



Effect of Some Natural Oils and Plant Extracts on Fruit Quality of Thompson Seedless Grape Cultivar.

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Abstract

The present study carried out during 2023 and 2024 seasons to investigate the effect of some plant extracts (turmeric extract, moringa leaf extract, black seed oil, jasmine oil and jojoba oil). The obtained results can be summarized as follows: The obtained results cleared that plant extract treatment induced an increase in berry length (cm), berry diameter and shape factor during the two seasons compared to control treatment. Concerning the shape factor, jasmine oil extract gave the highest value followed by jojoba oil 2 and black seed oil 2%. It could be noticed that control treatment gave the lowest values of the three traits. Regarding total soluble solids, all treatments resulted in a significant increase in the berries content of TSS % with the best treatments being black seed oil 2% comparing with control treatment it can be observed from the acidity % compared to the control. The treatments improved reducing sugars percentage in the grape berry juice during the two study seasons 'with a significant increase compared to the control.

Keywords: *Jasmine, Jojoba, Moringa, Thompson, Turmeric,*

Introduction

Egypt ranks the thirty-two positions worldwide for grape production (FAO, 2018). In Egypt, Grapes is considered the third position proceeded only by citrus and mango because of its high net return. The cultivated area devoted for Grapevines estimated by 186404 feddans and fruiting area of 178485 feddans produced 1790734 tons of fruits (Egyptian Ministry of Agriculture and Reclamation Statistics, 2023),

Assiut governorate where the present study was carried out occupied late position of grapevines cv. and production, area estimated by 2255 feddans and fruiting area of 2163 feddans producing about 27634 tons. It ranks eleventh in terms of area (Egyptian Ministry of Agriculture and Reclamation Statistics, 2023).

Using plant extracts especially turmeric extract had beneficial effects on growth and fruiting of different fruit crops and this is attributed to the higher own content of antioxidant from phenolic compounds, plant pigments and other organic compounds (Ammon and Whehl 1991; Osawa, 1994; Bruneton, 2001; Prakash and Majeed, 2003; Pons, 2003; Chowdhury *et al.*, 2007; Bhadwaj *et al.*, 2010 and Hanafy *et al.*, 2012).

The major function of Jasmonic acid (JA) and its various metabolites is regulating plant responses to abiotic and biotic stresses as well as plant growth and development. Regulated plant growth and development processes include growth inhibition, senescence, tendril coiling, flower development and leaf abscission (Delker *et al.*, 2006).

Jojoba oil is considered one of the most important of these substances, given its composition is completely different from that of all vegetable oils. Chemically, it is classified as a waxy liquid resulting from the combination of fatty acids and alcohols, and has a single, long carbon chain containing 40-44 carbon atoms. Therefore, it is used in a variety of fields (Yermanos, 1975). Furthermore, jojoba oil is one of these alternatives to nematicides, as it is characterized by its ability to eliminate mites and sucking insects, fungal diseases that affect plants, and control nematodes (Mostafa *et al.*, 2017)

Moringa oleifera L. leaf extract (MLE) has been used as a plant bio stimulant to improve product quality. The effectiveness of MLE is associated with its beneficial components, consisting of nutrients, phytohormones, secondary metabolites, amino acids, and bioactive compounds. The results are generally positive concerning physical, nutritional, and chemical qualities (Yuniati *et al* 2022). *Moringa oleifera* leaves are rich source of zeatin, ascorbate, carotenoids, phenolic compounds, calcium and potassium, so being explored as a natural plant growth enhancer, and also as a natural source of cytokinin (Fuglie, 1999 and Foidl *et al.*, 2001).

The target of this study was examining the effect of different plant extracts on vine growth, nutritional status, yield and berry quality of White Banaty grapes seedless grown under in Upper Egypt and producing grapes free of chemicals and suitable for export, by spraying them with natural materials that are safe for human health and free from harmful chemicals.

Materials and Methods

This experiment was executed during two consecutive seasons of 2203 and 2024 on eighteen Thompson seedless (white Banaty) grapevines grown at the Experimental Orchard of the Faculty of Agriculture, Assiut University, where the soil is clay loam. The selected vines were about twenty years old at the start of this study, and they were grown at a distance of 2×2 m and subjected to the same horticultural practices. By the head pruning strategy, all selected vines had 72 buds, with 16 fruiting spurs with four buds each and 4 replacement buds with two buds. The experiment consisted of six treatments and was replicated three times.

