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Effect of Spraying Pota Crastal Compound and Vast Trivalioum Compound on Growth and Nutritional Status of Superior Grapevines

Farouk, H. Abd El-Aziz [1], Mohamed A.M. Abada [2*] and Abd El Hafeez, Sh. Hassan[1]

[1]Hort. Dept. Fac. of Agric. Minia Univ. Egypt.
[2]Viticulture Dept. Hort. Res. Inst. ARC, Giza, Egypt.

*** Corresponding author**
Mohamed A.M. Abada

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Abstract

This study was carried out in three seasons 2019, 2020 and 2021 to examine the effect of spraying Pota crastal or Vast trivolium compounds each at 0.1% either once, twice or thrice on growth and vine nutritional status of Superior grapevines grown under El- Minia region. Application of Pota crastal or Vast trivolium compounds once, twice or thrice each at 0.1% was very effective in enhancing main shoot length, leaf area, wood ripening coefficient, pruning wood weight/ vine, chlorophylls a , b , total chlorophylls, total carotenoids, N, P, K, Mg (as %) Fe, Mn and Zn (as ppm) of superior grapevines over the control treatment.

Using vast trivolium compound was favourable in enhancing some characteristics of vegetative growth and vine nutritional status rather than application of Pota crastal compound. The improvement in the growth characteristics and vine nutritional status was associated with an increase in the number of spraying times from one to three times.

The best results with regard to character growth and vine nutritional status of superior grapevines grown under El- Minia region were observed due to treating the vines three times during each season at growth start, just after berry setting and at one month later intervals with vast trivolium compound at 0.1%.

Keywords*:* Superior grapevines; Pota crastal compound; Vast trivolium compound; berry growth characteristic; vine nutritional status.

Introduction

Superior grapevine cultivar is considered a prime and popular grapevine cv. successfully grown under Egypt conditions. Such cultivar ripens early, sometimes in the last week of May. In addition, it was early in ripening character which reduced competition. In spite of introducing numerous grapevine cvs recently to Egypt, such grapevine cvs is still one of the prime, main, popular and the most profitable grapevine cvs.

Fertilization of grapevines especially with all nutrients at balanced rate is really accompanied by improving growth and nutritional status of the vines. (Fraguas and Silva, 1998).

Supplying various grapevines cvs with their requirements from macro and micronutrients had very beneficial effects on growth and vine nutritional status through enhancing the biosynthesis of plant pigments proteins, carbohydrates, enzymes, fats, vitamins and hormones. (Nijjar, 1985 and Tisdale et al., 1985).

Amino acids, and seaweed extracts plays a definite role in protecting plant cells from senescence and death as well as increasing the plant resistance to various disorders the biosynthesis of organic food, cell division and natural hormones and alleviating the stresses that happened by environmental conditions. (Korabanov, 1977; Samiullah et al., 1988, Elade, 1992; Foyer and Lelandias 1993; Sandermann et al., 1998; and Khan et al., 2003).

This study aimed to throw some light on the effect of compounds Pota crastal and vast trivolium as stimulant compounds containing most macro and micronutrients as well as some antioxidants on growth and vine nutritional status of superior grapevines. Selecting the best number of sprays was responsible for growing the best results regard to growth and vine nutrition.

Materials and Methods

This study was carried out during 2019, 2020 and 2021 seasons on Forty-two uniforms vigour 14- years old Superior grapevines.

The selected vines are grown in a private vineyard located at Al- Howarta village, Minia district, El- Minia Governorate – Egypt.

Where the texture of the soil is clay (Table 1) soil analysis was done according to the procedures outlined by (Chapman and Pratt, 1965 and Black et al., 1965).

The selected vines are planted 2.0 x 3.0 meters apart (700 vines/ fed.) . The chosen vine was trained by cane pruning system leaving 96 eyes/ vine (six fruiting canes x 14 eyes plus six renewal spurs x 2 eyes). Using Gable supporting method, winter pruning was carried out the second week of December in three seasons during the surface irrigation system was followed using Nile water containing 175 ppm EC.

