA and GA_3). As well as some chemical constituents of berries (total soluble solids (T.S.S.) and reducing sugars) were increased with the application of the different treatments. The best results were obtained from the treatments of garlic or onion extract at 15 % followed by 20 %. On the contrary, the same treatments decreased total acidity in berries, free phenols and ABA in buds as compared to the control. It could be recommended to use garlic or onion extract at the rate of 15 % for improving bud break, berries quality, growth, yield and chemical constituents of grape buds

Key Words: Grapevine (*Vitis vinifera* L), Garlic extract, Onion extract, Bud break, Growth, Yield, Chemical constituents.

Grape (*Vitis vinifera,* L) is considered the most popular and favorite fruit crop in the world including Egypt, for being has an excellent flavors, nice test and high nutritional values. It can grow under different environmental conditions (Abd El-Galil *et al.*, 2003). Grapevine budbreak generally improves with increased exposure to chilling temperature (Dokoozlian *et al.*, 1995 and Dokoozlian, 1999).

Endodormancy, which develops in deciduous fruit trees in the fall, is characterized by requirement for sustained exposure to low, near freezing temperature before active shoot growth can resume in the spring. This need for exposure to low temperature is called a chilling requirement (Howe *et al.*, 1999). Since temperature zone fruit trees are grown in the subtropics and tropics where winter chilling is not sufficient to break rest, the need for artificial means to compensate for lack of natural chilling becomes a dominate factor in orchard cultivation (Erez, 1995).

Several chemicals can be used to induce bud break of deciduous fruit trees in areas lacking sufficient chilling units. Garlic and onion extract have been widely used for stimulating bud break in various fruit species. In this concern, Kim *et al.* (2000 a) study the effects of garlic or onion juice and its ethanol and ethyl ether extracts on 2 & 3-years-old "Campbell Early" grapevines. It was found that days to bud break were inversely related to chilling duration in 2-year-old vines. Also, reported that all the treatments were effective in increasing percentage bud break in vines chilled for 60 days, among which onion juice were most effective. Percentage bud break increased as chilling duration was prolonged. Moreover, Botelho *et al.* (2007) study the effect of garlic extract at 1.5 or 3.0% on bud break of "Cabernet Sauvignon" grapevine cuttings compared with the effects of the conventionally used hydrogen cyanamide at 1.5% immediately after 0, 168, 336, or 508 chilling hr (-6.0 C), respectively, before spraying. All treatments improved and advanced bud sprouting over the control. Garlic extract promoted bud sprouting, attaining greater than 70 % budbreak after 35 days for cuttings chilled for 168, 336, and 504 hr. Also, Morsi and El- Yazal (2008) reported on "Anna" apple (*Malus sylvestris*, Mill) variety that all studied growth parameters, date of flower bud break, percentage of bud break, fruit-setting ,fruit weight, fruit size, fruit number/tree, yield/tree (kg) and some chemical constituents of leaves (total chlorophyll, total carbohydrates, total protein, nitrogen, phosphorous and potassium contents) and some chemical constituents of fruits (total soluble solids(T.S.S.), T.S.S/ acid ratio, vitamin C, water content %, total free amino acids, total carbohydrates, total sugars and reducing sugars) were increased with the application of potassium nitrate (10%), garlic extract (20%), onion extract (20%), potassium nitrate (5%) mixed with garlic extract (10%) ,potassium nitrate (5%) mixed with onion extract (10%). The best results were obtained from the treatments of potassium nitrate at 5% mixed with onion extract at 10%, potassium nitrate at 5% mixed with garlic extract at 10% and potassium nitrate at 10%. On the contrary, the same treatments decreased total acidity and total phenols in fruits as compared to the control.

The beneficial effect of garlic and onion extract on bud break, growth, yield and some chemical constituents of different fruit species were studied by several workers (Kubota *et al.*, 1999a , Kubota *et al.*, 1999b, Kim *et al.*, 1999, Kim *et al.*, 2000a , Kim *et al.*, 2000b, Kubota *et al.*, 2000 and Botelho *et al.*, 2007) on grape trees, (Botelho & Muller, 2007a & b and Morsi & El-Yazal, 2008) on apple trees.

Accordingly, the present work was planned to study the effect of exogenous application of garlic and onion extracts at different rates on growth and yield, as well as seasonal changes of some chemical constituents of grape buds during different stages of growth at both 2006 and 2007 seasons.

Material and Methods

This study was carried out during the two successive seasons of 2006 and 2007 on two grapevine cvs., namely "Flam Seedless" and "Superior" grown at the Experimental farm of Faculty of Agric. at Demo, Fayoum, Egypt. The vines were 9 years old at the start of the study. The vines were spaced 3 m between rows and 3 m within row under drip irrigation system. Vines were trained with a single trunk to cane pruning with four wire trills in the telephone supporting system and pruned by leaving about 72 buds (6 fruiting canes involved 12 buds/cane).

Preparation of garlic and onion extracts

Garlic (local Variety) and onion (Giza20 variety) samples were ground using mortar and pestle and the active ingredients were extracted by ethyl alcohol (95%). The garlic or onion ethanol mixture was filtered and the alcohol was removed by evaporating under vacuum (30C°) using rotary evaporator, Buchi model 011. The extract was kept cool in refrigerator (4C°) until use. Garlic or onion extract was diluted by water to give the final concentration required (10, 15 and 20%) directly before use.

Onion as well as garlic extracts were applied in three concentrations, 10%, 15% and 20% in water, in addition to the control (spraying with water). Each tree received half (1/2) liter of the assigned solution. Spraying was carried out during the late stage of end dormancy of buds in 1st January in both seasons.

Each treatment was replicated on four individuals (vines) and receiving one of the following :

1- Control (spraying with water)
2- Onion extract at 10%
3- Onion extract at 15%
4- Onion extract at 20%
5- Garlic extract 10%
6- Garlic extract 15%
7- Garlic extract 20%

Triton B as a wetting agent at 0.1% was added to the spraying solution. The vines were sprayed using a back gum sprayer to the spur surface until well wetted.

All the agricultural and horticultural practices were carried out as usual.

The following parameters were determined to evaluate the effect of different spray treatments on growth, yield, and chemical constituents of grapevine.

1- Bud behaviors

Starting from beginning of February the numbers of bursted buds per vine were counted periodically, then the percentage of bud burst were calculated according to Sourial *et al.* (1993) as follows:

$$\text{Bud burst \%} = \frac{\text{No. of bursted buds} \times 100}{\text{Total No. of buds}}$$

The dates on which buds started to open were recorded and expressed as the number of days after 1st January to reach 50% bud opening .

2-Yield and yield components

At harvesting when at least, T.S.S. reach 18.4%, the number of clusters per vine was counted to determine the total yield/vine (kg).

3- Cluster and berry characteristics

At harvesting, five clusters were randomly taken from each vine and cluster weight (g), length, width (cm), number of berries per cluster, weight of 100 berries (g), Berry quality in terms of berries length (cm) and berries width were determined.

T.S.S. (%) using hand refractometer, total acidity (%) and reducing sugars (%) in juice were also determined as outlined in A.O.A.C. (1995). The obtained data were tabulated and statistically analyzed according to Snedecor and Cochran (1990).

Chemical analysis

Samples of buds were collected from each replicates 15 days intervals after spraying till march 31 in the two studied years for determination the seasonal changes in bud components. As well as samples of fruits were collected at harvesting from each treatment. Samples of buds and fruits were taken at random and immediately were transported to the laboratory for the following determinations.

