

ROLE OF ARBUSCULAR MYCORRHIZA (AM) AND YEAST IN IMPROVING QUALITY OF "BLACK MONUKKA" GRAPES

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ABSTRACT

This investigation was conducted for two successive seasons (2006 & 2007) on mature Black Monukka grapevines to disclose the effect of inoculation with arbuscular mycorrhiza (AM) and different doses of the yeast on improving quality of Black Monukka grapes. The chosen vines were ten-year-old, grown in a sandy loam soil, located at El-Khatatba, Menoufiya governorate; spaced at 2 X 2.5 meters apart and irrigated by the drip irrigation system, cane-pruned and trellised by the double "T" shape system. Eight treatments were applied as follows; control (Uninoculated vines), inoculation with arbuscular mycorrhiza (AM), inoculation with yeast (5g/vine), inoculation with yeast (10 g/vine), inoculation with yeast (15 g/vine), (AM) + (5g yeast/vine), (AM) + (10 g yeast/vine) and (AM) + (15 g yeast/vine).

The results showed that dual inoculation of AM-mycorrhizae and fifteen gms of yeast gave the best results in comparison with uninoculated vines. This treatment resulted in the best yield and its components as well as the best physical properties of bunches, improved the physical and chemical characteristics of berries and ensured the best vegetative growth parameters. Dynamics of wood ripening, total chlorophyll and percentages of total nitrogen, phosphorus and potassium of the leaves and total carbohydrates of the canes were also improved. With respect to microbiological activity in the rhizosphere, it was noticed that percentage of infection of AM-mycorrhizae, spore numbers of AM-mycorrhizae, the populations of total microorganism and yeast populations increased in the rhizosphere as a result of inoculation of AM-mycorrhizae and yeast.

INTRODUCTION

Biofertilizers are commonly called microbial inoculants which are capable of mobilizing important nutritional elements in the soil from non-usable to usable form by the crop plants through their biological processes. During the last decade, 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.*, 2007).

Arbuscular mycorrhizal (AM) fungi are known to influence and to be influenced by the activities of microorganisms in the soil (Bagyaraj 1990 and Andrade *et al.*, 1997). Mycorrhizal fungi are able to absorb and translocate elements to host root tissues, in addition, they can also break down certain complex minerals and organic substances in the soil and make it available to their hosts (Mona 2001). Several investigators reported that mycorrhizal fungi enhance growth and improve leaf nutrient content of their host plant (Gardiner & Christensen 1991) on pear seedlings, (Helail, 1993) on avocado seedlings, (Hassan & Awad 1993) on citrus seedlings, (Wafaa *et al.*, 2000) on

almond seedlings and (Mona 2001) on guava and banana plants. It is worth-mentioning that few researches are available in the literature concerning the effect of AM on fruit trees. AM fungi increased the yield by 66% of grapevines (Menge *et al.*, 1983) and yielded 73.57% of pineapple compared to the control (Thamsurakul *et al.*, 2000).

Yeast (*Saccharomyces cerevisiae*) is considered as a new promising biofertilizer for many crops. The positive effects of applying yeast could be due to one or more of the merits. Yeast aids in activating photosynthesis process through enhancing the release of carbon dioxide (Larson *et al.*, 1962). Yeast contains some natural growth regulators, i.e. auxin (IAA) (Moor, 1979) and cytokinins (Cks) (Ferguson *et al.*, 1987). The yeast was also found to encourage the uptake of various nutrients (Vilsmeier and Amberger 1988). In addition, it contains some important nutrients as N, P and K and some common amino acids (approximately 18 amino acids) (Abou-Zaid, 1984). 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 was reflected 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 bud fertility and hence yield of the vines (El-Mogy *et al.*, (1998); Mansour 1998; Kamelia *et al.*, 2000 a,b; Omran 2000; Esmaeil *et al.*, 2003 and Aisha *et al.*, 2006).

The interaction between soil microorganisms and AM fungi is important for plant growth (Linderman 1992). Most studies have dealt with the interactions between the selected bacteria or saprophytic fungi in relation to AM colonization enhancement (Fracchia *et al.* 2000), but little information is available concerning the effect of inoculation with yeast on rhizosphere microorganisms in general and on AM fungi in particular. Few studies about the effect of the commercial yeast *Saccharomyces cerevisiae* on AM fungi were carried out (Singh *et al.* 1991; Larsen and Jackobsen 1996 and Sampedro *et al.*, 2004).