Table (1) Analysis of the tested soil

Constituents	Values
Sand %	6.2
Silt %	19.8
Clay %	74.0
Texture	Clay
pH (1:2.5 extract)	7.98
EC (1: 2.5 extract) (dsm-1) 1cm /25oC	0.93
O.M.%	2.22
CaCO3 %	1.99
Total N %	0.11
Available P (ppm)	3.15
Available K (ppm)	428

Common horticultural practices such as fertilization, twice hoeings, irrigation, pinching and pest management were carried out as usual.

This study included the following seven treatments from application of Pota crastal and Vast trivolium each a 0.1% and frequencies.

Control (untreated vines).

Spraying Pota crastal compound at 0.1% once at growth start (1st week of Mar.)

Spraying Pota crastal compound at 0.1% twice at growth start (1st week of Mar.) and again just at berry setting (1st week of Apr.)

Spraying Pota crastal compound at 0.1% thrice at growth start (1st week of Mar.), again just at berry setting (1st week of Apr.) and one month later (1st week of May).

Spraying Vast trivolium compound at 0.1% once at growth start (1st week of Mar.)

Spraying Vast trivolium compound at 0.1% twice at growth start (1st week of Mar.) and again just at berry setting (1st week of Apr.)

Spraying Vast trivolium compound at 0.1% thrice at growth start (1st week of Mar.), again just at berry setting (1st week of Apr.) and one month later (1st week of May).

Each treatment was of three replicates, two vine per each (42 vines)

Triton B as a wetting agent at 0.05% was added to all Pota crastal and Vast trivolium solutions.

Table (2): Analysis of Pota crastal.

Parameters	Values
Amino acids %	5.0%
Some vitamins %	1.0%
K2O %	36.0%
N %	5.0%
P %	2.0%
Some micronutrients (Zn, Mn, B, Mo and Copalt)	2.0%

Table (3): Analysis of Vast trivolium.

Parameters	Values	Parameters	Values
Amino acids %	3.0%	Mn %	1.0%
Algae seaweed extract %	4.0%	Mg%	2.5%
Total N %	7.0%	Boron %	0.25%
P %	6.0%	Cu %	0.2%
K2O %	7.0%	Si %	0.2%
Fe %	1.5%	Copalt	0.01%
Zn %	1.0%		

Randomized complete block design (RCBD) was adopted for carrying out the statistical analysis of this study (Rangaswamy, 1995).

During three seasons, the following measurements were recorded:

1- Vegetative growth characteristics namely:

- Main shoots length (cm).

-leaf area $(cm)^2$ (Ahmed and Morsy, 1999).

-Wood ripening coefficient (Bourad, 1966).

-Pruning wood weight / vine (kg.).

2- Leaf chemical components namely

- chlorophylls a, b, total chlorophylls and total carotenoids (mg/ 1.0 g F.W.) (Von – Wettstein, 1957).

-Content leaf N, P, K and Mg (as %) Zn, Fe and Mn (as ppm) (Cottenie et al., 1982).

Statistical analysis was done, treatment means were compared using New L.S.D. at 5% (Mead et al., 1993).

Results And Discussion

1-Vegetatieve growth characteristics:

It is clear from the data in Table (4) that applications of compounds Pota crastal or Vast trivolium each at 0.1% once, twice or thrice significantly accompanied by stimulating the main shoot length, leaf area, wood ripening coefficient and pruning wood weight per vine comparing with non-application. The stimulation was associated with increasing compound frequencies. Application of Vast trivolium compounds was superior to the application of Pota crastal compound in enhancing the growth characteristics of the vines. The maximum values of main shoot length (125.5, 126.5 and 128.0 cm), leaf area (111.5, 112.5 and 113.0 cm2); wood ripening coefficient (0.93, 0.94 and 0.95) pruning wood weight (2.82, 2.88 and 2.95 kg) during 2019, 2020 and 2021 seasons respectively were observed on the vines that receive three sprays of Vast trivolium compound. Untreated vines had the lowest value. These results were true during three seasons.

