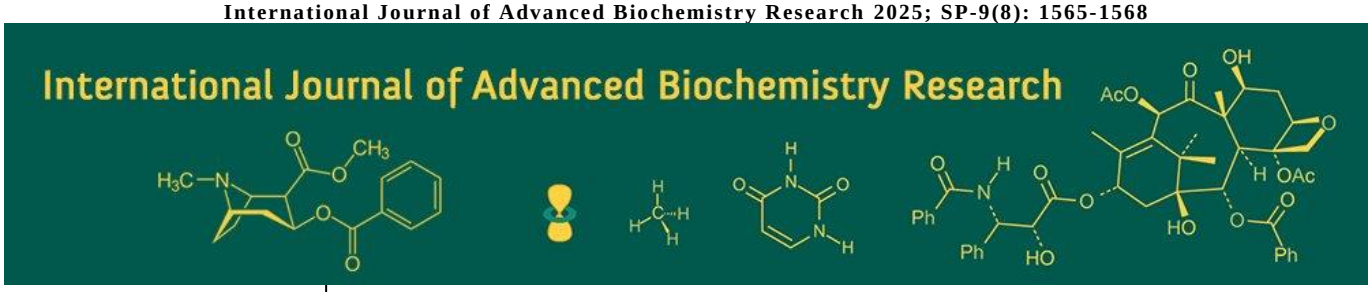

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Effect of different grafting time in naturally ventilated condition on success of wedge grafting in custard apple (*Annona squamosa* L.) cv. Sindhan

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Abstract
The present investigation aimed to evaluate the "Effect of different grafting time in naturally ventilated condition on success of wedge grafting in custard apple (*Annona squamosa* L.) cv. Sindhan" at the College Farm, College of Horticulture, Sardarkrushinagar Dantiwada Agricultural University, Jagudan, Dist. Mehsana, from February to July 2024. Six treatment were tested, comprising six different grafting times (T_1-T_6). The grafting times ranged from the 3rd week of February to the 1st week of May at every 15 days interval. The experiment was laid out in a Completely Randomized Design, with three repetitions. The results revealed that 3rd week of March (T_3) proved to be the most favorable grafting time, showing the shortest days taken for sprouting of graft (11.53) and highest number of sprouted grafts (90.56%) at 30 DAG. Significant improvements were also observed in other growth parameters, including the number of fully opened leaves 14.73, 20.07, length of scion 52.24 cm, 60.24 cm, girth of scion 8.68 mm, 10.99 mm at 45 and 90 DAG, respectively as well as graft survival percent 90.56 at 90 DAG. Based on results obtained from present investigation, it can be concluded that wedge grafting done at 3rd week of March recorded better growth, higher graft survival percent and economic return.

Keywords: Wedge grafting, custard apple, naturally ventilated condition

Introduction
Custard apple (*Annona squamosa* L.) is a dryland fruit crop of economic importance in India. Native to the tropical Americas, particularly the West Indies and South America. In India, it is cultivated mainly in Andhra Pradesh, Bihar, Madhya Pradesh, Maharashtra, Tamil Nadu, Gujarat and Odisha, covering 51.73 thousand ha with 548.27 thousand tonnes production (Anon., 2023) [2, 3]. In Gujarat, it occupies 7,900 ha with 79.56 thousand tonnes yield, predominantly in Bhavnagar district. Belonging to the family *Annonaceae* (40 genera, 120 species, only five edible), it is known as the "poor man's fruit" for its suitability to marginal soils. Major production constraints include a shortage of improved planting material and lack of standardized propagation techniques. Seed propagation is common but unsuitable for maintaining varietal traits due to the crop's heterozygous nature. Wedge grafting is preferred for producing true-to-type plants, ensuring genetic fidelity and higher yields. Grafting can be done in shade nets, naturally ventilated polyhouses and fan-and-pad polyhouses. Naturally ventilated polyhouses use passive airflow for temperature and humidity control, reducing stress on grafted seedlings. Success depends on climatic conditions and season, with March-May being optimal in South Gujarat (Chauvatia & Singh, 1999) [6], though precise timing is crucial. Wedge grafting offers better scion-rootstock compatibility, rapid establishment and higher survival rates. Considering the need for timely production and the future demands of the industry, standardizing the ideal grafting period under North Gujarat's conditions will ensure timely availability of quality planting material, meet the rising demand for improved varieties and enhance productivity in custard apple cultivation. This would further enhance the effectiveness of propagation techniques and improve overall productivity in the region.

