DOI: 10.15740/HAS/AU/12.TECHSEAR(3)2017/743-748
Agriculture Update
Volume **12** | TECHSEAR-3 | 2017 | 743-748
Visit us : *www.researchjournal.co.in*
e ISSN-0976-6847

RESEARCH ARTICLE :

Correlation studies of guava graft compatibility and its growth performance in relation with different nature of scion

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ARTICLE CHRONICLE :
Received :
10.07.2017;
Accepted :
25.07.2017

SUMMARY : In order to investigate the influence of nature of scion on graft success, subsequent growth of scion shoot and development of the successful grafts in guava, a field experiment was carried out in Nursery unit of Dr. P.D.K.V, Akola during the year 2015-16.The results were obtained for the correlation co-efficient. The correlation co-efficient indicates the presence of inherent association between various characters.The final survival of guava grafts were positively and significantly correlated with days required for bud sprouting (r=0.845**),graft take percentage(r=0.970**),scion length (r=0.956**)number of leaves (r=0.984**) and leaf area(r=0.809*)in relation with green quadrangular terminal shoot used as scion, while final survival was negatively associated with days required for sprouting when the brown corky shoot concerned.

How to cite this article : Reshma, U.R., Bharad, S.G. and Satkar, Kuntal (2017). Correlation studies of guava graft compatibility and its growth performance in relation with different nature of scion. *Agric. Update*, **12**(TECHSEAR-3) : 743-748; **DOI: 10.15740/HAS/AU/12.TECHSEAR(3)2017/743-748.**

KEY WORDS :
Guava, Grafting performance, Scion, Correlation

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BACKGROUND AND OBJECTIVES

Guava (*Psidum guavajava* L.) is one of the most common fruit grown in tropical and subtropical regions of the world and isconsidered to be one of the exquisite nutritionally valuable and remunerative crop (Singh *et al.,* 2000). It is also known as poor-man's apple due to low fetching prices and one of the most referred and legendary fruits because of its hardy and prolific bearing nature (Dhaliwal and Singla, 2002). The fruit is used for both fresh consumption and processing purposes. Due to high return and the potential for processing, there exists a great scope for bringing extensive area under guava crop in India. Besides its high nutritional value, it bears heavy crop every year and gives good economic returns (Singh *et al*., 2000).

However, the greatest handicap in guava plantation is indiscriminate multiplication of plants from unreliable sources by nurserymen (Singh, 2005). Proper care is not exercised in the selection of scion material from really outstanding and disease-free mother plant. The result is that large number of low grade guava plants are distributed and planted in the

field every year. These trees become a permanent liability to the growers as no amount of grafting, fertilization and care can change their genetic qualities. Non-availability of quality of planting materials and consequent substitution of poor quality seedling has adversely affected the guava production and productivity levels. Although a large number of nurseries have been established, there is an acute shortage of quality planting materials. The scenario is changing from traditional propagation with incorporation of science and technology in nursery management and trade.

Great difficulty was found in selecting scion containing buds in the proper stage of maturity which ultimately impairs the success rate and survivability of the grafts. The nursery men should take in account to use scion of different maturity stages during grafting to assess the varying degree of success rates. In grafting operation Kains and Mc Question (1958) found that, physiological maturity of scion wood is important in the process of successful graft union. The limitations due to shortage in supply of proper scion stick can be resolved by the maximum utilization of both the matured (brown corky wood) and the young green (quadrangular terminal shoot) (Nelson, 1954) without the wastage of any shoot portions from reliable sources.

The success and survivability of graft largely depend on time, scion condition such as nature, length, vigour, node number per scion, variety, method etc. To ensure higher per cent of graft success, grafting operation should conduct at proper time. Due to differences in scion nature, green quadrangular terminal shoots of the current year's growth made better scions than brown corky shoots of the previous year's growth (Mukherjee and Singh,1965). At the same time grafting success and survivability may also vary with time of grafting operation.

Not enough studies have been done so far onthe effects of nature of scion and grafting time on graft success in guava.Hence the present study was undertaken to appraise the correlation among different nature of scion and graft growth and compatibility parameters in guava.

RESOURCES AND METHODS

The experiment was conducted at Nursery unit, University Department of Horticulture, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola during November, 2015 to April, 2016. Akola is situated in subtropical region between 22^0 42'N latitude and 77^0 02' E longitudes. The annual rainfall is 850-900 mm and the recorded minimum annual rainfall was 366.50 mm. During the experimental period from November to April, the average maximum temperature during the hottest month (April) was 42.1^0C, whereas average minimum temperature in the coldest month (December) was 10.8^0C. The bright sun shine hours and wind speed were between 4.1 to 10.2 hrs and 3.6 to10.0 km /hr, respectively.

