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Role of Some Nutrients and Yeast Spraying, as well as Girdling and Leaf Defoliation on Fruiting of Early Sweet Grapevines

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Abstract:

The present study was carried out during 2019 and 2020 seasons to study the effect of yeast and landamine$_{Zn}$ spraying as well as girdling and leaf defoliation on yield and berry quality of Early Sweet grapes. The experimental set up in a randomized complete block design, where, the study included seven treatments with three replications one vine each. Yield/vine and cluster weight were significantly increased due to spray yeast or landamine$_{Zn}$ as well as girdling or leaf defoliation compared to untreated one (control). Spraying 4 g/L landamine$_{Zn}$ was very effective in increasing yield and cluster weight than other treatments. Moreover, all studied treatments significantly improved the berry quality in terms of increasing berry weight, reducing sugar total soluble solids and decreasing berry firmness and total acidity compared to untreated ones. No significant differences which obtained due to spray landamine$_{Zn}$ at 2 or 4 cm^3/L, as well as yeast, girdling or leaf defoliation. It could be concluded that spraying 2 to 4 cm^3/L landamine$_{Zn}$ to get high yield with good cluster and berry quality. In addition, to avoid damages arising from girdling and leaf defoliation of Early Sweet grapes.

Keywords: Yeast, nutrients, grapevines, girdling, defoliation and berry quality.

1- Introduction

Grapevines (*Vitis vinifera* L.) production is one of the most valuable and economical fruit crops worldwide. The total world area of grapes reached 10.5 million ha with a total production of 89 million ton fruits (**FAO, 2015**). In Egypt grapes are an economically important crop and cultivated area was 196905 feddan that produced about 1594781 ton of fruits. In addition, grapes are the most important export horticultural crop and the export value is about 10% while the quantity is about 3% of total horticultural export (**MALR, 2019**). Early Sweet cultivar is recognized as an early cultivar in the Egyptian market, hence it has a great importance for the local or international markets. Increasing the demand of grapevines cultivation required developing new strategies to increase the cropping with improve their quality. The increase could be achieved by importing cultural practices (**El-Salhy *et al*., 2010)**.

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Fertilization is an important and limiting factor for growth and productivity of grapevines. Potassium is an essential element for all living organisms and activates enzymes that has main role for photosynthesis and respiration, as well as carbohydrates and proteins biosynthesis (**Salisbury and Ross, 1992 and Leigh, 2001**).

Phosphorus (P) plays important role for the formation of nucleic acids and translocation of carbohydrate and protein synthesis. Deficiency of P clearly appeared in terms of reduce the yield and caused an adverse effect on fruit quality (**Havlin *et al*., 2005**). Zinc is involved in production and function of many enzymes as well as many growth hormones (**Salisbury and Ross, 1992**).

In addition, yeast has high content of mineral particularly, N, P and K, proteins, vitamin B and natural hormone. It might be play an essential role in direction and translocation of metabolites from leaves to the production organs and synthesis of protein, sugars and nucleic acids (**Natio *et al*. 1981 and Ferguson *et al*., 1987**).

Moreover, girdling had been be effective techniques to improve berry quality and advance maturity in wide variety of fruit trees (**Hossain *et al*., 2007**). As well as, leaf removal is a common management practice used in vineyards to regulate the microclimate within canopy, ensure penetration of sunlight to the clusters, remove shading and encourage better aeration of clusters and hence decrease bunch rot by Botrytis and improve berry quality (**Silvia *et al*., 2008 and Cook *et al*., 2015**).

The beneficial effects of potassium, phosphorus, zinc and yeast spraying, in addition girdling and leaf defoliation done on increasing yield and improving berry quality were emphasized by **Omar (2000), Shoaieb (2002), Poni *et al*. (2003), Petrie *et al*. (2003) Saleh *et al*. (2007), Er *et al*. (2009), Cook *et al*. (2015), Chang *et al*. (2015), Belal *et al*. (2017), Noori *et al*. (2018), Gouda *et al*., 2019 and Ahmed-Mona (2020**).

So, the aim of this study was to investigate the benefits of yeast and landamine$_{\mathbf{Zn}}$ spraying as well as girdling and leaf defoliation on fruiting of Early Sweet grapevines.

2- Materials and Methods

This investigation was executed through two successive seasons of 2019 and 2020 on Early Sweet grapevines were seven years old, budded on freedom vine rootstock and grown in sandy soil under drip irrigation system, 50 cm between drips, in private Orchard at Al-Marashdah, Qena Governorate. Vines were trained by cane method using Parron system at 2 x 3 m apart, number of clusters fixed to 25 bunch/ vine. Twenty one vines at almost uniform in their vigor were chosen and divided into seven different treatments including the control.

