

Breaking Bud Dormancy in "Flame Seedless" and "Superior Seedless" Grapevines Using Natural Extracts as Compared with Hydrogen Cyanamide

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ABSTRACT

This investigation was carried out during two seasons 2017 and 2018 on Flame seedless and superior seedless (*Vitis vinifera* L.) grapevines ten years old, grown in a private vineyard located at El-Beheira Governorate. The study was conducted to evaluate the potential effects of spraying with some natural substances (Garlic extract at 10 and 15% as well as Clove oil at 7 and 10%) as compared to artificial chemical treatment (Hydrogen cyanamide at 2.5%) usually used for breaking bud dormancy. The treatments were applied alone or combined with mineral oil at 2% two times (first week of January and one week later) in both seasons. The obtained results cleared that, the natural substances used, especially Garlic extract at 10 or 15% + mineral oil at 2% are resemble with Hydrogen cyanamide alone or with mineral oil at 2% treatment in hastening bud sprouting, shortening the duration of bud break, enhancing fertility coefficient, improving yield, cluster quality parameters (weight, length and width and berries per cluster), berries physical (weight, dimensions, volume) and chemical (SSC, SSC/acid ratio and anthocyanin contents of Flame seedless) quality parameters of both grapevine cvs. over control. Alternatively, Garlic extract can be used to safety release buds instead of that artificial chemical such as Hydrogen cyanamide.

Keywords: Natural extracts, Garlic extract, Clove oil, Dormex, Flame seedless, Superior seedless.

INTRODUCTION

Delaying bud break of grapes, as well as irregularity, are directly leads to delaying the harvesting time. Also, shorting the Egyptian exporting window and delayed vines entering in dormancy during the following year leads to a number of physiological defects that may affect in weakness and threaten the grapevine productivity. Currently, some chemical for bud break and yield promotion as dormex and thiourea are recommended in grapevines (El-Sawy, 2009 and Hussein, 2009). Hydrogen cyanamide substance is the extensively used to stimulate bud break in vineyards. However, it is extremely toxic, where the Environmental Protection Agency of the United States classifies this substrate in the highly toxic (grade I= highest toxicity category) Botelho *et al.*, (2010). In addition, using bud release synthetic chemicals considered an expensive cost and causes an environmental pollution. Consequently, it has been focused consideration on the foliar treatment of natural extracts as Onion extracts (Rady and Seif El-Yazal, 2013).

In searching for alternative methods, numerous of studies in Japan, Brazil, and California has exposed a positive effect of garlic paste in enhancing bud break in grapevines (Or *et al.*, 1999 and Vasconcelos *et al.*, 2007). In this respect, some of the plant extracts as garlic extract as well as clove oil as natural and safety substances could be used in breaking the dormancy of buds. It can be used as a partial substitute of chemical compounds for breaking the dormancy of buds, where clove oil and garlic extract at 5% from both of them recorded the best results of bud breaking percent, improving yield and quality of Superior grapevines (Ahmed *et al.*, 2014).

Moreover, Aguilaa *et al.* (2015) reported that, Cabernet Sauvignon grapevines treated with garlic extract at 3.0 %, recorded the highest percent of burst buds (63 shoots plant⁻¹), weight and the number of bunches per vine, whoever there were no differences in berry juice SSC%, titratable acidity and pH between garlic extract and Dormex treatments. Also spraying garlic extract on "Niagara Rosada" grapevines showed the similar results as usual treatments with CaCN₂ or H₂CN₂ and it was effective in reducing the time for breaking buds dormancy and the period from winter pruning to harvest moreover, it increased cluster number per vine (Botelho *et al.*, 2010). In the same trend, Corrales *et al.*

(2010) concluded that, garlic extract was effective in four table grape cultivars since it promoted bud breaking and advanced the fruit maturity by about three weeks and resulted in an excellent fruit quality. In addition, Rady and Seif El-Yazal, (2014) reported that, Garlic extract at 150 ml/l spray treatment increased bud break percentage, fruit set, number of fruits and yield of apple trees cv. "Anna" therefore, it can be adopted as a treatment for improving the bud break, growth and yield.

There are several compounds were derived from garlic (*Allium sativum* L.) extract as S-methyl cysteine sulfoxide, dimethyl disulfide, dimethyl trisulfide and dimethyl thiosulfonate (Vargas *et al.*, 2008) and clove oil as eugenol, β -caryophyllene and α -humulene (Jirovetz *et al.*, 2006). These active substances were tested as bud break agents in table grapes (*Vitis vinifera* L.). The volatile compounds from S-methyl cysteine sulfoxide promoted 100% of bud break (Vargas *et al.*, 2008). In the same manner, Kubota *et al.* (1999) reported that, the sulfur compounds isolated from garlic extract encouraged bud break in grapevines and it was associated with changes in sugar and amino acids concentrations.

The positive effect of natural garlic and clove extracts might be due to the active substances occurred in it as sulfur containing compounds (allyl group and mono, di, tri and tetra sulfides), volatiles, tannins, phenols antioxidants, vitamins, amino acids and plant pigments, cysteine acts the most important substrate for the synthesis of all additional organic compounds containing reduced sulphur. Also, cysteine is very important for additional biosynthesis pathways as the formation of GA3 and IAA during dormancy period which surely reflected on terminating bud dormancy (Miyazak and Yang, 1987 and Carvalho *et al.* 2016).

This study aimed to investigate the effect of the Garlic and Clove oil as natural extracts compared to Hydrogen cyanamide on bud behavior, vegetative growth, yield and fruit quality of 'Flame seedless and Superior seedless' grapevines cvs.

MATERIALS AND METHODS

This study was conducted during two successive seasons 2017 and 2018 on two grapevines cv. "Flame

seedless" and "superior seedless" grapevines (*Vitis vinifera* L.) ten years old, grown in a private vineyard located at Markez-Bader, El-Beheira Governorate Egypt. Vines were planted at 2 meters in a row and 3 meters between rows in sandy soil under drip irrigation system. Cane pruning method was adopted and winter pruning was carried out at first week of January leaving 80 eyes (ten fruiting canes x eight eyes) and 96 eyes (eight fruiting canes x twelve eyes) for "Flame seedless" and "superior seedless" vines, respectively with Parron supporting system. The selected vines were healthy and uniform in shape and received the normal cultural practices as recommended by the ministry of agriculture and land reclamation for grapevines. The tested vines of both cultivars were sprayed with Garlic extract at 10, 15%, Clove oil at 7, 10%, Hydrogen cyanamide (H_2CN_2 - dormex) at 2.5% and control (spray with water). All treatments were done alone and combined with mineral oil (MO) at 2%. Eleven treatments were arranged in randomized complete block design each one replicated three times with three vines for both cultivars.