The green quadrangular terminal shoots of current year's growth (S_1) and brown corky shoots of previous season growth (S_2), especially when the former were taken from axiliary growth forced by defoliation rather than by heading back were collected as scion. The collected graft sticks were of 12-15 cm long with 3 to 4 well developed axillary buds. The selected shoots were defoliated 7 days prior to grafting operation. At the same time, apical growing portion of selected shoots were also beheaded. This helps in forcing the dormant bud to swell. In this way, the buds on the scion were made ready to start sprouting at the time of grafting. The grafting operation wasemployed at three different periods *viz.*, 1st January (T_1),15th January (T_2) and 1st February (T_3). The experiment was laid out in Factorial Completely Randomized Design (FCRD) with six treatment combinations and replicated four times. For each treatment combination, grafting operations were performed on twenty five rootstocks for each plot of a block.

The data collected included days required for bud sprouting, graft take percentage, length of scion, number of leaves per graft, leaf area and final survival of grafts. The sprouting of graft – scion (first axillary bud breaking) were observed critically and data were collected everyday upto 30 DAG and number of days taken for sprouting was counted back to date of grafting.Those grafts in which the scion remained alive without shrivelling at the time of observation were recorded from each treatment separately and percentage of graft take was worked out.The length of scions was measured from the middle of the graft union to the apex of the terminal bud by measuring scale at 30 days intervals, starting from 30 days after grafting operation and was continued upto 90 DAG. The total number of new leaves per graft was counted at an interval of 30 days starting from 30 days after each grafting and was continued upto 90 days. The

number of leaves per graft was calculated as a cumulative number. The leaf area was estimated after 120 days from grafting operation by leaf area meter (Systronics make, model 211). Final survival of grafts were calculated for each replication of all the treatments on the basis of number of successful grafts out of total number of grafts prepared. The correlation co-efficient analysis was employed to find out the association among nature of scion and various growth and graft compatibility parameters and the studies were done by Karl Pearson's method.

OBSERVATIONS AND ANALYSIS

The results obtained from the present investigation are summarized below and graphically represented in Fig. 1.

Significant difference was observed in the number of days required for bud sprouting (Table 1).Due to cellular compatibility characteristics of scion wood in relation with maturities and active growing stage that enhanced early bud sprouting and required minimum days (22.70) in green quadrangular terminal shoot in accordance with optimum temperature and relative humidity in the month of February (S_1T_3) which was found to be at par with S_1T_2 (23.50 days) and S_1T_1 (23.85 days). Whereas, due to presence of more concentrated cell sap and hardiness, brown corky wood was used as scion and grafting operation done on 1st February (S_2T_3) required maximum days for bud sprouting (30.20 days) were found. The results are in conformity with Bharad *et al.* (1999) in tamarind, Beer *et al*. (2013) in guava, Bhatt *et al*.(2013) in guava, Parvin (2013) in Burmese grape and Kalabandi *et al.* (2014) in sapota.

The graft take percentage varied significantly due

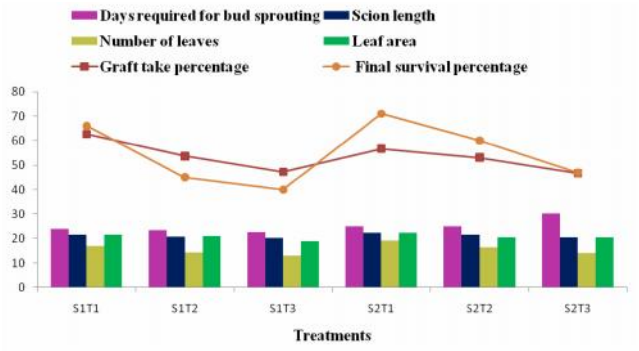

Fig. 1 : Interaction effect of nature of scion and graft time on growth and graft compatibility performance in guava

to the interaction effectof nature of scion and time of grafting (Table 1).The combination of green quadrangular terminal shoot and 1st January grafting (S_1T_1) recorded the maximum graft take (79 %), which was found to be significantly superior over all other treatments, followed by S_2T_1(70 %), S_1T_2(65 %),S_2T_2(64 %) and S_1T_3(54 %). However, the minimum graft take (53 %) was found in treatment combination brown corky wood and 1st February grafting (S_2T_3). This might be due to the supply of photosynthates, higher meristematic activity and other growth factors that were highly influence cambial activity in accordance with optimum temperature and relative humidity which further resulted subsequent grafting success (Shatil, 2011). Due to the favourable temperature and relative humidity during grafting and rapid flow of sap in stock and scion at that time might have contributed in the healing process and established the continuity of cambial and maximum graft take (Islam Minual, 2014).

