

Effect of Foliar Application and Soil Addition of Licorice and Yeast Extract on:

A- Improving the Growth of Red Globe Grafted Grapevines Seedlings.

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ABSTRACT

The application of some organic materials, Licorice extract, yeast extract alone or in combination with each other as foliar spraying and soil addition with different concentrations 10,15 and 20 g/L was studied on Red Globe grapevines seedlings. The experiment was conducted in the 2015 season and extended for two successive seasons, comprised eleven treatments to improve the quality of grafted seedlings. Results indicated that soil addition in two concentrations 20 g/L and 15 g/L of a mixer of Licorice extract and yeast respectively were the most effective in stimulating all growth characters with a significant effect on leaf area, number of leaves, leaf content of N %, shoot length and diameter and root length and number, followed by the foliar spraying treatments which induced significant increments in all parameters compared to the control.

Keywords: Grapevine seedlings, Licorice extract, Red globe, Yeast extract.

INTRODUCTION

Recently, one of the important developmental phenomena in the growth and survival of seedlings is the formation of adventitious roots at the base of seedlings which involves the initiation of several new meristematic areas in different tissues. As a result, in order to improve the vegetative growth and rooting in grapevine seedlings, a great attention has been focused on the possibility of using natural and safety substances.

Organic fertilizers have been extensively used for this purpose by minimizing the use of chemical fertilizers, improving soil characteristics and for the enhancement of crop production (Ram Rao *et al.* 2007).

Licorice extract and yeast extract were used in this investigation to partly replace some of the chemical fertilizers as they both contain several important compounds useful for plant growth as follow:

• Licorice extract (*Glycyrrhiza glabra*):

It is related to the family Leguminosae, which grows in many countries of the world and contain more than 100 various compounds, the most important of them are glycyrrhizin and phenolic compounds (Shibata 2000; Shabani *et al.* 2009).

Licorice extract is considered as one of the bio-fertilizers rich in many substances such as vitamins, amino acids and growth stimulating photo-hormones which cause the increment of apical meristem tissue activity that in turn led to the occurrence of cell division and elongation (Rawlings *et al.* 1994)

Moreover, it contains many minerals such as iron, potassium and phosphorus as well as saccharides that are absorbed by the leaves during spraying and play an important role in increasing the growth activities and consequently increase the foliar growth (Laroche *et al.* 2001).

The Turbines, such as Glycyrrhizic acid, are also one of those growth stimulants and considered as the first synthesized from Mevalonic, the compound which has similar effect to that GA₃ in the transformation of complex compounds to simple ones can be used by plants to build new proteins (Hardin *et al.* 2000; Aburjai and Natsheh 2003).

In addition, it contains magnesium which has a great effect increasing cell division, foliage growth and some biological plant activities (Moses *et al.* 2002).

• Yeast extract (*Saccharomyces cervisiae*, L.):

Yeast extract positive effect could be due to activating photosynthesis process through increasing the release of carbon dioxide (Larson *et al.* 1962). Moreover, it contains some natural growth regulators, such as auxin (IAA) (Moor 1979). It was also found to enhance the uptake of various nutrients as some amino acids and NPK (Abou-Zaid 1984). It is considered as one of the promising bio-fertilizer for many crops (Gomaa and Mohamed 2007).

The goal of this study was to identify optimal combinations of organic compounds without adversely affecting the shoot and root systems of 'Red Globe' for sustainable grape production. The specific objective was to divulge the influence of different doses yeast and Licorice extracts on all growth parameters of seedlings.

MATERIALS AND METHODS

The present work was conducted during two successive seasons 2015 and 2016 grown under black siran shading house located at the Horticulture Research Institute, Giza, Egypt. Red Globe seedlings grafted on Freedom rootstock grown in polyethylene bags filled with a mixer of sandy soil and peat moss were used in this investigation. Seedlings were irrigated manually with tap water twice a week.

One hundred thirty two seedlings were chosen for this study (11 treatments x 3 replicates x 4 seedlings / replicate).

