J. Agric. Sci. Mansoura Univ., 30 (4): 2331 - 2338, 2005

EFFECT OF FOLIAR APPLICATION OF YEAST AND UREA ON YIELD AND QUALITY OF THOMPSON SEEDLESS GRAPE (*VITIS VINIFERA* L.) GROWN IN LOAMY SAND CALCAREOUS SOIL

Sharaf, A. I.
Soil and Water Science Department, Faculty of Agriculture, El-Shatby, Alexandria University. Alexandria, Egypt.

ABSTRACT

Two field experiments were carried out during the seasons of 2003 and 2004 at El-Bostan area, Nubaria region. The aim of the study was to investigate the effect of foliar application of yeast extract, urea at two rates (0.5 and 0.75 % urea) and their combinations on yield and quality characters of Thompson seedless grapes (*Vitis vinifera* L.). Foliar application by yeast extract or urea (0.5 %) significantly increased the yield, density of berries per bunch, bunch and berry dimensions, weights of bunch and berry, as well as TSS and TSS/acidity ratio, while the fruit acidity significantly decreased.

Foliar application with yeast extract significantly increased N content of leaves from 0.9 % (untreated plants) to 2.0 %, as well as N content of leaves significantly increased from 0.9 % (untreated plants) to 3.4 % or 3.6 % by foliar application with 0.5 % or 0.75 % urea, respectively. However, foliar application with yeast extract in combination with urea (0.5 % or 0.75 %) was significantly decreased N content of leaves, as compared with urea foliar application alone. Also, foliar application with yeast extract, urea or in combination of both, significantly increased P and K contents of leaves as compared with untreated plants.

INTRODUCTION

Thompson seedless grape (*Vitis vinifera* L.) is one of the most important fruit crops, after citrus, grown in Egypt for local consumption and exportation. Berries are consumed as dessert or as raisin, win or fresh juice.

It is obvious that most, if not all, of the newly reclaimed lands in the western desert in Egypt have the problem of low productivity. Many previous studies revealed that NPK foliar sprays enhanced nutritional status and improved the yield and quality of different plant crops, especially in sandy which are grown in soil which characterized with poor fertility and low water holding capacity (El-Deeb, 1989; and Ibrahim et al., 1993).

Several studies attempted to shift the yield pattern of grapevine by inducing early flowering through the use of growth regulators such as GA_3 (El-Fadaly and Abou El- Hassan, 1986). Recently, there is a possibility of using natural growth substances to regulate plant growth, enhance flowering, and to improve yield and quality of crops. Yeast is a natural biostimulate and is very to safe humans, animals and environment (El-Araby, 2004). It is a natural source of many growth substances (thiamine, riboflavin, niacin, pyridoxine, biotein, cholin, floic acid and vit. B_{12}) and most of nutrients elements (Na, Ca, Fe, Mg, K, P, S, Zn and Si) as well as organic compounds protein, carbohydrate, nucleic acids and lipids (Nagodawithana, 1991). Furthermore, yeast plays a beneficial role in improving the formation of flower initiation due to its effect on carbohydrates accumulation (Winkler et al. 1962).

The objective of this study was to investigate the effect of foliar application with yeast extract or urea, single or in combination, on the yield, leaves nutrient contents and quality characters of Thompson seedless grape.

MATERIALS AND METHODS

Two field experiments were carried out at El-Bostan-Nubaria region to investigate the effect of foliar application of yeast extract and urea on nutrient contents and quality of grape grown in calcareous soil. Representative compost soil samples (0-20) were collected form the experimental field before planting. The soil was air-dried, ground by wooden mortar, passed through 2mm sieve and preserved for analysis. The soil was chemically analyzed for determination of electrical conductivity (EC) in saturated soil water paste extract, pH in 1:2.5 soil water suspensions, organic matter by Walkly and Black method (Page et al, 1982). Available nitrogen was extracted by 2 M KCl solution and N was determined by micro-Kjeldahl method (Page et al, 1982).

The amounts of available P and K were extracted by ammonium bicarbonate-DTPA reagent and P was calorimetrically measured by ascorbic acid/ammonium molybdate method and K was photometrical measured (Page et al, 1982). The amount of total carbonate was measured by calcimeter method (Black, 1982). The soil was physically analyzed for the determination of particle size distribution (sand, silt and clay) and water holding capacity to according to method of (Black, 1982). The results obtained are shown in Table (1).