The treatments were:

- T₁- Control (spray with water)
- T₂- Garlic extract at 10% (w/v)
- T₃- Garlic extract at 15% (w/v)
- T₄- Clove oil at 7 % (v/v)
- T₅- Clove oil at 10 % (v/v)
- T₆- Hydrogen cyanamide (H_2CN_2) at 2.5%
- T₇- Garlic at 10%+ 2% (MO)
- T₈- Garlic at 15%+ 2% (MO)
- T₉- Clove oil at 7%+ 2% (MO)
- T₁₀- Clove oil at 10%+ 2% (MO)
- T₁₁- Hydrogen cyanamide (H_2CN_2) at 2.5%+ 2% (MO)

All the selected vines were sprayed two times in the first week of January and one week later using hand sprayer ensuring a thorough wetting of buds. Triton B as a wetting agent at 0.05% was used with all treatments including control.

The Garlic extract was prepared using 150g of fresh peeled cloves of Garlic (*Allium sativum* L.) grinded in a blender then, the dough product was blend again in 0.5L distilled water, filtered and raised to 1L by distilled water to obtain 15% (Kubota and Miyamuki, 1992), the same manner was used for obtaining garlic extract at 10%. The Clove oil concentrations (7 and 10%) were prepared using 5ml isopropyl alcohol as emulsifier and then diluted by distilled water as described by Vargas *et al.*, (2008).

The following parameters were recorded to evaluate the studied treatments:

A-Buds behavior

- 1- **Bud burst% and the duration of bursting** were calculated at the beginning of growing seasons according to Bessis (1960) using the number of burst buds per vine every three days intervals and bud load/ vine data as the following equation:

$$\text{Bud burst \%} = \frac{\text{No. of bud burst per vine}}{\text{Total number of buds per vine}} \times 100$$

- 2- **Coefficient of fertility** was determined as described by Huglin (1958) using the following equation:

$$\text{Coefficient of fertility} = \frac{\text{No. of clusters per vine}}{\text{Total number of buds per vine}} \times 100$$

- 3- **Fruitful buds percentages** were calculated after fruit set using the following equation:

$$\text{Fruitful buds \% (Fruitfulness)} = \frac{\text{No. of fruitful buds per vine}}{\text{No. of bursted buds per vine}} \times 100$$

B-Vegetative growth characters

During each growing season, leaf area (cm²) of the apical 5th and 6th leaves of three shoots per vine was determined according to Ahmed and Morsy (1999).the number of leaves per shoot was counted before summer pruning carried out. Also, the average shoot length (cm) was determined and the coefficient of wood ripening was calculated according to Bouard (1996) using the following equation:

$$\text{Coefficient of wood ripening} = \frac{\text{The length of ripened part per shoot}}{\text{Total shoot length}}$$

D-Yield and cluster quality characters

At harvesting time, when berry juice SSC reached 16-17% according to Tourky *et al.*, (1995), number of clusters per vine was counted, then five clusters per vine were picked randomly for determining average cluster weight (g), length(cm) and width (cm) as well as berry weight (g), length (mm), diameter (mm) and volume (ml). Yield/ vine (kg) was determined (Number of clusters/vine x average cluster weight (g)/ 1000).

C- Berries chemical characters

Berries juice (SSC %) was determined using the hand refractometer apparatus and the titratable acidity (%) (Tartaric acid/100 ml of juice) was estimated according to (A.O.A.C., 1995) also; SSC/ acid ratio was calculated. Berries anthocyanin (mg/100g fresh weight) for "Flame seedless" berries was estimated according to Husia *et al.*, (1965).

Statistical analysis:

The data of both grapevine cultivars were statistically analyzed according to Snedecor and Cochran (1972) uses the M-Stat computer software program as the randomized complete block design. The differences among treatments were compared using LSD at 5%.

RESULTS AND DISCUSSION

A-Bud behavior

1-Bud burst %

Results of Table (1) and Figures (1 and 2) showed that, spraying all natural and chemical treatments two times (first week of January and one week later) after winter pruning increased bud break percentages significantly viruses the control. The use of Garlic extract at 15 and 10% plus mineral oil as well as Hydrogen cyanamide at 2.5% (dormex) with or without mineral oil (T₇, T₈, T₆ and T₁₁) were more effective in this respect. These treatments showed the highest significant bud break percent without significant differences among all of them versus control in both grapes cvs. and seasons. Moreover, these applications accelerated the starting of bud break and reduced the bursting period as compared to control and other treatments. The above four treatments were advanced bud breaking by a week than Garlic extract at 15 and 10% without mineral oil (T₁ and T₂) treatments and by about two weeks than control. These results are true in both grape cultivars and seasons of this study. The behavior of buds treated by the natural treatments, especially Garlic at 10

and 15% encourage for using these substances without loss benefits achieved with dormex. These results are in line with those of El-Sawy (2009) on "Superior seedless" grapevines, Vargas *et al.*, (2008) on grapevines cvs. "Flame Seedless" and "Perlette" and Aguilaa *et al.* (2015) on "Cabernet Sauvignon" grapevines they summarized that, the effect of clove and garlic on bud breaking dormancy in grapevines is reflected to the different active substances occurred in these natural extracts especially sulfur compounds (mono, di, tri and tetra sulfides and allyl group), antioxidants, amino acids, tannins and volatiles which acts as the initiator for different synthesis of the other organic compounds containing reduced sulfur. Moreover, stimulate the biosynthesis of GA₃ and IAA during dormancy period. Moreover, Carvalho *et al.* (2016) they concluded that, the natural Garlic extract (NGE) may be a potential substitute for synthetic growth regulators. The application of NGE at 10 or 15 % with 2% MO enhanced the bud breaking dormancy of 'BRS Cora' and 'BRS Rúbea', grapevines and showing the similar effect as like conventional treatment with H₂CN₂.

2- Fruitful buds %

Data in Table (1) cleared that, the fruitful buds percentages enhanced with all treatments in both grape cultivars as compared with control. The highest percentage was recorded with T₆, T₇, T₈ and T₁₁ with non significant differences among them, since it reached 77.12, 76.84, 77.09 and 77.34 ; and 76.86 , 76.97, 76.82 and 76.72 for "Flame seedless" in both seasons, respectively and 49.52 , 47.05 , 49.27 and 49.74; and 53.95 , 52.12 , 53.04 and 53.90 for "Superior seedless" in both seasons, respectively however, the lowest values was recorded with control (72.03 &71.41; and 40.90 & 42.81 for both seasons and

cultivars, respectively) treatments. It was followed by T₃ and T₁₀ for Flame seedless and T₃ for Superior seedless for both seasons, respectively. These results guide the possibility of using Garlic extract at 10 or 15% plus mineral oil with achieving the same benefits as like conventional treatment (dormex). These results are in line with those of Kubota *et al.* (2000) on "Thompson Seedless" and Abo-ELwafa *et al.* (2016) on "Flame Seedless" grapevines.