Eleven organic treatments, eight foliar and two soil additions were applied three times at 15 days intervals (at different phonological stages; starting from shoots having 10-15 cm length) as follow:

- 1- Foliar application of Licorice extract 10 g/L
- 2- Foliar application of Licorice extract 15 g/L
- 3- Foliar application of Licorice extract 20 g/L
- 4- Foliar application of Yeast extract 10 g/L
- 5- Foliar application of Yeast extract 15 g/L
- 6- Foliar application of Yeast extract 20 g/L
- 7- Foliar application of Licorice 15g/L+Yeast extract 15g/L

- 8- Foliar application of Licorice 20g/L+Yeast extract 20g/L
- 9- Soil addition of Licorice15g/L + Yeast extract 15 g/L
- 10-Soil addition of Licorice 20g/L+Yeast extract 20 g/L
- 11- Control (C).

A randomized complete block design was used in this experiment.

1-Physical and chemical characteristics of shoots and leaves:

a-Leaf area (cm²): Samples of leaves were randomly collected from each treatment for leaf area determination, (using leaf area meter, Model CI 203, U.S.A.) when the shoots reached 40-50 cm.

b-Number of leaves/shoot.

c-Leaf content of nitrogen %.

d-Shoot length (cm) and diameter (cm):

2- Physical characteristics of roots:

a-Root length (cm).

b-Root weight (g).

c-Root number.

3- Statistical analysis:

Means representing the effect of the tested treatments were compared by the New L.S.D. method at 0.05 according to Snedecor and Cochran (1980).

RESULTS AND DISCUSSION

1- Physical and chemical characteristics of leaves

a. Leaf area:

Leaf area development is an important characteristic affecting all root parameters of grapevines. Table (1) shows the effect of different treatments on the average leaf area of Red Globe seedlings. It is obvious from the recorded data that there are significant differences among treatments. The highest values were obtained from the treatment of soil addition by a mixer of Licorice extract and yeast 20 mg/L with a significant effect, followed by Licorice extract and yeast 15mg/L, then the combined foliar spraying treatments 20 and 15 g/L respectively which gave the lower values and the least values were obtained from single spraying of yeast 20g/L then the control in

both seasons. The positive effects of licorice may be due to that it contains mevalonic acid which is the initiator in the synthesis of GA 3 acid in plants, therefore spraying the plant with licorice extract improves the vegetative growth. These results are in harmony with those of Shayal Alalam (2009) who found by studying the effect of three concentrations of licorice extract on peach trees that the leaf area increases by increasing Licorice extract. Also these results are in parallel with those obtained by Zabar (2012) and Al- Hadethi *et al.* (2012) on grape and pear transplants respectively. Thanaa *et al.* (2016) found that the combined application of licorice and yeast extract on Almond rootstocks gave the highest significant leaf area.

b. Number of leaves/shoot:

Looking at the effect of both soil addition and foliar application of Licorice extract and yeast extract on the number of leaves, data in Table (1) clearly show that soil addition of Licorice extract and yeast extract 20 g/ L as well 15 g/L significantly increase the number of leaves/ shoot in relative to the foliar applications and the check treatment. Using a concentration of 20 g/ L was superior to using 15 g/ L in improving growth and vine nutritional status. Foliar applications treatments sprayed by Licorice extract 20 g/ L occupied the third position in this aspect and yeast 10 g/L application ranked the last position then the control. The promotion on these parameters was significantly associated with increasing concentration from 10 to 20 g/ L for Licorice and inversely for Yeast extracts; the increasing of concentrations caused harmful effects on the vegetative growth. A slight and insignificant promotion on these aspects was detected among the foliar concentrations of the mixer of Licorice and yeast 15 and 20 mg/L respectively. Yeast positive effect could be ascribed to its benefits in enhancing the release of carbon dioxide which led to activating photosynthesis process (Larson *et al.* 1962). The combined application of licorice root extract increased the number of leaves as mentioned by Thanaa *et al.* (2016).

Table 1. Effect of spraying licorice extract and yeast on leaf area, number of leaves/shoot, Leaf Nitrogen, shoot length and diameter of Red Globe seedlings during 2015 and 2016 seasons.