The seven different treatments were as follows:

1- Control.
2- Spraying with 2 g/L yeast.
3- Spraying with 4 g/L yeast.
4- Spraying with 2 cm^3/L Landamine$_{Zn}$.
5- Spraying with 4 cm^3/L Landamine$_{Zn.}$
6- Girdling arms after berry softening stage.
7- Manual hand defoliation by removed basal leaves.

All spraying treatments and leaf basal remove were carried out after fruit set, while girdling after berry softening stage (Veraison). Landamine$_{\mathbf{Zn}}$ as a nutritious solution that contains 24% potassium (K_2O), 21% phosphorus (P_2O_5) and 1.6% zinc (in chelated form). Girdling was carried out by removing a narrow ring of the bark (2 mm) entirely around the arms.

The experiment was arranged in a randomized complete block design (RCBD) with three replications, one vine per each. The following parameters were determined to evaluate the effects of different treatments on yield and berry quality during the two studied seasons.

At harvest date, the yield of each vine was recorded in terms of weight (in kg). Also, three clusters per each vine were taken at random for determinations the cluster and berry traits such as cluster weight and cluster compactness coefficient. Berry quality such as berry weight, big berry % and berry firmness, as well as total soluble solids %, reducing sugars % and total acidity %. Berry chemical properties were determined according to **A.O.A.C. (1995)**.

The statistical analysis of the present tabulated data was carried out according to **Snedecor and Chocran (1980)**. Averages were compared using the new L.S.D. values at 5% level.

3- Results

1- Yield and cluster traits:

Data presented in Table (1) show the effect of yeast and landamine$_{Zn}$ spraying as well as girdling and leaf defoliation on yield and cluster of Early Sweet grapevines during 2019 and 2020 seasons. It is obvious that, the results took the similar trend during the two studied seasons.

In general view, results declared that use either of landamine$_{Zn}$ or yeast gave the heaviest yield/vine and cluster followed by girdling and leaf defoliation. This is maybe, as the spraying treatments are at the beginning of berry growth stage, while the girdling takes place after berry softening.

The obtained yield/vine values were (6.69, 17.48, 17.01, 17.55, 16.63, 15.96 & 14.77 kg/vine) and cluster weight (667.5, 669.0, 680.5, 701.8, 655.0, 638.0 & 570.7 g av. two studied seasons) due to spray, 2 g/L yeast, 4 g/L yeast, 2 cm^3/L landamine$_{Zn}$, 4 cm^3/L landamine$_{Zn}$, girdling, leaf defoliation and untreated one (control), respectively. Hence, the corresponding increment percentage of yield/vine over control was attained (15.21, 18.35, 15.16, 18.82, 12.59 & 8.06%), respectively.

Table 1. Effect of yeast and landamine$_{Zn}$ spraying and girdling and leaf defoliation on yield and cluster traits of Early Sweet grapevines in 2019 and 2020 seasons.

Treat-ments	Yield/vine (kg)			Cluster weight			Cluster compactness		
	2019	2020	Mean	2019	2020	Mean	2019	2020	Mean
T_1	14.74	14.79	14.77	589.7	591.7	590.7	7.24	7.37	7.31
T_2	16.33	17.04	16.69	653.3	681.7	667.5	6.73	7.37	7.05
T_3	17.48	17.47	17.48	699.3	698.7	699.0	6.80	7.27	7.04
T_4	16.93	17.10	17.01	677.0	684.0	680.5	6.74	7.66	7.20
T_5	17.50	17.59	17.55	700.0	703.7	701.8	7.13	7.53	7.33
T_6	16.67	16.58	16.63	666.7	663.3	655.0	6.74	7.63	7.19
T_7	15.75	16.17	15.96	630.0	646.7	638.3	7.11	7.10	7.11
New L.S.D 5%	0.71	0.36	0.52	28.49	14.26	20.48	NS	NS	NS

T_1: Control, T_2: T_2: 2 g/L yeast, T_3: 4 g/L yeast, T_4: 2 cm^3/L landamine$_{Zn}$, T_5: 4 cm^3/L landamine$_{Zn}$, T_6: Girdling, T_7: leaf defoliation,

Moreover, the results showed that there were no significant effect on the cluster compactness coefficient compared to control, also, non-significant differences between the two concentration used as well as yeast or landamine$_{Zn}$ spraying. Therefore, from an economic point of view, it could be use yeast or landamine$_{Zn}$ at low concentration must be sprayed to produce a high yield/vine.