3- Coefficient of bud fertility

From the data in Table (1) it could be noticed that, the application of Hydrogen cyanamide (dormex) and natural extracts were effective enhancing the coefficient of bud fertility in both grape cvs. used in this study. The spraying with Garlic extracts at 10 and 15 % plus mineral oil (T₇ and T₈) treatments showed the similar effect as Hydrogen cyanamide at 2.5% alone and combined with mineral oil (T₆ and T₁₁) treatments. These applications recorded the highest significant percentages as compared to control and other treatments. This trend was cleared in both "Flame seedless" and "Superior seedless" grape cvs. during the two study seasons. These results encourage recommendation to use these extracts instead of artificial chemicals. These results agree with those found by Ahmed *et al.* (2014) stated that, natural materials (Turmeric at 5%, Cinnamon at 10%, Ginger at 10%, Colocynth at 5%, Nigella at 5%, Olive at 5%, Clove at 5% , Garlic at 5% , Red Chellies at 5% and Coffee at 10%) and chemical rest breakages agents (H₂O₂ at 10%, Salicylic acid at 5 to 10%, Thiourea at 2 to 8% and Dormex at 1 to 6%) were very effective in release bud dormancy, enhanced fruiting buds, hastening maturity and improving the yield and quality of Superior grapevines over the check treatments.

Table 1. Effect of Garlic extract, Clove oil and Hydrogen cyanamide spraying on bud break, fruitful buds and coefficient of fertility of "Flame seedless" and "Superior seedless" grapevines cvs. during 2017 and 2018 seasons.

Treatments	Bud burst (%)		Fruitful buds (%)		Coefficient of fertility	
	2017	2018	2017	2018	2017	2018
	Flame seedless					
T ₁	79.45	80.67	72.03	71.41	0.42	0.41
T ₂	90.16	91.22	75.30	76.09	0.46	0.47
T ₃	93.95	93.22	76.57	76.35	0.48	0.50
T ₄	83.92	82.03	72.95	72.21	0.44	0.45
T ₅	84.33	85.64	72.94	73.03	0.46	0.44
T ₆	96.37	96.81	77.12	76.86	0.53	0.57
T ₇	95.06	96.19	76.84	76.97	0.52	0.56
T ₈	96.95	97.11	77.09	76.82	0.53	0.56
T ₉	86.44	87.24	73.82	74.14	0.46	0.45
T ₁₀	88.11	89.11	74.64	75.20	0.45	0.46
T ₁₁	96.64	96.91	77.34	76.72	0.53	0.56
L.S.D at 5%	1.077	1.228	1.445	1.191	0.082	0.054
	Superior seedless					
T ₁	71.03	75.40	40.90	42.81	0.31	0.32
T ₂	79.31	82.15	44.23	48.27	0.36	0.34
T ₃	80.78	83.26	45.21	49.84	0.37	0.36
T ₄	72.48	77.67	41.84	43.62	0.34	0.34
T ₅	73.69	78.86	42.16	44.34	0.34	0.35
T ₆	83.69	86.87	49.52	53.95	0.39	0.40
T ₇	84.68	85.61	47.05	52.12	0.39	0.39
T ₈	83.56	86.72	49.27	53.04	0.39	0.40
T ₉	75.06	79.91	43.07	45.40	0.35	0.34
T ₁₀	77.36	81.64	43.46	46.11	0.36	0.36
T ₁₁	83.78	86.70	49.74	53.90	0.39	0.40
L.S.D at 5%	1.094	1.354	1.108	1.595	0.059	0.060

T₁= Control, T₂=Garlic ext. at 10%, T₃=Garlic ext. at 15%, T₄=Clove oil at 7%, T₅=Clove oil at 10%, T₆=H₂CN₂ at 2.5%, T₇=Garlic ext. at 10%+2% MO, T₈=Garlic ext. at 15%+2% MO, T₉=Clove oil at 7%+2% MO, T₁₀=Clove oil at 10%+2% MO and T₁₁=H₂CN₂ at 2.5%+2% MO.

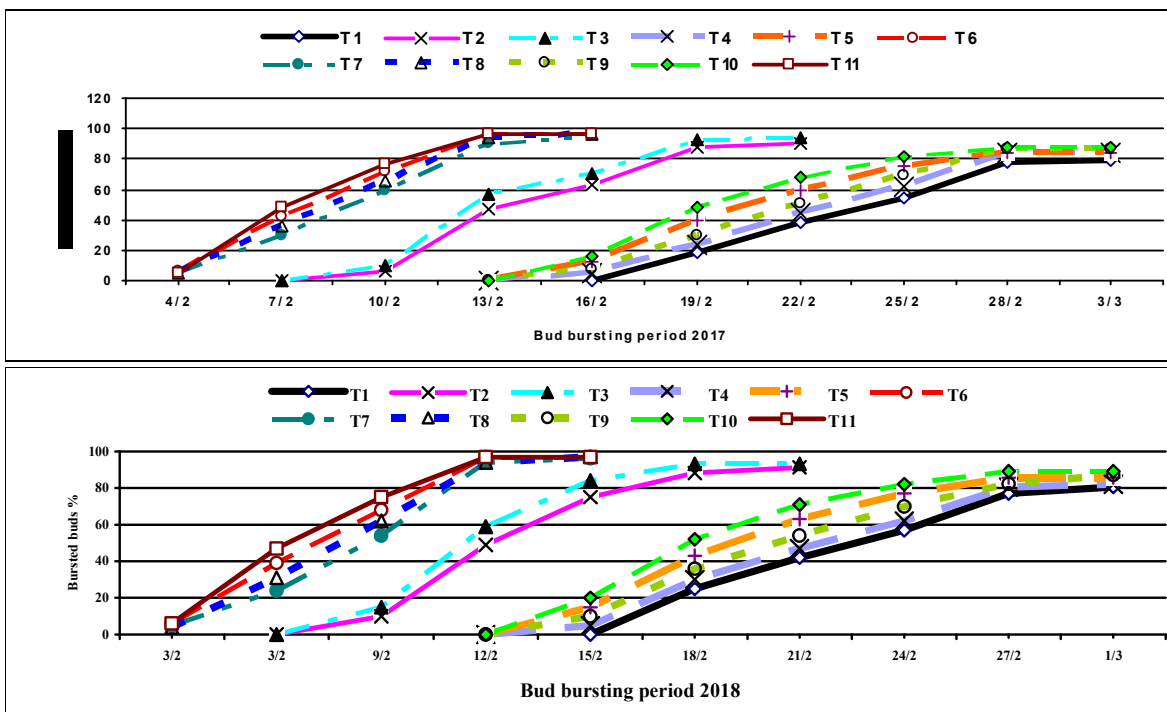


Figure 1. Effect of Garlic extract and Clove oil as compared with Hydrogen cyanamide on bud release of "Flame Seedless" grapevines during 2017 and 2018 seasons
 T₁= Control, T₂=Garlic ext. at 10%, T₃=Garlic ext. at 15%, T₄=Clove oil at 7%, T₅=Clove oil at 10%, T₆=H₂CN₂ at 2.5%, T₇=Garlic ext. at 10%+2% MO, T₈=Garlic ext. at 15%+2% MO, T₉=Clove oil at 7%+2% MO, T₁₀=Clove oil at 10%+2% MO and T₁₁=H₂CN₂ at 2.5%+2% MO.

