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Effect of time on the success of inarching in *Khirni* (*Manilkara hexandra* L.) cv. Thar Rituraj

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Abstract

A field experiment entitled “Effect of time on the success of inarching in *Khirni* (*Manilkara hexandra* L.) cv. Thar Rituraj” was conducted during the year 2022-2023 at the Instructional Farm, Department of Fruit Science, College of Horticulture and Forestry, Jhalawar. The experiment consisted of nine treatments, i.e. dates of inarching from 20th June to 30th November laid out in Randomized Block Design with three replications. Among different times, inarching practised during 30th July (T₃) was found significantly superior over all other treatments. In this treatment, the maximum increase was noticed in shoot parameters like length of new growth (29.96 cm), diameter of new growth (2.29 mm), number of nodes/plant (29), rootstock girth (7.61 mm), scion girth (6.46 mm), height of the plant (56.09 cm), number of primary branches (09) and leaf parameters like leaf length (4.13 cm), leaf width (2.99 cm), leaf area (8.02 cm²), number of leaves/plant (25) and chlorophyll content (1.35 mg/g) along with cent per cent survival was also observed in this treatment. Hence it may be summarized that inarching at the time of 30th July (T₃) can be practised as an alternative method of propagation of *Khirni* (*Manilkara hexandra* L.).

Keywords: *Khirni*, vegetative propagation, inarching, rootstock, scion, survival percentage

Introduction

Khirni is botanically known as *Manilkara hexandra* L. It belongs to the family Sapotaceae. It is locally known as a *Raina* or *Rayan*. *Khirni* is socio-economically important underutilized fruit species in Western Central India. It is native to the tropical South-East-Asia and found in Central and Peninsular India (Stewart and Brandis, 1992)^[13]. The tree is found in the wild state in South, North and Central India mostly in the states of Rajasthan, Gujarat, Madhya Pradesh and Maharashtra (Malik *et al.* 2010)^[4]. The genus *Manilkara* contains 130 species. However, *Manilkara hexandra* is a less known underutilized fruit crop but now-a-days it is gaining popularity. It is a slow-growing evergreen tree. It has a spreading growth habit suitable for growing on waste and barren lands.

Khirni is a commercially and medicinally important tropical tree species and it is a significant source of livelihood and nutritional support for the local tribal population. The tree of *Khirni* attains 8 to 20 m in height with blackish-grey, longitudinally fissured, and cracked bark. Leaves are simple, alternate, stipulate, petiole 8-20 mm long, slender, slightly grooved above, glabrous, lamina 5-10 cm x 3-4.5 cm, long elliptic, elliptic-obovate, obovate or ovate-oblong; base acute; apex obtuse or emarginate; margin entire, glabrous, coriaceous; lateral nerves 10-20 pairs, closely pinnate, slender and midrib raised below. Flowers are white when young, brownish-red when dry and fragrant in nature. The fruit of *Khirni* is a berry, its shape is ovoid or ellipsoid with 1.5-2.0 cm long, and reddish yellow in colour. Fruits of *Khirni* have high economic value as mature fresh fruits, which are sweet and a good source of minerals, sugars, protein, carbohydrates, and vitamin A (Pareek *et al.* 1998)^[7]. The seeds contain approximately 25% oil, which is used for cooking purposes (Xian-zi, 1996)^[14]. The bark also contains 10% tannin, which is utilized for the treatment of fever and can be used for tanning purposes (Anonymous, 1962)^[2].

At present, minor or underutilized fruit crops are gaining importance due to their significant role in human health, nutrition, medicinal and therapeutic uses, income security, and ecological balance. In most underutilized fruit crops, the vegetative method for commercial multiplication has not been standardized suiting particularly to a specific agro-climatic zone. The northern state of India, where the climate is dry and sub-tropical, is found to be suitable for growing most of the minor fruit crops of arid and semi-arid nature. Among them, *Khirni*

(*Manilkara hexandra*) is important. The vegetative propagation method is advantageous in raising quality planting material. This method reduces juvenility and maintains uniformity in the planting material. In *Khirni* still, stray propagation methods using seed is used. Devising standard propagation techniques for the *Khirni* plant is really helpful in bringing *Khirni* under commercial orcharding. Hence, in this research attempts were made to propagate *Khirni* practicing inarching during different time spans. However, the success of the technique depends upon the time of the process and that is further influenced by the locality. In inarching, the rootstock is brought close to the mother plant for this it is grown in a pot or container. The rootstock and scion shoots of pencil thickness are selected. A similar matching cut is also given on rootstock. Both rootstock and scion are brought close to each other and wrapped using polythene tape. When union takes place, the upper portion of the rootstock is cut and the scion shoot is detached from a mother plant from the below portion.