Black Monukka is one of the table grape cultivars; ripens in mid July to late August, seedless, sweet, crispy, purplish-black coloured, tender skin. The production of small to medium berries and loose bunches are negatively reflected on bunch quality (Harry *et al.*, 1991).

Therefore, the main objective of this study was to raise the yield/vine and its components to improve bunch and berry characteristics and vegetative growth of "Black Monukka" grapevines through the inoculation with arbuscular mycorrhiza (AM) and different doses of the yeast.

MATERIALS AND METHODS

This investigation was conducted for two successive seasons (2006 & 2007) in a private vineyard located at El-Khatatba, Menoufiya governorate; on mature Black Monukka grapevines to find out the effect of inoculation with arbuscular mycorrhiza (AM) and different doses of the yeast on improving quality of Black Monukka grapes. The chosen vines were ten-year-old, grown in a sandy loam soil (Table, 1), spaced at 2 X 2.5 meters apart and irrigated

by the drip irrigation system, cane-pruned and trellised by the double "T" shape system. The vines were pruned during the second week of January with bud load of (60 buds/vine). Ninety six uniform vines were chosen. Each four vines acted as a replicate and each three replicates were treated by one of the following treatments.

Table (1): Physical, chemical and microbiological analysis of the vineyard soil

Physical	Sand (%)	70.3
	Silt (%)	2.4
	Clay (%)	27.3
	Texture	Sandy loam
Chemical	Organic carbon (%)	0.06
	PH	7.75
	EC (Mmhos/cm)	1.45
	Water holding capacity (%)	27.0
	Ca Co ₃ (%)	0.6
	N (%)	0.89
	P (%)	0.11
	K (%)	0.54
Microbiological	Number of AM (spore/g soil)	3.7
	AM infection (%)	6.1
	Total microbial count (cfu/g soil)	11.4 x 10 ⁵
	Total yeast count (cfu/g soil)	0.07 x 10 ⁵

Eight treatments were applied as follows:

1. Control (Uninoculated vines).
2. Inoculation with arbuscular mycorrhiza (AM).
3. Inoculation with yeast (5 g/vine).
4. Inoculation with yeast (10 g/vine).
5. Inoculation with yeast (15 g/vine).
6. (AM) + (5 g yeast/vine).
7. (AM) + (10 g yeast/vine).
8. (AM) + (15 g yeast/vine).

Mycorrhizal spores were originally extracted from Egyptian soils. Soil drench was made around the roots of the vine at the second week of January. Spores of AM-mycorrhizae including the following genera *Glomus*, *Gigaspora* and *Acaulospora* were added after propagation. Extraction and counting of identified mycorrhizal spores occurred according to the method described by (Massoud, 1999) where the soil mass was gently removed from root system of each vine (250g), suspended and then sieved using the wet sieving and decanting technique. Five sieves (400, 250, 150, 75 and 65 mesh size) were used. The remained fractions were transferred into a glass bottle and diluted with water. The number of spores was estimated by spreading certain volume of mycorrhizal spore suspension onto a squared Petri-dish which was divided into squares from the base. The number was recorded using a binocular microscope (30-50X) (Daft and Hogarth 1983).

Mixed spores of AM-mycorrhizal genera via *Glomus* spp., *Gigaspora* spp. and *Acaulospora* spp., were prepared after extraction and mixed with sand as a carrier (40- 50 spore/gram inoculum) and then added to the soil at the rate of long inculum/line (1 m long) so each vine 2.5 m around needs 250 g inculum.

Three doses of the yeast (*Saccharomyces ccrvicisae*) inoculation (5, 10 or 15 g/vine) were prepared as cell suspension (g/L) dry weight. The density was evaluated to standardize the inoculation to 10^5 cells/ml. then soil drench was added through two dates: the 1st date (after bud burst) and the 2nd (after shattering). Yeast was grown on Hertz and Levine's medium (Difco 1984).

Yeast (*Saccharomyces ccrvicisae*) was active dry with gassing power 150 cm³/91 hour and its concentration was 95% of fungus cells.

