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Study the standardization of rootstock age in cleft grafting of papaya (*Carica papaya* L.)

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Abstract
The experiment entitled "Study the standardization of rootstock age in cleft grafting of papaya (*Carica papaya* L.)" was conducted at experimental farm, under Pt. Kishori Lal Shukla College of Horticulture and Research Station, Pendri, Rajnandgaon, Chhattisgarh. The experiment was laid out in Completely Randomized Design (CRD) with five treatments and three replications. The result revealed that among treatments T_1 (2 month seedling with cleft grafting) had highest graft success: minimum number of days taken to first sprouting (8.09 days), the maximum number of leaves per graft (9.26), age of rootstock (29.31 cm), length of scion (15.42 cm), length of rootstock (13.89), diameter of scion girth (27.47 mm), diameter of rootstock (35.83 mm), length of root (14.50 cm) and girth of root (10.90 mm).

Keywords: Papaya, cleft grafting, rootstock age

Introduction
Papaya (*Carica papaya* L.) also referred to as the papaya or pawpaw, is a member of the Caricaceae family and is native to the originated from Tropical America. Papaya is reputed to be the third most important fruit crop globally. The fruit crop has an economic impact in tropical and subtropical regions it is important fruit crop of tropical and subtropical region viz. India, Indonesia, Brazil, Mexico, Philippines and Zaire (Wadekar 2015) [12]. The prominent papaya cultivating regions in India are Karnataka, Gujarat, Orissa, West Bengal, Kerala, Chhattisgarh, Madhya Pradesh, Bihar, Uttrakhand and Maharashtra. The total land area of papaya cultivation in India is recorded as 142 thousand hectares with an annual yield of 6011 thousand metric tonnes (Anon. 2019 a) [2, 3, 4]. Papaya production in Chhattisgarh is 377.382 thousand MT, with a productivity of 26.48 MT/ha and a covered area of 13.987 thousand ha (Anon. 2019 b) [2, 3, 4], also grown on 0.395 thousand hectares in the Rajnandgaon district of Chhattisgarh, where output is at 8.295 MT. Durg, Raipur, Bilaspur, Mahasamund and Bemetara district where crop is mainly cultivated (Directorate of Horticulture and Farm Forestry C.G. 2021-22).
Growing papaya from seeds is common. Papaya seeds have a gelatinous sarcotesta covering it responsible for poor germination, seeds are costly, complicated and take time to produce in bulk, viability may also affects and need specific temperature to maintain, delay flowering and fruiting and delaying plant maturity by considering such parameters vegetative approaches are suitable rather propagate usual and papaya can be propagate through grafting method. (Sao Jose and Marin 1998) [11]. Grafting can improve papaya fruiting and production and reduce the height of desirable varieties and hybrids (Allan 2007 and Lange 1969) [1, 7].
The primary aim of grafting is to produce clones that are genetically identical to the parent plant or true to type plants. Other factors may include that plants take less time to grow, some plants unable to produce viable seeds can be grown vegetatively, grafting can be performed with multiple rootstocks by using a single plant as a scion, grafted plants produce flowers or fruits much earlier in comparison to seed propagated plants, enhance the quality traits of fruits, flowers, leaves and produce dwarf trees or shrubs also damaged trees may be fixed through grafting.

Materials and Methods

The experiment was carried out at Horticultural Research Farm, Pt. K. L. Shukla College of Horticulture & Research Station, Rajnandgaon, Mahatma Gandhi University of Horticulture and Forestry, Sankra-Patan, Durg (C.G.) during 2022-23. Rajnandgaon is located at 21.10° N latitude and 81.03° E longitudes at average elevation of 307 meters. The annual average rainfall is 1252 mm. during the period of experiment the mean maximum and minimum relative humidity recorded were 91% and 55%, the mean minimum and maximum sunshine duration during period of experiment were recorded 0.8 hrs. and 8.9 hrs.

It is useful for propagating small trees and the plant species which has straight grained wood and splits are considered ideal for cleft grafting. Leaves were trimmed to reduce transpiration loss. The seedling rootstocks which were 2 months of age, were topped off at 8-12 cm from the soil and about 1.5-2 cm slit was made at the middle part of the stem. The same size of scion wood selected in which at lower portion "V" shape wedge prepared. Then the prepared scion was inserted into the rootstock so as to ensure that both cambia were aligned, the whole graft was then wrapped firmly with sealing parafilm or Pepsi pipe to ensure good contact and to increase the humidity level around the grafted parts (Nguyen *et al.* 2017) [9].

Results and Discussion

Days taken to first sprouting

The minimum number of days required for first sprouting was recorded in treatment T_1 (2 month seedling with cleft grafting) (8.09 days), which is at par with T_2 (2.5 month seedling with cleft grafting) (8.63 days) while the maximum number of days required to start germination was found in treatment T_5 (4 month seedling with cleft grafting) (12.56 days).