Materials and Methods

The study entitled 'Effect of time on the success of inarching in *Khirni* (*Manilkara hexandra* L.) cv. Thar Rituraj' was conducted during the year 2022-23 at the Instructional Farm, Department of Fruit Science, College of Horticulture and Forestry, Jhalawar. The inarching was done at 25 cm height of rootstock. The age of the scion shoot was 3 months. During different point of inarching, same height (25 cm) plants of rootstock were used to prepare inarch. The incision for inarching was made 20 cm below the tip of scion. Thus, at each time of inarching, the height of plant (rootstock + scion) used for study was 45 cm. The treatments were replicated thrice as a part of an experiment. The experiment consisted of nine treatments, i.e. 20th June (T1), 10th July (T2), 30th July (T3), 20th August (T4), 10th September (T5), 30th September (T6), 20th October (T7), 10th November (T8) and 30th November (T9). The plant growth and development parameters were recorded at three months intervals.

Standard methods were used to record shoot parameters such as rootstock girth, scion girth, plant height, number of leaves per plant, number of primary branches, length of new growth and diameter of new growth. While, leaf parameters such as leaf length, leaf width, leaf area, number of leaves, chlorophyll content and survival percentage were measured after 90 days of inarching.

Results and Discussions

The investigation entitled "Effect of time on the success of inarching in *Khirni* (*Manilkara hexandra* L.) cv. Thar Rituraj" was carried during the year 2022-23.

The data clearly revealed that the inarching during 30th July (T₃) had significantly higher scion girth, rootstock girth, height of plant, length of new growth, diameter of new growth and survival percentage in plant of *Khirni* as shown in Table 1. The better growth in shoot parameters in inarching during 30th July (T₃) may have an association with the effect of time on inarching of plants of *Khirni*. Whenever the inarching was done on 30th November (T₉), the minimum growth in shoot parameters was recorded.

The data relating to average growth after 90 days of inarching are presented in Table 1. The maximum growth of scion girth (6.46 mm), rootstock girth (7.61 mm), plant height of (56.09 cm), length of new growth (29.96 cm) and diameter of new growth (2.29 mm), when inarching were done on 30th July (T₃), followed by 10th July (T₂). While the minimum average scion girth (5.34 mm), rootstock girth (6.87 mm), plant height (49.91) cm, length of the new growth (21.33 cm), diameter of the new growth (1.68 mm) after 90 days of inarching were observed when inarching was done on 30th November (T₉).

The average maximum survival percentage of inarched plants was recorded as 100% when inarching was done on 20th June, 10th July, 30th July, 20th August, 10th September and 30th September (T₁ to T₆). The minimum survival percentage was recorded at 66.67% on 20th October (T₇), 10th November (T₈) and 30th November (T₉).