Analysis of the tested soil at 0.0 to 30.0 cm. deep was carried out (according to Chapman and Pratt, 1965)

Table 1. Mechanical, physical and chemical analysis of the tested vineyard soil

Characters	Values	Characters	Values
Sand %	10.2	Total N%	0.09
Silt %	12.8	Available P (olsen ppm)	4.8
Clay %	77.0	Available K (ammonium ppm)	481.0
Texture	Clay	Fe (ppm)	3.6
pH (1:2.5 extract)	7.8	Zn (ppm)	4.2
EC (1:2.5 extract) (mmhos/ 1 cm 25C)	0.92	Mn (ppm)	3.3
O.M. %	1.95	Cu (ppm)	0.5
CaCO ₃ %	2.24		

The treatments were performed as follows:

- 1-Spraying with distilled water (control).
- 2-Spraying with turmeric extract at a concentration of 2%.
- 3-Spraying with moringa leaf extract at a concentration of 2%.
- 4-Spraying with 2% black seed oil.
- 5-Spraying with jasmine oil at a concentration of 2%.
- 6-Spraying with jojoba oil at a concentration of 2%.

The foliar applications were conducted three times per season; when the length of the cluster is about 10 cm, the second when the grain size reaches 3 mm, and the third at the beginning of the berry's softness.

Each treatment was replicated three times using one vines per replicate. In total, 18 selected vines were included in the study.

Measurement of some physical and chemical properties of berries.

- berry length (cm) and berry diameter (cm), and berry shape index (berry length/diameter).
- Total soluble solids (TSS) percentage
- Total acidity percentage (expressed as grams of tartaric acid per 100 ml of juice) (A.O.A.C., 2000).
- TSS to acidity ratio
- Reducing sugars percentage (Lane and Eynon, 1965).

The obtained data were statistically analyzed using a randomized complete block design (RCBD) by the SAS software program. The significance of mean differences was examined using Duncan's method, as outlined by Mead *et al.* (1993).

Results

1. Berry measurements

Date illustrated in table (1) showed the effect of some plant extracts on berry length (cm), berry diameter (cm.) and berry shape factor during 2023 and 2024 seasons. The obtained results cleared that plant extract treatment induced an increase in berry length (cm), berry diameter and shape factor during the two seasons compared to control treatment. Jasmine oil 2% gave the highest berry length (1.36 and 1.43 cm) followed by black seed oil 2 % (1.38 and 1.36 cm) and turmeric extract 2 % (1.36 and 1.34 cm) during 2023 and 2024 seasons respectively while the highest berry diameter values were obtained from turmeric extract (1.17 and 1.16 cm) followed by black seed oil (1.13 and 1.15 cm) and jasmine oil respectively (1.10 and 1.13 cm) during the two studied seasons. Concerning the shape factor, jasmine oil extract gave the highest values (1.24 and 1.27) followed by jojoba oil 2% (1.22 and 1.19) and black seed oil 2% (1.22 and 1.18). It could be noticed that control treatment gave the lowest values in the three traits.

Table 1. Effect of some plant extracts on berry length (cm), berry diameter (cm.) and berry shape factors of Thompson seedless grape cultivar during 2023 and 2024 seasons.

Treatment	Berry length (cm)		Berry diameter (cm)		Berry shape factor H/D	
	2023	2024	2023	2024	2023	2024
Jasmine oil 2%	1.36A	1.43A	1.10B	1.13B	1.24A	1.27A
Jojoba oil 2%	1.32A	1.30A	1.08C	1.09C	1.22A	1.19B
Black seed oil 2%	1.38A	1.36A	1.13B	1.15B	1.22A	1.18B
Moringa leaf extract 2%	1.30A	1.23B	1.07C	1.08C	1.22A	1.14B
Turmeric extract 2%	1.36A	1.34A	1.17A	1.16A	1.16B	1.16B
Control	1.20B	1.13C	1.06C	1.04C	1.13B	1.09C

Statistical analysis was performed using the new Least Significant Difference (L.S.D.) at a 5% significance level.