Total carbohydrates in buds mg/g dry weight were determined colorimetrically by using phenol-sulphuric acid reagent according to the method described by Herbert *et al.* (1971). Total free amino acids in buds were determined colorimetrically using ninhydrin reagent and counted as mg/g dry weight according to the method described by Jayarman (1981). Total indoles mg/g dry weight were determined according to Larson *et al.* (1962). Total and reducing sugars were determined as mg/g dry weight using phosphomolybdic acid reagent; free phenols in buds were determined as mg/g dry weight using Folin-Denis reagent and water content in buds were determined according to A.O.A.C. (1995). Plant hormones determination were carried out in samples collected in 16th March (bud break) of different treatments for "Flam Seedless" variety only in the second season. The samples were extracted by cold 80%

(V/V) aqueous methanol and ethyl acetate. The combined acidic ethyl acetate phase was reduced in volume to be used for GLC determination of acidic hormones such as IAA, GA_3 and ABA according to Shindy and Smith (1975).

Results

Date of bud break

Data presented in Table 1 clearly show that, all treatments hastened the beginning of bud break of "Flam Seedless" and "Superior" grape varieties as compared to the control. The best results was obtained with onion and garlic extracts at the rate of 15 %. The earliness reached about 20 and 21 days in the first season and 26 and 28 days in the second season for "Flam seedless variety and 26 and 19 days in the first season and 26 and 25 days in the second season for "Superior" variety, respectively over the control trees

Percentage of bud break

Table 1 clearly show that all the tested substances gave a higher percentage of bud break when compared with the control trees. The best results was obtained with onion or garlic extract at the rate of 15 %.The increase reached about 10.60 and 11.33 % in the first season and 18.55 and 20.09 % in the second season for "Flam Seedless" variety and 21.39 and 22.89 % in the first season and 18.34 and 23.96 % in the second season for "Superior" variety , respectively over the control trees .

TABLE 1. Effect of garlic and onion extracts on time and percentage of bud break of "Flame seedless and Superior" grapevines in 2006 and 2007 seasons.

Treatment	Days after treatment to first bud break				Bud break %			
	Flame seedless		Superior		Flame seedless		Superior	
	2006	2007	2006	2007	2006	2007	2006	2007
Control	85	88	75	77	66.60	64.20	70.10	71.15
Onion extract 10%	80	77	57	53	69.30	68.55	77.15	79.20
Onion extract 15%	65	62	49	51	73.66	76.11	85.10	84.20
Onion extract 20%	79	81	57	54	69.66	67.33	81.20	82.30
Garlic extract 10%	66	63	59	56	71.10	74.15	80.30	82.20
Garlic extract 15%	64	60	56	52	74.15	77.10	86.15	88.20
Garlic extract 20%	65	62	62	63	73.60	72.20	84.20	83.60
L.S.D. at 5%	2.80	2.91	6.80	6.53	1.46	1.73	2.30	2.54

Yields and its components

Data in Table (2, 3 and 4) indicated that all the tested substances increased grape yield and its components (number of clusters /vine, cluster weight, cluster length, cluster width ,number of berries/cluster ,berries width, berries length, and 100 berries weight) as compared to the control trees. Such trend was true during the two studied seasons. The maximum increases in yield/vine were recorded with onion or garlic extract at 15 % which recorded 72.23 & 75.27 % in the first season and 58.40 & 67.03 % in the second season for "Flam Seedless" variety and 76.60 & 74.75 % in the first season and 79.60 & 74.50 % in the second season for "Superior" variety, respectively over the control trees. Such trend was true with yield components. The maximum increases in yield components (number of clusters /vine, cluster weight, cluster length, cluster width, number of berries/cluster, berries width, berries length, and 100 berries weight) were recorded with onion or garlic extract at 15 %.

TABLE 2. Effect of garlic and onion extracts on cluster number/ vine and yield (Kg / vine) of " Flame seedless and Superior " grapevines in 2006 and 2007 seasons.

Treatment	No. cluster/vine				Yield (Kg/vine)			
	Flame seedless		Superior		Flame seedless		Superior	
	2006	2007	2006	2007	2006	2007	2006	2007
Control	33.55	34.65	37.25	39.23	12.78	13.68	12.44	12.55
Onion extract 10%	40.12	41.92	39.25	41.46	19.37	19.32	14.40	15.38
Onion extract 15%	42.35	42.52	43.18	43.95	22.02	21.67	21.97	22.54
Onion extract 20%	40.15	41.90	41.12	41.93	18.66	19.31	20.51	21.00
Garlic extract 10%	40.23	38.25	40.95	39.83	15.85	15.91	16.13	15.33
Garlic extract 15%	42.59	43.78	42.15	42.90	22.40	22.85	21.74	21.90
Garlic extract 20%	40.31	41.23	41.13	41.88	20.96	20.61	20.30	21.27
L.S.D. at 5%	0.79	0.53	0.89	0.72	3.35	4.39	1.51	1.76

Chemical constituent of buds

Water content

Water content which were found in the examined buds at 15 days intervals from 15th January till 31th March for both varieties as shown in Table 5 and illustrated in fig. (1 and 2) clearly show that water content rapidly increased at early spring during bud breaking, from the first sample reaching its maximum content at (31th of March) in "Flam Seedless" and at (1st of March) in "Superior" varieties.

All the treatments increased water content in buds of both varieties compared to the control trees. The large amount of water content was obtained when trees were treated by onion or garlic extract at the rate of 15 %.

TABLE 3. Effect of garlic and onion extracts on characteristics cluster of "Flame seedless and Superior " grapevines in 2006 and 2007 seasons.

Treatment	Cluster weight (g)				Cluster length (cm)				Cluster width (cm)				No. berries per cluster			
	Flame seedless		Superior		Flame seedless		Superior		Flame seedless		Superior		Flame seedless		Superior	
	2006	2007	2006	2007	2006	2007	2006	2007	2006	2007	2006	2007	2006	2007	2006	2007
Control	381	395	334	320	29	27	21	23	14	14.5	14	15	215	210	212	213
Onion extract 10%	483	461	367	371	30	30	22	24	16	17.5	14	15.2	225	219	215	225
Onion extract 15%	520	517	509	513	33	35	32	31	19	20	19	20	245	251	295	315
Onion extract 20%	465	461	499	501	31	28	24	26	18	19	15	16.2	240	249	263	272
Garlic extract 10%	394	416	394	385	32	31	30	29	19	19	18	19	240	245	250	240
Garlic extract 15%	526	522	516	519	33	32	33	32	20	20	20	22	270	276	270	286
Garlic extract 20%	520	500	506	508	30	31	31	30	16	16	16	19	220	241	220	246
L.S.D at 5%	13.25	18.63	30.69	27.95	1.26	1.69	2.60	2.69	1.69	1.45	2.26	2.29	9.36	9.29	9.88	9.24

TABLE 4 . Effect of garlic and onion extracts on characteristics berries of "Flame seedless and Superior " grapevines in 2006 and 2007 seasons.