2- Leaf chemical composition:

It is evident from the obtained data in Tables (5 to 7) that the eleven leaf chemical components namely chlorophyll a, chlorophyll b, total chlorophylls, total carotenoids, N, P, K, Mg, Fe, Zn, and Mn were significantly varied among the six compounds Pota crastal or Vast trivolium treatments. They were significantly enhanced by using compounds Pota crstal or vast trivolioum each at 0.1%, relative to the control treatment.

The stimulation was associated with increasing compounds frequencies. Application of Vast trivolium was Superior the application of Pota crastal in enhancing on these leaf chemical components. The maximum values of chlorophyll a (5.3, 5.4 and 5.5 mg/ 1.0 g F.W.), chlorophyll b (2.8, 2.9 and 3.0 mg/ 1.0 g F.W.); (total chlorophylls (8.1, 8.3, 8.5 mg/ 1.0 g F.W.)); total carotenoids (2.2, 2.3 and 2.4 mg/ 1.0 g F.W.), N (1.93, 1.96 and 1.99%); P (0.38, 0.39 and 0.39 %) ; K (1.31 , 11.32 and 1.33%) ; Mg (0.91, 0.92, 0.94%) , Zn (67.8, 68.0, 68.3 ppm) ; Fe (72.8, 73.5, 74.0 ppm) and Mn (73.2, 74.0 and 75.3 ppm) during three seasons, respectively were observed on the vines that received three sprays of compound Vast trivolium at 0.1%.

The lowest values were recorded on untreated vines. These results were true during three seasons.

Discussion

The previous positive of Amino acids, seaweed extracts and Macro and micronutrients on growth, nutritional status of the vines and yield as well as physical and chemical characteristics of berries in different grapevines cvs might be attributed to antioxidative aspects, of these amino acids which play an important role in plant defense against oxidative stress induced by unfavouable conditions. Also, they are responsible for stimulating the biosynthesis of proteins, cytokinins natural hormones like IAA, ethylene and DNA, RNA, cell division, organic food and plant pigments (Vianello and Meric, 1991; Elade, 1992 and Orth et al., 1993).

These beneficial effects are surely reflected in producing healthy vines. The present positive effects of amino acids on growth and nutritional status of the vines of superior grapevines are in agreement with those obtained by (Amin, 2007) on Red Roomy grapevines (Sayed – Heba, 2010) on Thompson seedless grapevines (Abdelaal, 2012) on Thompson seedless grapevines (Mohamed, 2014) and (Akl et al., 2014) on superior grapevines.

The beneficial effects of N, P, K, Mg, Fe, Mn, Zn, B and Co. on growth aspects, nutritional status of the vines, yield and berries quality might be ascribed to their

essential roles in building amino acids, proteins, natural hormones, vitamins, organic acids, various enzymes, organic foods and plant cells. Their positive action on enhancing cell division and the tolerance of the vines to all unfavourable stress could add another explanation (Nijjar, 1985; Mengel and Kirkby, 1987, and Mengel et al., 2010).

The results regarding the effect of macro and micronutrients are in concordance with Flame seedless grapevines those obtained by Abd El- Wahab (2010) on Superior grapevines Ahmed et al., (2011) on Thompson seedless grapevines, Akl et al., (2014) on Superior grapevines Farahat (2017) on early sweet grapevines and Ebrahiem (2017) on Flame seedless grapevines.