Materials and Methods
The experiment was conducted during the summer season of 2024 (February-July) at the College Farm, College of Horticulture, Sardarkrushinagar Dantiwada Agricultural

University, Jagudan, Mehsana. The study was laid out in a Completely Randomized Design (CRD) with six treatments and three replications. The variety *Sindhan* was used and the treatments comprised different grafting times: T_1-3rd week of February, T_2-1st week of March, T_3-3rd week of March, T_4-1st week of April, T_5-3rd week of April and T_6-1st week of May. Each treatment consisted of 20 plants, with a total of 360 plants in the experiment. Grafting was performed in polythene bags containing a potting mixture of farmyard manure, vermiculite and soil in equal proportions (1:1:1 v/v/v). The grafted plants were maintained under growing environments naturally ventilated polyhouse. Irrigation was provided manually and plant protection measures were applied as required. Uniform length, pencil thickness, healthy scion were used for grafting. The scion sticks were selected from mature shoots of current year growth from terminal portion of the mother plants of cultivar 'Sindhan' and were defoliated 10 days prior grafting. The grafting was done at 15 days intervals through wedge grafting. Observations were recorded after 30, 45 and 90 days after grafting. Formula used to analyse Survival percentage (%)

$$\text{Survival percentage} = \frac{\text{Total number of grafts success}}{\text{Total number of grafts prepared}} \times 100$$

The experiment involved a series of treatment combinations, outlined in the details below.

Table 1: Treatment combinations details

Sl. No.	Notation	Treatment combinations
1.	T_1	3rd week of February
2.	T_2	1st week of March
3.	T_3	3rd week of March
4.	T_4	1st week of April
5.	T_5	3rd week of April
6.	T_6	1st week of May

Results and Discussion

Days taken for sprouting of grafts

As presented in table 2a, grafting in the 3rd week of March (T_3) recorded the minimum days to sprouting (10.00), while maximum was recorded in the 1st week of May (T_6) *i.e.*, (21.53 days). Early sprouting in March-April grafts may be due to favourable temperatures, high carbohydrate reserves and active sap flow during this period (Panchal *et al.*, 2022; Hartmann *et al.*, 2007; Chauvatia & Singh, 1999) [21, 10, 6]. Delayed sprouting in May grafts could be attributed to reduced stored food materials, slowing callus formation and bud break (Giri & Lenka, 2008) [8], in agreement with findings in guava (Abbas *et al.*, 2013; Padmapriya *et al.*, 2021) [1, 20] and jackfruit (Kumar *et al.*, 2022) [17].

Sprouted grafts at 30 days after grafting (DAG)

T_3 produced the highest sprouted grafts (18.67%), *at par* with T_4 (18.00%), while T_6 recorded the lowest (11.00%) at 30 DAG, (Table 2a). Higher sprouting in March grafts was attributed to optimal temperature, relative humidity and assimilate availability, which enhanced meristematic activity and graft union healing (Nithya *et al.*, 2022) [19], These findings align closely with those reported in guava (Gotur *et al.*, 2017; Kholia *et al.*, 2022) [9, 15] and tamarind (Deshmukh and Bhagat, 2018) [7].

Number of fully opened leaves at 45 and 90 days after grafting (DAG)

At 45 DAG, T_3 recorded the highest leaf count (16.67), which was statistically *at par* with T_2 (15.27) and at 90 DAG, T_3 (22.47) was recorded highest number of fully opened leaves, which was statistically *at par* with T_4 (20.53). In contrast, T_6 had the lowest leaf counts (8.53 and 12.07, respectively at 45 and 90 DAG), (Table 2a). Early grafting favoured rapid bud break, leaf flushing and graft union formation under optimal temperature and humidity, whereas extreme conditions in May impeded callus formation and nutrient translocation (Bhandari *et al.*, 2021), These findings aligning with Panchal *et al.*, (2022) [21] in custard apple.