Treatment	Weight of 100 berries (g)				Berry length (cm)				Berry width (cm)			
	Flame seedless		Superior		Flame seedless		Superior		Flame seedless		Superior	
	2006	2007	2006	2007	2006	2007	2006	2007	2006	2007	2006	2007
Control	177.2	188.2	298.2	283.2	1.55	1.50	1.75	1.80	1.20	1.15	1.25	1.30
Onion extract 10%	220.3	238.8	309.1	296.8	1.56	1.59	1.78	1.88	1.20	1.18	1.63	1.69
Onion extract 15%	285.1	293.9	323.0	308.6	1.88	1.95	1.99	2.1	1.30	1..39	1.76	1.79
Onion extract 20%	252.6	255.1	300.6	286.6	1.75	1.73	1.85	1.95	1.25	1..31	1.66	1.69
Garlic extract 10%	212.6	222.35	312.5	303.2	1.57	1.62	1.81	1.86	1.25	1.28	1.68	1..62
Garlic extract 15%	278.3	289.6	324.7	315.2	1.80	1.76	1.98	2.00	1.32	1.36	1.72	1.76
Garlic extract 20%	236.4	257.5	313.8	300.5	1.63	1.55	1.93	1.95	1.23	1.21	1.23	1.41
L.S.D. at 5%	4.78	3.42	6.79	5.84	0.07	n.s.	0.05	0.09	0.09	n.s.	0.01	0.06

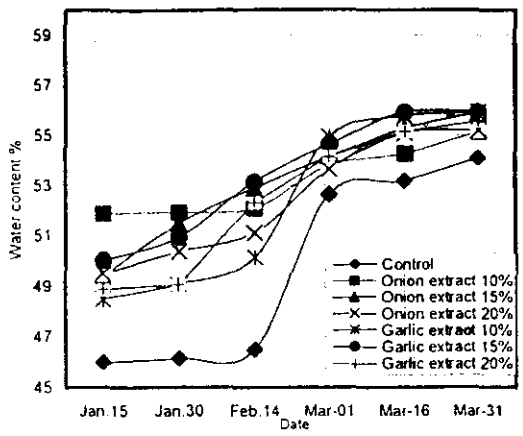

Fig. 1. Effect of onion and garlic extracts on bud water content % of "Flame seedless" grapevine is the mean of the two seasons under the study.

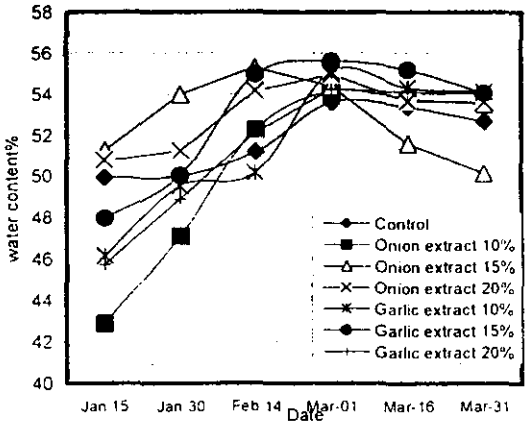

Fig. 2. Effect of onion and garlic extracts on bud water content % of "Superior" grapevine is the mean of the two seasons under the study.

Total carbohydrates

The data in Table 6 and Fig (3 , 4) indicated that the amount of total carbohydrates in "Flam Seedless" variety decreased from the first sample at 15th Jan. till 30th January, thereafter it increased gradually reaching its maximum values at 16th March (during bud breaking) followed with a decrease towards the last sample (after bud break). On the other hand, total carbohydrates in" Superior" variety gradually increased from the first sample till 1st March and thereafter it decreased till the last sample.

With regard to the effect of the spray treatments on total carbohydrates, it is clear from the present data that nearly all treatments gave higher values of total carbohydrates in both varieties when compared to the control trees. The best results were obtained by spraying with onion or garlic extract at the rate of 15 % on 16th March for Flame seedless and 1st March for Superior varieties (during bud breaking).

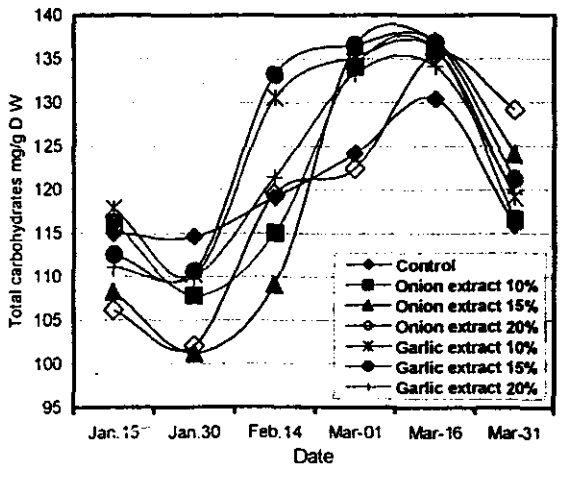

Fig. 3. Effect of onion and garlic extracts on total carbohydrates mg/g D.W of "Flame seedless" grapevine is the mean of the two seasons under the study.

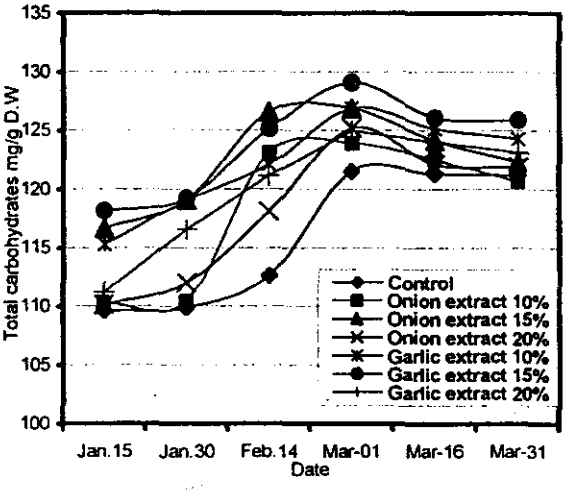

Fig. 4. Effect of onion and garlic extracts on total carbohydrates mg/g D.W of "Superior" grapevine is the mean of the two seasons under the study.

Total and reducing sugars

The data in Tables (7 , 8) and Fig. (5, 6, 7 and 8) clearly show that the total and reducing sugars content in "Flam Seedless" variety gradually decreased from the first sample till 30th January , thereafter it increased gradually reaching its maximum values at 16th March followed by a decrease towards the last sample. On the other hand, total and reducing sugars content in" Superior" variety gradually increased from the first sample till 1st March (bud break) and thereafter it decreased till the last sample.

Concerning the effect of the spray treatments on total and reducing sugars, it is clear from the present data that nearly all treatments gave higher values of total and reducing sugars in both varieties if compared to the control trees in 16th March for Flame seedless and 1st March for Superior varieties (during bud breaking). The best results were obtained by spraying the trees by onion or garlic extract at the rate of 15 %.

Total free amino acid

Data presented in Table 9 and illustrated in Fig. (9 , 10) show that total free amino acids content in buds of "Flam Seedless" variety gradually decreased from the first sample till 30th January, thereafter it increased gradually reaching its maximum values at 16th March followed by a decrease towards the last sample. On the other hand, total free amino acids content in" Superior" variety gradually increased from the first sample at 15th January till the last sample at 31th March.

Concerning the effect of the spray treatments on total free amino acids, it is clear from the present data that nearly all treatments gave higher values of total free amino acids in both varieties if compared to the control trees. The best results were obtained by spraying the trees by onion or garlic extract at the rate of 15 %.

TABLE 5. Effect of garlic and onion extracts on buds water content of "Flame seedless" and "Superior" grapevines in 2006 and 2007 seasons.