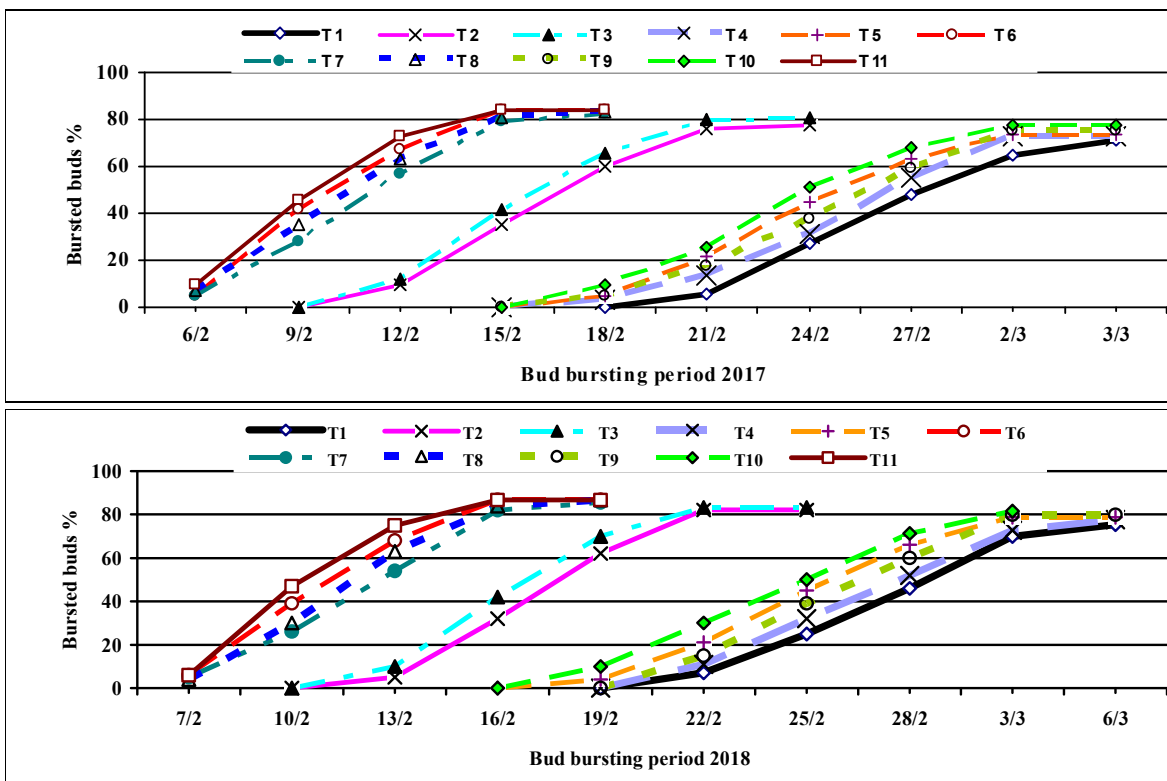


Figure 2. Effect of Garlic extract and Clove oil as compared with Hydrogen cyanamide on bud release of "Superior seedless" grapevines during 2017 and 2018 seasons
 T₁= Control, T₂=Garlic ext. at 10%, T₃=Garlic ext. at 15%, T₄=Clove oil at 7%, T₅=Clove oil at 10%, T₆=H₂CN₂ at 2.5%, T₇=Garlic ext. at 10%+2% MO, T₈=Garlic ext. at 15%+2% MO, T₉=Clove oil at 7%+2% MO, T₁₀=Clove oil at 10%+2% MO and T₁₁=H₂CN₂ at 2.5%+2% MO.

B- Vegetative growth characters:

From the data illustrated in Table (2), it is evident that, subjecting "Flame seedless" and "Superior seedless" vines to all natural (T₂, T₃, T₄ and T₅) extracts and Hydrogen cyanamide (T₆) alone or combined with mineral oil at 2% (T₇, T₈, T₉, T₁₀ and T₁₁) as bud releasing treatments significantly enhanced different vegetative growth parameters in terms of leaf area, shoot length, number of leaves per shoot and wood ripening coefficient over control. The vines sprayed with (T₆) alone or combined with mineral oil (T₁₁) recorded the highest significant values of leaf area, shoot length, number of leaves per shoot without significant differences between

them. It was followed in descending order by application of Garlic extract at 15% + mineral oil at 2% (T₈), Garlic extract at 10% + mineral oil at 2% (T₇), Garlic extract at 15% (T₃) and Garlic extract at 10% (T₂), respectively. However all spray treatments (natural extracts and chemical at different concentrations) recorded the highest significant values of wood ripening coefficient over the untreated vines (T₁) which recorded the lowest values. These results were similar in "Flame seedless" and "Superior seedless" grapevines throughout both study seasons. These results might due to the effect of those treatments in encouraging the buds to open prematurely, allowing a longer growing season.

Table 2. Effect of Garlic extract, Clove oil and Hydrogen cyanamide spraying on some vegetative growth parameters of "Flame seedless" and "Superior seedless" grapevines during 2017 and 2018 seasons