The experimental layout:

Thompson grapevine cultivar (*Vitis vinifera* L.) was grown in the present study for two successive seasons of 2003 and 2004. Vines were of 10 years old, raised cuttings, trained to the head pruning system and subjected to the normal cultivation practices. Twenty four veins were selected and grouped in 6 treatments with 4 replicates. The foliar application treatments were as follows:

1- Control (sprayed with water at full bloom).
2- Yeast extract (at pre-bloom stage: about 10 days before full bloom, and at full bloom.
3- 0.5 % of urea solution (at pre-bloom and full bloom stage).
4- 0.75 % of urea solution (at pre-bloom and full bloom stage).
5- Yeast extract + 0.5 % urea solution (at full bloom stage).
6- Yeast extract + 0.75 % urea solution (at full bloom stage).

The flower clusters and leaves per each vine were sprayed with two liters of each treatment. The experimental layout was a split-plot design in randomized complete blocks. The unit of plot area was 6 m^2 (2m x 3 m).
Yeast treatments were randomly arranged in the main plots; while, urea rates were randomly distributed in the sub-plots. The yeast extract was prepared by mixing 1 kg of row Baker's yeast with 1 kg sucrose and keeping them in water for fermentation at room temperature (25 ^{0}C) for 24 hrs allowing the release of growth substances, according to the method of Skoog and Miller (1957). This amount was diluted by 200 liters of water to treat one feddan.

Table (1): The main chemical and physical properties of the used soil.

Parameters	Growth Seasons	
	2003	2004
E.C dS m^{-1}	2.17	2.10
pH	8.00	7.80
Available N mg kg^{-1} soil	18.0	20.0
" P " "	2.6	3.8
" K " "	70	108
Total Carbonate %	14	15
Organic Matter %	0.20	0.28
Particle size distribution:		
Sand %	83	
Silt %	11	
Clay %	6	
Soil Texture	Loamy sand	
Water holding capacity %	12.0	

All sub-plots had received the same amounts of P and K fertilizers at the rates of 60 kg P_2O_5 Fed^{-1} as superphosphate (15.5% P_2O_5) and 90 kg K_2O Fed^{-1} as potassium sulphate (48% K_2O). Superphosphate was broadcasted before planting and potassium sulphate was applied in two equal doses: after two months from planting and at blooming stage. The common agricultural practices were carried out as used in the commercial production farms of grapevine. The pre-bloom stages were in 25 April and 20 April during successive both seasons of 2003 and 2004, respectively. The full bloom stages were in 4 May and 1 May of both 2003 and 2004 seasons, respectively.

Leaves of one year old cans, which bore bunches in summer, were collected (two cans per each vine) for the determination of N, P and K. Leaves were washed with tap water then rinsed with distilled water, oven-dried at 70 ^{0}C for 48 hrs, ground and finely using stainless steal mill and digested with H_2SO_4 and H_2O_2 according to the method outlined by Evenhuis and Dewaard (1980).

Fruit set percentage was recorded for 8 clusters treatment. At harvest, samples of 8 bunches per treatment was collected at random to determine bunch length and width (cm), bunch weight (g), number of berries per bunch (density). Total Soluble Solids (TSS) and total acidity in fruit juice were determined by the methods described in A.O.A.C. (1970). The TSS/ acidity ratio was calculated.

The obtained data were subjected to the statistics analysis according to Gomez and Gomez (1976).

RESULTS AND DISCUSSION

As shown in Table 1, the experimental soil is calcareous and contains very low amounts of both available N and P and organic matter. The soil also has low water holding capacity with loamy sand texture. There data indicated that the soil is infertility and requires specific fertilization treatment for improving its fertility.

1- Fruit set and density of berries per bunch:

Tables (2) and (3) indicate that fruit set and number of berries per bunch significant increased by spraying yeast extract alone or yeast extract + 0.5 % urea solutions, compared with those of untreated plants (control), in the two seasons. Also, spraying plants with yeast extract produced a significant increase of number of berries per bunch, in both seasons. The simulative effect of yeast extract on fruit set and number of berries per bunch may be attributed to its contents of bio-constituents such as protein, carbohydrate, Indol Acetic Acid (IAA), Gibberellic Acid (GA_3), Cytokinins (CK) and Abscisic Acid (ABA) as well as in mineral nutrients (Nagodawithana, 1991). Such constituents are known to be involved in cell division, protein and nucleic acid synthesis, and also have promotion to the formation of pollen grains and therefore the fruit set and the number of berries per bunch were increased as reported by Kraig and Haber (1980); and Spencer *el al.* (1983). Similar results were reported on tomato by El-Ghamriny *et al.* (1999) and Tartoura (2001) on pea plants. The co-application treatments (yeast extract + 0.5 % urea) were found to increase the fruit set and number of berries per bunch. This may be attributed to the dominating effect of yeast extract in this respect.