Treatment	Water content %											
	Flame seedless						Superior					
	Jan. 15	Jan. 30	Feb. 14	March 1	March 16	March 31	Jan. 15	Jan. 30	Feb. 14	March 1	March 16	March 31
Control	45.98	46.14	46.50	52.66	53.20	54.10	49.92	50.01	51.20	53.60	53.36	52.66
Onion extract 10%	51.89	51.95	52.10	53.81	54.30	55.15	42.86	47.10	52.30	54.15	53.77	53.50
Onion extract 15%	49.45	51.50	52.90	54.15	55.30	55.90	51.26	54.00	55.30	54.39	51.60	50.13
Onion extract 20%	49.52	50.39	51.12	53.66	55.11	55.20	50.78	51.26	54.17	54.95	53.66	53.60
Garlic extract 10%	48.52	49.10	50.17	54.96	55.78	55.95	46.14	49.52	50.17	55.10	54.30	54.10
Garlic extract 15%	50.05	50.96	53.15	54.66	55.95	55.95	47.03	50.05	54.96	55.60	55.18	54.05
Garlic extract 20%	48.88	49.10	52.33	54.15	55.18	55.55	45.71	48.88	52.15	54.25	54.10	54.00

The data presented in this table are the means of the two seasons under study.

TABLE 6. Effect of garlic and onion extracts on total carbohydrates content in buds of "Flame seedless" and "Superior" grapevines in 2006 and 2007 seasons.

Treatment	Total carbohydrates mg/g D.W											
	Flame seedless						Superior					
	Jan. 15	Jan. 30	Feb. 14	March 1	March 16	March 31	Jan. 15	Jan. 30	Feb. 14	March 1	March 16	March 31
Control	115.0	114.58	119.20	124.17	130.42	115.90	109.60	109.88	112.60	121.50	121.30	121.20
Onion extract 10%	116.25	107.83	115.10	134.12	136.15	116.67	110.30	110.50	123.10	123.90	122.50	120.66
Onion extract 15%	108.33	101.25	109.12	136.50	137.10	124.12	116.66	119.10	126.60	126.90	124.11	122.30
Onion extract 20%	106.18	102.10	119.58	122.50	135.50	129.10	110.11	112.01	118.10	125.18	122.13	121.90
Garlic extract 10%	117.92	110.30	130.60	135.21	136.10	119.20	115.25	119.00	122.10	126.90	125.15	124.30
Garlic extract 15%	112.50	110.66	133.21	136.60	136.90	121.25	118.15	119.21	125.15	129.10	126.10	125.90
Garlic extract 20%	111.11	109.99	121.50	133.30	134.12	119.66	111.21	116.60	121.11	124.95	124.00	123.11

The data presented in this table are the means of the two seasons under study.

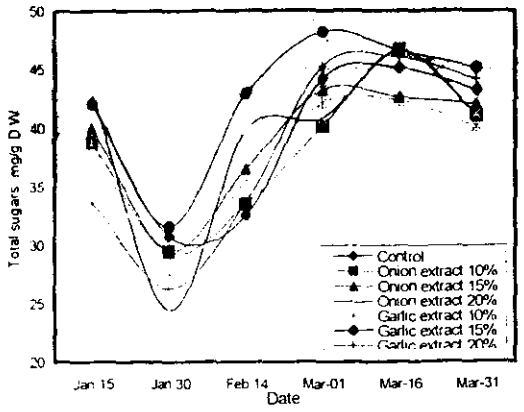

Fig 5. Effect of onion and garlic extracts on total sugars of "Flame seedless" grapevine.

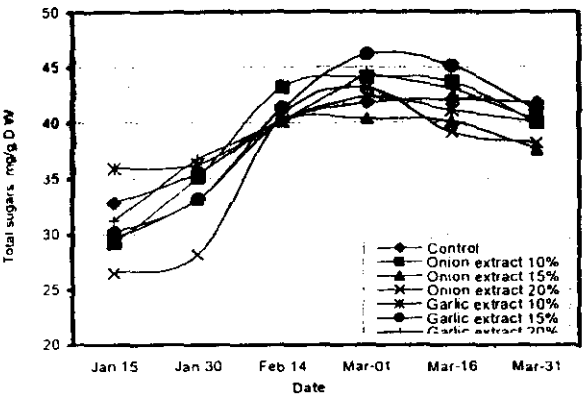

Fig 6. Effect of onion and garlic extracts on total sugars of "Superior" grapevine.

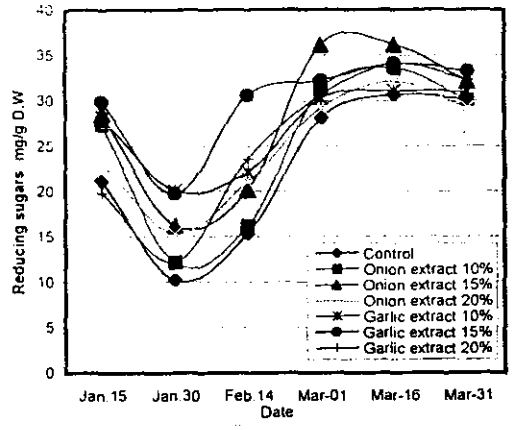

Fig 7. Effect of onion and garlic extracts on reducing sugars as mg/g D.W of "Flame seedless " grapevine is the mean of the two seasons under the study.

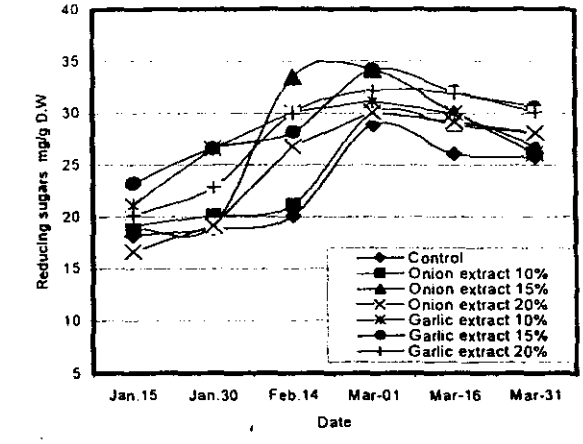

Fig 8. Effect of onion and garlic extracts on reducing sugars as mg/g D.W of "Superior" grapevine .is the mean of the two seasons under the study.

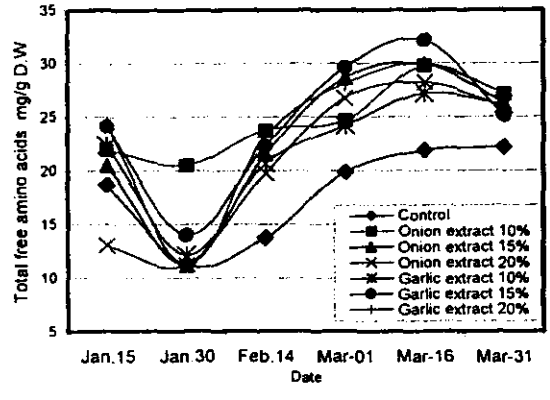

Fig 9. Effect of onion and garlic extracts on total free amino acids mg/g D.W of "Flame seedless " grapevine is the mean of the two seasons under the study .

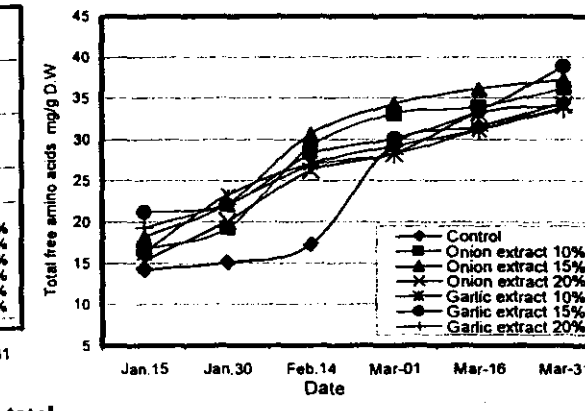

Fig 10. Effect of onion and garlic extracts on total free amino acids mg/g D.W of "Superior " grapevine is the mean of the two seasons under the study .