The findings may be linked possibly as a result of the rapid graft union act that enhanced the translocation of food materials from leaves of the rootstock through union which also enhanced excellent flashing of new leaves. Similar findings were literates by Van-Hong Nguyen, Chung-Ruey Yen (2017) [9] in papaya and Kumar *et al.* (2000) [6] in mango.

Number of leaves per graft

The maximum number of leaves per graft was recorded in treatment T_1 (2 month seedling with cleft grafting) (9.26), which is at par with T_2 (2.5 month seedling with cleft grafting) (9.03) while the least number of leaves was seen in treatment T_5 (4 month seedling with cleft grafting) (7.89).

The reason might be due to the fact that, rapid establishment of the graft union. Further, it accelerates the plant's physiological reactions and compounds that stimulates the formation of new leaves at a faster rate. The outcomes were relied with Van-Hong Nguyen, Chung-Ruey Yen (2017) [9] in papaya.

Age of rootstock (height of plant in cm)

The highest height of plant was recorded in T_1 (2 month seedling with cleft grafting) (29.31 cm), which is at par with T_2 (2.5 month seedling with cleft grafting) while the least height was recorded in treatment T_5 (4 month seedling with cleft grafting) (21.62 cm).

Maybe this is caused due to the whenever scion grafted with young rootstock generating an instantaneous graft union, promoting rapid and early activity of enzymes for compound synthesis and cell proliferation. In addition, it stimulates the plant's physiological mechanisms and content that stimulates the height of grafted plant in faster rate. Similar findings were literates by Van-Hong Nguyen, Chung-Ruey Yen (2017) [9] in papaya.

Length of scion (cm)

The highest Length of was recorded in treatment T_1 (2 month seedling with cleft grafting) (15.42 cm), which is at par with T_2 (2.5 month seedling with cleft grafting) (13.76 cm) While the shortest scion length was recorded in treatment T_5 (4 month seedling with cleft grafting) (11.37 cm).

This occurrence might be credited to the immediate graft union when the scion is grafted with a young rootstock. This union, in consequently, endorses the plant's physiological functions by offering a substance that ultimately functions as a power source for its cellular reactions. Furthermore, the grafted plant show the fastest growth rate of scion length. The outcomes were relied with Van-Hong Nguyen, Chung-Ruey Yen (2017) [9] in papaya.

Length of rootstock (cm)

The highest Length of rootstock was recorded in treatment T_1 (2 month seedling with cleft grafting) (13.89 cm), which is at par with T_2 (2.5 month seedling with cleft grafting) (12.75 cm) While the shortest rootstock length was recorded in treatment T_5 (4 month seedling with cleft grafting) (11.24 cm).

These outcomes might be linked to that whenever cleft grafting practiced with young rootstock it form quick graft union therefore facilitated in rapid cell proliferation, strengthening of the plant's physiological functions and substance that ultimately boost the cellular reactions as well as the growth rate of rootstock length in grafted plant. These findings are compatible by Van-Hong Nguyen, Chung-Ruey Yen (2017) [9] in papaya.

Diameter of scion girth (mm)

The highest diameter of scion girth was recorded in treatment T_1 (2 month seedling with cleft grafting) (27.47 mm), which is at par with T_2 (2.5 month seedling with cleft grafting) (26.45 mm) While the shortest Diameter was recorded in treatment T_5 (4 month seedling with cleft grafting) (25.02 mm).

The greater diameter of the scion might be due to the rapid growth of the young rootstock and the rapid formation and healing of the graft union. This is encouraged by the ability to regenerate of plant cells, as well as the activities of cell division, vascular tissue development, and cellular differentiation. These mechanisms collectively boost the growth rate of the scion diameter. The outcomes are supported by Van-Hong Nguyen, Chung-Ruey Yen (2017) [9] in papaya.

Diameter of rootstock girth (mm)

The highest diameter of rootstock girth was recorded in treatment T_1 (2 month seedling with cleft grafting) (35.83 mm), which is at par with T_2 (2.5 month seedling with cleft grafting) (34.98 mm) While the shortest diameter was recorded in treatment T_5 (4 month seedling with cleft grafting) (33.49 mm).

The highest performance is possibly credited active growth of the young rootstock which has a positive relationship with the potential for regeneration of a plant part, as well as quick growth rate, cell division, vascular tissue development and differentiation mechanisms, these mechanisms collectively boost the growth rate of the rootstock width. The outcomes are in accordance with those of by Van-Hong Nguyen, Chung-Ruey Yen (2017) [9] in papaya.

Length of root (cm)

The highest Length of root in T_1 (2 month seedling with cleft grafting) (14.50 cm), which is at par with T_2 (2.5 month seedling with cleft grafting) (13.89 cm) while the shortest Length of root was recorded in treatment T_5 (4 month seedling with cleft grafting) (12.06 cm).