Treatments	Leaf area (cm ²)		Number of leaves/shoot.		Leaf content of Nitrogen %		Shoot length (cm)		Shoot diameter (cm)	
	1 st	2 nd	1 st	2 nd	1 st	2 nd	1 st	2 nd	1 st	2 nd
	Season	Season	Season	Season	Season	Season	Season	Season	Season	Season
Foliar spraying of Licorice 10 g/L	118.7	120.1	26.2	26.8	1.17	1.20	42.6	41.1	0.52	0.54
Foliar spraying of Licorice 15 g/L	132.6	135.4	30.6	31.0	1.21	1.25	56.6	56.8	0.64	0.62
Foliar spraying of Licorice 20 g/L	139.8	141.6	33.2	33.6	1.24	1.27	67.2	67.6	0.73	0.78
Foliar spraying of Yeast 10 g/L	113.9	115.2	25.0	26.4	1.15	1.16	39.4	40.2	0.47	0.49
Foliar spraying of Yeast 15 g/L	127.2	128.9	28.7	29.9	1.19	1.22	44.0	45.3	0.58	0.58
Foliar spraying of Yeast 20 g/L	85.3	85.8	18.7	19.9	1.05	1.04	28.7	29.5	0.35	0.34
Foliar spraying of Licorice +Yeast (15 g/L)	97.1	101.2	22.1	24.5	1.11	1.12	36.1	37.2	0.44	0.46
Foliar spraying of Licorice + Yeast (20g/L)	91.0	93.5	20.3	21.3	1.09	1.10	29.3	30.4	0.38	0.40
Soil addition of Licorice + Yeast (15 g/L)	142.3	145.4	40.5	42.4	1.30	1.29	83.2	85.0	0.91	0.90
Soil addition of Licorice + Yeast (20 g/L)	158.7	162.1	45.3	46.8	1.36	1.41	90.3	90.9	1.01	1.15
Control	79.1	80.7	12.4	13.0	1.02	1.01	25.5	24.1	0.31	0.39
New L.S.D at 5%	1.30	1.12	0.83	0.75	0.01	0.01	0.13	0.12	0.02	0.01

c. Leaf content of Nitrogen (%):

Concerning the results in Table (1) nitrogen, content in the leaves was significantly affected by all

treatments in both seasons. However, soil addition with licorice extract and yeast extract 20 g/ L as well 15 g/L significantly increased N% content for both seasons,

respectively. On the other side, the yeast extract 20 g/L was the lowest leaf nitrogen content followed by the control or both seasons. This result could be due to the important role of licorice extract that contain a profile of proteins, amino acid and monosaccharide in addition to different types of vitamins (B, C, E) lignins, folic acid and mineral compounds such as sodium, silicone, calcium, iron, aluminum, magnesium, cobalt, potassium, zinc and phosphorus, these substances play an important role in the growth and in increasing the leaf mineral content (Arystanova *et al.* 2001; Vispute and Khopade 2011). These results also were parallel with Al-Hadethi *et al.* (2012) and Abd El -Hamied and El-Amary (2015) who found that spraying pear with licorice extract gave the highest value in leaf nitrogen content.

d. Shoot length (cm) and diameter (cm):

Shoot length and diameter are important quality parameters for table grapes. The mean values of foliar application and soil addition of Licorice extract and yeast extract according to different concentrations are displayed in table (1). From the results of statistical analysis, there are significant differences in shoot length and diameter among the soil addition by a mixer of

Licorice extract and yeast 20 g/L and 15g/L concentrations. However, a mixture of 20 g/L was the most effective in increasing both shoot length and diameter. The results are in coincidence with those obtained by Rawlings *et al.* (1994) who reported that these obtained results may be due to availability of Licorice extract in increasing the activity of apical meristem tissue as it is one of the organic fertilizers rich in vitamins, amino acids and growth stimulating photo-hormones that resulting in cell division and elongation.

2- Physical characteristics of roots

a. Root length (cm):

It is evident from the obtained data in Table (2) that there is a significant stimulation on root length with using soil addition of Licorice extract and yeast extract 20 g/L, rather than the other treatments and the control in both seasons. These obtained results may be ascribed to the yeast content of plant growth regulators such as cytokinins and auxins which promote the cell division and development by inducing the initiation of new vascular tissue (Bonner and Galston, 1952; Rost *et al.* 1984; Raven *et al.* 1992; Salisbury and Ross 1992; Preece and Read 1993).

Table 2. Effect of spraying licorice extract and yeast on the physical characteristics of roots of Red Globe grapevine seedlings during 2015 and 2016 seasons.