TABLE 7. Effect of garlic and onion extracts on total sugars content in buds of "Flame seedless" and "Superior "grapevines in 2006 and 2007 seasons.

Treatment	Total sugars mg/g D.W											
	Flame seedless						Superior					
	Jan.15	Jan.30	Feb.14	March 1	March 16	March 31	Jan.15	Jan.30	Feb.14	March 1	March 16	March 31
Control	42.10	30.82	32.50	44.20	45.10	43.21	32.76	35.50	40.21	41.80	41.10	41.80
Onion extract 10%	38.78	29.39	33.47	40.11	45.60	41.10	29.20	35.10	43.20	44.10	43.66	40.00
Onion extract 15%	40.00	29.59	36.50	43.21	42.60	42.00	29.60	33.15	40.11	40.33	40.11	37.60
Onion extract 20%	42.86	24.49	39.79	40.82	46.50	41.16	26.50	28.18	40.66	43.13	39.10	38.18
Garlic extract 10%	38.78	27.55	35.51	42.10	42.30	40.10	35.90	36.30	40.18	42.33	41.10	40.05
Garlic extract 15%	41.98	31.63	42.86	48.15	46.60	45.10	30.12	33.11	41.33	46.15	45.10	41.11
Garlic extract 20%	33.67	26.33	33.67	45.21	46.00	44.15	31.20	36.80	40.15	44.45	43.11	40.20

The data presented in this table are the mean of the two seasons under study

TABLE 8. Effect of garlic and onion extracts on reducing sugars content in buds of "Flame seedless" and "Superior " grapevines in 2006 and 2007 seasons.

Treatment	Reducing sugars mg/g D.W											
	Flame seedless						Superior					
	Jan. 15	Jan. 30	Feb. 14	March 1	March 16	March 31	Jan. 15	Jan. 30	Feb. 14	March 1	March 16	March 31
Control	21.18	10.20	15.33	28.10	30.66	30.15	18.21	18.86	20.11	28.90	26.10	25.80
Onion extract 10%	27.38	12.11	16.20	31.21	33.60	30.10	19.18	20.11	21.18	30.00	28.90	28.00
Onion extract 15%	28.60	16.26	20.18	36.15	36.20	32.18	18.90	19.25	33.50	34.21	30.10	26.81
Onion extract 20%	23.17	15.37	21.10	29.18	32.10	29.25	16.66	19.15	26.80	30.12	29 18	28.12
Garlic extract 10%	28.18	20.11	22.16	30.25	31.10	31.00	21.15	26.60	30.11	31.21	30.00	26.15
Garlic extract 15%	29.90	19.75	30.60	32.25	34.11	33.30	23.25	26.60	28.21	34.21	32.10	30.60
Garlic extract 20%	19.85	12.21	23.60	30.60	34.10	32.33	20.15	22.88	30.01	32.25	31.90	30.11

The data presented in this table are the mean of the two seasons under study.

TABLE 9. Effect of garlic and onion extracts on total free amino acids content in buds of "Flame seedless" and "Superior " grapevines in 2006 and 2007 seasons.

Treatment	Total free amino acids mg/g D.W											
	Flame seedless						Superior					
	Jan. 15	Jan. 30	Feb. 14	March 1	March 16	March 31	Jan. 15	Jan. 30	Feb. 14	March 1	March 16	March 31
Control	18.66	11.19	13.73	19.87	21.85	22.18	14.20	15.10	17.26	29.50	31.60	34.33
Onion extract 10%	21.97	20.52	23.73	24.66	29.75	27.10	16.60	19.25	29.12	33.10	33.90	36.18
Onion extract 15%	20.52	11.19	21.52	28.61	29.90	26.26	18.21	22.15	30.66	34.25	36.15	37.21
Onion extract 20%	13.06	11.19	19.75	26.71	28.18	25.90	15.25	20.10	26.18	28.28	33.11	34.15
Garlic extract 10%	22.39	12.13	20.66	24.18	27.15	26.11	16.21	23.21	27.10	29.19	31.20	33.90
Garlic extract 15%	24.15	13.99	22.30	29.60	32.15	25.11	21.18	22.10	28.16	30.12	33.42	38.80
Garlic extract 20%	24.25	11.19	23.18	28.10	29.91	27.10	19.29	22.16	26.80	28.21	31.10	33.60

The data presented in this table are the mean of the two seasons under study.

Total indoles

Data presented in Table 10 and illustrated in Fig. (11 , 12) generally show that total indoles in buds of "Flam Seedless" variety gradually decreased from the first sample till 30th January , thereafter it increased gradually reaching its maximum values at the last sample (31th March). On the other hand, total indoles in" Superior" variety gradually increased from the first sample at 15th January till the last sample at 31th March.

Concerning the effect of the spray treatments on total indoles, it is clear from the present data that nearly all treatments gave higher values of total indoles in both varieties if compared to the control trees. The best results were obtained by spraying the trees by onion or garlic extract at the rate of 15 %.

TABLE 10. Effect of garlic and onion extracts on total indoles content in buds of "Flame seedless" and "Superior " grapevines in 2006 and 2007 seasons.

Treatment	Total indoles mg/g D.W											
	Flame seedless						Superior					
	Jan. 15	Jan. 30	Feb. 14	March 1	March 16	March 31	Jan. 15	Jan. 30	Feb. 14	March 1	March 16	March 31
Control	2.12	2.01	2.29	2.50	3.18	3.11	1.41	1.95	2.03	2.30	2.35	2.40
Onion extract 10%	2.56	1.95	2.70	2.76	3.41	3.42	2.10	2.15	2.56	2.63	2.76	2.79
Onion extract 15%	2.86	1.80	2.95	3.30	3.40	3.40	2.30	2.35	2.46	2.71	2.85	3.01
Onion extract 20%	2.30	1.90	2.61	2.93	3.21	3.26	2.10	2.16	2.38	2.46	2.53	2.69
Garlic extract 10%	2.60	1.75	2.83	2.96	3.40	3.41	2.20	2.29	2.41	2.49	2.78	2.95
Garlic extract 15%	2.95	2.10	3.15	3.26	3.36	3.44	2.46	2.53	2.63	2.77	2.91	3.21
Garlic extract 20%	2.61	2.01	2.86	2.95	3.15	3.36	2.19	2.3	2.45	2.61	2.80	2.93

The data presented in this table are the mean of the two seasons under study

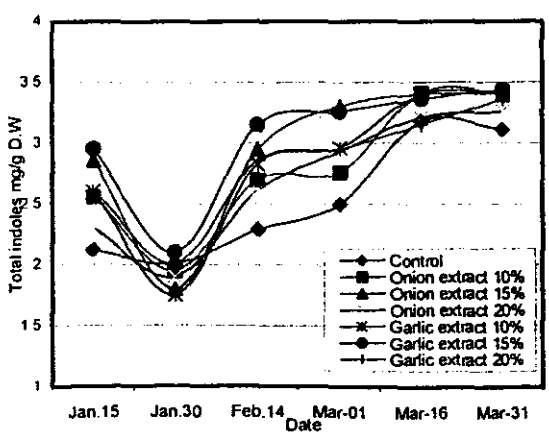

Fig. 11. Effect of onion and garlic extracts on total indoles as mg/g D.W of "Flame seedless " grapevine is the mean of the two seasons under the study .

