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PERFORMANCE OF WEDGE GRAFTING IN GUAVA (*PSIDIUM GUAJAVA* L.) UNDER DIFFERENT GROWING CONDITIONS

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Abstract

The experiment was conducted to find out best month for wedge grafting in guava out of four months *viz*. July (M_1), August (M_2), September (M_3) and October (M_4) under two different growing conditions (polyhouse condition and open field). Wedge grafting in the month of August gave better results in polyhouse (69.88 %) as well as in open field condition (67.12 %). Polyhouse condition gave better response than open field condition with respect to number of days taken to sprouting, graft-take per cent, sprouting per cent, number of leaves per new shoot, height of graft, girth of graft and graft survival percentage.

Key words: Guava, wedge grafting, polyhouse condition, open field condition.

Introduction

Guava (*Psidium guajava* L.) popularly known as "Apple of tropics" or "Poor man's apple" is a fruit of tropical and sub-tropical climate. It belongs to family Myrtaceae and one of the most promising fruit crops of India and is considered to be one of the most exquisite nutritionally valuable and remunerative crop (Singh *et al.,* 2000). Guava is one of the richest sources of vitamin C and pectin compared to other fruits, the whole fruit is good source of calcium, a fair source of phosphorous and iron. It is also stewed and used in short cakes, puddings, sauce, ice cream, chutney and other products. However, guava fruits are commercially processed into jellies, jams, cream, cheese, puree, juice, powder and nectar. With respect to area, production and productivity in India it is estimated to be 2.68 lacks ha, 36.68 lacks MT and 13.7 MT/ha, respectively. Uttar Pradesh ranked first in area (45000 ha), highest production (84100 MT) and maximum productivity (39.6 MT/ha) are recorded in Madhya Pradesh (Anons., 2014). Besides its high nutritive value, it bears heavy crop every year and gives handsome economic returns (Singh *et al.,* 2000). This has prompted several farmers to take up guava cultivation on a commercial scale. In recent years, guava is getting popularity in the international trade due to its nutritional value and processed products (Singh *et al.*, 2005). However, the greatest handicap in guava plantation is indiscriminate multiplication of plants from unreliable sources by nurserymen (Singh *et al.*, 2005). That results large number of low grade guava plants are distributed and planted in the field every year. Un-availability of quality planting materials and consequent substandard of poor quality seedlings adversely affecting the guava production and productivity. So for rapid and successful propagation technique is required as the area under guava crop is expanding and there is a much demand to prepare the guava planting material round the year by involving rapid multiplication technique. Guava plants have been propagated through seeds and several other propagation technique have been developed. These proper techniques are still not commercially viable due to varying rate of success, absence of tap root system and long duration to achieve successful quality planting materials. Therefore, a technique (wedge grafting) in guava has been developed at Central Institute of Sub-tropical Horticulture (CISH),

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Lucknow (UP). Wedge grafting has a tremendous potential for multiplying guava plants rapidly throughout the year either in polyhouse or open field condition in varied climatic conditions of our country, and guava plants are required throughout the year. There is no reported work done in propagation of guava using wedge grafting in Gujarat. The potential use of climate in South Gujarat under the heavy rainfall zone can be utilized for round the year production of guava plants. Keeping in view of all these facts, the present investigation was carried out to know the effect of suitable season, growing condition and their interaction in wedge grafting of guava to ensure availability of superior planting material of guava for its large commercial cultivation.

