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EFFECT OF DIFFERENT YEAST DOSES AND TIME OF APPLICATION ON GROWTH, YIELD AND QUALITY OF RUBY SEEDLESS GRAPEVINES

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ABSTRACT

This study was carried out during ٢٠٠٨ and ٢٠٠٩ seasons to investigate the effect of various yeast doses and time of application on vine surface area, yield and quality of Ruby seedless grapes. Three doses of yeast treatments (٣, ٦ or ٩ g/vine/ season) were applied via drench at three dates namely; after bud burst, after fruit set and at four weeks later.

The best effective dose was ٩ g/vine/ season. Application of yeast after bud burst is recommended to ensure the best vegetative growth, while, application after fruit set or four weeks later is recommended to increase the yield and enhance quality of berries i.e. enhancing, TSS/ acid, total sugars content and total anthocyanins content in berry skin.

Biofertilization of Ruby seedless grapevines once with yeast at ٩ g./ vine/ season four weeks after berry setting is essential for improving yield and quality of the berries.

INTRODUCTION

The area of grape (*Vitis vinifera*, L.) increased greatly through the last decades. It reached about (١٦٧٠٤٨) feddans. The fruitful ones are about ١٥٣٩٥٦ feddans with a total annual production of (١٥٣١٤١٨) tons according to the statistics of Ministry of Agriculture and Reclamation in ٢٠٠٩. Ruby seedless grape has been commercially grown since ١٩٨٦ and extensively spread in commercial plantations, particularly in newly reclaimed areas. The berry is deep red in appearance and is very firm and sweet. So, Ruby seedless cultivar is considered as one of the most important grape for jellies, jams, wine, juice making, fresh consumption and production of raisins.

The relationship between grape yield, fruit quality and health seems to be a complex and can be influenced by nitrogen fertilization. Increasing nitrogen supply enhances photosynthesis which means that more sugar is available for growth and fruit quality (Keller, ٢٠٠٥). Whereas, excess of nitrogen supply results in an excessive vegetative growth and shaded canopies which leads to a decrease in yield and producing poor quality fruits.

Recently, a great attention has been focused on the possibility of using natural and safety substances in order to improve plant growth, yield and quality of many crops. Biofertilizers have been extensively used as an eco-friendly approach to minimize the use of chemical fertilizers, improve soil fertility status and for the enhancement of crop production by their biological activity in the rhizosphere (Ram Rao *et al.*, ٢٠٠١).

Yeast (*Saccharomyces cervicisae*, L.) is considered as one of the promising biofertilizer for many crops (Eman *et al.*, ٢٠٠٨).

The positive effect of yeast application could be due to one or more merits: yeast aids in activating photosynthesis process through enhancing the release of carbon dioxide (Larson *et al.*, ١٩٦٢), or/and yeast contains some natural growth regulators, i.e. auxin (IAA) (Moor, ١٩٧٩) and cytokinins (Ferguson *et al.*, ١٩٨١).

Also, the yeast was found to encourage the uptake of various nutrients as N, P and K and some common amino acids (Abou-Zaid, ١٩٨٤). Moreover, soil drench applications of yeast are probably

promoting the uptake of different nutrient elements through modifying pH value of the soil solution towards acidity medium which reflect on yield and its components and fruit quality of various grape cultivars. In this respect, many researchers emphasized the importance of the aforementioned practices for raising yield and hence bunch quality of the vines (EL-Mogy *et al*., ١٩٩٨; Mansour, ١٩٩٨; Amen *et al*., ٢٠٠٠b; Omran, ٢٠٠٠; Esmaeil *et al*., ٢٠٠٣; Gaser *et al*., ٢٠٠٦ and Abd EL-Wahab *et al*., ٢٠٠٨).

Therefore, the main objective of this study was to disclose the influence of different levels from active dry yeast extract and time of application on growth, yield and fruit quality of Ruby seedless grape.