Chemical analysis of the active dry yeast :

N (%)	Polysaccharides (%)	Fats (%)	Protein (%)	Fiber (%)	Ash (%)	Thiamin (B1) (mg)	Riboflavin (B2) (mg)	Niacin (B4) (mg)	Vitamin (B6) (mg)	Vitamin (B12) (mg)
7.3	32.3	3.5	35	1.1	6.7	2.33	5.41	36.7	4.41	0.02

The following parameters were adopted to evaluate the tested treatments:-

Representative random samples of 6 bunches/vine were harvested at maturity when TSS reached about 16-17% according to Tourky *et al.*, (1995). The following characteristics were determined:

1. Yield and physical characteristics of bunches:

Yield/vine (kg) was determined as number of bunches/vine X average bunch weight (g). Also, average bunch weight (g), bunch length and width (cm) were determined.

2. Physical characteristics of berries:

Berry weight (g), berry size (cm³), berry dimensions (length and diameter) (cm), berry firmness and adherence strength (g/cm³) (using Shatilons's instrument) were determined.

3. Chemical characteristics of berries:

Total soluble solids in berry juice (T.S.S.) (%) by hand refractometer and total titratable acidity as tartaric acid (%) (A.O.A.C. 1985). Hence TSS /acid ratio and total anthocyanin of the berry skin (mg/100g fresh weight) according to Husia *et al.*, (1965) were calculated.

4. Some characteristics of vegetative growth

- 1- Average shoot diameter (cm).
- 2- Average shoot length (cm).
- 3- Average number of leaves/shoot.
- 4- Average leaf area (cm²) of the apical 5th and 6th leaves using a CI-203-Laser Area-meter made by CID, Inc., Vancouver, USA.
- 5- Total leaf area/vine (m²) was determined by multiplying average number of leaves/shoot by average leaf area then by the number of shoots per vine.

5. Chemical characteristics of vegetative growth

- 1-Leaf content of total chlorophyll was measured by using nondestructive Minolta chlorophyll meter SPAD 502 of the 5th and the 6th leaves (Wood *et al.*, 1992).
- 2-Leaf content of total nitrogen (%) (Pregl, 1945), phosphorus (%) (Snell and Snell 1967) and potassium (%) (Jackson, 1967).
- 3-Cane content of total carbohydrates (%) (Smith *et al.*, 1956).

6. Dynamics of wood ripening:

Four shoots/vine of the current season growth were tagged to follow up monthly the rate of wood ripening starting from mid of June till mid of October. Total length of the shoot as well as length of the part of the ripened shoot (changing from greenish to brownish color) was measured. Then, coefficient of wood ripening was calculated by dividing length of the ripened part by the total length of the shoot according to Bouard (1966).

7. Microbiological studies:-

Samples were taken after harvest and determined as follows:

- 1- AM infection (%): estimated according to (Massoud, 2005).
- 2-Number of AM (spore/g soil): estimated according to (Massoud, 2005).
- 3-Total microbial count ($\times 10^5$ colony forming unit (cfu)/g soil): estimated according to (Esher and Jensen 1972).
- 4-Total yeast count ($\times 10^5$ colony forming unit (cfu)/g soil): estimated according to (Difco, 1984).

• Statistical analysis:

The complete randomized block design was adopted for the experiment. The statistical analysis of the present data was carried out according to Snedecor and Chocran (1972). Averages were compared using the new L.S.D. values at 5% level. Percentages were transformed by a certain equation prior to the statistical analysis and thereafter percentages were presented with statistical letters.

RESULTS AND DISCUSSION

1. Yield and bunch Physical characteristics:

Yield in general was significantly increased by the inoculation with arbuscular mycorrhiza (AM) and different tested doses of the yeast (Table, 2). Dual inoculation of AM and fifteen gms of yeast resulted in the highest values of this estimate (11.13 and 11.55 Kg/vine) for both seasons respectively, whereas, the lowest values were obtained from uninoculated vines (9.78 and 10.37 Kg/vine) for both seasons respectively.

The effect of treatments goes in parallel to bunch weight which was appreciably increased due to the dual inoculation of AM and fifteen gms of yeast (463.9 and 481.3 gms) compared with control (uninoculated vines) which had the lowest values (407.6 and 432.2 gms) for both seasons respectively.

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Effect of inoculation with arbuscular mycorrhiza (AM) and different tested doses of the yeast on bunch dimensions i.e. bunch length and width was statistically insignificant.

