Assiut Journal of Agricultural Sciences 54 (2) 2023 (180-189) Website: http://ajas.journals.ekb.eg/
ISSN: 1110-0486 / EISSN: 2356-9840 E-mail: ajas@aun.edu.eg

(Original Article)

Effect of Girdling and Cincturing on Setting and Yield in Balady Mandarin Trees

Sabah M. Badawy[1] and Azza S. Hussein[2*]

[1]Citrus Department, Agricultural Research Center, Sohag, Egypt
[2]Pomology Department, Faculty of Agriculture, Assiut University, Assiut, Egypt

*Corresponding author email: azza.mohamed@agr.aun.edu.eg
DOI: 10.21608/ajas.2023.199563.1244

Abstract

Growing citrus fruit trees became more expensive over the last few years as a result of rising production costs. Thus, less environmentally harmful methods were employed in an effort to find a technique to lower these costs while obtaining a high yield and quality of fruits free from any chemical residues. This study was carried out during two consecutive seasons of 2020 and 2021 on 15 uniformed Balady Mandarin trees, 20 years old, budded on sour orange rootstock, and planted at a distance of 5×5 m in the productive farm at the Agricultural Research Center in Shandawel Island, Sohag Governorate. The experiment aims to study the influence of girdling and cincturing on the fruit setting and yield of Balady mandarin trees. The results showed that all girdling and cincturing treatments (girdling or cincturing the trunk or branches) had a positive effect on flowering, fruiting, leaves content of carbohydrates, yield, and some fruit quality properties (TSS and TSS/acid ratio), while they led to a decrease in the leaves content of nitrogen in Balady mandarin trees under the climatic conditions of Sohag Governorate. The study recommends the importance of girdling the branches and trunk of the Balady mandarin trees under Sohag conditions to enhance the yield and quality of the fruits.

Keywords: *Balady mandarin trees, Girdling, Cincturing, Fruitlet, Flowering*

Introduction

Mandarin is one of the world's most significant citrus trees, as its fruit is a valuable source of nutrients, vitamins, and other antioxidant compounds (Putnik *et al*., 2017).

Many horticultural practices are done to improve mandarin tree production, such as girdling and cincturing (El-Sayed, 2021).

The process of removing the bark or phloem ring that surrounds the trunk or branch is called girdling. This causes blockage of the phloem transport pathway, with sugar building up above the girdle (Rivas *et al*., 2006; Yang *et al*., 2013).

Girdling was utilized in order to encourage flowering and enhance fruit set (Goren *et al*., 2003; Boyd and Barnett, 2011; Yilmas *et al*., 2018).

Received: 26 March 2023/ Accepted: 18 April 2023/ Published online: 25 April 2023

It is often used practically in citrus and other trees; it may improve carbohydrate balance and increase their availability, which manages the growth and production (Khandaker *et al*., 2011).

Girdling is additionally shown to modulate the partitioning of photosynthates, nutrients, minerals, and plant growth regulators in citrus trees (Rivas *et al*., 2007).

It has been found that the cytokinin and gibberellin content of the shoots is modified along with the C/N ratio, which is boosted as a result of girdling (Li *et al*., 2003). Also, it can improve fruit quality, including fruit size, length, diameter, total soluble solids, fruit color, and ascorbic acid content (Verreynne *et al*., 2001; Rivas *et al*., 2006; Yang *et al*., 2013).

The technique of cincturing is considered a less severe treatment where the positive effects of girdling can be retained without having a negative impact on the tree and where the cut is made through the layer of bark to the central hardwood without the removal of any bark (Hackney *et al*., 1995).

The objective of this investigation was to study the effect of girdling or cincturing (trunk or branch) on the fruit setting and yield of Balady mandarin trees.

Materials and Methods

This study was carried out during two consecutive seasons of 2020 and 2021 on 15 uniformed Balady Mandarin trees, 20 years old, budded on Sour Orange rootstock, and planted at a distance of 5 x 5 meters in the productive farm at the Agricultural Research Center in Shandawel Island, Sohag Governorate, where the soil is clay and well drained and a surface irrigation system was followed.