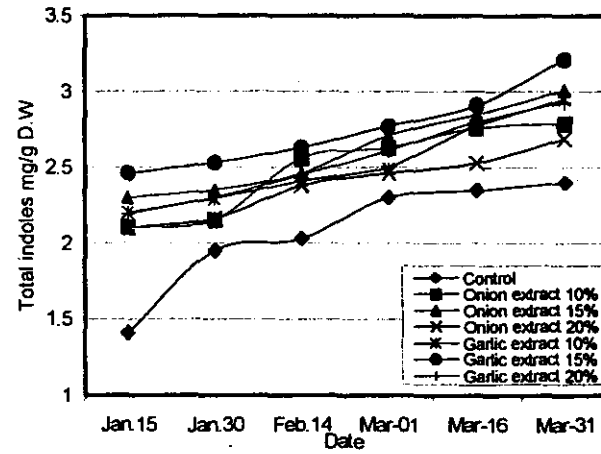

Fig. 12. Effect of onion and garlic extracts on total indoles as mg/g D.W of "Superior " grapevine is the mean of the two seasons under the study .

Plant hormones

The data in Table 11 indicated that all treatments increased the amount of indole acetic acid (IAA) & gibberellic acid (GA3) and decreased the amount of abscicic acid (ABA) in buds of "Flam Seedless" variety. The best results were obtained by spraying the trees with onion or garlic extract at the rate of 20 %. The increase were 14.27 and 15.61 % for (IAA) & 28.66 and 33.83 % for (GA3), respectively over the control trees

TABLE 11. Effect of garlic and onion extracts on plant hormones concentration in buds of "Flame seedless" grapevine at bud breaking 16th March in 2007 season.

Treatments	Indole acetic acid µg/gm F.W.	Gibberellins µg/gm F.W.	Abscisic acid µg/gm F.W.
Control	11.21	4.64	0.56
Onion extract 10%	11.83	4.76	0.42
Onion extract 15%	12.66	5.91	0.33
Onion extract 20%	12.81	5.97	0.31
Garlic extract 10%	11.93	4.98	0.40
Garlic extract 15%	12.77	5.99	0.32
Garlic extract 20%	12.96	6.21	0.21

Free phenols

The data in Table 12 and Fig. (13 and 14) indicated that the amount of free phenols in "Flam Seedless" variety gradually increased from the first sample till 30th January, thereafter, it decreased reaching its minimum values at (31th March) in the last sample. On the other hand, free phenols in "Superior" variety gradually decreased from the first sample till (31th March) in the last sample.

With regard to the effect of the spray treatments on free phenols, it is clear from the present data that nearly all treatments gave low values of free phenols in both varieties when compared to the control trees.

TABLE 12. Effect of garlic and onion extract on free phenols content in buds of "Flame seedless" and "Superior " grapevines in 2006 and 2007 seasons.

Treatment	Free phenols mg/g D.W											
	Flame seedless						Superior					
	Jan. 15	Jan. 30	Feb. 14	March 1	March 16	March 31	Jan. 15	Jan. 30	Feb. 14	March 1	March 16	March 31
Control	5.72	7.07	5.05	4.72	4.50	4.10	6.22	5.30	4.18	3.90	3.30	2.90
Onion extract 10%	3.53	6.06	5.38	5.15	4.71	3.90	5.55	4.60	4.10	3.51	3.10	2.60
Onion extract 15%	3.70	3.93	3.53	3.10	2.95	2.85	3.95	3.60	3.25	3.15	3.00	2.56
Onion extract 20%	5.72	8.41	5.38	4.40	4.10	3.80	5.10	4.93	4.50	3.21	3.06	2.73
Garlic extract 10%	4.88	7.91	4.88	4.42	3.90	3.41	4.30	4.15	3.95	3.81	3.63	2.95
Garlic extract 15%	5.38	6.73	5.40	4.49	4.10	4.00	3.86	3.73	3.56	3.2	3.01	2.81
Garlic extract 20%	4.88	5.72	5.40	4.72	4.40	4.15	4.33	4.13	3.96	3.65	3.15	2.78

The data presented in this table are the mean of the two seasons under study.

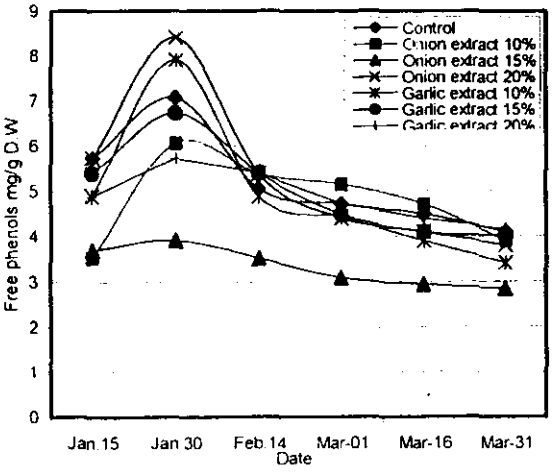

Fig. 13. Effect of onion and garlic extracts on Free phenols mg/g D.W of "Flame seedless " grapevine is the mean of the two seasons under the study .

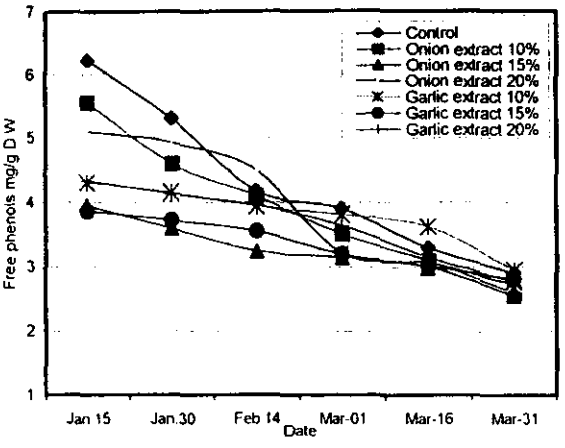

Fig. 14. Effect of onion and garlic extracts on Free phenols mg/g D.W of "Superior " grapevine is the mean of the two seasons under the study .

Chemical constituents of berries

Data of Table 13 clearly showed that spraying grape trees with any of the tested substances significantly improved the chemical constituents of berries (total acidity, total soluble solids (T.S.S.), reducing sugars and dry weight, as compared to the control trees. Such trend was true during the two studied seasons. The maximum increase in total soluble solids was recorded with onion extract at 20 or garlic extract at 15 % which recorded 6.74 & 12.35% in the first season and 9.94 & 23.39 % in the second season for "Flam Seedless" and 17.33 & 40.00 % in the first season and 25.51 & 38.62 % in the second season for "Superior" variety, respectively over the control trees. The same trend was true for reducing sugars and dry weight. The maximum increase in reducing sugars and dry weight was recorded with onion extract at 20 or garlic extract at 15 % which recorded 21.29 & 11.06% for reducing sugars and 18.00 & 26.46% for dry weight in the first season and 18.97 &7.23% for reducing sugars and 22.64 & 29.96 % for dry weight in the second season in "Flam Seedless" variety and 20.93 & 20.83% for reducing sugars and 22.90 & 25.47 % for dry weight in the first season and 15.73 &18.79% for reducing sugars and19.32 &16.47 % for dry weight in the second season in "Superior" variety , respectively over the control trees. On the other hand, the data in Table 13 also showed a marked decrease in total acidity concentrations in berries when trees were treated with any of the tested substances comparing with the control trees.

TABLE 13. Effect of garlic and onion extracts on berries acidity, T.S.S, reducing sugars and dry weight percentage of "Flame seedless and Superior" grapevines in 2006 and 2007 seasons.