Length of scion (cm) at 45 and 90 days after grafting (DAG)

As presented in table 2b, T_3 showed maximum scion length (54.53 cm at 45 DAG and 61.86 cm at 90 DAG), which was statistically *at par* with T_2 and T_4, whereas T_6 showed lowest scion length (43.22 cm at 45 DAG and 49.06 cm at 90 DAG). Greater length in early grafts was attributed to early sprouting, faster union formation and improved nutrient absorption (Nithya *et al.*, 2022) [19], This results are consistent with reports given by Syamal *et al.*, 2012 [25], Sweeti *et al.*, 2016 [24] Barathkumar, 2017 [4] in aonla and Karna *et al.*, 2018 [14] in mango.

Girth of scion (mm) at 45 and 90 days after grafting (DAG)

T_3 showed maximum girth of scion at 45 and 90 DAG (8.99 mm and 11.51 mm, respectively), which was statistically *at par* with T_4. In contrast, T_6 had the lowest girth (6.48 mm and 9.14 mm at 45 and 90 DAG), (Table 2b). Increased girth in early grafts was linked to higher carbohydrate reserves, early sprouting, greater leaf production and better photosynthate supply, which also correlated with greater plant height (Hiwale *et al.*, 2008) [11], in agreement with findings in custard apple (Kudmulwar *et al.*, 2008; Kamble *et al.*, 2024) [16, 13] and mango (Thutte *et al.*, 2020) [26].

Graft survival percent at 90 days after grafting (DAG)

Maximum survival percentage was observed in T_3 (93.33%), was statistically *at par* with T_4 (90.00%), while T_6 recorded the lowest (55.00%), (Table 2b). High survival percentage in March-April grafts was due to favourable climatic conditions and higher carbohydrate content in physiologically active plants. Majumder *et al.* (1972) [18] reported 90 percent success on grafting using scions taken from non-flowering shoots compared with 70 percent success from flowering shoots. Similar results are observed by Singh and Sengupta (1996) [23] in mango, Joshi *et al.* (2000) [12], Giri and Lenka (2008) [8] and Panchal *et al.* (2022) [21] in custard apple.

Table 2a: Effect of time of grafting on growth parameters

Treatment notations	Treatment details	Days taken for sprouting of grafts	Sprouted grafts at 30 (DAG)	Number of fully opened leaves at 45 (DAG)	Number of fully opened leaves at 45 (DAG)
T_1	3rd week of February	16.33	14.67	13.47	17.80
T_2	1st week of March	11.80	14.67	15.27	18.67
T_3	3rd week of March	10.00	18.67	16.67	22.47
T_4	1st week of April	11.53	18.00	14.13	20.53
T_5	3rd week of April	17.73	14.33	10.53	15.67
T_6	1st week of May	21.53	11.00	8.53	12.07
	SE (m)±	0.45	0.49	0.48	0.65
	C.D. at 5%	1.41	1.51	1.50	2.03
	C.V.%	5.35	5.58	6.47	6.39

Table 2b: Effect of time of grafting on growth parameters

Treatment notations	Treatment details	Length of scion (cm) at 45 (DAG)	Length of scion (cm) at 90 (DAG)	Girth of scion (mm) at 45 (DAG)	Girth of scion (mm) at 90 (DAG)	Graft survival percent at 90 (DAG)
T_1	3rd week of February	44.74	52.29	7.72	10.48	73.33
T_2	1st week of March	51.46	57.11	8.57	10.05	73.33
T_3	3rd week of March	54.53	61.86	8.99	11.51	93.33
T_4	1st week of April	50.03	59.00	8.22	10.62	90.00
T_5	3rd week of April	43.41	50.18	7.20	10.19	71.67
T_6	1st week of May	43.22	49.06	6.48	9.14	55.00
	SE (m)±	1.29	1.32	0.29	0.34	2.45
	C.D. at 5%	3.98	4.09	0.89	1.05	7.55
	C.V.%	4.67	4.18	6.40	5.71	5.58

Conclusion

Based on results obtained from present investigation, it may thus be concluded that the 3rd week of March represents the most suitable period for wedge grafting in custard apple under naturally ventilated conditions, ensuring improved graft establishment, accelerated growth and higher survival rates, thereby offering significant potential for enhancing nursery efficiency and grower profitability.

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