Treatments	Leaf area (cm) ²		Number of leaves per shoot		Shoot length (cm)		Wood ripening coefficient	
	2017	2018	2017	2018	2017	2018	2017	2018
Flame seedless								
T ₁	104.14	108.26	24.84	22.05	134.09	125.13	0.85	0.87
T ₂	132.11	129.96	30.68	29.97	151.82	149.25	0.95	0.96
T ₃	138.85	135.72	32.60	31.12	163.54	154.68	0.96	0.96
T ₄	111.68	114.42	25.71	23.55	137.67	131.29	0.93	0.94
T ₅	115.82	118.08	26.82	24.66	142.06	136.64	0.93	0.95
T ₆	154.51	155.26	38.10	36.88	201.25	194.56	0.96	0.96
T ₇	143.02	139.85	34.14	32.26	170.56	158.54	0.96	0.96
T ₈	149.15	146.27	36.96	33.88	183.94	163.02	0.96	0.96
T ₉	120.75	119.72	27.29	26.91	145.19	140.12	0.93	0.94
T ₁₀	127.91	124.42	29.21	28.21	147.95	145.45	0.94	0.95
T ₁₁	153.96	156.48	39.46	37.50	202.31	195.43	0.96	0.96
L.S.D at 5%	3.808	3.181	1.589	1.477	2.086	1.866	0.076	0.054
Superior seedless								
T ₁	108.77	102.73	20.17	21.00	93.93	98.73	0.74	0.75
T ₂	129.72	141.50	24.73	26.65	116.23	126.53	0.93	0.90
T ₃	135.43	147.48	26.33	27.37	122.03	132.47	0.95	0.92
T ₄	114.83	113.43	23.50	22.63	95.33	102.27	0.81	0.83
T ₅	115.93	118.40	22.48	22.58	97.93	110.60	0.80	0.85
T ₆	151.13	162.53	30.97	30.83	141.57	155.33	0.95	0.95
T ₇	139.73	153.63	27.86	28.00	129.73	138.00	0.94	0.94
T ₈	144.30	158.88	28.75	29.33	134.67	143.87	0.93	0.95
T ₉	119.57	123.83	22.17	23.58	100.10	116.97	0.82	0.87
T ₁₀	124.43	132.35	23.18	24.86	106.50	120.63	0.85	0.89
T ₁₁	153.18	166.73	30.67	31.59	142.23	154.87	0.94	0.96
L.S.D at 5%	2.086	2.950	1.286	1.204	0.762	0.675	0.061	0.073

T₁= Control, T₂=Garlic ext. at 10%, T₃=Garlic ext. at 15%, T₄=Clove oil at 7%, T₅=Clove oil at 10%, T₆=H₂CN₂ at 2.5%, T₇=Garlic ext. at 10%+2% MO, T₈=Garlic ext. at 15%+2% MO, T₉=Clove oil at 7%+2% MO, T₁₀=Clove oil at 10%+2% MO and T₁₁=H₂CN₂ at 2.5%+2% MO.

These results are in harmony with those of Kubota and Miyamuki (1992) and Ahmed *et al.* (2014) who reported that, application of natural extracts (Garlic at 5 % and, Clove oil at 5%) as bud breakages treatments were effective in enhancing different vegetative growth parameters such as leaf area, number of leaves per shoot and mean shoot length of "Superior seedless" grapevines.

C- Cluster characters and yield

1- Cluster weight, number and yield/ vine

Data presented in Table (3) cleared that, spraying natural extracts (Garlic extract at 10 and 15 % and clove oil at 7 and 10%) as well as Hydrogen cyanamide alone (T₆) or combined with mineral oil (T₁₁) as bud breakage treatments increased significantly both cluster weight and yield per vine of the two grapevines cvs. versus control in both seasons. Using Garlic extract at 15 % and Hydrogen cyanamide at 2.5% plus mineral oil at 2% recorded the highest significant values of the above mentioned

characters followed in deciding order by Hydrogen cyanamide at 2.5% alone (T₆) however, Garlic extract at 10% plus mineral oil at 2% (T₇) came at the third order and has surpassed other natural extracts treatments. On the other hand control treatments showed the lowest values. This trend was cleared in the two grapevines cultivars and during both seasons. As for cluster number, Flame seedless vines sprayed by Garlic extract at 15% (T₃) in both seasons followed by vines sprayed with T₇ in the first season and T₂ in the second one. However, vines treated by T₆, T₈ and T₁₁ in the first season and that received T₈ and T₁₁ in the second one. These results are in line with those of Abd El-Razek *et al.* (2011) and Ahmed *et al.* (2009) they concluded that, the using of Garlic extract and mineral oil as bud release treatment was very effective in breaking bud dormancy, improving the yield and fruit quality of Peach (*Prunus persica*) trees cv. over the check treatments.

Table 3. Effect of Garlic extract, Clove oil and Hydrogen cyanamide spraying on cluster weight and yield per vine of Flame seedless and Superior seedless grapevines during 2017 and 2018 seasons

Treatments	Cluster weight (g)		Cluster number (No.)		Yield/vine (Kg)	
	2017	2018	2017	2018	2017	2018
	Flame seedless					
T ₁	322.33	359.33	35.93	33.73	11.58	12.12
T ₂	395.00	401.33	35.42	36.95	13.99	14.83
T ₃	412.00	432.33	36.50	36.31	15.04	15.70
T ₄	360.00	375.33	33.08	34.74	11.91	13.04
T ₅	371.00	380.67	33.37	35.49	12.38	13.51
T ₆	440.00	465.00	36.00	35.01	15.84	16.28
T ₇	428.00	445.33	36.26	35.88	15.52	15.98
T ₈	467.33	497.00	35.01	34.45	16.36	17.12
T ₉	373.00	381.00	34.32	36.25	12.80	13.81
T ₁₀	384.67	387.33	34.06	36.38	13.10	14.09
T ₁₁	470.67	502.33	34.99	33.86	16.47	17.01
L.S.D at 5%	7.989	7.226	2.562	2.101	0.274	0.211
	Superior seedless					
T ₁	356.00	341.00	23.54	26.77	8.38	9.13
T ₂	394.67	382.33	24.86	26.94	9.81	10.30
T ₃	401.33	390.67	25.42	27.77	10.20	10.85
T ₄	367.33	354.67	23.77	26.48	8.73	9.39
T ₅	373.00	361.67	23.89	26.57	8.91	9.61
T ₆	415.33	404.67	28.44	29.09	11.81	11.77
T ₇	408.33	399.33	25.79	28.17	10.53	11.25
T ₈	434.67	417.67	28.78	31.75	12.51	13.26
T ₉	379.33	369.33	24.07	26.81	9.13	9.90
T ₁₀	385.67	376.00	24.37	25.96	9.40	9.76
T ₁₁	432.00	419.33	29.24	31.76	12.63	13.32
L.S.D at 5%	4.523	5.399	2.621	3.520	0.253	0.234

T₁= Control, T₂=Garlic ext. at 10%, T₃=Garlic ext. at 15%, T₄=Clove oil at 7%, T₅=Clove oil at 10%, T₆=H₂CN₂ at 2.5%, T₇=Garlic ext. at 10%+2% MO, T₈=Garlic ext. at 15%+2% MO, T₉=Clove oil at 7%+2% MO, T₁₀=Clove oil at 10%+2% MO and T₁₁=H₂CN₂ at 2.5%+2% MO.