2- Bunch and Berry Dimensions:

Tables (2) and (3) revealed that yeast extract spraying treatments, either alone or with any urea rates, caused significant increase in both bunch and berry dimensions over the control, in both seasons. On the other hand, application of 0.75% urea spray caused a slight decrease in both bunch and berry length and had no effect on their diameters. These indicate the role of yeast extract on improving the quality of both bunch and berries of Thompson grape. These results are in agreement with those reported by Diaz and Maldonado (1992) on Pertetz and Flame seedless grapes.

3- Bunch and Berry Weights:

Tables (2) and (3) showed that there were marked increases of both bunch and berry wrights at all treatments over the control treatment. However, this increase was not significant, in both seasons. The increased weight of berries treated with yeast was more than that of the untreated ones and was connected with growth substances in yeast extract as reported by Nagodawithana (1991). On the other hand, the roles of N, in urea sprays treatments, had promoting effect for increasing the vegetative growth and consequently increasing the weights of both bunch and berry.

4- Total Soluble Solids (TSS) and TSS/acidity ratio:

Tables (2) and (3) showed that the total soluble solids (TSS) and TSS/acidity ratio, in fruit juice, were significantly and positively affected by yeast extract spraying alone or in combination with urea application (0.5 % or 0.75%), as compared with the control. On the other hand, a single application of urea at 0.5 % or at 0.75 % significantly decreased the juice content of TSS than the control. A similar decrease in TSS was also found by Morris *et al.* (1978) with Alar spray application and Forlani *et al.* (1983) with CCC treatments on " Concord " grapevine; and " Gaglioppo" or " Greco Bianco", respectively .

Table (2): Effect of foliar application with yeast extract and urea on yield and quality of Thompson grapevine of season 2003.

Treatments	Fruit Set %	No. of berries/ Bunch	Bunch length (cm)	Bunch width (cm)	Bunch weight (g)	Berry length (mm)	Berry Diam. (mm)	Berry weight (g)	TSS %	Acidity %	TSS/ acidity Ratio
1- Control	26.1	64.3	25.2	11.2	219	16.1	11.2	2.6	10.0	0.70	14.28
2- Yeast spray	48.6	89.2	35.3	16.8	372	21.6	13.2	4.1	12.6	0.60	21.0
3- 0.50 % urea	35.3	74.6	29.2	13.4	263	17.8	12.2	3.4	9.2	0.78	11.79
4- 0.75 % urea	30.4	70.3	28.4	10.0	240	15.2	12.4	3.2	8.3	0.79	10.51
5-Yeast+ 0.50%urea	46.0	85.5	35.1	15.4	378	20.0	13.0	4.3	14.8	.63	23.49
6- Yeast + 0.75 % urea	31.0	72.1	33.8	14.8	243	18.4	12.8	4.2	14.3	.65	22.00
LSD 5 %	5.5	15.1	9.0	3.2	25	3.7	1.4	1.2	0.4	0.05	1.52

Table (3): Effect of foliar application with yeast extract and urea on yield and quality of Thompson grapevine of season 2004.

Treatments	Fruit set %	No. of berries/ Bunch	Bunch length (cm)	Bunch width (cm)	Bunch weight (g)	Berry length (mm)	Berry Diam. (mm)	Berry weight (g)	TSS %	Acidity %	TSS/ Acidity Ratio
1- Control	27.2	65.3	26.5	11.7	217	15.7	11.4	2.5	10.2	0.73	13.97
2- Yeast spray	50.3	92.4	37.3	17.4	381	22.3	13.9	4.3	13.7	0.58	23.62
3- 0.05 % urea	36.1	73.1	30.4	13.8	270	18.8	12.4	3.1	9.0	0.81	11.11
4- 0.75 % urea	32.0	69.5	29.7	10.0	249	14.8	12.6	3.2	8.1	0.85	9.53
5- Yeast + 0.5% urea	47.8	86.8	36.0	15.8	383	21.8	13.5	4.4	15.7	0.65	24.15
6- Yeast + 0.75 % urea	32.2	71.0	34.1	15.0	251	19.0	12.9	4.3	14.0	0.66	21.21
LSD 5 %	5.4	14.5	8.6	3.0	26	3.6	1.2	1.1	0.3	0.04	1.50

5- Leaf Nutrient Contents:

5.1-Nitrogen: Table 4 shows that foliar application with urea significantly increased N content in leaves relative to that of the control. However, increasing urea application rate (from 0.5 % to 0.75 %) did not significantly affect N content in leaves. This point out to those increasing rates of urea foliar application has no significant effects on N content in leaves.