T2

Yield produced in response to inoculations could be mainly attributed to the enhancement effect of AM and yeast inoculations on bunch weight. The positive effect of AM and yeast inoculations can be explained by those mycorrhizal fungi which are able to absorb and translocate elements to host root tissues, in addition, they can also break down certain complex minerals and organic substances in the soil and make them available to their hosts (Mona 2001). Furthermore, yeast is considered as a source for IAA and cytokinin-like substances which encourage the uptake of various nutrients (Moor, 1979 and Ferguson et al., 1987). Moreover, the interaction between soil microorganisms and AM fungi is important for plant growth (Linderman 1992).

The obtained results are nearly similar to those achieved by Menge *et al.*, (1983) found that AM fungi increased the yield of grapevines by 66%. Also, Thamsurakul et al., (2000) found that AM fungi increased the yield of pineapple by 73.57% compared to the control. As for the effect of yeast, Kamelia *et al.*, (2000a) on "King Ruby" cv., Omran (2000) and Esmaeil et al., (2003) on "Roumi Red" cv. and Aisha *et al.*, (2006) on "Flame Seedless" found that yeast applications as foliar or soil drench significantly increased bunch weight and yield /vine.

2. Physical characteristics of berries:

Positive effects attributed to inoculation with arbuscular mycorrhiza (AM) and different tested doses of the yeast were evident on physical characteristics of berries i.e. berry weight, size, length, diameter, firmness and adherence strength (Table, 3). The highest values of those parameters were detected in case of vines treated with dual inoculation of AM and fifteen gms of yeast amounting to 2.93 & 3.02 gms for weight, 2.83 & 2.94 cm³ for size, 2.11 & 2.16 cm for length, 1.64 & 1.65 cm for diameter, 292.5 & 307.5 g/cm³ for firmness and 195.1 & 203.0 g/cm³ for adherence strength in both seasons respectively.

The positive effect of AM and yeast inoculations on berry physical properties could be attributed to that yeast contains some natural growth regulators, i.e. auxin (IAA) (Moor, 1979) and cytokinins (Cks) (Ferguson *et al.*, 1987). Also, it enhances the formation and movement of natural hormones specially cytokinins and GA₃ and increases cell division in meristematic tissues (Nijjar 1985). Moreover, the interaction between soil commercial yeast and AM fungi is essential for growth and development of plants (Sampedro et al., 2004).

The obtained results are in agreement with those reported by El-Mogy *et al.*, (1998) on "Thompson Seedless" cv., Kamelia *et al.*, (2000b) on "King Ruby" cv., Omran (2000) and Esmaeil *et al.*, (2003) on "Roumi Red" cv. and Aisha *et al.*, (2006) on "Flame Seedless" who found that yeast applications as foliar or soil drench significantly increased berry physical properties i.e. weight, size, length and width.

T3

3. Chemical characteristics of berries:

Results presented in (Table 4) revealed that all berry chemical characteristics; i.e. TSS, Acidity, TSS/acid ratio and anthocyanin content of berry skin were significantly affected by inoculation with arbuscular mycorrhiza (AM) and different tested doses of the yeast. Dual inoculation of AM and fifteen gms of yeast generally resulted in higher values of TSS percentage, TSS/acid ratio, anthocyanin content in berry skin and lower acidity of the juice as compared to uninoculated vines.

The positive effect of AM and yeast inoculations on berry chemical properties i.e. TSS%, TSS/acid ratio and anthocyanin content of berry skin and the negative effect on acidity% in the grape juice could be attributed to the absorption and translocation of elements to host root tissues by mycorrhizal fungi (Mona 2001) and the enhancement effects of photosynthesis process and increasing promoter hormones as cytokinins by yeast. It is well known that these hormones induce a considerable increase in sugar content, and consequently cause an increase in TSS%, TSS/acid ratio and anthocyanin content in berry skin and a decrease in acidity% in the grape juice.

These results are in agreement with those found by El-Mogy et al., (1998) on "Thompson Seedless" cv., Kamelia et al., (2000b) on "King Ruby" cv., Omran (2000) and Esmaeil et al., (2003) on "Roumi Red" cv. and Aisha et al., (2006) on "Flame Seedless" who found that yeast applications as foliar or soil drench significantly increased TSS%, TSS/acid ratio and anthocyanin content in berry skin and decreased total acidity% of the juice. Moreover, the interaction between soil microorganisms and AM fungi is important for plant growth (Linderman 1992).