Girdling and cincturing treatments were performed prior to blossoming in late December around the trunk or branches (four branches at different directions), using a knife without injuring the wood.

This investigation included five treatments, as follows:

1. Control (trees without girdling or cincturing).
2. Trunk girdled trees.
3. Branch girdled trees.
4. Trunk cinctured trees.
5. Branch cinctured trees.

A randomized complete block design (RCBD) was used to arrange the treatments, with three replicates of each treatment and one tree in each replication .

The parameters that were measured include:

A) Flowering and fruiting parameters:

Emerging flowers on four branches in each direction were counted at March's end; following fruit set (at the end of April the remaining fruitlets were counted, and consequently, the percentage of fruit set was calculated.

In December of each season, the retained fruits were recorded by recording the number of harvested fruits per branch. In addition, at the harvest date, the fruit retention percentage was calculated in relation to the number of flowers.

B) Components of the yield and fruit quality:

During the studied seasons in mid-December at color break, the number of fruits per tree was counted, then fruit weight (g) was determined, and yield (kg/tree) was estimated.

Ten fruits were randomly taken from each tree to surmise physical and chemical characteristics. Fruit weight (g), size (cm^3), and fruit juice volume (cm^3) were measured. The chemical characteristics of juice, including the total soluble solids % using a handheld refractometer and the total acidity % (expressed as citric acid) by titration with 0.1 NaOH using phenolphthaline as an indicator, were determined (A.O.A.C., 1995). The ratio of TSS to acid was then calculated.

C) Leaf chemical analysis:

Each season, non-fruiting and non-flashing shoot leaf samples were collected at random in September, washed twice in tap water, again in distilled water, dried at 70 °C till weight constants were reached, then ground and digested.

Leaf carbohydrates were extracted and estimated using the method outlined by Malik and Singh (1980).

The nitrogen percentage in leaves was determined according to Wild *et al*. (1985).

The acquired data was analyzed statistically in accordance with Gomez and Gomez (1984). The means of the treatments were contrasted using the LSD test at the 0.05 level.

Results and Discussion

A) Effect of girdling and cincturing treatments on the floral, fruiting, and yield characteristics of Balady mandarin trees:

Data in Table (1) revealed that the number of flowers per branch of Balady mandarin trees was substantially increased by the tested girdling and cincturing treatments. The highest numbers of flowers per branch (362.67 and 284.33 flowers) were recorded for girdled branch treatment, followed by (351.33 and 270.67 flowers) per girdled trunk treatment.

Data also stated that cincturing treatments were recorded (349.33 and 218.00 flowers) for branch cincturing and (292.00 and 205.33 flowers) for trunk cincturing, compared with the control treatment, which recorded (208.67 and 191.33 flowers), respectively, during the two studied seasons. Our results were in line with those obtained by Mostafa and Saleh (2006), Rivas *et al*. (2006), Rivas *et al*. (2007), Pereira *et al*. (2010), Ibrahim *et al*. (2016), and Yilmas *et al*. (2018).

Table 1. Effect of girdling and cincturing treatments on the floral, fruiting, and yield characteristics of the Balady mandarin cultivar during the 2020 and 2021 seasons