Foliar application of yeast extract significantly increased N content in leaves relative to the control, but this level was significant lower than in leaves sprayed by urea (0.5 % or 0.75 %). It is clear from Table (4) that foliar application with yeast extract and urea mixture significantly decreased N contents as compared with N content in leaves sprayed by urea alone. This point out that yeast extract could inhibit N uptake by leaves when sprayed with yeast extract and urea mixture.

5.2- Phosphorus: Table (4) shows that foliar applications with yeast extract significantly increased the P contents in leaves relative to that of control. This was also found in leaves sprayed by urea (0.5 % or 0.75 %). Foliar application with yeast extract and urea mixture significantly improved P contents in leaves relative to that of control and also to those sprayed with yeast extract alone or with urea alone. These points out that yeast extract improving the levels of P in leaves when applied in combination with urea.

5.3- Potassium: Table (4) shows that foliar applications with yeast extract, with urea (0.5 % or 0.75 %) or in combination of both significantly increased K contents in leaves relative to that of control.

According to Simth *et al.* (1957) it is clear that the values of N and P contents were within the optimum-high level, while that of K was within the low-optimum level.

Table (4): Effect of foliar application with yeast extract and urea on leaf nutrient contents of Thompson grapevine during seasons of 2003 and 2004.

Treatments	Nitrogen %		Phosphorus %		Potassium %	
	2003	2004	2003	2004	2003	2004
1- Control	0.9	1.2	0.11	0.10	0.29	0.27
2- Yeast spray	2.0	1.9	0.43	0.45	0.69	0.68
3- 0.5 % urea	3.4	3.3	0.41	0.35	0.64	0.70
4- 0.75 % urea	3.6	3.5	0.39	0.32	0.54	0.56
5-Yeast+0.5% urea	2.2	2.0	0.68	0.69	0.70	0.72
6-Yeast+ 0.75 % urea	2.3	2.2	0.64	0.65	0.73	0.60
LSD 5 %	0.26	0.25	0.20	0.18	0.18	0.16

REFERENCES

A.O. A.C. (1970) Association of official Agric. Chemists. Official Methods of Analysis (11th ed.) Washington, D.C.

Black, C. A.; Evans, D. D., White , I. I. ; Ensminger, L. E. and Clark, F. F. (1982). Methods of Soil Analysis. Am. Soc. Agron. Inc. Series No. 9 in Agron. Madison, Wisconsin.

Chapman, H. D. and Pratt, P. F. (1961). Methods of analysis for soils, plants and waters. Div. of Agric.. Sci., Priced. Pub., 4034. Univ. of California, U.S.A.

Diaz, D.H. and Maldonado, L.A. (1992). Forchlorfenuron effect on berry size and maturity of pertetz and flame seedless grapes. Proc. Plant Growth Reg. Soc. Am. 19: 123-128.

El-Araby, S.M. (2004). Effect of foliar Application of yeast and Boron on growth, yield potentials and quality characteristics of globe Artichoke (Cynara Scolymus, L.). J. Adv. Agric. Res. Vol. 9(1): 69-85.

El-Deeb, M.D.E. (1989). Studies on the nutritional status of Citrus in some areas of Kaliobia, Ph.D. Thesis, Faculty of Agric. Moshtohir. Zagazig Univ.

El-Fadaly, K.A. & E.A. Abou El-Hassan (1986). Effect of GA, ethrel (Ethaphon) and cycocel (CCC) on the earliness and yield of globe artichoke (Cynara Scolymus L.) Bull. Facu. Agric., Cairo Univ., 37: 357-365.

El-Ghamriny, E.A., H.M.E. Arisha, and K.A. Nour (1999). Studies in tomato flowering, fruit set, yield and quality in summer seasons. 1- spraing with thiamine, ascorbic acid yeast. Zagazig J. Agric. Res., 26(5): 1345-1346.

Evenhuis, B. and P. W. Dewaard (1980). Principles and practices in plant analysis FAO SOIL Bull. 38 (1); 152-163.

Forlani, M.; Ratundo, A. and S.L. Pera (1983). Effect of CCC on the grapevine cultivars Gaglioppo and Greco Bianco. Rivista di viticoltura di Enologia, 36 (12): 555-561.

Gomez, K. A., and A. A. Gomez (1976). Statistical Procedures for Agricultural Research, with Emphasis on Race. International Institute, Los Banos, Philippines.