The positive action of seaweed extracts applications on growth aspects; nutritional status of the vines and yield as well as berries of quality of Superior grapevines was attributed to the following reasons. It has higher content of some macro and micronutrients as well as vitamins B1, B2, B6, B12 and natural hormones such as IAA, GA3 and cytokinins and some antioxidants (Kannaiyann, 2002 and Irizar-Garza et al., 2003). These results concerning the effect of seaweed extract on promoting growth and fruiting of Superior grapevines are in accordance with those obtained by Seleem – Basma and Abd El- Hameed (2008) and Gad El-Kareem and Abd El- Rahman (2013) on Ruby seedless grapevines , Farag, (2006) ; Abd El- Hameed et al., 2010 ; El Saman, 2010 and Aly- Samar, 2015 on Flame seedless grapevines and Tony, (2016) on Superior grapevines.

Conclusions

Carrying out three sprays of compounds vast trivolium at 0.1% gave the best results with regard to berry set, yield and berries quality of Superior grapevines grown under El Mina- region.

Conflicts of Interest/ Competing interest

All authors declare that they have no conflicts of interest.

Data availability statement

All data sets collected and analyzed during the current study are available from the corresponding author on reasonable request.

Table (4): Effect of spraying pota crastal and vast trivolium on some vegetative growth characteristics of Superior grapevines during 2019, 2020 and 2021 seasons.

Treatments	Main shoot length (cm.)			Leaf area $(cm)^2$			Wood ripening coefficient			Pruning wood weight / vine (kg.)		
	2019	2020	2021	2019	2020	2021	2019	2020	2021	2019	2020	2021
Control (untreated vines)	112.0	113.5	115.0	96.5	98.0	98.5	0.67	0.67	0.68	1.94	1.95	1.95
Spraying pota crastal compound at 0.1% once	115.5	117.0	118.0	99.5	100.0	101.0	0.71	0.72	0.73	2.25	2.30	2.35
Spraying pota crastal compound at 0.1% twice	119.0	120.5	121.0	104.5	105.0	106.0	0.77	0.78	0.79	2.40	2.45	2.48
Spraying pota crastal compound at 0.1% thrice	121.0	122.0	123.0	106.0	107.0	108.0	0.80	0.81	0.82	2.48	2.52	2.60
Spraying vast trivolium	119.5	121.0	122.0	105.0	106.0	107.0	0.79	0.80	0.81	2.45	2.50	2.55

compound at 0.1% once												
Spraying vast trivolium compound at 0.1% twice	124.0	125.5	126.0	109.5	110.0	111.0	0.91	0.92	0.93	2.75	2.80	2.85
Spraying vast trivolium compound at 0.1% thrice	125.5	126.5	128.0	111.5	112.5	113.0	0.93	0.94	0.95	2.82	2.88	2.95
New L.S.D. at 5%	1.3	1.6	1.8	1.1	1.2	1.3	0.03	0.04	0.05	0.09	0.11	0.11

Table (5): Effect of spraying Pota crastal and vast trivolium on photosynthetic pigments in the leaves (mg/ g F.W.) of Superior grapevines during 2019, 2020 and 2021 seasons.

Treatments	**Chlorophyll a (mg/ g. F.W.)**			**Chlorophyll b (mg/ g. F.W.)**			**Total chlorophylls (mg/ g. F.W.)**			**Total carotenoids (mg/ g. F.W.)**		
	2019	**2020**	**2021**	**2019**	**2020**	**2021**	**2019**	**2020**	**2021**	**2019**	**2020**	**2021**
Control (untreated vines)	3.5	3.7	3.8	1.3	1.3	1.4	4.8	5.0	5.2	1.1	1.1	1.1
Spraying pota crastal compound at 0.1% once	4.2	4.3	4.4	1.7	1.8	1.8	5.9	6.1	6.2	1.4	1.4	1.5
Spraying pota crastal compound at 0.1% twice	4.6	4.7	4.8	2.0	2.2	2.3	6.6	6.9	7.1	1.7	1.7	1.8
Spraying pota crastal compound at 0.1% thrice	4.7	4.8	5.0	2.2	2.4	2.5	6.9	7.2	7.5	1.9	1.9	2.0
Spraying vast trivolium compound at 0.1% once	4.5	4.6	4.7	1.9	2.1	2.3	6.4	6.7	7.0	1.8	1.8	1.8
Spraying vast trivolium compound at 0.1% twice	5.1	5.2	5.4	2.6	2.6	2.7	7.7	7.8	8.1	2.1	2.2	2.3
Spraying vast trivolium compound at 0.1% thrice	5.3	5.4	5.5	2.8	2.9	3.0	8.1	8.3	8.5	2.2	2.3	2.4
New L.S.D. at 5%	0.3	0.4	0.5	0.2	0.2	0.3	0.5	0.6	0.7	0.1	0.2	0.2