Treatments	Number of flowers/branch			Initial fruit set %			Fruit retention after June drop %			No. harvested fruits/branch			Final fruit retention % at harvest			Yield kg/tree		
	2020	2021	Mean	2020	2021	Mean	2020	2021	Mean	2020	2021	Mean	2020	2021	Mean	2020	2021	Mean
Control	208.67 D	191.33 E	200.00	26.87 E	25.50 D	26.19	23.60 E	18.67 E	21.14	8.67 D	9.67 D	9.17	6.30 D	10.22 D	8.26	48.56 E	49.86 E	49.21
Trunk girdling	351.33 B	270.67 B	311.00	37.29 B	44.38 B	40.84	35.36 B	35.72 B	35.54	17.33 B	18.33 B	17.83	10.06 B	12.46 B	11.26	70.14 B	70.66 B	70.40
Branch girdling	362.67 A	284.33 A	323.50	40.18 A	45.95 A	43.07	36.51 A	38.41 A	37.46	19.00 A	20.00 A	19.50	11.11 A	13.91 A	12.51	72.19 A	76.44 A	74.32
Trunk cincturing	292.00 C	205.33 D	248.67	32.18 D	39.73 C	35.96	30.18 D	30.88 D	30.53	15.00 C	15.33 C	15.17	8.09 C	10.67 CD	9.38	55.42 D	56.68 D	56.05
Branch cincturing	349.33 B	218.00 C	283.67	33.45 C	43.66 B	38.56	31.67 C	34.36 C	33.02	16.33 B	17.00 B	16.67	8.34 C	11.11 C	9.73	61.56 C	64.82 C	63.19

Different letters within the same column indicate significant differences, as determined by the LSD test ($p \leq 0.05$).

Table 2. Effect of girdling and cincturing treatments on the physical and chemical characteristics of Balady mandarin fruits during the 2020 and 2021 seasons

Treatments	Fruit weight (g)			Fruit size (cm^3)			Juice volume (cm^3)			TSS %			TA %			TSS/TA ratio		
	2020	2021	Mean	2020	2021	Mean	2020	2021	Mean	2020	2021	Mean	2020	2021	Mean	2020	2021	Mean
Control	144.50 D	132.30 E	138.40	149.97 E	139.03 E	144.50	61.12 C	65.33 B	63.23	12.47 C	12.40 AB	12.44	1.14 A	1.41 A	1.28	11.06 B	8.80 B	9.93
Trunk girdling	159.33 B	152.97 B	156.15	168.85 B	159.37 B	164.11	63.90 B	69.07 B	66.49	13.27 AB	12.53 AB	12.90	0.99 AB	1.33 A	1.16	13.40 A	9.43 B	11.42
Branch girdling	174.50 A	160.97 A	167.74	186.67 A	169.43 A	178.05	65.94 A	75.97 A	70.96	13.67 A	12.80 A	13.24	0.93 B	1.19 B	1.06	14.65 A	10.74 A	12.70
Trunk cincturing	157.27 C	139.63 D	148.45	164.31 D	147.40 D	155.86	60.29 D	65.97 B	63.13	13.07 B	11.67 C	12.37	0.96 B	1.34 A	1.15	13.59 A	8.72 B	11.16
Branch cincturing	157.30 C	140.33 C	148.82	165.18 C	149.25 C	157.22	61.58 C	67.43 B	64.51	13.13 B	12.27 B	12.70	0.97 B	1.19 B	1.08	13.56 A	10.32 A	11.94

Different letters within the same column indicate significant differences, as determined by the LSD test ($p \leq 0.05$).

The impact of girdling and cincturing on increasing fruit set may relate to photoassimilates accumulating in the canopy due to the obstruction of soluble sugar transport downward.

All girdling or cincturing treatments significantly increased fruit set percentage during the two studied seasons, and there were considerable differences between most of the treatments.

Both girdling and cincturing treatments had a significant influence on the number of retained fruits and the percentage of their retention in the 2020 and 2021 seasons. The obtained results showed that the number of retained fruits percentage after June drop was highest with girdling branch treatment (36.51 and 38.41) against (23.6 and 18.67) for control in the 2020 and 2021 seasons, respectively. The percentage of fruit retained, with regards to the initial fruit set, indicated a similar trend, where the highest percentages were obtained by branch girdling treatment, which recorded (11.11% and 13.91%) compared to the control, which recorded (6.30% and 10.22%), respectively, in the 2020 and 2021 seasons.