Materials and Methods

The present experiment entitled "Performance of wedge grafting in guava (*Psidium guajava* L.) under different growing conditions" was conducted at Agriculture Experimental Station (AES), Paria. Navsari Agricultural University, Paria, Gujarat, India From July 2016 to January 2017.Wedge grafting of guava was carried in four season *viz*., July (S_1), August (S_2), September (S_3) and October (S_4) under two different growing conditions like open field conditions (G_1) as well as in polyhouse (G_2). The experiment was laid out in Completely Randomized Design (CRD) with factorial concept and three repetitions and eight treatment combinations. The grafting was done on 6-8 month-old seedling, guava seedlings were raised by using the local seeds, seeds were sown in pro-tray, after germination when seedlings attained 3-4 leaf stage they were transplanted to polythene bags (300 gauge thickness) with well drained medium black soil and FYM (1:1) Further, healthy and good quality guava seedlings were used for grafting. Collection of scion stock: the terminal one season old scion shoots which having 15 to 18 cm long of pencil thickness (0.5 to 1.0 cm) with 3 to 4 healthy buds and free from pest and disease were selected for grafting. Selected scions were defoliated on the mother plant, about one week prior to detachment apical growing portion of selected shoots was beheaded, which helped in forcing the dormant grafts to swell. In this way, the grafts on the scion were made ready to start sprouting at the time of grafting. For grafting lower end of the selected and detached scion stick was prepared in the form of wedge of about 4-5 cm. The top portion of the root stock was decapitated at 15-20 cm height and then top portion of the stem was split vertically about 4-5 cm in length forming "V" shape. The wedge shaped scion was inserted in to the "V" shaped slit and tied with polythene strip and then placed grafted plants in open field as well as in polyhouse condition as per the treatment. The observations recorded regularly on success of grafting such as graft-take per cent, days taken to sprout, graft sprouting per cent and vegetative parameter like height of graft (cm), number of leaves per new shoot, girth of graft and leaf area (cm^2) and finally graft survival percentage were recorded at 120 DAG. And were analysed statistically for interpretation of results.

Results and discussion

The statistical analysed data presented in the Table 1 and 2. Revealed that number of days taken to sprout, graft-take per cent, sprouting per cent, vegetative parameter and survival percentage of grafts were significantly influenced by effect of different month of grafting as well as growing conditions and their interaction. The grafting done during the month of August recorded minimum days (11.10) to sprouting of graft, highest graft-take per cent (71.43) and maximum sprouting per cent (69.63), whereas maximum days (20.74) taken to sprouting, lowest graft-take per cent (60.60) and minimum sprouting per cent (54.34) were found in October month of grafting data presented in table-1. The most success of grafts in month of August might be due to optimum temperature and high humidity prevailed during this period which had resulted in successful union of cambium layers of stock and scion, early callus formation and initiation of subsequent growth. South Gujarat condition belongs to high rain fall zone, which receive maximum rainfall along with higher humidity and optimum temperature might have developed conducive environment for graft success. Least success of graft were recorded in October month, which might be due to higher temperature and lower humidity as well as severe winter in this month resulted in reduced rate of graft success. The present results are also in accordance with result of Dhunaga *et al.* (1988) who recorded minimum number of days taken to sprouting of graft in guava during August month, Similar results were also observed by Sonawane *et al*. (2012) in carambola. Syamal *et al***.** (2012) revealed that faster sprouting of guava grafts during August month. Singh *et al*. (2007) also reported that wedge grafting performed well during August and gave good success. Saroj *et al*. (2000) in anola. Tewari and Bajpai (2002) reported that highest success of graft of aonla is possible in August. Paul *et al.* (2010) who recorded maximum graft-take in sapota in the month of July and August. Similar research work is supported by Munthaj *et al.* (2014) in guava. Singh and Singh (2007) in tamarind. Whereas Grafts prepared under polyhouse took minimum days (13.27) to sprout, highest graft-take (71.43 %) and maximum

Table 1: Effect of season of grafting and growing conditions on guava grafts.

	Days taken to sprouting	Graft-take %	Sprouting %	Height of graft (cm)	No. of leaves per new shoot	Leaf area (cm^2)	Girth of graft (cm) at 120 DAG	Survival % at 120 DAG
Seasons of grafting								
S_1	15.57	65.06	63.21	21.44	12.03	23.02	1.34	55.34
S_2	11.10	71.43	69.63	27.20	13.41	24.80	1.43	68.50
S_3	17.47	61.81	60.23	20.65	10.31	22.08	1.14	52.24
S_4	20.74	60.60	54.34	17.60	9.62	21.03	1.07	49.04
Cd at. 5%	0.86	**2.71**	**2.51**	**1.23**	**0.65**	**0.96**	**0.06**	**1.64**
Cv %	6.39	**5.03**	**4.88**	**6.82**	**6.86**	**5.06**	**5.92**	**3.49**
Growing conditions								
G_1	19.17	61.18	58.20	19.48	10.23	21.78	1.17	51.87
G_2	13.27	68.27	65.50	23.96	12.46	23.68	1.31	60.69
Cd at. 5%	0.61	**1.91**	**1.71**	**0.87**	**0.46**	**0.68**	**0.04**	**1.16**
Cv %	6.39	**5.03**	**4.88**	**6.82**	**6.86**	**5.06**	**5.92**	**3.49**

Table 2: Interaction effect of season of grafting and growing conditions on guava grafts.