Table (6): Effect of spraying pota crastal and vast trivolium on percentages of N, p, K and Mg in the leaves of Superior grapevines during 2019, 2020 and 2021 seasons.

Treatments	**Leaf N %**			**Leaf P %**			**Leaf K %**			**Leaf Mg %**		
	2019	**2020**	**2021**	**2019**	**2020**	**2021**	**2019**	**2020**	**2021**	**2019**	**2020**	**2021**
Control (untreated vines)	1.68	1.69	1.69	0.13	0.13	0.14	1.09	1.11	1.11	0.58	0.59	0.60
Spraying pota	1.72	1.73	1.74	0.21	0.22	0.23	1.17	1.18	1.1	0.66	0.67	0.68

crastal compound at 0.1% once												
Spraying pota crastal compound at 0.1% twice	1.77	1.78	1.79	0.28	0.29	0.30	1.21	1.22	1.23	0.75	0.76	0.77
Spraying pota crastal compound at 0.1% thrice	1.79	1.80	1.81	0.30	0.31	0.32	1.23	1.24	1.25	0.78	0.79	080
Spraying vast trivolium compound at 0.1% once	1.77	1.78	1.79	0.29	0.30	0.31	1.20	1.21	1.22	0.76	0.77	0.79
Spraying vast trivolium compound at 0.1% twice	1.89	1.91	1.93	0.36	0.37	0.38	1.28	1.29	1.30	0.86	0.87	0.89
Spraying vast trivolium compound at 0.1% thrice	1.93	1.96	1.99	0.38	0.39	0.39	1.31	1.32	1.33	0.91	0.2	0.94
New L.S.D. at 5%	0.04	0.05	0.06	0.002	0.002	0.003	0.02	0.02	0.03	0.03	0.03	0.03

Table (7): Effect of spraying pota crastal and vast trivolium on Fe, Mn and Zn (as ppm) in the leaves of Superior grapevines during 2019, 2020 and 2021 seasons.

Treatments	Leaf Fe (ppm)			Leaf Mn (ppm)			Leaf Zn (ppm)		
	2019	2020	2021	2019	2020	2021	2019	2020	2021
Control (untreated vines)	53.5	54.0	55.0	55.0	55.8	56.0	48.5	49.0	49.0
Spraying pota crastal compound at 0.1% once	60.0	61.5	62.0	60.8	62.0	62.5	56.2	57.0	57.5
Spraying pota crastal compound at 0.1% twice	65.5	66.5	67.0	66.2	66.9	67.3	61.0	61.5	61.8
Spraying pota crastal compound at 0.1% thrice	68.0	68.5	69.0	68.5	69.0	71.0	62.5	62.8	63.0
Spraying vast trivolium compound at 0.1% once	66.0	66.8	67.5	66.4	67.1	67.8	61.5	61.8	62.0
Spraying vast trivolium compound at 0.1% twice	70.5	71.0	72.5	71.2	72.0	73.0	66.5	66.9	67.2
Spraying vast trivolium compound at 0.1% thrice	72.8	73.5	74.0	73.2	74.0	75.3	67.8	68.0	68.3
New L.S.D. at 5%	1.8	1.9	1.9	1.9	1.9	2.0	1.6	1.7	1.7

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