Treatments	Root length (cm)		Root weight (g)		Root number (Lateral roots)	
	1 st Season	2 nd Season	1 st Season	2 nd Season	1 st Season	2 nd Season
Foliar spraying of Licorice 10 g/L	25.2	24.3	15.0	16.2	18.3	20.3
Foliar spraying of Licorice 15 g/L	28.0	28.6	20.4	20.3	20.5	24.6
Foliar spraying of Licorice 20 g/L	30.8	29.1	22.4	23.6	21.5	25.5
Foliar spraying of Yeast 10 g/L	24.3	26.2	10.1	11.0	17.7	17.5
Foliar spraying of Yeast 15 g/L	27.4	29.1	18.8	19.4	19.7	20.3
Foliar spraying of Yeast 20 g/L	17.2	16.5	6.5	7.5	14.0	14.5
Foliar spraying of Licorice +Yeast (15 g/L)	22.8	20.3	9.8	9.7	17.3	19.5
Foliar spraying of Licorice + Yeast (20g/L)	20.9	19.6	7.6	7.2	17.0	16.8
Soil addition of Licorice + Yeast (15 g/L)	34.5	35.1	23.2	24.4	22.0	26.9
Soil addition of Licorice + Yeast (20 g/L)	35.3	36.9	25.7	27.6	35.2	30.8
Control	14.1	13.8	5.4	6.9	13.0	14.8
New L.S.D at 5%	0.03	0.02	0.13	0.12	0.01	0.01

b. Root weight (g):

There are significant differences among treatments in root weight as shown in table (2). Soil addition of a mixer of Licorice extract and yeast extract 20 g/ L significantly improved root quality in term of increasing the root weight relative to the other treatments and the control in both seasons. The positive effect of yeast application could be attributed to its content of auxins as mentioned by Köse and Güleriyüz (2006).

c. Root number:

It is clear from the obtained data in table (2) that the maximum root number was gained by the soil addition of a mixer of Licorice extract and yeast extract 20 mg/ L, which significantly affected the number compared to all the other treatments and the control in both seasons. Since auxins found in yeast are the dominant regulator of lateral root development, there is

a tight connection between these types of hormones and root development, as demonstrated by Benkova and Hejatkó (2009); Fukaki and Tasaka (2009).

CONCLUSION

In conclusion, spraying plant extracts of Licorice in combination of some organic extracts such as yeast as a soil addition or foliar application improved both root and shoot system growth of Red Globe grapevines. In particular, the soil addition treatment with licorice roots and yeast extracts (20 g/L) were the best compared to the rest of foliar sprayed treatments in terms of all studied parameters. These natural compounds have the potentiality as alternatives to chemical fertilizers and growth regulators in improving all growth parameters of seedlings.

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تأثير الرش الورقي والإضافة الأرضية لمستخلص العرقسوس والخميرة على:

أ- تحسين النمو لشتلات العنب الرد جلوب المطعومة

فرج محمد المرسي ، ماجدة نجيب محمد عبد الله و سلوى عادل بدرش
قسم بحوث العنب - معهد بحوث البساتين - مركز البحوث الزراعية - الجيزة

تم دراسة تأثير إضافة مستخلص العرقسوس والخميرة منفرداً أو مخلوط رشاً على الأوراق أو إضافة أرضية بتركيز ١٠، ١٥، ٢٠ جم / لتر على النمو الخضري والجذور لشتلات العنب صنف الرد جلوب المطعوم على أصل الفريديم. وقد أجريت التجربة خلال موسم ٢٠١٥ - ٢٠١٦ بإحدى الصوب بمعهد البساتين بم. افظة الجيزة على شتلات عمر عام نامية في أكياس من البولي إيثيلين بها مخلوط من التربة الرملية والبيت موس ، وتروى بماء الصنبور أسبوعياً. واشتملت الدراسة على إحدى عشر معاملة منهم تسع معاملات رش ورقي ومعاملتين إضافة أرضية. وأظهرت النتائج أن الإضافة الأرضية لمخلوط العرقسوس والخميرة بتركيز ٢٠ جم / لتر أعطت أفضل النتائج وأدت الى زيادة مساحة سطح الورقة، وم توأها من النيتروجين، وعدد الأوراق وكذلك طول وقطر الساق أما بالنسبة للمجموع الجذري فأدت الى زيادة طول ووزن وعدد الجذور بالشتلة، ويليها الإضافة الأرضية لمخلوط العرقسوس والخميرة بتركيز ١٥ جم / لتر ثم الرش الورقي مقارنة بالكنترول.