Our findings were in line with those obtained by Rivas *et al*. (2007), Santos *et al*. (2014), and Ibrahim *et al*. (2016).

Data at harvest showed a similar tendency, where the branch girdling treatment gave the highest numbers of harvested fruits (19.00 and 20.00 per branch) compared with the control treatment, which recorded (8.67 and 9.67 fruits/branch), respectively, during the two studied seasons.

In accordance with the results in Table (1), we can notice that girdling or cincturing treatments significantly increased the number of harvested fruits, and there were significant differences between most of the treatments.

Table (1) clearly exhibited that during the two studied seasons, all treatments substantially increased the yield (kg) of Balady mandarin trees in comparison to the control.

The best results in terms of yield were gained from bunch girdling trees, followed by trunk girdling trees. Where the total yield associated with these treatments was (72.19 & 76.44 kg/tree) and (70.14 & 70.66 kg/tree) compared with the control treatment, which recorded (48.56 & 49.86 kg/tree), respectively, during the 2020 and 2021 seasons.

The positive influence of girdling and cincturing treatments may be due to the increment of fruit set and the delaying of fruitlet abscission.

These results were in agreement with Mostafa and Saleh (2006), Cimo *et al*. (2013), Nascente *et al*. (2015), Yilmas *et al*. (2018), and El-Sayed (2021).

B) Effect of girdling and cincturing treatments on the fruit quality of Balady mandarin trees:

1- Effect of girdling and cincturing treatments on physical properties:

Data in Table (2) demonstrated the impact of (trunk or branch) girdling or cincturing treatments on the physical properties of Balady mandarin trees in the 2020 and 2021 seasons. It was clear to notice that all treatments significantly improved fruit weight and size compared to the control treatment during the two studied seasons.

The best treatment was branch girdling, while fruit weight values reached (174.50 g and 160.97 g) and fruit size reached (186.67 cm^3 and 169.43 cm^3) compared with the control, which recorded (144.50 g and 132.30 g) and (149.97 cm^3 and 139.03 cm^3), respectively, during 2020 and 2021.

There were statistically significant differences between most of the treatments during the two studied seasons. These results were in agreement with Ariza *et al*. (2004), Roussos and Tassis (2011), Cimo *et al*. (2013), Nascente *et al*. (2015), and El-Sayed (2021).

In this regard, it was clear to notice that the effect of (trunk or branch) girdling or cincturing treatments on fruit juice content followed a similar trend, where all treatments increased fruit juice content compared with the control, but there were no noticeable differences between most of the treatments during the two studied seasons. The best treatment was branch girdling, while fruit juice content values reached (65.94 cm^3 and 75.97 cm^3) compared with the control treatment, which recorded (61.12 cm^3 and 65.33 cm^3), respectively, in 2020 and 2021.

These results were in agreement with Mostafa and Saleh (2006), Nascente *et al*. (2015), and El-Sayed (2021).

These findings may be due to the fact that girdling and cincturing treatments may enhance fruit growth through the buildup of carbohydrates.

2- Effect of girdling and cincturing treatments on fruit chemical properties:

Data regarding the mandarin fruit juice chemical properties are shown in Table 2. It was revealed that during the two seasons studied, all treatments raised the TSS% of Balady mandarin fruits, and there were no discernible differences between most of the treatments.

The best results were registered from trees that were branch girdled, which recorded 13.67% & 12.80% compared with control trees (12.47% & 12.40%), respectively, in 2020 and 2021. On the other side, all treatments reduced total acidity (%) compared to the control, while branch girdling treatment had the lower values, which recorded 0.93 & 1.19 % compared with the control (1.14 and 1.41 %), respectively, during the 2020 and 2021 seasons.

All treatments boosted the ratio of TSS to acid, while the TSS/acid ratio values of girdled branches were recorded (14.65 & 10.74) compared with the control, which recorded (11.06 & 8.80), during the 2020 and 2021 seasons.

