

Original Research Article

<https://doi.org/10.20546/ijcmas.2022.1108.017>

Effect of Girdling on Flushing Pattern and Yield of Bombai Litchi

Agniva Halder * and Debalina Majhi

Department of Fruit Science, Bidhan Chandra Krishi Viswavidyalaya, Mohanpur-741252, Nadia, West Bengal, India

*Corresponding author

ABSTRACT

Keywords

Litchi, Girdling, Vegetative and Reproductive Growth and Yield

Article Info

Received:
02 July 2022

Accepted:
31 July 2022

Available Online:
10 August 2022

Trunk and primary branch girdling was carried out on 17 years old litchi (*Litchi chinensis* Sonn.) plants of Bombai variety at Horticultural Research Station, Mondouri, BCKV during 2017-2019. to find out the effect of Girdling on the vegetative and reproductive flushing pattern and yield of Bombai Litchi. The experiment was put on RBD consisted of eleven different treatments viz., Girdling (1mm, 2mm, 3mm, 4mm and 5mm width) was done on primary branches of plants [T₁, T₂, T₃, T₄ and T₅ respectively] and girdling on main trunk with 1mm, 2mm, 3mm, 4mm and 5mm width [T₆, T₇, T₈, T₉ and T₁₀ respectively] and an untreated control. All the treatments were replicated three times. Consecutive two years of girdling on the same plant showed a great impact on flowering behaviour and fruit setting percentage as well as boosted the yield.

Introduction

Litchi (*Litchi chinensis* Sonn.) is native to South China and South-Eastern Asia and has been widely cultivated for its prized fruit since 1766 B.C. (Menzel, 1984). It is considered one of the most environmentally sensitive plants and is adopted to only a few subtropical countries in the world. High rainfall and humidity induce good growth in litchi. A dry autumn and winter are essential for good flowering (Nakata & Watnabe, 1966).

In the West Bengal state of India the main commercial variety of litchi is Bombai, which is famous for its very attractive colour and sweetness,

but the main problem is irregular bearing. There are reports which reflect that the phenomenon of irregular bearing could be overcome by using girdling techniques (Morse and Oosthuizen, 1993).

Girdling is a specific process of cincturing, where rings of bark ranging in size and depth are cut out of the phloem from the roots to leaves. One of the best-known effects of girdling is the accumulation of assimilates above the girdle. Generally, increased levels of carbohydrates can be found throughout the canopy (Weaver and McCune, 1959). In this relevant context the present research was undertaken to study Effect of Girdling on Flushing Pattern and Yield of Bombai Litchi.

Materials and Methods

The present experiment entitled “Effect of Girdling on Flushing Pattern and Yield of Bombai Litchi.” was conducted at Horticulture Research Station, Mondouri, Bidhan Chandra Krishi Viswavidyalaya, Nadia, West Bengal, India during the period of 2017- 2019.

The 17-years old litchi trees of ‘Bombai’ variety planted at 10 m×10 m spacing were used for the experiment. The girdling treatment was done during October targeting the 2nd flush of vegetative growth of Bombai litchi.

With the help of a sharp knife, steel wire and measuring scale girdle was done so carefully to remove the bark portion without damaging the cambium layer of the plant. Eleven different treatments, viz., Girdling (1mm, 2mm, 3mm, 4mm and 5mm width) was done on primary branches of plants [T₁, T₂, T₃, T₄ and T₅, respectively] and girdling on the main trunk with 1mm, 2mm, 3mm, 4mm and 5mm width [T₆, T₇, T₈, T₉ and T₁₀ respectively] and untreated control (T₁₁).

All the treatments were replicated three times and laid out in a randomized block design. In the 2nd season (2018-19) same treatment was done 8-12 cm over the previous seasons (2017-18) girdled portion.

Results and Discussion

Vegetative Flash and Flowering Behaviour

It is clear from table A.1 that girdling delayed the appearance of vegetative flush and panicle emergence. During 1st year (2017-18), mixed flowering panicle and irregular fruiting were observed in the experimental orchard of Bombai litchi and in nearby areas of the Gangetic alluvial zone.

Sparse flowering resulting in low yield was also observed in case of the Bombai variety of litchi. In the experimental field, it was observed that the

plants which were girdled showed better flowering than non-girdled plants which reflects the differences in yield (table A.3). Even within the same plant, girdled branches produced flowering. In contrast, other branches of that same plant produce sparse or no flowering.