2. Chemical constituents

Table (2) Illustrated the effect of spraying with some plant extracts on the chemical characteristics of grape berries the obtained results show that all treatment led to a significant improvement in the quality traits of the berries compared to the control treatment. Regarding total soluble solids, all treatments resulted in a significant increase in the berries content of TSS % with the best treatments being black seed oil 2% (24 and 24.33 %) followed by jasmine oil 2% (23.66 and 23.66 %) and turmeric extract 2% (23.33 and 23.33 %) comparing with control treatment (21.00 and 21.33 %) during 2023 and 2024 seasons respectively it can be observed from the acidity % compared to the control.

The best treatment in this respect was jasmine oil 2% which gave (0.36 and 0.33 %) followed by turmeric extract 2% (0.38 and 0.35 %) compared to the control (0.64 and 0.61 %) during the two studied season there were no significant differences among the treatments in this regard.

The results regarding the ratio of TSS / acidity indicate that spraying with plant extracts led to a significant increase compared to the control.

The treatments improved reducing sugars percentage in the grape berry juice during the two study seasons 'with a significant increase compared to the control. The black seed oil at 2% gave the highest values of reducing sugars % (19.73 and 19.40 %) followed by jasmine oil 2% (19.00 and 18.96 %) and turmeric extract 2% (18.66 and 18.66 %) while the lowest values (16.06 and 16.33 %) obtained from the control treatment during 2023 and 2024 seasons respectively.

Table 2. Effect of some plant extracts on TSS (%), acidity (%), TSS / acidity and reducing sugars % of Thompson seedless grape cultivar during 2023 and 2024 seasons.

Treatments	TSS (%)		Acidity (%)		TSS / acidity		Reducing sugars %	
	2023	2024	2023	2024	2023	2024	2023	2024
Jasmine oil 2%	23.66A	23.66A	0.36B	0.33B	65.72A	71.70A	19.00A	18.96A
Jojoba oil 2%	23.33A	23.00A	0.39B	0.36B	59.82B	63.89A	18.43B	18.00B
Black seed oil 2%	24.00A	24.33A	0.43B	0.40B	55.81B	60.83A	19.73A	19.40A
Moringa leaf extract 2%	22.00B	22.00B	0.42B	0.41B	52.38B	53.66B	17.30C	17.33C
Turmeric extract 2%	23.33A	23.33A	0.38B	0.35B	61.39A	66.66A	18.66A	18.66A
Control	21.00B	21.33B	0.64A	0.61A	32.81C	34.97C	16.06D	16.33D

Statistical analysis was performed using the new Least Significant Difference (L.S.D.) at a 5% significance level.

Discussions

Using natural plant extracts as safety agents for human and environment are the new alternative compounds which might help in improving yield and berry quality plant extracts are characterized by their higher content of organ sulfur compounds, volatile components proteins, fats, lannins, nutrients, antioxidants and vitamins (Peter, 1999).

The obtained results demonstrated that the application of plant extracts significantly enhanced fruit physical and chemical characteristics such as berry length (cm), berry diameter (cm.), berry shape factor, TSS, TSS to acidity ratio and reducing sugars percentage in grape berries compared to the control.

This improvement indicates better fruit quality and ripening status, likely due to the bioactive compounds present in the plant extracts that may stimulate metabolic activity and sugar accumulation. These results are consistent with what has been obtained by Refaai and Silem (2021), Gouda (2021), Abdel Aal *et al* (2017), El-Salhy *et al* (2017), El- Senosy *et al* (2021), Abada *et al* (2023), Akl *et al* (2017), Masoud *et al* (2024), Masoud *et al* (2023), Abou-Zaid *et al* (2022), Khan *et al* (2020), Alsahy and Aljabary (2020), Aly *et al* (2020), Abou-Zaid *et al* (2025), Mohamed *et al* (2022), Bassiony and Ibrahim (2016), Yuniati *et al* (2022), Mosa *et al* (2021), Uwakiem (2021), Abdel Aal *et al* (2018), Abdelghany and Rizkalla (2024), Shaheen *et al* (2018), El-Akad *et al* (2021), El-Kenawy (2018), and Bedrech *et al* (2016).