2- Berry quality:

Data of berry quality as affected by different treatments are presented in Tables (2 & 3). Data indicated that all treatments significantly increased the berry weight and the big berry percentage compared to control. Spraying with 4 cm^3/L landamine$_{Zn}$ gave the heaviest and biggest berries, followed by spraying with 4 g/L yeast as compared to the control and other treatments. The obtained 25 berry weight was (90.8, 93.2, 92.2, 94.8, 90.2, 89.2 & 78.5 g av. of the two studied seasons) due to spray yeast at 2 g/L & 4 g/L, landamine$_{Zn}$ at 2 cm^3/L & 4 cm^3/L, girdling leaf defoliation and control, respectively. Hence the corresponding increment percentage due to use studied treatments over untreated one (control) attained (15.66, 18.73, 17.45, 20.76, 14.90 & 13.63%), respectively.

In addition, all treatments significantly decreased the berry firmness compared to control. Spraying landamine$_{Zn}$ improved the berry firmness compared to spray yeast, then, it could be arranged in descending order as follow (15.06, 14.63, 13.87, 13.63, 12.11 & 11.58, respectively) when vines were treated with 2cm^3/L landamine$_{Zn}$ followed by 4cm^3/L landamine$_{Zn}$, defoliation, girdling & 2gm/L yeast and the lowest at vine was treated with 4gm/L yeast, as compared with untreated vine (16.17). Hence, the decrement percentage of berry firmness attained (25.10, 28.38, 6.86 & 9.25% as av. of the two studied seasons) due to spray with 2 g/L yeast, 4 g/L yeast, 2 cm^3/L landamine$_{Zn}$ or 4 cm^3/L landamine$_{Zn}$ compared to unsprayed ones (control), respectively. Moreover, the results showed that there were no significant differences between the two concentrations used of yeast or landamine$_{Zn}$ as well as girdling or leaf defoliation.

Moreover, the results emphasized the importance of spraying landamine$_{Zn}$ in pre-ripening stage of berries. This treatment leads to production of good appearance clusters with high hardiness berries, which extend the marketing period and increases the price.

Moreover, previous data cleared that all studied treatments significantly increased total soluble solids and reducing sugar and significantly decreased the total acidity in berry juice compared to untreated one (control). So, it could be arranged the obtained TSS values in descending order as follow (16.70, 16.57, 16.08, 15.97, 15.47, 15.35 & 13.67% as an av. of the two studied seasons) due to use 4 cm^3/L landamine$_{Zn}$, 4 g/L yeast, 2 g/L yeast, 2 cm^3/L landamine$_{Zn}$, girdling, leaf defoliation and untreated ones (control), respectively. Hence, the corresponding increment percentage of total soluble solids TSS was attained (22.17, 21.21, 17.63, 16.83, 13.17 & 12.29) due to use treatments compared to untreated ones (control), respectively.

Table 2. Effect of yeast and landamine$_{Zn}$ spraying and girdling and leaf defoliation on berry traits of Early Sweet grapes in 2019 and 2020 seasons.

Treat-ments	Weight 25 berries			Berries firmness (g/cm^3)			Big berries %		
	2019	2020	Mean	2019	2020	Mean	2019	2020	Mean
T_1	80.7	76.3	78.5	16.74	15.61	16.17	93.51	92.74	93.13
T_2	91.7	90.0	90.8	12.42	11.80	12.11	94.94	94.98	94.96
T_3	93.7	92.7	93.2	11.65	11.29	11.58	94.60	95.89	95.24
T_4	92.3	92.0	92.2	15.36	14.77	15.06	95.91	96.64	96.27
T_5	95.0	94.7	94.8	14.84	14.42	14.63	97.49	97.32	97.40
T_6	92.7	87.7	90.2	13.82	13.45	13.63	15.43	15.50	15.47
T_7	89.3	89.0	89.2	14.17	13.57	13.87	15.33	15.37	15.35
New L.S.D 5%	**3.22**	**5.11**	**4.03**	**1.23**	**0.88**	**1.01**	**1.29**	**1.20**	**1.19**

T_1: Control, T_2: T_2: 2 g/L yeast, T_3: 4 g/L yeast, T_4: 2 cm^3/L landamine$_{Zn}$, T_5: 4 cm^3/L landamine$_{Zn}$, T_6: Girdling, T_7: leaf defoliation.

Table 3. Effect of yeast and landamine$_{Zn}$ spraying and girdling and leaf defoliation on TSS, reducing sugars and acidity of Early Sweet grapes in 2019 and 2020 seasons.