Consecutive two years of girdling on the same plant showed a great impact on flowering behaviour and fruit setting percentage, which resulted in bumper fruiting in the next season (2018-19). However, there were prominent differences between girdled plants and non-girdled plants (table A.2 and A.3).

Branch girdling inhibits shoot growth and downward translocation of photo-assimilates via phloem in litchi cultivar Feizixiao (Wang *et al.*, 2010). Menzel and Simpson (1987) noticed that girdling improved flowering percentage by 40-80% in trees that would have an inadequate flowering percentage in the spring season.

Hermaphrodite: male flower ratio

Highest hermaphrodite: male flower ratio per panicle was observed in treatment 1 (girdling in primary branches with 1 mm width) with a ratio of 0.40 followed by treatment 8 (girdling in main trunk with 3 mm width) with 0.39. Which were much better than the ratio in control 0.36 (table A.2).

Chen and Luo (1998), observed that spiral girdling or ringing is an effective method for increasing pistillate flower production. Mandal *et al.*, (2014) reported that cincturing increases the ratio of hermaphrodite and male flowers in Bombai litchi at Murshidabad district of West Bengal.

Fruit Set

The highest fruit setting percentage (31.39 %) was observed in treatment 3 (girdling in primary branches with 3 mm width) and followed by treatment 7 (girdling in the main trunk with 2 mm width). Minimum fruit setting was observed in control treatment (T₁₁) with 9.25% (Table A.2).

Table.1 Effect of girdling on vegetative and reproductive behaviour of litchi var. *Bombai*

	Date of Girdling	Appearance of vegetative flush	Date of Panicle Emergence	Date of 1st flower opening	Date of fruit set	Date of rind colour appearance	Date of harvesting
1st year (2017-18)	9 th November 2017	10.11.17 to 20.11.17 (1 to 11 DAG)	21.01.18 – 23.01.18 (73 to 75 DAG)	Male- 27.02.18 (110 DAG) Hermaphrodite - 05.03.18 (116 DAG) Pseudohermaphrodite - 20.03.18 (131 DAG)	24.03.18 to 25.03.18 (135- 136 DAG)	24.04.18- 25-04.18 (166-167 DAG)	1 st Fortnight of May 2018
Control	-	10.11.17 to 20.11.17	Poor to no flowering	-	Poor to no fruitng	-	-
2nd year (2018-19)	29 th October 2018	20.11.18 to 25.11.18 (22 to 27 DAG)	27.01.19 to 29.01.19 (90 to 92 DAG)	Male- 03.03.19 (124 DAG) Hermaphrodite - 11.03.19 (132 DAG) Pseudohermaphrodite - 23.03.19 (144 DAG)	29.03.19 to 30.03.19 (150- 151 DAG)	07.05.19 to 08.05.19 (189-190 DAG)	2 nd Fortnight of May 2019
Control	-	16.11.18 to 20.11.18	24.01.19 to 27.01.19	-	26.03.19 to 27.03.19	07.05.19 to 08.05.10	2 nd Fort night of May 2019

*DAG: Days after girdling

Table.2 Effect of girdling on reproductive flush & fruit setting behaviour of litchi var. Bombai

2 nd Year(2018-19)	Treatment	Nos of Hermaphrodite flower/panicle	Nos of male flower/panicle	Hermaphrodite : Male (Ratio)	Fruit set %
Girdled Plant portion Girdled (Girdling done in Primary branches)	T ₁ (1mm)	115.00	286.00	0.40	24.94
	T ₂ (2mm)	125.33	331.33	0.37	20.80
	T ₃ (3mm)	112.33	308.00	0.36	31.39
	T ₄ (4mm)	97.00	255.66	0.37	18.74
	T ₅ (5mm)	92.66	271.33	0.34	25.70
Girdled (Girdling done in Main Trunk)	T ₆ (1mm)	113.66	294.33	0.38	15.40
	T ₇ (2mm)	183.33	495.66	0.36	29.19
	T ₈ (3mm)	87.00	220.00	0.39	24.16
	T ₉ (4mm)	87.00	240.66	0.35	27.92
	T ₁₀ (5mm)	129.00	359.33	0.36	22.58
Non girdled	T ₁₁ (control)	158.00	431.66	0.36	9.25
SEm±		24.03	60.46	0.01	4.21
CD (5%)		70.90	178.37	0.04	12.42
CV (1%)		96.72	243.30	0.04	16.94