Conclusion

Under the experimental conditions, it can be recommended to spray Thompson seedless (White Banaty) grape vines with 2% Black seed oil or 2% Jasmine oil or 2% Turmeric extract to increase yield and improve berries quality.

References

- A.O.A.C. (2000). Association of Official Agricultural Chemists, Official Methods of Analysis A.O.A.C. Benjamin Franklin Station, Washington, D.C.M.S.A. 440-512.
- Abada, A.M., Uwakiem, K.M. and El-Saman, Y.A. (2023). Effect of Spraying Some Amino Acids, Algae Extract, and Turmeric Extract on Shot Berries, Yield and Berries Quality of Prime Seedless Grapevines. *New Valley Journal of Agricultural Science*. 3 (7): 603-613.
- Abdel Aal, M. K.A; Abada, A.M.M and Mohamed, A.E.H. (2017). Trials for Solving the Problem of Poor Berries Colouration and Improving Yield of Crimson Seedless Grapevines. *New York Science Journal*, 10(12): 91- 103.
- Abdelghany, A. M. M. and Rizkalla, M. K. (2024). Efficiency of Foliar Application with Some Plant Natural Oils on Yield and Berries Quality of Ruby Seedless Grape Cultivar. *J. of Plant Production, Mansoura Univ.* 15 (9):495 – 500.
- Abou-Zaid, E.A.A.; Usman, R.A. and Hussein, A. S. (2025). Effect of Natural Moringa Leaf Extract, Dry Yeast, and Potassium Thiosulfate on Thompson Seedless Grape cv. under Assiut Climatic Conditions. *Assiut Journal of Agricultural Sciences* 56(3):192-213.
- Abou-Zaid, E.A.A.; Mostafa A.A.R; Gouda, F.M.A. and Abd Al-sanad, A.Y.M. (2022). Effect of Sifofex (CPPU) and Some Plant Extracts Spraying on Red Roomy Grapevines. *Assiut Journal of Agriculture Science*, 53 (4): 55-70.
- Akl, M. M. A.; Abada, A.M. and Gadalla, F. A.F. (2017). Effect of some plant extract on growth and nutritional status of seedless grapevine transplants. *J. Product. and Dev.*, 22(2): 323-337.
- Ali, M.A., Harhash, M.M., Bassiony, S.S., and Felifal, M.M.S. (2020). Effect of foliar spray of sitofex, moringa leaves extract and some nutrients on productivity and fruit quality of “Thompson seedless” grapevine. *Journal of the Advances in Agricultural Researches*, 25(1): 112-129.
- Alsahy, B.F.J. and Aljabary, A.M.O. (2020). Effect Of Moringa Leaves Extracts and Licorice Roots on Some Growth Characteristics and Yield of Grape (*Vitis Vinifera* L.) Cv. Halawany. *Plant Archives*. 20 (2): 2616-2623.
- Ammon, H. and Wehl, M. (1991). Pharmacology of *Curcuma Longa*, *Planta Med.* 57: 1-7.
- Bassiony, S. S. and Ibrahim, G.M. (2016). Effect of Silicon Foliar Sprays Combined with Moringa Leaves Extract on Yield and Fruit Quality of "Flame Seedless" Grape (*Vitis vinifera* L.). *J. Plant Production, Mansoura Univ.*, 7(10) :1127 – 1135.
- Bedrech, S.A., Mohamed, M.N. and Abo Rehab, M.E.A. (2016). Effect of Some Organic Compounds and Cluster Thinning on Quality Characteristics and Powdery Mildew of Flame Seedless. *Egypt. J. Hort.* 43(2): 355-369.
- Bhadwaj, R.L.; Dhashora, L.K. and Mukherjee, S. (2010). Effect of neem leaf extract and benzyladenine on post-harvest shelf- life of orange (citrus reticulate Blanco). *J. Adv.*