MATERIALS AND METHODS

This investigation was carried out during two successive seasons (٢٠٠٨ and ٢٠٠٩) in a private vineyard located near Gharbia governorate, on nature Ruby seedless grapevines. The vines were ten-years old, grown in a clay loamy soil under surface irrigation system, spaced at ٢ x ٣ meters apart and trained to the bilateral cordon. The vines were pruned during the second week of February with bud load (٤٦ buds/vine) as ٢٣ spurs x ٢ buds. The vines were pruned to spur and trellised according to the telephone system and received the normal cultural practices usually applied in commercial orchard. Ninety uniform vines were chosen and subjected to ١٠ treatments with ٣ replicates, ٣ vines each, and each three replicates were treated with one of the following treatments :

١- Control.
٢- Yeast ٣ g/vine after bud burst.
٣- Yeast ٣ g/vine after fruit set.
٤- Yeast ٣ g/vine ٤ weeks after fruit set.
٥- Yeast ٦ g/vine after bud burst.
٦- Yeast ٦ g/vine after fruit set.
٧- Yeast ٦ g/vine ٤ weeks after fruit set.
٨- Yeast ٩ g/vine after bud burst.
٩- Yeast ٩ g/vine after fruit set.
١٠- Yeast ٩ g/vine ٤ weeks after fruit set.

All treatments were added as soil drench.

Preparation of yeast extract:

The pure dry yeast powder was activated by using sources of carbon and nitrogen with ratio of ٦:١. This ratio is suitable to get the highest vegetative production of yeast, each ml of activated yeast contained about ١٢٠٠٠ yeast cells (Barnett *et al*., ١٩٩٠). Such technique allowed yeast cells to grown multiplied efficiently during conductive aerobic and nutritional conditions. To produce de novo beneficial bioconstituents i.e. phytohormones, carbohydrates, proteins, amino acids, fatty acids, vitamins, enzymes, minerals …etc., hence allowed such constituents to release out of yeast tissues in readily form such technique for yeast preparation based on; ١) nutritional media of glucose and casein as favourable sources of C, N and other essential elements (P, K, Mg, Fe, Mn, Cu, B and Mo as well as Na and Cl) in suitable balance (Barnett *et al*., ١٩٩٠), and ٢) air pumping and adjusting incubation temperature. The media then subjected to two cycles of freezing and thawing for disruption of yeast tissues and releasing their bioconstituents directly before using. The chemical analysis of active dry yeast is shown in Table ١.

Field observations and laboratory measurements:

١- Average leaf area (m^2/vine) : was estimated during the first week of May by picking twenty mature leaves from the fifth and seventh leaves from the shoots tip. The area was measured by using digital planimeter to measure leaf area and then multiply by leaves number/vine to determine the total leaf area/vine (m^2) according to Wettstein (١٩٥٧)

٢- Chlorophyll pigments (mg/g fresh weight) : ten leaves per replicate were collected for the determination of total chlorophyll content (mg/ ١٠٠ g fresh weight).

Table ١: Chemical analysis of the active dry yeast according to Gaser *et al*. (٢٠٠٦).

N	Polysacc-harides	Fats	Fiber	Ash	Thiamin (B ١)	Ribofla-vin (B ٢)	Niacin (B ٥)	Vitamin (B ٦)	Vitamin (B ١٢)
٧.٣%	٣٢.٣%	٣.٥%	١.١%	٦.٧%	٢.٣٣mg	٥.٤١mg	٣٦.٧mg	٤.٤١mg	٠.٠٢mg

At harvest:

- Yield (kg/vine) was estimated considering that the clusters were thinned to ٤٠ clusters/vine.
- Cluster weight (gm).
- Total soluble solids (TSS %) was estimated using hand refractometer, total acidity (as tartaric acid in berry juice) was determined according to the A.O.A.C. (١٩٨٠) and then, TSS/acid ratio was calculated. Total anthocyanin content in berry skin (mg/١٠٠ g fw) was estimated according to Hise *et al*., (١٩٦٥). Total sugar content in berries was determined by Schaffer and Somogy method as described by Ranganna (١٩٧٩).

Statistical analysis :

The data obtained were statistically analyzed as complete randomized block design according to Snedecor & Cochran (١٩٨٠).