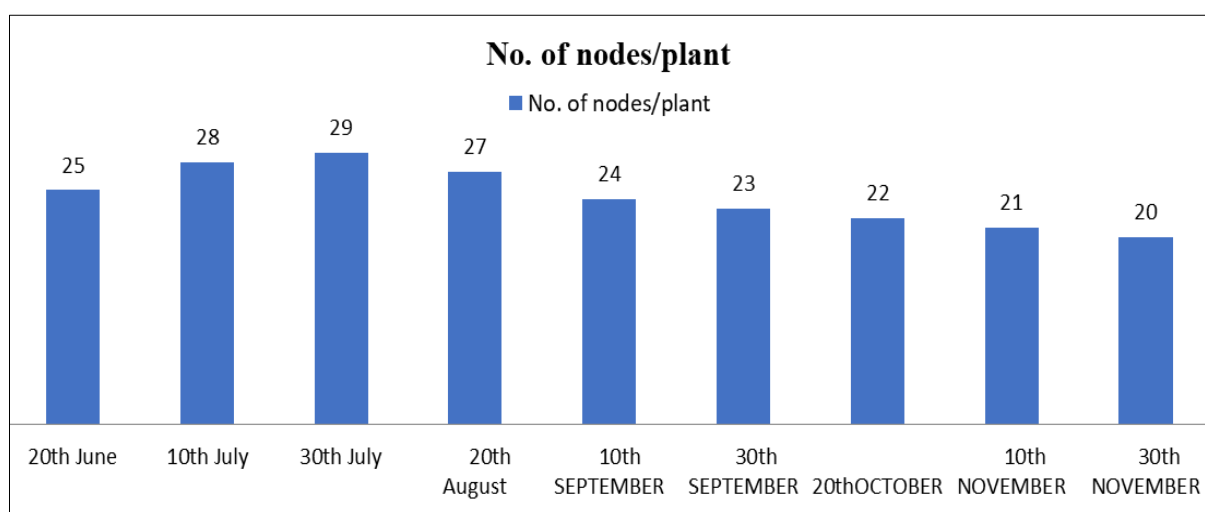


Fig 1: Effect of time on the number of nodes per plant after 90 days of inarching

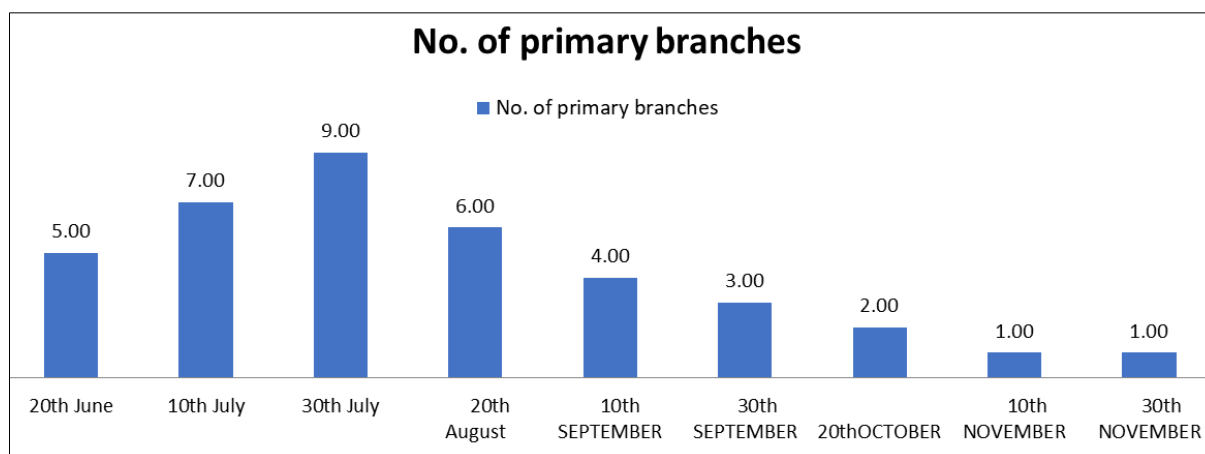


Fig 2: Effect of time on the number of primary branches after 90 days of inarching

Table 1: Effect of time on the scion girth, rootstock girth, plant height, length of new growth, diameter of new growth and survival percentage after 90 days of inarching

Treatments	Scion girth (mm)	Rootstock girth (mm)	Plant height (cm)	Length of new growth (cm)	Diameter of new growth (mm)	Survival percentage (%)
T ₁ 20 th June	5.92	7.23	53.43	27.63	2.03	100.00
T ₂ 10 th July	6.23	7.44	55.11	28.83	2.19	100.00
T ₃ 30 th July	6.46	7.61	56.09	29.96	2.29	100.00
T ₄ 20 th August	6.08	7.35	53.95	26.51	2.11	100.00
T ₅ 10 th September	5.85	7.17	52.45	25.62	1.96	100.00
T ₆ 30 th September	5.72	7.09	51.42	24.59	1.89	100.00
T ₇ 20 th October	5.63	7.01	50.87	23.12	1.81	66.67
T ₈ 10 th November	5.51	6.94	50.27	22.29	1.75	66.67
T ₉ 30 th November	5.34	6.87	49.91	21.33	1.68	66.67
C.D. (5%)	0.03	0.04	0.07	0.57	0.05	11.90
S.Em (±)	0.01	0.01	0.02	0.18	0.01	3.93

The effect of different times of inarching on the number of nodes per plant and number of primary branches after 90 days as shown in figure 1 and 2. The maximum number of nodes (29) and number of primary branches (5) after 90 days of inarching were found when inarching was followed during 30th of July (T₃). It was found to be significant to all other treatments and the minimum number of nodes per inarched plant (20) and number of primary branches (1) after 90 days of inarching was done on 30th of November (T₉).