Season of grafting	**S_1**		**S_2**		**S_3**		**S_4**		**CD at**	**CV**
Growing conditions	**G_1**	**G_2**	**G_1**	**G_2**	**G_1**	**G_2**	**G_1**	**G_2**	**.5%**	**%**
Days taken to sprouting	18.23	12.92	11.79	10.40	21.54	13.41	25.13	16.34	1.22	6.39
Graft-take %	62.39	67.73	68.83	74.03	59.42	64.21	54.08	67.12	3.83	5.03
Sprouting %	59.46	66.96	66.95	72.32	58.22	62.24	48.19	60.50	3.55	4.88
Height of graft (cm)	17.71	25.17	25.27	29.13	19.53	21.76	15.42	19.78	1.74	6.82
Number of leaves per new shoot	10.67	13.39	12.13	14.70	8.85	11.77	9.27	9.97	0.91	6.86
Leaf area (cm^2)	22.49	23.55	23.92	25.67	20.27	23.90	20.45	21.60	1.35	5.06
Girth of graft (cm) at 120 DAG	1.32	1.36	1.36	1.51	1.02	1.25	1.00	1.14	0.09	5.92
Survival % at 120 DAG	50.00	60.68	67.12	69.88	48.15	56.33	42.20	55.88	2.31	3.49

sprouting (65.50) per cent as compare to open field condition conform from table-1. The most likely reason for best graft success in guava wedge grafting under polyhouse condition was perhaps due to higher relative humidity in polyhouse as compared to open field conditions. High humidity greatly influences bud sprouting and graft union, creation of high humidity around the graft-scion which reduces the desiccation of active tissue of scion bud under polyhouse condition. Also it could be that the rootstocks raised in polyhouse found good environment for its growth as compared to open field condition. Therefore, a healthy vigorous and robust rootstock raised under polyhouse condition would lead to better graft union and good sprouting percentage. Hartman and Kester (1979) reported that temperature and relative humidity activates the cambial cells during monsoon. The callus tissue arising out of the cambial region is composed of thin walled turgid cells which can easily desiccated and die off and relative humidity can protect such cells in the cambial region of the graft union. Similar result was found by Syamal *et al.* (2013) in bael. Harshvardhan *et al.* (2014) in jack fruit. Beer *et al.* (2013) and Syamal *et al*. (2012) in guava. In case of interaction effect of season of grafting and growing conditions, the significantly minimum days (10.40) taken to sprouting, maximum graft-take (74.03) per cent and highest sprouting (72.32) per cent was recorded in grafting done in month of August under polyhouse condition, while the maximum days (25.13) taken to sprouting of graft, minimum (60.60) graft-take per cent and lowest (48.19) sprouting per cent were recorded in treatment S_4G_1 *i.e.* grafting done during October under open field condition from the table-2. With respect to vegetative growth parameters of grafts like height of graft (cm), number of leaves per new shoot, leaf area (cm^2) and girth of graft (cm) was significantly influenced by