Table.3 Effect of girdling on Yield of litchi var. Bombai

Girdled Plant portion	Treatment	1 st Year(2017-18)	2 nd Year(2018-19)
		Yield (kg plant ⁻¹)	Yield (kg plant ⁻¹)
Girdled (Girdling done in Primary branches)	T ₁ (1mm)	51.66	74.50
	T ₂ (2mm)	49.63	75.83
	T ₃ (3mm)	49.83	75.16
	T ₄ (4mm)	53.50	80.50
	T ₅ (5mm)	46.96	76.00
Girdled (Girdling done in Main Trunk)	T ₆ (1mm)	46.63	72.66
	T ₇ (2mm)	49.93	76.83
	T ₈ (3mm)	47.00	73.50
	T ₉ (4mm)	48.80	76.83
	T ₁₀ (5mm)	44.73	75.16
Non girdled	T ₁₁ (control)	42.60	69.58
SEm±		2.14	1.38
CD (5%)		6.31	4.09
CV (1%)		8.61	5.58

Yield

Girdling showed an impressive effect on the economic yield of Bombai litchi over control treatments (Table A.3). During 1st year (2017-18), highest yield (53.5 kg tree⁻¹) was obtained from treatment 4 (girdling at primary branches with 4 mm width) followed by second highest (51.66 kg tree⁻¹) from treatment 1 (girdling at primary branches with 1 mm width) which were far better than control (42.60 kg/tree).

Similarly in next cropping season (2018 -19), highest yield (80.5 kg tree⁻¹) was obtained from treatment 4 (girdling at primary branches with 4 mm width) followed by second highest (76.83 kg tree⁻¹) from both of treatment 7 (girdling in main trunk with 2 mm width) and treatment 9 (girdling in main trunk with 4 mm width) which were also far better than control (69.58 kg tree⁻¹). Under the Bihar condition, it was recorded that the average yield during both years from all girdled treatments was higher than that from the control (Kumar *et al.*, 2017). It is evident that girdling suppressed and delayed vegetative flush in winter and promoted

flowering. So the yield increases. The timing for girdling was also important.

Consecutive two years of girdling at the same plant also have a great impact on the growth period of litchi (from appearance of vegetative flush to rind colour appearance of the fruit). So, girdling showed a positive impact on regulating the reproductive behaviour and maturity time of crop, which is very fruitful for Bombai litchi, as it can extend the harvesting time, thus it affects the economic value or crop yield of that litchi orchard.

References

- Chen, J. Z. and Luo, X. Z. 1998. Advances in research on modulation of flower sex of litchi trees. *South-China-Fruits*, 27(6):26-27.
- Kumar, A., Pandey, S. D., Patel, R. K., Srivastava, K., Tripathi, M. and Nath, V., 2017. Effect of girdling on flowering and fruiting of litchi (*Litchi chinensis*) in subtropics of Bihar. *Indian Journal of Agricultural Sciences*, 87(3):397-401.
- Mandal, D., Sarkar, A., & Ghosh, B. 2014.

- Induction of flowering by use of chemicals and cincturing in “Bombai” litchi. *Acta Hort.*, (1029):265–271
- Menzel, C. M. 1984. The pattern and control of reproductive development in lychee: A Review. *Sci. Hort.*, 22(4):333–45.
- Menzel, C. M. and Simpson, D. R., 1987. Effect of cincturing on growth and flowering of lychee over several seasons in subtropical Queensland. *Australian J. of Exp. Agric.*, 27(5):733-738.
- Morse, R. L. and Oosthuizen, J. H. 1993. Litchi flower manipulation by girdling. *S. Africa Litchi Growers' Assoc. Yearbook*, 5:10-11.
- Nakata, S. and Watnabe, Y. 1966. Effects of photoperiod and night temperature on the flowering of *Litchi chinensis*. *Bot. Gaz.*, 127(2/3):146–52.
- Wang, L., Wang, H., Li, J. and Huang, X. 2010. Effects of branch girdling on shoot growth and mineral nutrients in litchi. *J.I of Fruit Sci*, 27(2):257-260.
- Weaver, R J, McCune, S B. 1959. Girdling: its relation to carbohydrate nutrition and development of Thompson seedless, Red Malaga and Ribier grapes. *Hilgardia* 28:421–456.

How to cite this article:

Agniva Halder and Debalina Majhi. 2022. Effect of Girdling on Flushing Pattern and Yield of Bombai Litchi. *Int.J.Curr.Microbiol.App.Sci*. 11(08): 176-181. doi: <https://doi.org/10.20546/ijemas.2022.1108.017>