2-Cluster length, width and berries/cluster

Data in Table (4) clear the enhancement effect of dormex and natural substances used as bud breakage treatments on cluster quality characters of both Flame seedless and Superior seedless table grapes as compared to control. Vines sprayed by Hydrogen cyanamide at 2.5% + mineral oil at 2% (T₁₁) showed the highest cluster length followed by the same dormex concentration without mineral oil (T₆) treatment. But vines sprayed by Garlic extract at 15 % plus mineral oil at 2% (T₈) came at the third degree followed by Garlic extract at 10 % plus mineral oil at 2% (T₇) however, vines of control (T₁) recorded the lowest values. Regarding cluster width, the same Table (4) cleared that, vines sprayed with dormex at 2.5% regardless mineral oil (T₆ and T₁₁) recorded the highest significant cluster width followed in descending orders by vines sprayed with T₈, T₇, T₃ and T₂, respectively.

Concerning number of berries per cluster, it could be noticed that, all treatments enhanced the number of berries per cluster, especially Hydrogen cyanamide at 2.5% regardless mineral oil (T₆ and T₁₁) and Garlic extract at 10 and 15 % plus mineral oil at 2%, (T₇ and T₈) which recorded the highest number without significant differences among them, however vines of control showed the lowest number of berries. The abovementioned results were confirmed as for the two grapevines cultivars used in this study during both seasons. These results are in agreement with those of Hassan (2008), Abd El-Wadoud (2010) and Maldonado *et al.* (2010) they summarized that, spraying Garlic extract at 3% on four grapevines cultivars

(Flame seedless, Red Globe, Superior seedless and Perlette) encouraging bursting buds about three weeks after application and produced the highest number of cluster and cluster weight.

D- Berry physical characters

Berries weight, length, diameter and volume

Data listed in Table (5) cleared that, the different berries quality parameters of both Flame Seedless and Superior seedless table grape were greatly affected by the application of chemical and natural substances in both seasons. Berry weight, length, diameter and volume increments were more pronounced in vines sprayed with Hydrogen cyanamide at 2.5% with or without mineral oil (T₆ and T₁₁) and Garlic extract at 10 and 15% plus mineral oil at 2% (T₇ and T₈) with non-significant differences among them followed increased order recorded with Garlic extract at 10 and 15% alone (T₂ and T₃) treatments. However, control (T₁) vines showed the lowest values of all abovementioned characters. This trend was true during 2017 and 2018 seasons in both grape cvs. The enhancement effect of both Hydrogen cyanamide and Garlic extracts on berries quality parameters might due to the effect of the both on earliness bud sprouting which gain along growing season that helps for more accumulation of carbohydrates. These results are in harmony with those of Abo-EL Wafa *et al.* (2016) and Maldonado *et al.* (2010) they concluded that, vines of Flame seedless, Red Globe, Superior seedless and Perlette treated with Garlic extract at 3% enhancing different cluster quality and produced the highest berry length and diameter.

Table 4. Effect of Garlic extract, Clove oil and Hydrogen cyanamide spraying on yield and cluster parameters of "Flame seedless" and "Superior seedless" vines during 2017 and 2018 seasons

Treatments	Cluster length (cm)		Cluster width (cm)		Berries/cluster (No.)	
	2017	2018	2017	2018	2017	2018
	Flame seedless					
T ₁	20.07	21.33	17.84	18.00	127.9	116.6
T ₂	24.67	25.00	20.73	20.62	131.0	129.9
T ₃	25.53	27.33	21.83	21.84	133.5	131.8
T ₄	21.67	22.67	19.00	18.60	133.4	140.8
T ₅	22.67	23.33	19.85	18.91	131.6	131.4
T ₆	32.67	31.33	26.43	24.92	137.5	146.5
T ₇	26.33	27.67	23.33	22.76	138.0	145.8
T ₈	27.00	28.33	24.66	24.18	138.2	146.3
T ₉	23.33	23.67	20.02	19.47	132.6	134.8
T ₁₀	23.83	24.33	20.92	19.90	130.0	140.3
T ₁₁	33.33	35.00	26.67	25.12	138.0	145.1
L.S.D at 5%	0.179	0.163	0.595	0.737	1.703	1.481
	Superior seedless					
T ₁	18.87	20.58	14.50	15.83	119.1	120.2
T ₂	22.69	24.43	16.57	19.68	121.3	122.6
T ₃	21.92	23.72	17.55	19.13	120.9	128.2
T ₄	19.27	21.13	14.80	16.03	121.8	130.2
T ₅	20.23	21.84	15.10	16.75	121.4	130.1
T ₆	26.10	26.92	18.76	22.15	124.6	131.3
T ₇	24.16	25.23	17.85	20.09	123.8	132.0
T ₈	25.50	26.12	18.36	21.28	123.8	131.2
T ₉	21.00	22.15	15.52	17.02	121.4	127.3
T ₁₀	21.63	22.47	15.83	17.55	121.2	124.4
T ₁₁	26.53	26.84	19.03	22.10	127.4	131.0
L.S.D at 5%	0.511	0.466	0.350	0.190	1.961	1.088

T₁= Control, T₂=Garlic ext. at 10%, T₃=Garlic ext. at 15%, T₄=Clove oil at 7%, T₅=Clove oil at 10%, T₆=H₂CN₂ at 2.5%, T₇=Garlic ext. at 10%+2% MO, T₈=Garlic ext. at 15%+2% MO, T₉=Clove oil at 7%+2% MO, T₁₀=Clove oil at 10%+2% MO and T₁₁=H₂CN₂ at 2.5%+2% MO.

Table 5. Effect of Garlic extract, Clove oil and Hydrogen cyanamide spraying on some berry characters of "Flame seedless" and "Superior seedless" grapevines during 2017 and 2018 seasons