These results were in agreement with Dawood *et al*. (2001), Ariza *et al*. (2004), Rivas *et al*. (2006), Ibrahim *et al*. (2016), and El Sayed (2021).

These results may be attributed to the fact that girdling and cincturing treatments may enhance fruit growth by accumulating carbohydrates.

C) Effect of girdling and cincturing treatments on total carbohydrates and nitrogen percentages in the leaves of Balady mandarin trees:

Data in Table (3) presented the effect of (trunk or branch) girdling or cincturing treatments on total carbohydrates (%) and N (%) of Balady mandarin leaves in the 2020 and 2021 seasons.

It was clear to notice that most treatments significantly increased total carbohydrates; the best treatment was branch girdling, as total carbohydrates values recorded (18.72% and 14.02%) compared with the control treatment, which recorded (13.61% and 10.28%), respectively, in 2020 and 2021. These results were in agreement with Goren *et al*. (2003), Mostafa and Saleh (2006), Rivas *et al*. (2006), Rivas *et al*. (2010), Ibrahim *et al*. (2016), and El-Sayed (2021).

In addition, it was clear that most treatments significantly decreased leaf content of nitrogen (%), where the best treatment was trunk cincturing, while N% reached (4.04% and 4.10%), compared with control, which recorded (5.30% and 4.60%), respectively, during 2020 and 2021.

These findings were consistent with Cimo *et al*. (2013) and Nascente *et al*. (2015). These results may be caused by the reality that the technique of cincturing is considered a less severe treatment where the positive effects of girdling can be retained without having a negative impact on the tree because the cut is made through the layer of bark to the central hardwood without the removal of any bark.

Table 3. Effect of girdling and cincturing treatments on total carbohydrates and nitrogen percentages in the leaves of Balady mandarin trees during the 2020 and 2021 seasons

Treatments	Total carbohydrates %			Nitrogen %		
	2020	2021	Mean	2020	2021	Mean
Control	13.61 B	10.28 C	11.95	5.30 A	4.60 A	4.95
Trunk girdling	18.69 A	13.91 A	16.30	3.84 BC	3.89 AB	3.87
Branch girdling	18.72 A	14.02 A	16.37	3.53 CD	3.55 B	3.54
Trunk cincturing	13.64 B	10.97 C	12.31	4.04 B	4.10 AB	4.07
Branch cincturing	18.69 A	12.16 B	15.43	3.29 D	3.84 AB	3.57

Different letters within the same column indicate significant differences, as determined by the LSD test ($p \leq 0.05$).

Conclusion

During a two-year study, the response of Balady mandarin trees to girdling or cincturing treatments was determined. Overall, flowering, fruiting, leaf carbohydrate content, yield, and some fruit quality characteristics were all positively impacted by all girdling and cincturing treatments under the climatic conditions of Sohag Governorate. They also showed a trend towards to decrease mandarin leaves content of nitrogen. According to the results obtained, it can be

recommended to conduct girdling for Balady mandarin trees under Sohag conditions in order to enhance the yield and quality of the fruits.

References

A.O.A.C. (1995). Association of Official Agricultural Chemists, Official Methods of Analysis, 16th Ed., Washington, DC, USA.

Ariza, R., Cruzaley, R., Vázquez, E., Barrios, A. and Alarcón, N. (2004). Efecto de las labores culturales en la producción y calidad del limón mexicano de invierno. Rev. Fitotec. Mex., 27(1): 73-76.

Boyd, L.M. and Barnett, A.M. (2011). Manipulation of whole vine carbon allocation using girdling, pruning, and fruit thinning affects fruit numbers and quality in kiwifruit. HortScience, 46(4): 590-595.

Cimo, G., Bianco, R.L., Gonzalez, P., Bandaranayake, W., Etxeberria, E. and Syvertsen, J.P. (2013). Carbohydrate and nutritional responses to stem girdling and drought stress with respect to understanding symptoms of huanglongbing citrus. HortScience, 48(7): 920-928.

