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Effect of time and width of girdling on fruit quality of mango (*Mangifera indica* L.) cv. Alphonso

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Abstract
The experiment was laid out in Randomized block design with factorial concept comprising four treatments of girdling width viz., 0.75 cm (W_1), 1.00 cm (W_2), 1.25 cm (W_3) and 1.50 cm (W_4) and three treatments of girdling time i.e. 15th July (T_1), 15th August (T_2) and 15th September (T_3) of girdling time as along with control. The treatments were replicated thrice. Results of present investigation revealed the girdling treatment during 15th July with girdled width of 1.50 cm was significantly influenced maximum TSS (^{0}Brix), Reducing sugars and Total sugars and lowest in Acidity (%) compared to other treatments and Control.

Keywords: Time, width, girdling, fruit quality, mango, *Mangifera indica* L. cv. Alphonso

Introduction
Orchardists have practiced the use of girdling and related techniques in horticulture since last few decades in order to increase the fruit production. The culture of fruit trees is geared toward production of a high-value crop, reduce fruit drop integrating quantity and quality. This is achieved by various techniques; including breeding, nutrition, pest control and bio-regulators as well as direct manipulations of the plant itself. Direct plant manipulations leading to the desired yield consist of two kinds of horticultural techniques. Removal of certain tree organs (e.g. training, pruning, fruit thinning) and interference with translocation between major tree organs (e.g. girdling, ringing, scoring, branch bending, which modifies auxin distribution, may be included in this second category). Fruit trees might be viewed as a system of sinks and sources (leaves, reproductive organs and roots) interconnected via vascular organs (trunk, branches and scaffold roots). Girdling is basically an intervention in the phloem transport between canopy and roots, in an attempt to manipulate the distribution of photosynthate, mineral nutrients and plant bio-regulators (Goren *et al*., 2004) [4].

Pattern of movement and distribution of 14 C - photosynthate in mango at various stages of flowering and fruit development, the immediate and most direct reason for the heavy drop of fruit lets is the competition between them for a limit supply of photo-assimilates, as well a competition from developing shoots for these substances. Girdling generally causes an accumulation of carbohydrate above the girdle and a diminution of carbohydrates in the root system (Noel, 1970; Wallerstein *et al.*, 1974 and Wallerstein *et al.*, 1978) [10, 19, 18]. It would be there for expected that the number of fruit retained by bearing mango trees would be increased by girdling before fruitlets begin to drop (Chacko, 1984) [1]. Wide varieties of fruit species are girdled to induce flowering, improving fruit set, enlarge fruit size, advance maturity, increase yields and improve fruit quality parameters. Grape, mango, litchi, orange, peach, olive, avocado, apple *etc*. have responded in these areas.

Materials and methods
The experiment was conducted at Agriculture Experimental Station, Navsari Agricultural University, and Paria, which is situated at Valsad district of Gujarat and Regional Horticultural Research Station, Navsari Agricultural University, Navsari. The experiment was laid out in randomized block design with factorial concept comprising four treatments of girdling width viz., 0.75 cm (W_1), 1.00 cm (W_2), 1.25 cm (W_3) and 1.50 cm (W_4) and three treatments of girdling time i.e. 15th July (T_1), 15th August (T_2) and 15th September (T_3) of girdling time as along with control.

Girdling practiced mainly on secondary branches (50-60%) of the plants. Selected healthy plants having five or more than five secondary branches. Use of sharp pruning saw and small scale measurement tape for management of proper width of girdled portion. Girdling was done very carefully without damage of xylem tissue, only cut were made between peel and xylem. After girdling, applied the copper oxychloride 50% WP paste on girdled portion for protection of girdled portion.

Results

Data presented in Table 1. reveled that significantly maximum TSS (^{0}Brix) of the fruit was obtained in 1.50 cm of girdling width (W_4) treatment (20.90 ^{0}Brix) which was at par with W_3 treatment. While, the minimum TSS (^{0}Brix) was obtained in 0.75 cm girdling width (W_1) treatment (18.97 ^{0}Brix) which was at par with W_2 and W_3 treatments. Among different girdling time, girdling during 15th July (T_1) treatment produced significantly maximum TSS (20.46 ^{0}Brix). While, the minimum TSS (^{0}Brix) was obtained with T_3 treatment (19.05 ^{0}Brix) which was at par with T_2 treatment, significantly the lowest acidity (%) was obtained in 1.50 cm of girdling width (W_4) treatment (0.271%) which was statistically at par with W_3 treatment. While, the highest titrable acidity (%) was obtained in girdling W_1 treatment (0.313%). Among different girdling width, significantly maximum reducing sugars (%) of the fruit were obtained in 1.50 cm of girdling width (W_4) treatment (3.79%) which was statistically at par with W_3 treatment. While, the minimum reducing sugar (%) were obtained in 0.75 cm girdling width (W_1) treatment (3.49%) which were statistically at par with W_2 treatment. Total sugars (%) were significantly affected by different treatments of girdling width. Significantly maximum total sugars (%) were found in 1.50 cm girdling width (W_4) treatment (19.11%,). While, minimum total sugars (%) were found in W_1 treatment (17.22%) which was at par with W_2 treatment (Table 1).