Treatments	Berry weight(g)		Berry length(cm)		Berry diameter(cm)		Berry volume(ml)	
	2017	2018	2017	2018	2017	2018	2017	2018
	Flame seedless							
T ₁	2.52	2.28	18.70	20.37	17.00	17.07	2.56	2.77
T ₂	2.96	3.09	21.30	23.80	18.37	18.53	3.04	3.48
T ₃	3.13	3.28	22.83	23.33	19.33	19.10	3.30	3.67
T ₄	2.60	2.54	19.33	21.90	17.63	17.43	2.69	2.75
T ₅	2.67	2.58	20.23	22.20	17.87	17.57	2.74	2.81
T ₆	3.40	3.48	25.20	24.15	22.07	20.23	3.82	3.92
T ₇	3.37	3.39	24.77	23.87	21.73	19.93	3.75	3.75
T ₈	3.38	3.45	25.00	23.90	21.87	20.30	3.88	3.88
T ₉	2.71	2.64	21.47	21.67	17.90	17.53	2.85	3.07
T ₁₀	2.77	2.76	22.87	22.37	18.00	17.83	2.97	3.23
T ₁₁	3.41	3.47	25.17	23.93	22.00	20.17	3.71	3.91
L.S.D at 5%	0.205	0.216	1.143	1.216	0.762	0.865	0.261	0.247
	Superior seedless							
T ₁	2.64	3.22	19.00	20.03	18.37	19.48	2.72	2.91
T ₂	3.22	3.53	23.43	24.30	22.30	23.40	3.33	3.56
T ₃	3.34	3.62	24.43	24.43	23.20	23.60	3.51	3.59
T ₄	2.69	3.32	22.17	21.97	19.78	20.10	2.99	3.00
T ₅	2.85	3.40	21.23	22.03	20.00	21.77	3.06	3.23
T ₆	3.65	3.73	26.03	26.82	24.67	25.03	3.75	3.85
T ₇	3.41	3.67	25.77	27.07	24.40	24.70	3.63	3.93
T ₈	3.66	3.72	26.10	26.77	24.80	24.91	3.74	3.89
T ₉	2.98	3.45	22.10	22.03	20.90	21.80	3.14	3.35
T ₁₀	3.10	3.48	22.40	23.47	21.50	22.20	3.28	3.42
T ₁₁	3.63	3.73	26.13	26.81	24.80	25.10	3.76	3.91
L.S.D at 5%	0.260	0.273	0.826	0.877	0.840	0.964	0.258	0.267

T₁= Control, T₂=Garlic ext. at 10%, T₃=Garlic ext. at 15%, T₄=Clove oil at 7%, T₅=Clove oil at 10%, T₆=H₂CN₂ at 2.5%, T₇=Garlic ext. at 10%+2% MO, T₈=Garlic ext. at 15%+2% MO, T₉=Clove oil at 7%+2% MO, T₁₀=Clove oil at 10%+2% MO and T₁₁=H₂CN₂ at 2.5%+2% MO.

E-Berry chemical characters

1-SSC%

Data presented in Table (6) show the enhancement effect of using natural extracts as bud dormancy release treatments as compared to chemical agent two times (first week of January and one week later) after winter pruning and control. It is clear that, using of Garlic extract at 10 and 15% combined with mineral oil at 2% (T₇ and T₈) as well as Hydrogen cyanamide at 2.5% with or without mineral oil (T₆ and T₁₁) recorded the highest SSC percentages as for both Flame seedless and Superior seedless however, control treatments of both grapevine cultivars recorded the lowest values through 2017 and 2018 seasons. These results are in harmony with the findings of Biazi *et al.*, (2010) and Morsi and Seif El-yazal (2008) they reported that, the use of plant extracts for terminating bud dormancy was very effective in this respect, advanced maturity and enhancing fruit quality of Apple Trees.

Table 6. Effect of Garlic extract, Clove oil and Hydrogen cyanamide spraying on berry chemical characters of "Flame seedless" and "Superior seedless" grapevines during 2017 and 2018 seasons.

Treatments	SSC %		Acidity %		SSC/acid ratio	
	2017	2018	2017	2018	2017	2018
Flame seedless						
T ₁	16.20	16.57	0.57	0.62	28.59	26.72
T ₂	17.02	17.43	0.55	0.53	30.76	32.89
T ₃	17.25	17.64	0.54	0.52	31.94	33.93
T ₄	16.53	17.72	0.53	0.58	31.00	30.55
T ₅	16.51	17.80	0.53	0.55	31.15	32.36
T ₆	18.43	18.53	0.53	0.53	34.77	34.97
T ₇	18.52	18.47	0.54	0.51	34.30	35.97
T ₈	18.25	18.60	0.53	0.52	34.43	35.77
T ₉	16.56	17.60	0.55	0.53	30.11	33.21
T ₁₀	16.77	17.63	0.56	0.53	29.95	33.63
T ₁₁	18.52	18.67	0.53	0.52	34.73	35.90
L.S.D at 5%	0.817	1.259	ns	0.054	1.866	1.597
Superior seedless						
T ₁	16.10	16.25	0.70	0.72	23.11	22.47
T ₂	16.53	16.82	0.67	0.69	24.68	24.38
T ₃	17.33	17.17	0.64	0.66	26.94	26.02
T ₄	16.80	16.93	0.69	0.76	24.23	22.38
T ₅	16.57	16.74	0.71	0.72	23.44	23.36
T ₆	17.87	18.08	0.56	0.55	32.10	32.87
T ₇	17.87	17.85	0.65	0.68	27.49	26.38
T ₈	17.77	17.87	0.58	0.54	30.46	33.09
T ₉	16.53	16.62	0.70	0.71	23.73	23.52
T ₁₀	16.67	16.75	0.68	0.71	24.39	23.70
T ₁₁	17.73	18.03	0.55	0.55	32.05	32.78
L.S.D at 5%	1.060	0.865	ns	0.076	0.781	0.948

T₁= Control, T₂=Garlic ext. at 10%, T₃=Garlic ext. at 15%, T₄=Clove oil at 7%, T₅=Clove oil at 10%, T₆=H₂CN₂ at 2.5%, T₇=Garlic ext. at 10%+2% MO, T₈=Garlic ext. at 15%+2% MO, T₉=Clove oil at 7%+2% MO, T₁₀=Clove oil at 10%+2% MO and T₁₁=H₂CN₂ at 2.5%+2% MO.

2-Berries juice acidity

Data established in Table (6) cleared that, the vines of both table grapes used in this study were affected by using all treatments. The juice acidity was reduced significantly as compared to control. The reduction was more pronounced with Hydrogen cyanamide (T₆ and T₁₁) and Garlic extracts regardless using mineral oil (T₂, T₃, T₇ and T₈). This trend was cleared in the second season only

for both grape cvs. Our results are in line with those of Miele *et al.* (1991) and Ahmed *et al.* (2014) they stated that, spraying Garlic and Clove extracts as bud dormancy release were effective in increase bud breakage percent, enhancing SSC, SSC/ acid ratio and reduced berries juice acidity of Superior seedless grapes.

3-SSC/acid ratio

Data in Table (6) showed the positive effect of different applications used in this study on SSC/acid ratio of berries juice of Flame seedless and Superior seedless grapes. the vines treated with Hydrogen cyanamide at 2.5% (dormex) + mineral oil at 2% (T₁₁) and without adding mineral oil (T₆) as well as that of Garlic extracts at 10 and 15 %+ mineral oil at 2% (T₇ and T₈) showed the highest ratio without significant differences among them. Those were followed by vines treated with Garlic extract at 15 and 10% alone (T₂ and T₃), however vines of control recorded the lowest values.

These results were true during the both seasons and cultivars. These findings are in line with those of Abo-ELwafa *et al.* (2016) and Morsi and Seif El-yazal (2008) they stated that using of Garlic extract at 20% and Onion extract at 20 % were effective in enhancing chemical constituents of apple fruit as TSS and TSS/ acid ratio and decreased total acidity compared to the control.