RESULTS AND DISCUSSION

Vine surface area:

Data presented in Table ٢ indicate that all yeast applications after bud burst improved the leaf area of Ruby seedless vines compared with the other application dates or the control. Data revealed that the highest significant values were obtained from the application of ٩ g of yeast after bud burst followed by ٦ and ٣ g/vine in this respect amounting to ٢٠.١٥-٢٦.٥٣-٢٩.١٦, ٢٤.٤٣-٢٥.١٩ and ٢٢.٥٤-٢٤.٦٥ m^2/vine in both seasons, respectively. The positive effect of yeast applications on leaf area can be explained by the activation of photosynthesis process through enhancing the release of carbon dioxide (Larson *et al*., ١٩٦٢). Also, yeast contains natural plant growth promoters specially IAA and cytokinins (Moor, ١٩٧٩).

The present results are in line with those obtained by Mansour (١٩٩٨) on Anna apple, El-Mogy *et al*., (١٩٩٨) on Thompson seedless cv., Amen *et al*., (٢٠٠٠a) on King Ruby cv. Omran (٢٠٠٠) and Esmaeil *et al*., (٢٠٠٣) on Roumi Red cv. and Gaser *et al*., (٢٠٠٦) on Flame seedless grape who pointed out that yeast application as foliar or soil

drench significantly increased vegetative growth compared with the untreated vines (control).

Table ٢: Effect of yeast doses and time of application on leaf area and yield during ٢٠٠٨ and ٢٠٠٩ seasons.

Treatment	Leaf area (m^2/vine)		Yield (kg/vine)	
	٢٠٠٨	٢٠٠٩	٢٠٠٨	٢٠٠٩
Control	١٨.٤٥	١٩.٢١	١٨.٠	١٨.٨
Yeast ٣ g/vine after bud burst.	٢٢.٥٤	٢٤.٦٥	١٩.١	١٩.٦
Yeast ٣ g/vine after fruit set.	١٩.٤٠	٢٠.٤٠	٢٠.٠	٢٠.٠
Yeast ٣ g/vine ٤ weeks after fruit set.	١٩.٣٧	٢٠.٤٠	٢١.٠	٢١.٠
Yeast ٦ g/vine after bud burst.	٢٤.٤٣	٢٥.٩١	٢٠.٦	٢٠.٨
Yeast ٦ g/vine after fruit set.	١٩.٦٤	٢٠.٨٦	٢١.٠	٢١.٣
Yeast ٦ g/vine ٤ weeks after fruit set.	١٩.٥٩	٢٠.٨٤	٢٢.٨	٢٢.٨
Yeast ٩ g/vine after bud burst.	٢٦.٥٣	٢٩.١٦	٢١.٨	٢١.٩
Yeast ٩ g/vine after fruit set	٢٠.١٣	٢٠.٩٣	٢٢.٣	٢٢.٣
Yeast ٩ g/vine ٤ weeks after fruit set.	٢٠.١٥	٢١.٠٢	٢٣.٢	٢٣.٢
L.S.D at ٥ %	٠.٤١	٠.٥٣	٠.٢٨	٠.٣١

Yield :

Data in Table ٢ show that all yeast treatments significantly increased the yield of King Ruby cv. compared with the control. Yeast applied at ٩ g/vine ٤ weeks after fruit set resulted in the highest values (٢٣.٢- ٢٣.٢ kg/vine) followed by ٦ g/vine (٢٢.٨- ٢٢.٨ kg/vine) during both seasons, respectively. This positive effect can be explained by the activation of photosynthesis process through enhancing carbon dioxide release, Furthermore, and IAA and cytokinin- like substance which encourage the uptake of various nutrients (Moor, ١٩٧٩).

These results are nearly similar to those reported by Amen *et al*., (٢٠٠٠a) on King Ruby and Gaser *et al*., (٢٠٠٦) on Flame seedless who found that yeast applications significantly increased the yield/vine.

TSS, acidity and TSS/acid ratio:

Data in Table ٣ indicated that yeast application ٤ weeks after fruit set resulted in more pronounced values of TSS %, TSS/acid ratio

and decreased acidity compared with the control. Applied doses significantly increased the parameters compared with the control except for the acidity which significantly decreased.