Ibrahim, T.A.; F.F. Ahmed and K.G. Assy (1993). Behavior of Balady mandarin trees, (*Qutrus* reticulata L.) growing in sandy soil to different forms and concentrations of potassium foliar sprays. Assuit J. of Agric. Sci. vol. 24:3.

Kraig E. and J. E. Haber (1980). Messenger ribonucleic acid and protein metabolism during speculation of *Saecharomyces* cervisiae. J. Bacterial, 144: 1098-1112.

Morris, J.R.; D.I. Gawthon and S E. Spayed (1978). Evaluation of daminozide on concord grapevine of different fruit set potential. Hort. Sci., 13: 696-697.

Nagodawithana, W.T (1991). Yeast technology. Univ. foods corporation Milwaukee, Wisconsin, van nostrand reinhold, New York. 273p.

Page, A. L.; R. H. Miller and D. R. Keeney (Ed.) (1982). Methods of Soil Analysis. Part 2 No. 9 (Part 2) in the series Agronomy Am. Soc. of Agro. Madison, Wis. USDA.

Simth, C. B.; H. K. Flemingand H. J. Poobaugh (1957). The nutritional status of Concord grapevine in Erie Country and Pennsylvania, as indicated by petiole and soil analysis. Proc. Amer. Soc Hort. Sci. 70: 189-196.

Skoog, E and C.O. Miller (1957) Biological action of growth substances. Cambridge Univ. Press Camb. 1997-2000.

Spencer, T.F.T., S.M. Dorothy, and A.R.W. Smith (1983). Yeast Genetics Fundamental and Applied Aspects. Springer-Verlag, New York, USA. pp. 16-18.

Tartoura, E. A. A. (2001). Response of pea plants to yeast extract and two sources of N-fertilizers. J. Agric. Sci. Mansoura Univ., 26 (12): 7887-7901.

Winkler, A.J., J.A. cook, W.M. Kliewer, and L.A. Lider (1962). General Viticulture. Univ. Calif. Press, USA.

تأثير التسميد الورقى بمستخلص الخميرة واليوريا على أنتاج ونوعية محصول العنب البناتى (Vitis vinifera L.) Thompson النامى فى الأرض الرملية الجيرية

أحمد اسماعيل شرف

قسم علوم الاراضى والمياه – كلية الزراعة – جامعة الاسكندرية –الشاطبى– الاسكندرية – مصر.

أقيمت تجربتان حقليتان خلال موسمى ٢٠٠٣/٢٠٠٤ فى مزرعة بمنطقة البستان بالنوبارية لدراسة تأثير التسميد الورقى بمستويين من اليوريا (٠,٥ % ، ٠,٧٥ %) منفردا أو مع رش محلول مستخلص الخميرة، وذلك على أنتاج ونوعية العنب النباتى صنف تومسون Thompson (Vitis vinifera L.).

أوضحت النتائج أن التسميد الورقى بمستخلص الخميرة واليوريا (٠,٥ %) أدى الى تحسين معنوى فى أنتاج وصفات كرمات العنب، حيث أزداد طول وعرض ووزن العنقود وكذلك أزداد ووزن الحبة على العنقود مقارنة بالنباتات الغير معاملة، وكذا أزدادت النسبة المئوية للمواد الصلبة الذائبة الكلية (TSS %)، وايضا ازدادت نسبة المواد الصلبة الذائبة الكلية الى الحموضة (TSS/acidity ratio) بينما أنخفضت النسبة المئوية للحموضة فى العصير.

كما أظهرت أهم النتائج أيضا ان محتوى الأوراق فى النتروجين أزداد معنويا من (٢,٠ %) فى النباتات الغير معاملة الى (٣,٤ %) بينما كان محتوى الأوراق فى النتروجين ٣,٤ % و ٣,٦ % عند الرش باليوريا منفردا بتركيز (٠,٥%) و (٠,٧٥%) على التوالى. وقد أدى الرش الورقى بمستخلص الخميرة واليوريا معا بتركيز (٠,٥%) أو (٠,٧٥%) الى أنخفاض معنوى فى محتوى النتروجين بالأوراق بالمقارنة بالنباتات التى رُشت باليوريا فقط. ومن ناحية أخرى أزداد معنويا محتوى الأوراق فى كلا من الفوسفور والبوتاسيوم عند رش الأوراق بمستخلص الخميرة فقط أو اليوريا عند أى تركيز (٠,٥ % أو ٠,٧٥ %) ، أو الأثنين معا ، بالمقارنة بالنباتات الغير معاملة.

وتحققت أفضل النتائج بصفة عامة عند الرش بمستخلص الخميرة منفردا أو مع ٠,٥ % يوريا.