Similar results were reported by Singh and Sengupta, (1996)^[12] observed better growth of shoot parameters in inarching/grafting in sapota; Patil *et al.* (2009)^[10] in *Khirmi*; Mulla *et al.* (2011)^[5] and Muniyappan *et al.* (2019)^[6] in jamun crop. The better improvement in shoot parameters of inarched plants of *Khirmi* could be attributed to ideal temperature (25 to 35 °C) as prevailed from July to August,

which has a role in augmenting physiological processes in the plant. As *Khirmi* prefers high humidity (60 to 87%) which reduces water stress and transpiration losses which might favour better growth of the shoot parameters.

The data relating to the leaf parameters in inarching techniques at different times are presented in Table 2. The table depicts that the maximum leaf length (4.13 cm), leaf width (2.99 cm), leaf area of (8.02 cm²), number of leaves (25 leaves), maximum chlorophyll content (1.35 mg/g) after 90 days of inarching, when inarching was done on 30th July (T₃) which was found to be statistically significant to all other treatments. Whereas, the minimum leaf length (3.49 cm), leaf width (2.41 cm), leaf area of (5.46 cm²), number of leaves (16 leaves) and chlorophyll content (0.69 mg/g) were recorded when inarching was done on 30th November (T₉).

Table 2: Effect of time on the leaf length, leaf width, and leaf area, number of leaves per plant and chlorophyll content after 90 days of inarching

Treatments	Leaf length (cm)	Leaf width (cm)	Leaf area (cm ²)	No. of leaves/plant	Chlorophyll content (mg/g)
T ₁ 20 th June	3.85	2.72	6.80	21	1.06
T ₂ 10 th July	4.01	2.89	7.53	23	1.21
T ₃ 30 th July	4.13	2.99	8.02	25	1.35
T ₄ 20 th August	3.92	2.80	7.13	22	1.13
T ₅ 10 th September	3.77	2.66	6.51	20	0.98
T ₆ 30 th September	3.70	2.60	6.25	19	0.91
T ₇ 20 th October	3.62	2.54	5.97	18	0.85
T ₈ 10 th November	3.56	2.48	5.73	17	0.78
T ₉ 30 th November	3.49	2.41	5.46	16	0.69
C.D. (5%)	0.06	0.03	0.03	0.58	0.03
S.Em (±)	0.02	0.01	0.01	0.19	0.01

Similar studies were reported better effectivity in inarching when it was done during July. Kumar *et al.* (2020)^[3] observed better growth of leaf parameters in jackfruit; Patel *et al.* (2007)^[8] in sapota; Muniyappan *et al.* (2019) in *Khasi mandarin*; Patil *et al.* (2010)^[9] in sapota on *Khirmi* rootstock and Akter *et al.* (2016)^[11] in jamun. Better growth in the leaf parameters in inarching done during 30th July (T₃) may be considered associated with time of inarching and favourability of environmental variables bound to it. Such a situation might have proven promotory to cell division, consequently, more meristematic activity, cell elongation and thus leaf parameters attached to the inarching done during the time of 30th July. It might be undertaken that under favourable temperature and humidity there may probably be better absorption of nutrients by the plant (Salisbury and Ross, 1985)^[11].

Conclusion

It can be concluded that inarching during 30th July (T₃) had been a better influence on the overall success of inarching in *Khirmi* (*Manilkara hexandra* L.) cv. Thar Rituraj. In this treatment (30th July -T₃), the growth of shoot parameters like length of new growth (29.96 cm), diameter of new growth (2.29 mm), number of nodes/plant (29), rootstock girth (7.61 mm), scion girth (6.46 mm), height of the plant (56.09 cm), number of primary branches (09) and leaf parameters like leaf length (4.13 cm), leaf width (2.99 cm), leaf area (8.02 cm²), number of leaves/plant (25) and chlorophyll content (1.35 mg/g) were found maximum at the time of final observation during March.

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