Control *vs* Rest of the treatments analysis on TSS (^{0}Brix) was significantly affected with different treatment of girdling width and girdling time (Table 1). Significantly maximum TSS (^{0}Brix) was obtained in treated treatments (19.70 ^{0}Brix), also significantly the lowest titrable acidity (%) was obtained in treated treatments (0.290%). Also Treated treatments produced significantly maximum total sugars (17.99%).

Discussion

Different treatments of girdling width were significant on TSS (^{0}Brix), titrable acidity (%), reducing sugars (%) and total sugars (%). While, in case of girdling time on titrable acidity (%), reducing sugars (%) and total sugars (%) were found non-significant. While, it was significant with respect to TSS (^{0}Brix) content.

Quality parameters of the fruit *viz.*, TSS, reducing sugar and total sugars were significantly maximum in 1.50 cm girdling width (W_4) treatment and minimum conformed in 0.75 cm girdling width (W_1) treatment. This might be due girdling blocked the translocation of sucrose from leaves to roots through phloem bundles (Li and Xiao, 2001) [9]. The temporarily blockage resulted in decrease in starch content of the roots and accumulation of sucrose in the leaves which helped to increase sucrose levels in fruits (Onguso *et al*., 2004, Schneider, 1969, Plaut and Reinhold, 1967) [11, 16, 12]. These results are agreement with Reddy and Prakash (1989), Cheema *et al.* (1997) [2], Dhillon and Bindra (1999) [9], Ahmad and Zargar (2005), Koshita *et al.* (2011) [8] in grape; Rather *et al.* (2011) [14] in litchi and Roussos and Tassis (2011) in citrus.

The data pertaining on acidity (%) was significantly minimum in 1.50 cm girdling width (W_4) treatment and maximum acidity (%) was obtained in 0.75 cm girdling width (W_1) treatment. This might be due to total sugar and starch contents were higher above the ringing than below the ringing which lead to decrease in titrable acidity (%) content of the fruits (Onguso *et al*., 2004, Schneider, 1969, Plaut and Reinhold, 1967) [11, 16, 12]. This is in agreement with Rather *et al.* (2011) [14], Rani and Brahmachari (2002) [13] and Huang *et al.* (2012) [6] in litchi; Day and DeJong (1990), Onguso *et al.* (2004) [11] in peach; Khandekar *et al.* (2011) [7] in jamun and Tuan *et al.* (2012) [17] and Zhao *et al.* (2013) [20] in apple. Among different girdling time, 15th July of girdling time (T_1) gave the significantly maximum content of TSS (^{0}Brix) than later girdling treatments *i.e.* T_2 (15th August) and T_3 (15th September). This might be due to the earlier girdling resulted more response in carbohydrates accumulation, large amount of carbohydrates produced by photosynthesis used to be utilized for fruit development ultimately which improved quality of the fruits. Similar findings were reported by Cheema *et al.* (1997) [2] and Dhillon and Bindra (1999) [3] in grape and Onguso *et al.* (2004) [11] and Hossain *et al*. (2006) [5] in peach.

Different girdling widths and girdling time on control *vs* rest of the treatment analysis concerned, significant variation was observed in quality parameters of the fruits *viz.*, TSS (^{0}Brix), acidity and total sugars. This might be due to girdling blocked the translocation of sucrose from leaves to roots through phloem bundles. This way the block decrease starch content in root system and accumulated of sucrose in the leaves which help to increase sucrose levels of the fruits. (Onguso *et al*., 2004) [11] reported that sugar and starch contents were higher above the ringing than below which increases TSS (^{0}Brix) and total sugar which lead to decreased in acidity (%) of fruits.

Summary and Conclusion

On the basis of results obtained in the experiment, it can be concluded that girdling during 15th July with 1.50 cm width gave maximum TSS (^{0}Brix), Reducing sugars and Total sugars and lowest in Acidity (%). From present study it can be inferred that the girdling during 15th July with 1.50 cm width were proved beneficial for improving fruit quality parameters of fruit of mango cv. Alphonso.

Table 1: Effect of time and Width of girdling on fruit quality of mango (*Mangifera indica* L.) cv. Alphonso.