The reason might be due to the young rootstock that have potential to form early graft union and regenerating ability of a plant part as well as it strengthening of the plant's physiological functions and enzyme activity that triggered more root initiation and root cell elongation, which in turn boost roots length. Similar results were literates in papaya by Van-Hong Nguyen, Chung-Ruey Yen in (2017) [9].

Girth of root (mm)

The maximum girth of root in T_1 (2 month seedling with cleft grafting) (10.90 mm), which is at par with T_2 (2.5 month seedling with cleft grafting) (9.98 mm) While the shortest girth of root was recorded in treatment T_5 (4 month seedling with cleft grafting) (8.28 mm).

It could be linked with fact, the young rootstock which possessed the potential to start graft unions and regenerate plant components, facilitated the rapid and early enzymatic activity necessary to produce compounds that induce cell proliferation and boost the lateral growth of rootstocks. The outcomes are in accordance with those of Van-Hong Nguyen, Chung-Ruey Yen in (2017) [9] in papaya.

Table 1: The performance of cleft grafting in papaya during different periods

Treatments	Days taken to first sprouting	Number of leaves per graft	Age of rootstock (Height of plants)	Length of scion (cm)	Length of rootstock (cm)	Diameter of scion girth (mm)	Diameter of rootstock girth (mm)	Length of root (cm)	Girth of root (cm)
(T_1) 2 month seedling with cleft grafting	8.09	9.26	29.31	15.42	13.89	27.47	35.83	14.50	10.90
(T_2) 2.5 month seedling with cleft grafting	8.63	9.03	26.51	13.76	12.75	26.45	34.98	13.89	9.98
(T_3) 3 month seedling with cleft grafting	10.74	8.72	25.82	13.16	12.66	25.76	34.86	13.00	9.47
(T_4) 3.5 month seedling with cleft grafting	11.89	8.28	24.88	12.94	11.94	25.38	34.29	12.61	8.75
(T_5) 4 month seedling with cleft grafting	12.56	7.89	21.62	11.37	11.24	25.02	33.49	12.06	8.28
S.Em	0.61	0.46	0.66	0.55	0.55	0.65	0.74	0.55	0.53
C.D.	1.93	1.46	2.06	1.74	1.72	2.04	2.32	1.73	1.68
C.V.	8.05	6.66	4.46	5.40	5.53	4.46	4.19	5.46	6.04

Conclusion

According to the research findings, it may be concluded that cleft grafting of papaya performed well for papaya graft success, growth and survival of grafted plants and among the different ages of rootstock, the treatment of 2 month old seedling or root stock (T_1) had recorded the day's taken to first sprouting, number of leaves per graft, height of plant, length of scion and rootstock, Diameter of scion and rootstock, graft success, Survival percentage, length and girth of root.

Reference

1. Allan P. Phenology and production of *Carica papaya* 'Honey Gold' under cool sub-tropical conditions. Acta Horticulturae. 2007;740:217-23.
2. Anonymous. Area and production of horticultural crops in India. Government of India Ministry of Agriculture & Farmers Welfare; c2019.
3. Anonymous. Area and production of horticultural crops in Chhattisgarh. Department of Agriculture, Directorate of Farm Forestry, Chhattisgarh; c2019.
4. Anonymous. Food data central. United States Department of Agriculture; c2019.
5. Hartmann HT, Kester DE, Davies FT, Geneve RL. Plant propagation: principles and practices. 6th ed. New Delhi: Prentice Hall of India Private Ltd.; c1997. p. 398-480.
6. Kumar S, Ram S, Singh CP. Success of veneer and cleft grafting at different grafting heights of seedling rootstocks in Dashehri mango. Indian Journal of Horticulture. 2000;57(3):212-214.
7. Lange AH. Reciprocal grafting of normal and dwarf Solo papaya on growth and yield. Hort Science. 1969;4:304-306.
8. Lee J, Oda K. Adaptation of a grafting method for *Carica papaya* based on seedling behaviour. HortScience. 2003;54(6):982-987.
9. Nguyen VH, Yen CR. Rootstock age and grafting season affect graft success and plant growth of papaya (*Carica papaya* L.) in greenhouse. Chilean Journal of Agricultural Research. 2017;78(1):59-67.
10. Ramkhelawan G, Baksh A. Effects of rootstock age and grafting time on cleft grafting in 'Tainung No.2' papaya. International Journal of Research in Agriculture Science. 2018;5(2):2348-3997.
11. Sao J, Marin SLD. Aspects on asexual propagation in papaya. Chilean Journal of Agricultural Research. 1998;78(1):307-313.
12. Wadekar AR. Effect of different pre-sowing treatments on growth of papaya (*Carica papaya* L.) seedlings. M.Sc. thesis, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani; c2015.