Table ٣: Effect of yeast doses and time of application on TSS, acidity and TSS/acid ratio during ٢٠٠٨ and ٢٠٠٩ seasons.

Treatment	TSS %		Acidity %		TSS/acid ratio	
	٢٠٠٨	٢٠٠٩	٢٠٠٨	٢٠٠٩	٢٠٠٨	٢٠٠٩
Control	١٥.٥٣	١٥.٧	٠.٣٦	٠.٣٥	٤٢.٧	٤٤.٨
Yeast ٣ g/vine after bud burst	١٦.٢٠	١٦.٥	٠.٢٢	٠.٢١	٧٢.٥	٧٨.٤
Yeast ٣ g/vine after fruit set	١٦.٦٧	١٦.٩	٠.٢٢	٠.٢٠	٧٤.٦	٨٣.٠
Yeast ٣ g/vine ٤ weeks after fruit set.	١٥.٧٠	١٨.٢	٠.٢٤	٠.٢٣	٧٢.٣	٧٦.٤
Yeast ٦ g/vine after bud burst	١٦.٤٠	١٦.٨	٠.٣٠	٠.٢٩	٥٤.١	٥٧.٩
Yeast ٦ g/vine after fruit set	١٦.٨٧	١٧.٥	٠.٣١	٠.٣٠	٥٤.٤	٥٩.٠
Yeast ٦ g/vine ٤ weeks after fruit set	١٧.٧٣	١٧.٩	٠.٢٧	٠.٢٥	٦٦.٦	٧٢.٧
Yeast ٩ g/vine after bud burst	١٧.٠٠	١٧.٠	٠.٢٩	٠.٢٦	٥٨.٠	٦٤.٦
Yeast ٩ g/vine after fruit set	١٧.٨٠	١٨.٦	٠.٢٨	٠.٢٧	٦٤.٤	٦٩.٧
Yeast ٩ g/vine ٤ weeks after fruit set	١٨.٨٠	١٩.٣	٠.٢٨	٠.٢٧	٦٧.٩	٧١.٣
L.S.D at ٥ %	٠.٥٦	٠.٤٨	٠.٠٢	٠.٠١	٥.٧٣	٤.٤٨

Table ٣ also reveals that the highest significant effect was in the application of ٩ g yeast ٤ weeks after fruit set amounting to ١٨.٨-١٩.٣

% in the case of TSS %. Meanwhile, in the case of acidity % and TSS/acid ratio the results did not take the same line but differed from one to another. The positive effects of yeast application on berry chemical properties i.e. TSS %, TSS/acid ration and the negative effects on acidity % in the grape juice could be attributed to the enhancement effects of photosynthesis processes and increasing promoters hormones as cytokinins (Moor, ١٩٧٩).

It is well known that these hormones induce a considerable amount of sugar contents and consequently caused an increase in TSS %, TSS/acid ratio and a decrease in acidity % in the grape juice. These results are in agreement with those found by Gaser *et al.*, (٢٠٠٦) who found that yeast application increased TSS, TSS/acid ratio and decreased total acidity of the juice of Flame seedless.

Total sugars, anthocyanin and chlorophyll:

Data in Table ٤ show that all treatments increased total sugars, total anthocyanin and chlorophyll compared with the control. Yeast application (٩ g/vine) ٤ weeks after fruit set resulted in the highest significant sugars content, anthocyanin and chlorophyll than the other treatments or the control.

Table ٤: Effect of yeast doses and time of application on total sugars, total anthocyanin and chlorophyll during ٢٠٠٨ and ٢٠٠٩ seasons.