- Dev. Res. 1(1): 32-37.
- Bruneton, J. (2001). Famacogenosia. Zaragoza, Ed. Acriba, P. 294-296.
- Chapman, H.D. and Pratt, P.F. (1965). Methods of analysis of Soils, Plant and Water, Calif Univ. Division of Agric. Sci., 172-173.
- Chowdhury, M.N.A.; Rahim, M.A.; Khalequzzaman, K.M.; Humauam, M.R. and Alam, M.M. (2007): Effect of plant extracts and time of application on incidence of anthracnose, yield and quality of mango, Int. J. Sustain, crop. Prod.2 (5): 59-68.
- Delker, C.; Stenzel, I.; Hause, B.; Miersch, O.; Feussner, I.; Wasternack, C. (2006). "Jasmonate Biosynthesis in *Arabidopsis thaliana* – Enzymes, Products, Regulation". Plant Biology, 8 (3): 297–306.
- El- Senosy, A.O., Abada, A.M. and El-Masry, S. El-D. (2021). Response Of Flame Seedless Grapevines Grown Under Sandy Soil to Foliar Spraying of Some Plant Extracts. Egyptian-Arab J. Applied Sci. And Tech. 1(2):11- 19.
- El-Akad, M.M., Rizkalla, M.K. and Ibrahim, R.A. (2021). Effect of gibberellic acid and jasmine oil on yield and fruit quality of Ruby Seedless grape cultivar. SVU-International Journal of Agricultural Sciences, 3 (1): 85-95.
- El-Kenawy, M. A. (2018). Effect of Spraying Jasmonicacid, Girdling and Their Combinationson Growth, Yield and Fruit Quality of Crimson Seedless Grapevine. Egypt. J. Hort. 45(1): 25 – 37.
- El-Salhy, A.M.; Ibrahim R.A.; Mgawer M.A. and Abd El-Hafiz G.N. (2017). Effect of some Plant Extracts Spraying on Growth and Fruiting of Flame Seedless Grapevines. Assiut J. Agric. Sci., 48 (3): 188-197.
- FAO (2018). Food and Agriculture Organization Statistical Year Book, FAO Roome Italy.
- Foidl, N., Makkar, H.P.S and Becker, K. (2001). The potential of *Moringa oleifera* for Agricultural and Industrial uses. A report presented at Dares-salam on what development potential for moringa products. October 20th-November 2nd, The Miracle Tree: The Multiple Attributes of Moringa, pp:45–76. Fuglie LJ (Ed.). CTA, Wageningen, Netherlands.
- Fuglie, L.J. (1999). The miracle tree: *Moringa oleifera*, natural nutrition for the tropics. Church World Service, Dakar, 68.
- Gouda, M.F (2021). Response of Thompson Seedless Grapevines to Foliar Sprays with GA₃ and some Natural Compounds. Assiut J. Agric. Sci., 52 (5):142-152.
- Hanafy, M.F.; Saadawy, F.M.; Milad, S.M.N. and Ali, R.M. (2012). Effect of some natural extracts on growth and chemical constituents of *Scheffera arboricola*. J. of Hort. Sci., ornamental; plants 4(1): 26-33.
- Khan, A.S., Ibrahim, M., Basra, S.M.A., Ali, S., Almas, M.H., Azam, M., Anwar, R., Hasan, M.U. (2020). Post-bloom applied moringa leaf extract improves growth, productivity and quality of early-season maturing grapes (*Vitis vinifera*). Intl J Agric Biol. 24 (5):1217–1225.
- Lane, J. M. and Eynon, L. (1965). Determination of reducing sugars by means of Fehling solution with methylene blue as indicator. A.O.A.C. Washington-D.C. U.S.A. pp. 100-110.