Treatment	Acidity %				T.S.S %				Reducing sugars %				Dry weight %			
	Flame seedless		Superior		Flame seedless		Superior		Flame seedless		Superior		Flame seedless		Superior	
	2006	2007	2006	2007	2006	2007	2006	2007	2006	2007	2006	2007	2006	2007	2006	2007
Control	0.79	0.81	0.80	0.70	17.8	17.1	15.00	14.50	17.80	18.81	19.15	19.26	16.55	16.25	18.68	17.85
Onion extract 10%	0.69	0.61	0.73	0.68	14.2	13.29	16.33	16.46	20.61	19.81	19.25	19.46	15.10	18.10	17.55	19.00
Onion extract 15%	0.64	0.61	0.64	0.65	15.2	16.20	15.20	16.16	21.56	22.27	23.05	22.23	16.93	19.90	16.93	17.53
Onion extract 20%	0.66	0.65	0.63	0.71	19.0	18.80	17.60	18.20	21.59	22.38	23.16	22.29	19.53	19.93	20.50	21.30
Garlic extract 10%	0.72	0.75	0.82	0.73	16.84	16.14	16.84	15.90	16.60	17.81	21.53	19.89	19.35	18.96	19.35	19.41
Garlic extract 15%	0.59	0.61	0.79	0.71	20..0	21.10	21.00	20.10	19.77	20.17	23.14	22.88	20.93	21.12	20.93	20.79
Garlic extract 20%	0.79	0.73	0.79	0.71	17.90	13.19	17.99	16.90	17.78	19.99	21.20	21.99	19.45	18.66	20.40	20.75
L.S.D. at 5%	0.02	0.05	0.05	0.02	0.30	0.82	0.90	0.60	0.22	0.26	0.10	0.11	0.25	0.19	0.36	0.41

Discussion

Spraying grape trees with any of the tested treatments (garlic extract at 10, 15 and 20% and onion extract at 10, 15 and 20%,) resulted in vigorous growth as well as high productivity with good fruit quality for grape trees. Treatments increased the measured growth characters, this was due to the fact that these treatments resulted in more availability of some nutrients, *i.e.*, (sulfur etc ....) to vines. In this concern Kubota *et al.* (1999a) investigated the active substances in garlic which is responsible for breaking bud dormancy in grapevines. The compounds were identified as diallyl mono-, di-, tri-, and tetra-sulfides, but only trace amounts of dimethyl mono- and di-sulfides were presented. Exposure to volatiles of diallyl di-and tri-sulfides was the most effective treatment in promoting bud break, irrespective of the concentration and the duration of exposure. However, the effects of dimethyl sulfide and diallyl sulfide on budbreak varied among the concentrations and the duration of exposure. These results indicate that the active substances in garlic, responsible for breaking bud dormancy in grapevines, are sulfur- containing compounds with an allyl group (CH_2CHCH_2), particularly dially disulfide. Moreover, Sellappan and Akoh (2002) investigated the active substances in onion , the compounds were identified as flavonoids , quercetin ,myricetin and kaempferol .Flavonoids, a major group of plant phenols, include compounds, which are potent antioxidants. The antioxidant activity of flavonols may apparently due to their ability to act as free radical acceptors as indicated by Xiao and Parkin (2002). Moreover, El-Mansy and Walker (1969) reported that phenols induce several multibiological responses which ultimately lead to the promotion of flowering. Also, Kefeli and Kutacek (1977) suggested that plant phenols may be divided into three groups, promotive, inhibitor and inactive. They added that promotion of plant growth by phenols may proceed through the modulation of either IAA biosynthesis or its destruction. Enhancement of growth parameters with garlic and onion extracts (as sulfur natural compound) would be expected since sulfur is a constituent of the amino acids cysteine, cystine and methionine and hence proteins. Both of these amino acids are precursors of other sulfur-containing compounds such as coenzymes and secondary plant products. Sulfur is a structural constituent of these compounds (*e.g.*, R^1-C-S-C-R^2) or acts as a functional group (e.g., R- SH) directly involved in metabolic reactions. About 2% of the organic reduced sulfur in the plant is present in the water-soluble thiol (- SH) fraction, and under normal conditions The tripeptide glutathione accounts fore more than 90% of this fraction Marschner (1995). Cysteine, the first stable product of the assimilatory sulfate reduction, acts as a precursor for the synthesis of all other organic compounds containing reduced sulfur, as well as for other biosynthetic pathways, such as the formation of ethylene (Miyazaki and Yang, 1987).

Sulfate reduction in the leaves leads to export in the phloem of reduced sulfur compounds, mainly as glutathione to sites of demand for protein synthesis (*e.g.*, in the shoot apex, fruits, but also roots) and probably also for regulation of sulfate uptake by roots (Rennenberg, 1989). On the other hand, sulfolipids are

particularly abundant in the thylakoid membranes of chloroplasts, about 5% of the chloroplast lipids (Schmidt, 1986). Sulfolipids may also be involved in the regulation of ion transport across biomembranes. Sulfolipids levels in roots have been shown to be positively correlated with plant salt tolerance, the higher the level the greater the tolerance (Stuiver *et al.*, 1981). Also, the favorable effect of the used substances on date of flower bud opening may be due to their stimulation effect of natural gibberellin. In this connection Subha-Drabandhu (1995), concluded that the induction of flowering could be correlated with a natural rise in gibberellin which promote flower formation in plants by either facilitating the formation of flowering hormone in the leaves or expressing it in the growing buds. Gibberellins also may be a primarily responsible for bolting which may be essential for the formation of the floral stimulus in leaves. Also, Skene (1969) reported that when a bud opens and attains the shape of shoot, its tip acts as a strong sink for metabolites and thus being interception center for photosynthates and nutrient results in earlier start of the bloom. Also , garlic and onion extracts used in this study, have an improving effect on vegetative growth parameters. This may be attributed to the essential role of these substances in the synthesis of some amino acid and consequently, formation of growth regulators especially auxin, and ethylene. The improving effect of garlic and onion extracts on yield and its components was mainly attributed to its positive action on enhancing growth parameters and photosynthetic pigments. The improving effect of garlic and onion extracts on buds water content may be due to the early activity. In this concern George *et al.* (1990) suggested that water and nutrients may also be mobilized to the growing points at the expense of the developing fruits. Moreover , Borkowaska (1980) found that the transition of buds from the dormant stage to the bursting process is related to an increase in the water content in the tissue, mobilization of nutrients, activation of hydrolytic enzymes and intensification of respiration. The stimulating effect of garlic and onion extracts as foliar spray on total carbohydrates concentration in buds of sprayed trees may be directly or indirectly due to certain enzymes which activate the anabolic processes leading to the accumulation of these substances. In this connection Bachelard and Wightman (1973) concluded that the period of increase in dry weight of both flower and vegetative buds appear to be due to the movement of metabolites could have come from twigs, branches and roots of trees. Moreover, Schnug (1993) reported that , more than 80% of total sulfur in *Allium* species may be bound to such compounds, in onion (*Allium cepa*) for example as *S*-propylysteine sulfoxide (R= - CH_2 - CH_2 - CH_3). Glucosinolates are characteristics compounds of the secondry metabolism of at least 15 dicotyledonous taxa, including the Brassicaceae .Sulfur in its nonreduced form, *i.e.* as sulfate ester, is a component of sulfolipids and is thus a structural constituent of all biological membranes. In sulfolipids the sulfo group is coupled by an ester bond to C_6 sugar, for example, glucose. The stimulating effect of garlic or onion extract as foliar spray on total and reducing sugars may be due to these substances that stimulate the conversion of the non-soluble carbohydrates to the soluble ones by activating the hydrolytic enzymes. In this concern, Baz (1984) showed that a considerable increase in reducing sugars were evident during active growth periods whereas these sugars were very low during the