Treat-ments	Reducing sugars %			Acidity %			T.S.S.%		
	2019	2020	Mean	2019	2020	Mean	2019	2020	Mean
T_1	10.99	11.08	11.04	0.572	0.522	0.547	13.60	13.73	13.67
T_2	12.98	12.58	12.78	0.455	0.407	0.431	16.10	16.07	16.08
T_3	13.07	12.84	12.96	0.420	0.400	0.410	16.73	16.40	16.57
T_4	12.24	13.19	12.72	0.430	0.398	0.414	15.80	16.13	15.97
T_5	13.36	13.37	13.37	0.415	0.385	0.400	16.87	16.53	16.70
T_6	12.00	12.65	12.32	0.475	0.428	0.452	15.43	15.50	15.47
T_7	12.19	13.10	12.65	0.453	0.452	0.453	15.33	15.37	15.35
New L.S.D 5%	**0.76**	**0.93**	**0.79**	**0.044**	**0.023**	**0.034**	**0.77**	**1.01**	**0.84**

T_1: Control, T_2: T_2: 2 g/L yeast, T_3: 4 g/L yeast, T_4: 2 cm^3/L landamine$_{Zn}$, T_5: 4 cm^3/L landamine$_{Zn}$, T_6: Girdling, T_7: leaf defoliation.

There are no significant differences between the two used concentration of any used materials, as well as spray with landamine$_{Zn}$ or yeast, also, girdling or defoliation done.

Therefore, from economic view, it could be recommended to spray with 2 cm^3/L landamine$_{Zn}$ or 2 g/L yeast which produces early grape berries with good quality.

4- Discussion

In general view, all treatments significantly improved all studied traits in term increased the yield/vine, cluster weight, berry weight and percentage of big berry/cluster and significantly decreased berry firmness and juice acidity compared to untreated ones (control).

In general, 4 cm^3 landamine$_{Zn}$, 4 g yeast and 2 cm^3 landamine$_{Zn}$ gave the best effect in this respect compared to control and other treatments. These results emphasized the importance of landamine$_{Zn}$ spraying those contents of potassium, phosphorus and zinc. These nutrients minerals had positive effect on the growth and nutritional status of vines, thus increasing the yield and improving the cluster traits with good berry quality.

Higher potassium supply increased TSS content and reduced total acidity of berries. Moreover, phosphorus is a major element required by plants for cellular membranes, enzymes and energy **(Havlin *et al*., 2005)**.

Zinc is involved in the production and functioning of many enzymes as well as many growth hormones that lead to stimulation of carbohydrates, proteins and the DNA formation **(Salisbury and Ross, 1992 and Hassan *et al*., 2010)**.

The promotive effect of potassium, phosphorus and zinc using on fruiting of grapevines were emphasized by **El-Shamy and Haggag (1987), Ravi-Kumar *et al*. (1988), Mohamed and Abdel-Aal (2000), Shoaieb (2002), Poni *et al*. (2003), Al-Mashileh and Al-Rayes (2004), Saleh *et al*. (2007), Er *et al*. (2009), Chang *et al*. (2015), Noori *et al*. (2018), El-Badawy (2019), Abou-Zaid and Shaaban (2019) and Ahmed-Mona (2020).** They concluded that using different forms of potassium, phosphorus or zinc spraying had a positive effect on yield and berry quality different grape cultivars.

In addition, the improving effect of yeast application was attributed to auxins, hormones, vitamins, chelating agents and enzyme produced which have stimulatory effects on cell division

and enlargement, nutrient uptake, protein synthesis and improves net photosynthese (**Ferguson *et al*., 1987)**.

The results dealing with the effect of yeast spraying on grapevines fruiting are in harmony with those of **Hassan (2002), Omran and Abdel-Latif (2003), Gasar-Aisha *et al*. (2006), El-Salhy *et al*. (2006), Fawzi *et al*. (2014), El-Halaby *et al*. (2015), Al-Hawezy & Ibrahim (2018) and Radwan *et al*. (2019)**. They concluded that spraying yeast significantly increased the yield/vine, as well as significantly improved of berry quality.

Moreover, girdling and scoring had been be effective techniques to improve berry quality and advance maturity in wide variety of fruit trees. These positive effects are due to accumulate carbohydrates in the parts above girdle and results enhance and hasten ripening (**Takayoshi and Katsutashi, 2006**). In addition, leaf removal is management practice commonly used in vineyards to regulate the microclimate within canopy, ensure penetration of sunlight to the clusters, remove shading and encourage better aeration of clusters (**Petrie *et al*., 2003; Silvia *et al*., 2008 and Cook *et al*., 2015)**.

The results of girdling on improving berry quality of grapevines was supported by many authors such as **Fawzi and Eman (2003), Abd El-Wahab (2006), Abu-Zahra (2010), Soltekin *et al*. (2015) and El-Kenawy (2018)**. As well as, defoliation was obtained by investigators, **Di Lorenzo *et al*. (2011), Diago *et al*. (2012), Palliotte *et al*. (2012) and Feng *et al*. (2015)**.

Conclusion

On the light of the current results, it could be concluded that spraying 2-4 cm^3/L landamine$_{Zn}$ to produce high yield with good cluster and berry quality for local and export markets. In addition, to avoid damages arising from errors of girdling and leaf defoliation.

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