4. Some characteristics of vegetative growth

Inoculation with arbuscular mycorrhiza (AM) and different tested doses of the yeast improved the vegetative growth parameters (expressed as shoot diameter, shoot length and total leaf area/vine) and coefficient of wood ripening (Table, 5). Dual inoculation of AM and fifteen gms of yeast resulted in higher values of these parameters as compared to uninoculated vines.

The positive effect of AM and yeast inoculations on vegetative growth parameters could be explained by that AM mycorrhizae produced enzymes that enhance the respiration of the root (Edrees 1982). He also noticed an increase in plant growth due to the improved uptake of elements and the production of growth promoting substances. However, inoculation with AM gave more repaid growth and increased plant biomass, plant height, leaf number, leaf area than the non inoculated plants. In addition, Mona (2001) emphasized that mycorrhizal fungi are able to absorb and translocate elements to host root tissues. In addition, they can also break down certain complex minerals and organic substances in the soil and make them available to their hosts. Moreover, several researchers reported that AM mycorrhizae usually increase the growth of plants by enhancing nutrient uptake. There are three possible explanations for the greater uptake of mineral nutrients by mycorrhizal plants compared to non-mnycorrhizal ones (Tinker, 1975 and Abbott & Robson, 1982).

T4

T5

First, mycorrhizae increase nutrient uptake by reducing the distance at which nutrients must diffuse to plant roots (Hattingh *et al.*, 1973 and Rhodes & Gerdemann, 1975). Secondly, mycorrhizal roots may differ from non-mycorrhizal roots in the relationship between rate of nutrient absorption and nutrient concentration at the absorbing surface (Cress *et al.*, 1979). Finally, mycorrhizal hyphae may chemically modify the availability of nutrients for uptake by plants. From a consideration of the published evidence; it is likely that VAM increase nutrient uptake from soil primarily by shortening the distance that nutrients must diffuse through soil to the root. It is likely, therefore, that effects of mycorrhizae in increasing nutrient uptake will be most marked for nutrients which move to roots principally by diffusion and for plant species with coarse roots and sparse, short root hairs (Baylis, 1975).

With respect to yeast, it is considered as a source for IAA and cytokinin-like substances which encourage the uptake of various nutrients; this was reflected on vegetative growth parameters (Moor, 1979 and Ferguson *et al.*, 1987).

The obtained results are nearly similar to those achieved by several investigators who reported that mycorrhizal fungi enhance vegetative growth of their host plant (Gardiner & Christensen 1991) on pear seedlings, (Helail, 1993) on avocado seedlings, (Hassan & Awad 1993) on citrus seedlings, (Wafaa *et al.*, 2000) on almond seedlings and (Mona 2001) on guava and banana plants. As for the effect of yeast, El-Mogy *et al.*, (1998) on "Thompson Seedless" cv. As well as, Kamelia *et al.*, (2000a) on "King Ruby" cv., Omran (2000) and Esmaeil *et al.*, (2003) on "Roumi Red" cv. and Aisha *et al.*, (2006) on "Flame Seedless" pointed out that yeast application as foliar or soil drench significantly increased main shoot length, produced thicker canes, and improved vine vigour in comparison with the untreated vines (control).

5. Chemical characteristics of vegetative growth

Data presented in (Table 6) revealed that total chlorophyll and percentages of total nitrogen, phosphorus and potassium of the leaves and total carbohydrate content of the canes were increased significantly by the inoculation with arbuscular mycorrhiza (AM) and different tested doses of the yeast. Also, it can be noticed that the dual inoculation of AM and fifteen gms of yeast generally resulted in higher values of these parameters as compared to uninoculated vines.

The obtained results are in agreement with those given by several investigators who reported that mycorrhizal fungi improve leaf nutrient content of their host plant (Dixon *et al.*, 1988) on citrus seedlings, El-Sharkawy 1989) on citrus seedlings, (Gardiner & Christensen 1991) on pear seedlings, (Fares 1992) on faba bean, (Helail, 1993) on avocado seedlings, (Hassan & Awad 1993) on citrus seedlings, (El-Absawy 1994) on Casuarina trees and (Wafaa *et al.*, 2000) on almond seedlings and (Mona 2001) on guava and banana plants. In addition, some researchers found that AM-mycorrhizae increased chlorophylls content of leaves (El-Sharkawy 1989) on citrus seedlings and increased carbohydrate content of canes (Dixon *et al.*, 1988) on citrus seedlings.