Dawood, S.A., Meligy, M.S. and El-Hamady, M.M. (2001). How to regulate cropping in "Balady" mandarin trees (B) using girdling and GA_3. Minufiya J. Agric. Res., 26(3): 883-894.

EL-Sayed, M. (2021). Effect of girdling and gibberellic acid application on yield and fruits quality characteristics of "Balady" mandarin. Egyptian J. Desert Res., 71(1): 75-97.

Gomez, K.A. and Gomez, A.A. (1984) Statistical Procedures for Agricultural Research, 2nd Ed.; Wiley Inter Science: New York, NY, USA; pp. 1–690.

Goren, R., Huberman, M. and Goldschmidt, E.E. (2003). Girdling: Physiological and Horticultural Aspects. Horticultural Reviews, 30: 1-36.

Hackney, C.R., Boshoff, M. and Slabbert, M.J. (1995). Increasing yield of young "Hass" avocado trees using the cincturing technique. South African Avocado Growers' Association Yearbook, 18: 54-55.

Ibrahim, M.M., Mohamed, A.O., Mohamed, A.H. and Omar, A.A. (2016). Effect of some girdling treatments on fruiting behavior and physio-chemical properties of "Washington" navel orange trees. J. Agric. Vet. Sci., 9(6): 58-65.

Khandaker, M.M., Hossain, A.S., Osman, N. and Boyce, A.N. (2011). Application of girdling for improved fruit retention, yield and fruit quality in *Syzygium samarangense* under field conditions. Int. J. Agric. Biol., 13: 18-24.

Li, C.Y., Weiss, D. and Goldschmidt, E.E. (2003). Girdling affects carbohydrate-related gene expression in leaves, bark and roots of alternate-bearing citrus trees. Ann. Bot. (Lond.) 92(1):137-143.

Malik, C.P. and Singh, M.B. (1980). In: "Plant Enzymology and Histo-Enzymology". A text manual. Kalyani Publishers, New Delhi, India.

Mostafa, E.A.M. and Saleh, M.M.S. (2006). Response of "Balady" mandarin trees to girdling and potassium sprays under sandy soil conditions. Res. J. Agric. Biol. Sci., 2(3): 137-141.

Nascente, A.C.S., Anjos, R.A.R., Santos, P.G.F., Mendes, L.W.A., Custodio, J.P.C., Dion, H. Jr., Silveira, P.S. and Matos, F.S. (2015). Productivity of *Citrus latifolia* plants subjected to branch girdling. African J. Agric. Res., 10(46): 4209-4214.

Pereira, C.S., Siqueira, D.L., Salomao, L.C.C. and Cecon, P.R. (2010). Fixação de frutos de limeiras ácidas "Tahiti" aneladas e tratadas com ácido giberélico. Rev. Bras. Frutic., 32(4): 1238-1243.

Putnik, P., Barba, F.J., Lorenzo, J.M., Gabrić, D., Shpigelman, A., Cravotto, G. and Kovačević, D.B. (2017). An integrated approach to mandarin processing: Food safety and nutritional quality, consumer preference, and nutrient bioaccessibility. Compr. Rev. Food Sci. Food Saf., 16(6): 1345-1358.

Rivas, F., Gravina, A. and Agusti, M. (2007). Girdling effects on fruit set and quantum yield efficiency of PSII in two citrus cultivars. Tree physiol., 27(4): 527-535.

Rivas, F., Martínez-Fuentes, A., Mesejo, C., Reig, C. and Augusti, M. (2010). Girdling effect on fruitlets hormonal and nutritional content in different citrus shoot types. J. Agrociencia (Montevideo), 14(1), 8-14.

Rivas, F., Erner, Y., Alos, E., Juan, M., Almela, V. and Agusti, M. (2006). Girdling increases carbohydrate availability and fruit set in citrus cultivars irrespective of parthenocarpic ability. J. Hortic. Sci. Biotechnol., 81(2): 289-295.