Treatment	Total sugars %		Total anthocyanin (mg/١٠٠g)		Chlorophyll (mg/١٠٠g fw)	
	٢٠٠٨	٢٠٠٩	٢٠٠٨	٢٠٠٩	٢٠٠٨	٢٠٠٩
Control	١٢.٦٥	١٢.٨٢	٢.١٤	٢.١٩	١٨.٤٥	١٩.٢١
Yeast ٣g/vine after bud burst	١٢.٩٧	١٣.١٤	٢.٦٩	٢.٧١	٢٢.٥٤	٢٤.٦٥
Yeast ٣g/vine after fruit set	١٣.٣٨	١٣.٨٧	٢.٧٢	٢.٧٣	١٩.٤٠	٢٠.٤٠
Yeast ٣g/vine ٤ weeks after fruit set.	١٣.٩٧	١٣.٩٩	٢.٧٤	٢.٧٦	١٩.٣٧	٢٠.٤٠
Yeast ٦g/vine after bud burst	١٣.٩١	١٤.٠٠	٢.٧١	٢.٧٨	٢٤.٤٣	٢٥.٩١
Yeast ٦g/vine after fruit set	١٤.٦٤	١٤.٨٩	٣.٠١	٢.٩٢	١٩.٦٤	٢٠.٨٦

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Yeast ٦ g/vine ٤ weeks after fruit set	١٥.٨٣	١٥.١٣	٣.١١	٣.١٣	١٩.٥٩	٢٠.٨٤
Yeast ٩ g/vine after bud burst	١٤.٤٥	١٤.١٥	٢.٩٣	٢.٨٣	٢٦.٥٣	٢٩.١٦
Yeast ٩ g/vine after fruit set	١٤.٢١	١٥.٨١	٣.١٦	٣.١٧	٢٠.١٣	٢٠.٩٣
Yeast ٩ g/vine ٤ weeks after fruit set	١٧.٣٩	١٧.٣٠	٣.٢١	٣.٣٠	٢٠.١٥	٢١.٠٢
L.S.D at ٥ %	٠.٢٣	٠.٣٦	٠.٠٧	٠.١٩	٠.٤١	٠.٥٣

The highest values were obtained from the application of ٩ g yeast ٤ weeks after fruit set amounting to ١٧.٣٩-١٧.٣٠ % in the case of total sugars, ٣.٢١-٣.٣٠ mg/g in the case of total anthocyanin and the highest values of chlorophyll were obtained from the application of ٩ g yeast after bud burst ٢٦.٥٣-٢٩.١٦ mg/g fw in the both seasons, respectively. These results are in agreement with those found by Amen et al., (٢٠٠٠a) on King Ruby, Gaser et al., (٢٠٠٦) on Flame seedless and Abd EL-Wahab et al., (٢٠٠٨) on Black Monukka grapevine.

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تأثير تركيز ومواعيد إضافة الخميرة الجافة على النمو والمحصول وبعض صفات جودة الثمار لكرمات عنب الكنج روبى

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أجرى هذا البحث بغرض دراسة تأثير المعاملة بالخميرة الجافة بتركيزات مختلفة ومواعيد مختلفة وذلك على المسطح الورقي للكرمة (متر مربع) وكمية المحصول وجودة حبات العنب الروبى سيدلس. تم إضافة ثلاثة جرعات من الخميرة الجافة أرضياً وهى (٣ ، ٦ ، ٩ جم/كرمة) فى ثلاثة مواعيد مختلفة وهى : الأول بعد إكتمال تفتح البراعم ، والثانى بعد العقد مباشرة ، والثالث بعد العقد بأربعة أسابيع.

وقد أوضحت النتائج المتحصل عليها من هذه الدراسة إلى أن إضافة الخميرة بتركيز ٩ جم/كرمة أعطى أفضل النتائج حيث أنه عند إضافتها فى الموعد الأول أعطت أفضل مسطح ورقي أما عند إضافتها فى الموعدين الثانى والثالث أعطت أعلى محصول/كرمة بالإضافة إلى تحسين خصائص الحبات في صورة زيادة المواد الصلبة الذائبة الكلية ونسبتها إلى الحموضة والسكريات الكلية في الحبات وصبغة الأنثوسيانين في قشرة الحبات.

ان التسميد الحيوي لكرمات العنب الروبي سيدلس باستخدام الخميرة بمعدل ٩ جرام/ كرمة/ موسم مرة واحدة بعد عقد الحبات بأربعة أسابيع يكون ضروريا لتحسين كمية المحصول وجودة الحبات.