T6

As for the effect of yeast, El-Mogy *et al.*, (1998) on "Thompson Seedless" cv. As well as, Kamelia *et al.*, (2000a) on "King Ruby" cv., Omran (2000) and Esmaeil *et al.*, (2003) on "Roumi Red" cv. and Aisha *et al.*, (2006) on "Flame Seedless" pointed out that yeast application as foliar or soil drench significantly increased leaf nutrient content in comparison to the untreated vines (control).

6. Dynamics of wood ripening:

Data presented in Fig. (1) indicate that wood ripening gradually increased through the considered measuring dates for both seasons of the study.

Concerning the effect of inoculations, it is apparent that the highest increase in the rate of wood ripening from 1-July till 1-October was observed in the dual inoculation of AM and fifteen gms of yeast (0.85 and 0.88) for both seasons respectively, whereas, the lowest rate was obtained from Uninoculated (0.79 and 0.82) for both seasons respectively.

These results are in agreement with those found by Aisha *et al.*, (2006) on "Flame Seedless" who found that yeast applications as foliar or soil drench significantly increased the rate of wood ripening.

Data illustrated in Figures (2 & 3 & 4) indicated the existence of a highly positive correlation between total leaf area per vine (m²) and yield (kg), between total leaf area per vine (m²) and anthocyanin content of berry skin (mg/100g F.W.) and between total leaf area per vine (m²) and cane total carbohydrates (%) in both seasons.

7. Microbiological studies:

1- AM infection (%):

In concern with the percentage of infection of grapevines roots with Am-mycorrhizal fungi, data shown in table (7) and illustrated in Figure (5) revealed that the treatment 15g yeast + Am-mycorrhizae showed the best infection percentages (82.4 & 90.1%) for both seasons respectively, and increased over control by (8.8 & 4.7) fold for both seasons respectively.

This finding indicates that the yeasts stimulated the development of the fungus in the presymbiotic stage. However, the effect of soil yeasts on AM colonization was greater when cells were applied as a suspension. Inoculating microorganisms as a suspension has been used in other studies of interactions between AM fungi and yeast (Sampedro *et al.*, 2004). Interestingly, the soluble exudates of yeasts increased AM colonization of plants by *G. mosseae* to approximately the same extent to which they increased hyphal length of the AM fungus (Sampedro *et al.*, 2004).

2- Number of AM (spore/g soil):

Results in table (7) and in figure (6) showed that the effect of inoculation with arbuscular mycorrhiza (AM) and different concentrations (5, 10 or 15g/vine) of the yeast on number of spores/g soil, where the obtained results revealed that the treatment of 15g yeast + AM-mycorrhizae gave the highest spore numbers, they recorded (236.4 & 452.6 spore/g soil) for both seasons respectively, and increased over control by (40.9 & 44.3) fold for both seasons respectively.

F1

F2 -3 -4

T7

F5 – 6 – 7- 8

These findings are in line with those obtained by (Turk *et al.*, 2006) who explained that Am-mycorrhizae colonize plant roots and mainly into the surrounding bulk soil extending the roots depletion zone around the root system. This was enhanced by yeast exudates that improved the interaction with other soil microorganism such as N-Fixers and led to the extensive hyphal growth beyond the nutrient depletion zone surrounding the root and this resulted in increasing spore number of AM-mycorrhizae which are considered as beneficial agents in the soil for one year.

3- Total microbial count (-x10⁵cfu/g soil):

Data in table (7) and in figure (7) showed that the effect of inoculation with arbuscular mycorrhiza (AM) and different concentrations (5, 10 or 15g/vine) of the yeast (*Saccharomyces cerevisiae*) in the soil cultivated with "Black Monukka" grapevines on total microbial count. The results indicated that the addition of yeast at the concentration of (15g/vine) with AM-mycorrhiza increased the populations of rhizospheric microorganisms in the roots. It was recorded the highest populations of rhizospheric microorganism (120.0 & 229.7 cfu/g soil) for both seasons respectively, where they increased over control by (7.4 & 8) fold for both seasons respectively.

These results are in agreement with those obtained by (Godeas *et al.*, 1999) who explained that the increase in populations of rhizospheric microorganism in roots of most plants are influenced by a combined inoculation of yeasts and AM fungi where the soluble exudates of yeasts increased AM colonization and consequently, greater microbial abundance in the soil.