Roussos P.A. and Tassis, A. (2011). Effect of girdling, nitrogen, zinc and auxin foliar spray applications on mandarin fruit "Nova" quality characteristics. Emir. J. Food Agric., 23(5):431-440.

Santos, D.D., Siqueira, D.L.D., Salomao, L.C.C., Cecon, P.R., Oliveira, G.P., Machado, D.L.M. and Zucoloto, M. (2014). Levels of carbohydrates and chlorophyll fluorescence a leaves of acid lime trees "Tahiti" subjected to girdling and ringing of branches. Cienc. Rural, 44(10):1725-1731.

Verreynne, J.S., Rabe, E. and Theron, K.I. (2001). The effect of combined deficit irrigation and summer trunk girdling on the internal fruit quality of "Marisol" Clementines. Sci. Hortic., 91(1-2): 25-37.

Wild, S.A., Corey, R.B., Layer, J.G. and Voigt, G.K. (1985). Soils and Plant Analysis for Tree Culture, 3rd Ed.; Oxford and IBH Publishing Co.: New Delhi, India, 1985; pp. 529–546.

Yang, X.-Y., Wang, F.-F., Teixeira da Silva, J.A., Zhong, J. and Liu, Y.-Z. (2013). Branch girdling at green mature stage affects fruit ascorbic acid contents and expression of genes involved in L.galactose pathway in citrus. New Zealand J. Crop Hortic. Sci., 41(1): 23-31.

Yilmas, B., Cimen, B., Incesu, M., Yesiloglu, T. and Yilmaz, M. (2018). Influence of girdling on the seasonal leaf nutrition statues and fruit size of "Robinson" mandarin (*Citrus reticulate* Blanco). Appl. Ecol. Environ. Res., 16(5): 6205-6218.

تأثير التحليق والحز على العقد والمحصول في أشجار اليوسفي البلدي

صباح محمد بدوي[1]، عزه سامي حسين[2]

[1]مركز البحوث الزراعية، جزيرة شندويل، سوهاج، مصر

[2]قسم الفاكهة، كلية الزراعة، جامعة أسيوط، أسيوط، مصر

الملخص

أصبحت زراعة أشجار الحمضيات المثمرة أكثر تكلفة خلال السنوات القليلة الماضية نتيجة لارتفاع تكاليف الإنتاج. لهذا ، تم استخدام طرق أقل ضرراً بالبيئة في محاولة لإيجاد تقنية لخفض هذه التكاليف مع الحصـــول على إنتاجية وجودة عالية من الثمار الخالية من أي بقايا كيميائية. أجريت هذه الدراسة خلال موسمين متتاليين 2020 و 2021 علي خمسة عشر شجرة يوسفي بلدي عمر 20 ســـنة مطعومه علي أصـــل النارنج ومزروعة علي مســـافة 5 × 5 متر في المزرعة الإنتاجية بمركز البحوث الزراعية بجزيرة شندويل بمحافظة سوهاج.

تهدف التجربة لدراسة تأثير التحليق والحز على عقد الثمار ومحصول أشجار اليوسفي البلدي.

أوضـحت النتائج أن جميع معاملات التحليق والحز قيد الدراسـة (تحليق أو حز الجذع أو الأفرع)، كـان لهـا تـأثير إيجـابي على الإزهـار والاثمـار ومحتوى الأوراق من الكربوهيـدرات والانتـاجيـة وبعض خصـائص جودة الثمار (نسـبة المواد الصـلبة الذائبة الكلية و نسـبة المواد الصـلبة الذائبة الكلية إلى الحموضة)، بينما أدت لتقليل محتوى الأوراق من النيتروجين في أشجار اليوسفي البلدي تحت الظروف المناخية لمحافظة سـوهاج. وتوصـى الدراسـة بأهمية تحليق أفرع وجذع أشـجار اليوسفي البلدي تحت ظروف سوهاج لتحسين إنتاجية وجودة الثمار.