Treatments	TSS (ºBrix)	Titrable Acidity (%)	Reducing sugars (%)	Total sugars (%)
Width of Girdling (W)				
W_1	18.97	0.313	3.49	17.22
W_2	19.29	0.295	3.52	17.78
W_3	19.63	0.282	3.63	17.89
W_4	20.90	0.271	3.79	19.11
S.Em.±	0.28	0.004	0.05	0.21
C.D. at 5%	0.80	0.012	0.13	0.61
Time of Girdling (T)				
T_1	20.46	0.288	3.67	18.50
T_2	19.59	0.289	3.59	17.82
T_3	19.05	0.295	3.56	17.65
S.Em.±	0.24	0.004	0.04	0.18
C.D. at 5%	0.69	NS	NS	NS
Interaction effect (W x T)				
S.Em.±	0.49	0.007	0.08	0.37
C.D. at 5%	NS	NS	NS	NS
CV%	6.04	6.059	5.41	4.97
Treated *vs* Control				
Treated Mean	19.70	0.290	3.60	17.99
Control	17.69	0.330	3.47	16.06
S. Em. ±	0.51	0.007	0.08	0.38
C.D. at 5%	1.02	0.015	NS	0.77

References

1. Chacko EK. Physiology of vegetative and reproductive growth in mango (*Mangifera indica* L.) trees. Proc. First Australian Mango Res. Workshop, CSIRO, Melbourne, 1984, 54-70.
2. Cheema SS, Bindra AS, Dhaliwal HS, Dhillon WS. Effect of flower thinning, girdling and gibberellic acid on fruit quality of Perlette Grpes. J Res. Punjab Agri. Uni. 1997; 34(2):163-167.
3. Dhillon WS, Bindra AS. Effect of berry thinning and girdling on fruit quality in grapes. Indian Hort. J. 1999; 56(1):138-41.
4. Goren R, Huberman M, Goldschmidt EE. Girdling: Physiological and horticultural aspects. Hort. Rev. 2004; 30:1-35.
5. Hossain ABMS, Mizutani F, Onguso JM, Elshereif AR. Dwarfing peach trees and development of fruit quality by maintaining partially ringed bark strips as an innovative process in dwarfing technology. Botanical Studies. 2006; 47:251-257.
6. Huang D, Liu S, Zhou X, Qian D, Wu C, Xu Y. The effect of spiral girdling on the fruit-setting and development of young litchi trees. Acta Hort. 2012; 928:145-150.
7. Khandekar MM, Hossain AS, Osman N, Boyce AN. Application of girdling for improved fruit retention, yield and fruit quality in *Syzygium samarangense* under field conditions. Int. J Agric. Bio. 2011; 13(1):18-24.
8. Koshita Y, Yamane T, Yakushiji H, Azuma A, Mitani N. Regulation of skin color in 'Aki Queen' grapes: Interactive effects of temperature, girdling, and leaf shading treatments on coloration and total soluble solids. Scientia Hort. 2011; 129:98-101.
9. Li C, Xiao Y. Girdling increases yield of 'Nuomici' Litchi. Acta Hort. 2001; 558:233-235.
10. Noel AR. The girdled tree. *Bot. Rev.*, 1970; 36:162-195.
11. Onguso JM, Mizutani F, Hossain ABMS. Effect of partial ringing and heating of trunk on shoot growth and fruit quality of peach trees. Bot. Bull. Acad. 2004; 45:301-306.
12. Plaut Z, Reinhold L. The effect of water stress on the movement of 14 C sucrose of titrated water within the supply of leave of young bean plants. Australian J Biol. Sci. 1967; 20:297-307.
13. Rani R, Brahmachari VS. Effect of growth substances and girdling on fruit set, fruit drop and quality of litchi (*Litchi chinensis* Sonn.). Hort. J. 2002; 15(3):1-8.
14. Rather JA, Wani SH, Haribhushan A, Bhat ZA. Influence of girdling, thinning and GA_3 on fruit quality and shelf life of grape (*Vitis vinifera* L.) cv. Perlette. Elixir Agric. 2011; 41:5731-5735.
15. Roussos P, Tassis A. Effects of girdling, nitrogen, zinc and auxin foliar spray applications on mandarin fruit "Nova" quality characteristics. Emir. J Food Agric. 2011; 23(5):431-439.
16. Schneider H. Effect of trunk girdling on phloem of trunk of sweet orange trees on sour orange rootstocks. Hilgardia, 1969; 22:593-601.
17. Tuan M, Nguyen, Yen C. Effect of S-girdling on fruit growth and fruit quality of wax apple. World Academy Sci., Eng. Tech. 2012; 72:216-221.
18. Wallerstein I, Goren R, Bental Y. Effect of ringing on root starvation in sour orange seedlings. J Hort. Sci., 1978; 53:109-113.
19. Wallerstein I, Goren R, Monsellse SP. The effect of girdling on starch accumulation in sour orange seedlings. Candian J Bot. 1974; 52:935-937.
20. Zhao Y, Zhang L, Gao M, Tian L, Zheng P, Wang K *et al*. Influence of girdling and foliar applied urea on apple (*Malus domestica* L.) fruit quality. Pakistan J. Bot. 2013; 45(5):1609-1615.