- Maher Kh. Uwakiem. (2021). Growth and Productivity of Red Globe Grapevines as Affected with Spraying of Fenugreek Seed Sprout, Nano-Boron and Moringa Extract. Hortscience Journal of Suez Canal University. 10 (1): 49-61.
- Masoud, A., Mohamed, A., Abdou Zaid, I., Abd El-Hakim, M. (2024). Effect of Foliar Application of Some Natural Compounds on Growth and Fruiting of Ruby Seedless Grapevines. Assiut Journal of Agricultural Sciences, 55 (4): 177-188.
- Masoud, A., Mohamed, A., Abou-Zaid, I., Abd El-Hakim, M. (2023) Effect of Foliar Application with Some Certain Natural and Chemical Compounds on Yield and Cluster Weight of Ruby Seedless Grape Cultivar. Assiut Journal of Agricultural Sciences, 54 (1): 198-212.
- Mead, R.; Currow, R.N. and Harted, A.M. (1993). Statistical Methods in agricultural and experimental Biology. 2nd Ed. Chapman Hall, London, pp. 54-60
- Mohamed, A.A.; Gouda F.M.; Saleh, F.E.M and Omran, Yasser, A.M. (2022). Efficiency of Extracts of Three Medicinal Plants to Improve Growth, Yield and Quality of Red Roomy Grapevine. Assiut Journal of Agriculture Science 53 (1): 45-59.
- Mosa F. A.W, Salem Z. M., Al-Huqail A. Asma, and Ali M. Hayssam. (2021). Application of Glycine, Folic Acid, and Moringa Extract as Bio-stimulants for Enhancing the Production of 'Flame Seedless' Grape Cultivar. "Grape cultivar and bio-stimulants," BioResources, 16(2): 3391-3410.
- Mostafa, M.A., Mahmoud N.A., Anany A.E. and El-Sagheer A.M. (2017). Plant essential oils as eco-friendly management tools for root knot nematode on cucumber plants. The Journal of Zoology Studies, 4(1): 01–05.
- Osawa, T. (1994). Plant antioxidant protective role against oxygen Radical species. C, T. 109 (10): 77-81.
- Peter, K.V. (1999). Information on turmeric and ginger. Indian species 6 (2 and 3): 12-14.
- Pons, L.I. (2003). Foto protection vegetal (11) of farm 22: 163-164.
- Prakash, L. and Majeed, S. (2003). Multifunctional ingredients. The Noval face of natural C, T: 118(11): 41-47.
- Refaai M. M. and Silem A. A.E.M. (2021). Impact of spraying chitosan and turmeric extract on fruiting of Flame seedless grapevines. Egyptian-Arab J. Applied Sci. and Tech, 1(2):21-28.
- Shaheen A. Shereen, El-Soda A. S. and El-Bolok T.K. (2018). Effect Of Spraying Hydrogen Cynamide, Garlic Oil, Olive Oil and Jasmine Oil on Earliness of Budburst, Yield and Fruit Quality of Fig (Sultani Cv.). Middle East J. Agric., Res., 6: 464-473.
- Yermanos, D. M. (1975). Omega-3 fatty acids: Key: Keystritional health. Journal of the American Oil Chemists, 43(9): 215–219.
- Yuniati N., Kusumiyati Kusumiyati, Syariful Mubarak and Bambang Nurhadi. (2022). The Role of Moringa Leaf Extract as a Plant Biostimulant in Improving the Quality of Agricultural Products. Plants, 11: 2186. <https://doi.org/10.3390/plants11172186>

تأثير رش بعض الزيوت الطبيعية والمستخلصات النباتية على محصول وجوده ثمار العنب النباتي الابيض

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الملخص

أجريت الدراسة الحالية خلال موسمي 2023، 2024 لدراسة تأثير بعض المستخلصات النباتية (مستخلص الكركم، مستخلص أوراق المورينجا، زيت حبة البركة، زيت الياسمين وزيت الجوجوبا).

ويمكن تلخيص النتائج التي تم الحصول عليها على النحو التالي:

أوضحت النتائج التي تم الحصول عليها أن معاملة المستخلص النباتي أدت إلى زيادة في طول الثوت (سم)، وقطر الثوت وعامل الشكل خلال الموسمين مقارنة بمعاملة الكنترول. فيما يتعلق بعامل الشكل، أعطى مستخلص زيت الياسمين أعلى القيم يليه زيت الجوجوبا 2 وزيت الحبة السوداء 2٪. يمكن ملاحظة أن معاملة الكنترول أعطت أقل القيم في الصفات الثلاث. فيما يتعلق بالمواد الصلبة الذائبة الكلية، أدت جميع المعاملات إلى زيادة معنوية في محتوى الثوت من TSS٪ مع أفضل المعاملات التي كانت زيت الحبة السوداء 2٪ مقارنة بمعاملة الكنترول يمكن ملاحظة ذلك من الحموضة٪ مقارنة بمعاملة الكنترول. حسنت المعاملات نسبة السكريات المختزلة في عصير العنب والثوت خلال موسمي الدراسة "بزيادة معنوية مقارنة بمعاملة الكنترول.

الكلمات المفتاحية: العنب، الجوجوبا، المورينجا، الكركم، الياسمين.