period of retarded growth. Moreover, Whitworth and Young (1992) working on apple trees found that starch is being used as source of metabolites during chilling. They also added that sucrose and hexose (glucose + fructose) are important sugars during early growth. Also, Gemma (1995) pointed out that numerous changes in the level of carbohydrates occurred in buds as they based from the non-growing stage beginning of growth, they added that starch accumulated during the period of photosynthetic activity and is used for regeneration of growth in the spring. Moreover, El-Mansy and Walker (1969) and Abo-Hussein (1970) concluded that reducing sugars induce several multibiological responses which ultimately lead to the promotion of flowering. Moreover, the increase in total free amino acids in buds after garlic and onion extract treatments may be due to the increase in cysteine , cystine and methionine since sulfur is a constituent of these amino acids. In this concern, Hill-Cottingham (1968) found that there was a decrease in the nitrogen concentration of the woody tissues in the spring, particularly in the bark tissues of shoots. This was attributed to the movement of nitrogenous compounds from the bark and wood to the developing flower buds and growing points. Also Kuroi (1974) indicated that the nitrogen (including amino acid) was low level in buds or roots during dormant stage and reached maximum just prior to bud break, the nitrogen stored mostly in the roots and translocated to buds befor bud break and early growth. Moreover, Bachelard and Wightman (1973) observed that a probable correlation could exist between the state of dormancy and the dominant total amino acids in the buds. Moreover, they added that significant decrease in the dormant status of buds occurred and this was accompanied by an increase level of catabolic metabolism of protein. A further changes in anabolic metabolism nearly two weeks before bud burst resulted in a net synthesis of cellular constituents in preparation for bud burst. Moreover, Marschner (1995) reported that, reduced sulfur is a structural constituent of several coenzymes and prosthetic groups such as ferredoxin, biotin (Vitamin H), and thiamine pyrophosphate (Vitamin B_1). In many enzymes and coenzymes such as urease, sulfotransferases and coenzymes A. The decrease in free phenols after garlic and onion extract treatments may be due to that the reduction in free phenols contrasted with the increase in total indoles i.e. indogenous promoters increased and consequently, indogenous inhibitors decreased in the buds which led to increasing in plant growth parameters. In this respect, showed that phenolic effect on plant growth was contributed to either antagonism with I.A.A. activity. Moreover, Wang *et al.* (1991) on apple found that dormant buds contained a high amount of phenolic substances which decreased after bud break then increased until the start of bud expansion. Phenolic compounds are found to be patent modifiers of catalase, peroxidase and polyophenol oxidase activity, as both inhibitors and stimulators in apple buds .Moreover, these substances may be stimulate the oxidation process of phenols by increasing the peroxidase activity. The stimulating effect of garlic and onion extract as foliar spray on indole acetic acid (IAA) and gibberellic acid (GA_3) may be attributed to the increase in total free amino acids in buds specially tryptophan amino acid. In this concern, Tuner (1972) reported that natural breaking of dormancy was accompanied with increasing build up of endogenous gibberellins and the break down of starches to

sugars. Also, Baz (1984) reported that, for breaking dormancy naturally or chemically, a pronounced increase in the endogenous gibberellins occurred with emergence from the dormant state to sprouting. Moreover, Robert and Francis (1985) reported that the increase in endogenous GA, content which induce the synthesis of hydrolytic enzymes, increase the mobilization of these sugars to developed buds. Moreover, Subha- drabandhu (1995) reported that some different spray treatments may break dormancy by decreasing ABA content in buds. Moreover, the stimulating effect of garlic and onion extracts on physical characters (cluster weight and size), number of berries per cluster, weight of 100 berries and chemical berries characters (T.S.S, total acidity, reducing sugars) was mainly attributed to its positive action on enhancing growth parameters (Table 1) .Concerning the effect on T.S.S. and acidity in berries, the results showed that all treatments increased T.S.S. significantly and decreased the total acidity. This increase in T.S.S. may be due to the increase in synthesis of carbohydrates and its accumulation in the developing fruits of the treated trees. In this connection. Boghdadi (1964) mentioned that sugars represented about 70% of the total soluble solids (T.S.S) in apple fruits and the increase in sugars lead to increase in T.S.S. He also added that the increase in cellular sap lead to decrease in acidity as a result of dilution of the organic acids. Moreover, Mann and Singh (1990) on pear, found that the increase in T.S.S. may be due to rapid conversion of starch, and the decrease in total acids content with advancement of ripening period may be due to that the acids are converted into soluble solids. In this connection, George *et al.* (1990) suggested that water and nutrients may also be mobilized to the growing points at the expense of the developing fruits.

In view of the aforementioned results, as a substitution of harmful synthetic growth regulators, it has been concluded that the results of this study give an evidence to the role of garlic or onion extract as one of the natural and safety substances in breaking bud dormancy. Thus using garlic or onion extract greatly increased growth and grape yield as well as improved grape quality and its chemical constituents. The constituents of the used substances participate in the different metabolic processes which increased syntheses of carbohydrates, sugars, total free amino acids, and plant hormones so that the use of garlic extract or onion extract could increase grape productivity with high fruit quality.

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تأثير مستخلص كل من الثوم والبصل على تفتح البراعم والنمو والمحصول وصفات الحبات والمحتوى الكيماوي لكرمات العنب صنفى الفليم سيدلس والسوبيريور

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أجرى هذا البحث خلال موسمين متتاليين ٢٠٠٦ و٢٠٠٧م فى تربة رملية طميية بمزرعة التجارب بكلية الزراعة بالفيوم لدراسة تأثير رش كرمات العنب بمستخلصى الثوم والبصل على تفتح البراعم والنمو والمحصول وصفات الحبات والمحتوى الكيماوي لكرمات العنب صنفى الفليم سيدلس و سوبريور. تم رش الكرمات بسبعة معاملات وهى (مستخلص الثوم بتركيز ١٠و١٥و٢٠٪ ومستخلص البصل بتركيز ١٠ و ١٥و٢٠٪) بالإضافة إلى الكونترول (الرش بالماء فقط).

أوضحت النتائج المتحصل عليها بصفة عامة أن كل من صفات النمو (ميعاد تفتح البراعم ونسبة تفتح البراعم) وايضا المحصول/كرمة (كجم) و صفات المحصول (وزن العنقود وطول العنقود وعرض العنقود وعدد العناقيد لكل كرمة وعدد الحبات لكل عنقود ووزن ١٠٠ حبة وطول الحبة و عرض الحبة) والتغيرات الموسمية فى المكونات الكيماوية للبراعم (المحتوى المائى والكربوهيدرات الكلية والسكريات الكلية والمختزلة والأحماض الأمينية الحرة الكلية و الأندولات الكلية والهرمونات النباتية مثل اندول حامض الخليك وحامض الجبريلك) وأيضاً محتوى الحبات من المواد الصلبة الذائبة الكلية والسكريات المختزلة قد زادت نتيجة الرش بالمعاملات المختلفة، وتم الحصول على أعلى القيم للقياسات السابقة عند استخدام مستخلص الثوم او البصل بتركيز١٥ ٪ يلية التركيز٢٠ ٪ وعلى العكس من ذلك أدى الرش باستخدام نفس المعاملات إلى تناقص محتوى الحبات من الحموضة الكلية و محتوى البراعم من الفينولات الكلية و حامض الابسيسيك مقارنة بالكنترول.

وهكذا نوصى باستخدام مستخلص الثوم أو البصل بتركيز ١٥ ٪ رشا على الشجيرات لتحسين تفتح البراعم والنمو الخضري والمحصول والمكونات الكيماوية للبراعم والحبات.