different season of grating as well as different growing condition and their interaction, the maximum (27.20 cm) height of graft, highest (13.41) number of leaves per new shoot, maximum (24.80 cm^2) leaf area and maximum (1.43 cm) girth of graft was occurred in August month of grafting. Whereas minimum (17.60 cm) height of graft, lowest (9.62) number of leaves per new shoot, minimum (20.03 cm^2) leaf area and lowest (1.07 cm) girth of graft were recorded in October month of grafting from Table-1. Possible reason for maximum vegetative growth obtained in the month of August in the present study was due better production of assimilates for vegetative growth during August season and optimum temperature, sufficient sunlight, high relative humidity and ensured water availability which had increased the rate of photosynthesis and led to the formation of more food materials that facilitated and improved the growth and development of the sprouts. This might be also due to prevailing ideal temperature and relative humidity congenial for plant activity which had resulted in increased number of sprouts with more meristematic activity during August and early healing of graft union during this month. The reason for poor vegetative growth in the month of October was mainly because the plants were less exposed to sun light due to cloudy weather and severe winter observed during this month which had adversely affected the photosynthesis in plants by stomata closing in mesophyll cells there by resulting in less vegetative growth under South Gujarat agro-climatic region. Alternatively, less growth in September grafted plants may be due to excessive weed growth and increase in temperature which might have suppressed the vegetative growth of the grafted plants. Present findings are duly supported by Singh *et al.* (2003) in lasoda, and Dhakad and Honda (1986) in mango. Similar findings were obtained by Syamal *et al*. (2012) and Rani *et al*. (2015) in guava *cv.* Allahabad. Giri and Tanka (2009) who observed maximum number of leaves in softwood grafting in bael during month of August, Sarada *et al.* (1991) also observed better vegetative growth when softwood grafting done in cashew during month of August and also by Gadekar ***et*** *al.* (2010) in same crop. Angadi and Karadi (2012) in Jamun. Whereas under different growing condition the polyhouse condition significantly varied from open field condition with respect to height of graft (cm), number of leaves per new shoot, leaf area (cm^2) and girth of graft (cm). Maximum (23.96 cm) height of graft, highest (12.46) number of leaves, maximum (23.68 cm^2) leaf area and highest (1.31 cm) girth of graft. However minimum (19.48 cm) height, lower (10.23) number of leaves per shoot, lowest (21.78 cm^2) leaf area and lower (1.17 cm) girth of scion after grafting was recorded under open field condition from table-1. The probable reason for better vegetative growth of poly house condition grafted plant might be attributed to favourable growing conditions with enhanced CO_2 assimilation as compared to plants under open conditions, which increases the rate of photosynthesis and leads to formation of more photosynthates that facilitate and improve the growth and development of the sprout.Similar results were obtained by Syamal *et al*. (2012) in guava and Syamal *et al*. (2013) in bael, Dhakal and Honda (1986) in mango, Singh *et al.* (2003) in lasoda, Sarada *et al.* (1991) and Syamal *et al.* (2012) reported maximum leaves under polyhouse condition in guava. In interaction effect, Data in table -2. shown maximum 29.13 cm height, 14.70 leaves per new shoot, 25.67 cm^2 leaf area and 1.51 cm girth of grafts was recorded with respect to grafting done during August month under polyhouse condition, meanwhile lowest 15.42 cm height and 1.00 cm girth of graft were reported in grafting done in month of October under open field condition, and 20.27 cm^2 leaf area, and 8.85 number of leaves per new shoot of graft was recorded in September month grafting with open field condition.

Finally graft survival percentage as influenced by different seasons, August month gave significantly highest survival (68.50) percentage which was followed by July while lowest survival (49.04) percentage was recorded in October. Whereas under different growing conditions the maximum (60.69) survival percentage was recorded under Polyhouse while minimum survival percentage (51.87) was observed under open field condition. With respect to the interaction effect of season and growing conditions, the highest (69.88) percentage of graft survival was found in S_2G_2 treatment combination (grafting during August under poly house condition). While the minimum survival percentage (42.20) was observed in treatment combination S_4G_1 *i.e.* grafting in October under open field condition presented in table 1 and 2. This might be due to adequate supply of desired healthy and matured scion sticks coupled with warm humid climate attributed to favourable environmental conditions for successful bud union and better establishment of grafts during the month of August. Similar results were also obtained by Syamal *et al.* (2012) in guava by wedge grafting. The present findings are also supported by Singh and Singh (2007) and Pathak *et al*. (1991) in the month of August, Sawke *et al.* (1985) in December and Sarada *et al.* (1991) in the month of August in cashew.

Conclusion

Based on the results of the present investigation entitled "Performance of wedge grafting in guava (*Psidium guajava* L.) under different growing conditions." it can be concluded that treatment combination S_2G_2 (grafting in August month under poly house condition) was found to be the best treatment among all treatment studied as it required minimum days to sprouting along with maximum graft-take per cent, sprouting percentage, number of leaves per new shoot, height and girth of graft and survival percentage of graft after 120 days of grafting.

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