4-Berries anthocyanin content

Figure (3) showed the effect of Garlic extracts and Clove oil as well as Hydrogen cyanamide at different concentrations used as bud breakage treatments on berries anthocyanin content of Flame seedless grape. It is cleared that, vines sprayed by Hydrogen cyanamide at 2.5% (T₆ and T₁₁), Garlic at 10 and 15% combined with mineral oil 2% (T₇ and T₈) treatments showed the highest values followed by Garlic at 10 and 15% (T₂ and T₃) alone however, vines of control showed the lower concentration in both seasons.

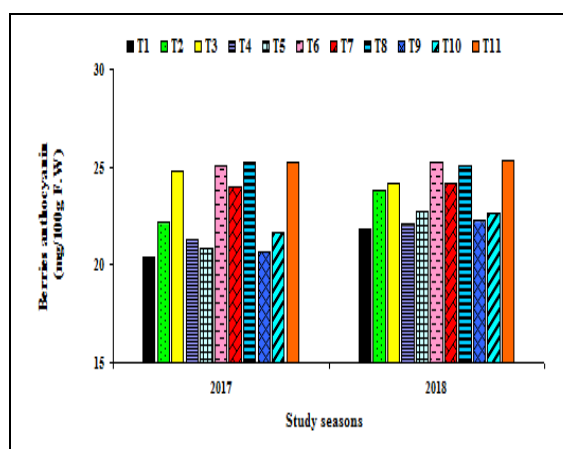


Figure 3. Effect of Garlic extract and Clove oil as compared with Hydrogen cyanamide on berries anthocyanin content of "Flame Seedless "grapevines during 2017 and 2018 seasons

T₁= Control, T₂=Garlic ext. at 10%, T₃=Garlic ext. at 15%, T₄=Clove oil at 7%, T₅=Clove oil at 10%, T₆=H₂CN₂ at 2.5%, T₇=Garlic ext. at 10%+2% MO, T₈=Garlic ext. at 15%+2% MO, T₉=Clove oil at 7%+2% MO, T₁₀=Clove oil at 10%+2% MO and T₁₁=H₂CN₂ at 2.5%+2% MO.

The enhancement effect of spraying with natural extracts and dormex may be due to those effects on encouraging different vegetative growth parameters which increased carbohydrates accumulation Abo-ELwafa *et al.* (2016). These results are in line with those of Sonego *et al.* (2002) and Carvalho *et al.* (2016) concluded that, natural and chemical bud break agents were very effective in hastening maturity and improving the yield and quality of the berries of 'BRS Rúbea' and 'BRS Cora' grapevines.

F- Cost and yield

From the results of this study, the spraying with dormex as well as garlic extract especially at 15% each of them plus mineral oil produced 3.423 and 3.346 ton, respectively in the first season and 3.420 and 3.504 ton over control, respectively of Flame seedless fruits. Also, it showed 2.975 and 2.891 ton, respectively in the first season and 2.891 and 2.933 ton over control, respectively of Superior seedless fruits. These results encourage using Garlic extract especially when taking into account the cost of spraying of dormex reached 1000 and 1300 L.E., however Garlic extract spraying cost 200 and 350 in both seasons respectively.

CONCLUSION

According to the results, using of natural extracts, especially Garlic at 10 or 15% plus mineral oil at 2% two times as bud breaking dormancy treatment in Flame seedless and Superior seedless grape cvs. showed the best results of bud release acceleration, high percentages of bud burst, best vegetative growth, yield, physical characters of cluster and berries showing super effect like dormex as a conventional treatment. So it can be use plant extracts as Garlic extract as natural and safety substances in breaking dormancy of buds with achieving similar benefits as artificial chemicals.

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كسر سكون البراعم في كروم العنب صنفى الفلايم سيدلس والسبيريرور سيدلس باستخدام بعض المستخلصات الطبيعية مقارنة بسيناميد الهيدروجين صا بر سعد بسبوني ومنال جمال محمد ابراهيم قسم بحوث العنب - معهد بحوث البساتين - مركز البحوث الزراعية - الجيزة - مصر

أجريت هذه الدراسة خلال موسمي ٢٠١٧ و ٢٠١٨ وذلك لاختبار تأثير الرش ببعض المستخلصات الطبيعية (مستخلص الثوم بتركيزي ١٠ و ١٥% وزيت القرنفل بتركيزي ٧ و ١٠%) مقارنة بسيناميد الهيدروجين بتركيز ٢.٥%. تم تطبيق هذه المعاملات اما منفردة او مضاف اليها الزيت المعدني بتركيز ٢% و قد تم رش المعاملات بعد التقليم الشتوي مرتين الاولى خلال الاسبوع الاول من شهر يناير والثانية بعد الاولى باسبوع بالإضافة الى معاملة المقارنة (الكنترول) وذلك لدراسة تأثير هذه المعاملات على كسر السكون والاسراع من تفتح البراعم وانتظام التفتح والنمو الخضري وصفات الجودة والمحصول لكروم العنب صنفى الفليم سيدلس والسبيريرور سيدلس عمرها عشر سنوات والمزروعة في تربة رملية على مسافات ٢ x ٣ متر بين الكرمات والصفوف على الترتيب لكلا الصنفين وتروى بنظام الري بالتنقيط مع التدعيم باستخدام الكعايب الاسباني بمنطقة مركز بدر محافظة البحيرة. استخدم نظام التقليم القصبى وتم تثبيت عدد العينين على الكرمات المستخدمة بمعدل ٨٠ و ٩٦ عين للكرمة لكلا الصنفين على الترتيب. اوضحت النتائج ان استخدام المستخلصات الطبيعية خاصة مستخلص الثوم بتركيزات ١٠ او ١٥% مضافا اليها الزيت المعدني كان متساوى مع استخدام سيناميد الهيدروجين منفردا او مضاف اليه الزيت المعدني في التبريد بفتح البراعم و تقصير فترة التفتح وتحسين معامل الخصوبة والمحصول وصفات الجودة العناقيد (الوزن- الطول- العرض- عدد الحبات على العنقود) والحبات (الوزن- الطول- العرض- الحجم) و الصفات الكيميائية (نسبة المواد الصلبة الذائبة- نسبة المواد الصلبة الذائبة/ الحامضية) لكلا صنفى العنب محل الدراسة بالإضافة الى محتوى الثمار من الانثوسيانين في صنف الفليم سيدلس مقارنة بسيناميد الهيدروجين والرش بالماء. ولذا يمكن استخدام مستخلص الثوم بالتركيزات المذكورة كبديل امن للمواد الكيماوية في كسر سكون براعم العنب.