4- Total yeast count (-x10⁵cfu/g soil):

As regards to total yeast count, data presented in table (7) and illustrated in Fig. (8) showed that the positive effect of interaction between yeast and AM-mycorrhizae and the count of yeast cells that colonize the roots of grapevines increased with increasing inoculum addition. The treatment of 15g yeast + AM-mycorrhizae gave the best yeast populations which emphasize the pathogenic symbiosis of the two fungi and their beneficial role if they added individually or in combination. Consequently the populations of yeast increased the treatment of 15g yeast + AM-mycorrhizae recorded (34.5 cfu/g soil) in the first season and (66.0 cfu/g soil) in the second one, and increased over control by (345 & 373.1) fold for both seasons respectively.

These results are in the same line with those obtained by (Godeas *et al.*, 1999) who explained that the beneficial effects of soil yeasts and AM fungi increase with increasing the rate of yeast addition where the ability of yeasts on their stimulate AM hyphal length may increase the chance of contact between fungal hyphae and plant roots, and consequently may increase mycorrhiza establishment.

8. Economical justification/Feddan of the recommended treatment (Inoculation with arbuscular mycorrhiza and 15gms yeast/vine) compared with control:

It can be shown from the data presented in Table (8) that applying dual inoculation of AM and fifteen gms of yeast gave the maximum net profit compared with the control in both seasons.

T 8

The very slight raise in the cost of production/Feddan over control for this treatment is economically justified in view of the higher price of the yield obtained from this treatment.

In conclusion, the ability of yeasts or their exudates for increasing the positive effects of AM-mycorrhizae on quality of Black Monukka grapes can be exploited to improve the use and efficiency of this fungus in agriculture.

From the obtained results, it can be concluded that dual inoculation of AM-mycorrhizae and yeast at the rate of 15gms gave the optimum results for yield, fruit quality, vegetative growth and useful microbiological activity for Black Monukka grapevines.

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دور فطر الميكروهيذا والخميرة في تحسين جودة صفات العنب "البلاك مونوكا"

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أجرى هذا البحث لمدة موسمين متتاليين (٢٠٠٦، ٢٠٠٧) على كرمات عنب صنف البلاك مونوكا بهدف دراسة تأثير التلقيح بفطر الميكروهيذا مع تركيزات مختلفة من الخميرة على تحسين جودة صفات العنب البلاك مونوكا، وكانت الكرمات عمرها ١٠ سنوات نامية في تربة طميية رملية، منزرعة بمنطقة الخطاطبة – التابعة لمحافظة المنوفية على مسافة ٢ X ٢,٥ متر، وكانت تروى بنظام الري بالتنقيط، وتم تقليم الكرمات تقليماً قصيباً تحت نظام التدعيم "T" المزدوج. وقد تم إجراء ثمانية معاملات وهي المقارنة (كرمات غير ملقحة)، التلقيح بفطر الميكروهيذا، التلقيح بالخميرة (٥ جم/كرمة)، التلقيح بالخميرة (١٠ جم/كرمة)، التلقيح بالخميرة (١٥ جم/كرمة)، التلقيح بفطر الميكروهيذا مع الخميرة (٥ جم/كرمة)، التلقيح بفطر الميكروهيذا مع الخميرة (١٠ جم/كرمة)، التلقيح بفطر الميكروهيذا مع الخميرة (١٥ جم/كرمة).

أشارت نتائج الدراسة إلى أن التلقيح الثنائي بفطر الميكروهيذا والخميرة بتركيز ١٥ جرام/كرمة قد أعطت أفضل النتائج مقارنة بالكرمات الغير ملقحة حيث أعطت أعلى محصول ومكوناته بالإضافة إلى تحسين الصفات الطبيعية للعناقيد والصفات الطبيعية والكيمائية للحبات مع الحصول على أفضل قياسات خضرية وديناميكية نضج الخشب بالإضافة إلى محتوى الأوراق من الكلوروفيل الكلي والنسبة المئوية من النيتروجين والفوسفور والبوتاسيوم ومحتوى القصبات من الكربوهيدرات. وبالنسبة للنشاط الميكروبي في منطقة إنتشار الجذور، لوحظ أن النسبة المئوية للإصابة بالميكروهيذا، عدد جراثيم الفطر، العدد الكلي للميكروبات الكلية، العدد الكلي لخلايا الخميرة قد إزدادت نتيجة التلقيح بفطر الميكروهيذا والخميرة.