It is evident from Table 1 that, there was no significant variation in interaction effect of nature of scion and time of grafting operation on scion length. The maximum scion length (22.43 cm) was recorded in brown corky shoot used as scion and the grafting operation done on1stJanuary, while the minimum scion length (20.21 cm) was found in green quadrangular terminal shoot used as scion and grafted on1st February.

The data presented on Table 1 showed interaction effect of nature of scion and grafting time on number of leaves per graft and which was found to be non significant. The highest number of leaves per graft (19.20) was found in treatment combination brown corky shoot and 1st January grafting (S_2T_1), while it was lowest (12.95) in treatment combination green quadrangular and 1st February grafting (S_1T_3).

During the present investigation, the nature of scion in combination with grafting time showed a significant influence on leaf area. The highest leaf area (22.33 cm^2) was recorded in treatment combination brown corky shoot and 1st January grafting (S_2T_1), whereas lowest leaf area (19.14cm^2) was found in treatment combination green quadrangular and 1st February grafting (S_1T_3). The significant variation in leaf area might be due to combined effect of favourable environmental conditions and the cellular compatibility characteristics of scion wood owing different maturities and the favourable physiological condition of scion, which helped to maintain higher growth (Parvin, 2013) and adequate supply of photosynthates

during the early stage of graft establishment which enhanced growth of plants (Shatil, 2011).The results are in agreement with Bharad and Mahorkar (2010) in jamun, Mulla *et al*. (2011) in jamun. Haldankar and Jadhav (2001) in clove grafted on jamun rootstocks and Angadi and Karadi (2012) in jamun.

The final survival of grafts were recorded at 120 days after grafting. Statistical analysis of data showed significant influence of nature of scion and grafting time on final survival .The combination of brown corky wood and 1st January grafting (S_2T_1) recorded the highest final survival percentage (71.00%), which was found to be significantly superior over all other treatments, followed by S_1T_1(66.00%) and S_2T_2 (60.00%).However, the minimum final survival percentages of grafts (40.00%) were found in the treatment combination green quadrangular terminal shoot and 1st February grafting (S_1T_3). The similar types of response has been reported by Samiullah *et al*. (2004) in guava. He reported that, the mean values of different scion parts reveal maximum plant survival by use of middle scion parts, followed by basal and apical parts, respectively. The apical scion part did not show better survival percentage. The reason might be that, they are softwood and more sensitive to temperature. Mostly they dried before the union of scion and stock .The results are also in conformity with Hossain (2007) in mango, Syamal *et al*.(2012) in guava and Beer *et al*. (2013) in guava, Parvin (2013) in Burmese grape, Banik (2014) in lemon and Islam Minul (2014) in pummelo

Table 1 : Effect of nature of scion and grafting time on graft growth and compatibility in guava

Treatments	Days required forbud sprouting	Graft take percentage (%)	Scion length (cm)	Number of leaves per graft	Leaf area (cm^2)	Final survival of grafts (%)
S_1T_1	23.85	79.00(62.77)	21.64	16.90	21.58	66.00
S_1T_2	23.50	65.00(53.71)	20.87	14.35	20.98	45.00
S_1T_3	22.70	54.00(47.27)	20.21	12.95	19.14	40.00
S_2T_1	25.00	70.00(56.82)	22.43	19.20	22.33	71.00
S_2T_2	24.95	64.00(53.12)	21.57	16.40	20.69	60.00
S_2T_3	30.20	53.00(46.70)	20.51	14.10	20.46	47.00
C.D. (P = 0.05)	1.80	3.14	0.59	3.58	0.54	5.51

Figures in the parentheses are transformed values

Table 2 : Correlation studies among growth and graft compatibility parameters in relation with green quadrangular terminal shoot used as scion in guava

	Days required for bud sprouting	Graft take percentage	Shoot length	Number of leaves	Leaf area	Final survival of grafts
Final survival of grafts	0.845**	0.970**	0.956**	0.984**	0.809*	----
Leaf area	0.998**	0.927**	0.946**	0.899**	----	
Number of leaves	0.925**	0.997**	0.992**	-----		
Shoot length	0.964**	0.998**	----			
Graft take percentage	0.949**	-----				
Days required for bud sprouting	-----					

* Correlation is significant at the 0.01 level of probability; ** Correlation is significant at the 0.05 and 0.01 level of probability

Table 3 : Correlation studies among growth and graft compatibility parameters in relation with brown corky shoot used as scion in guava

	Days required for bud sprouting	Graft take percentage	Shoot length	Number of leaves	Leaf area	Final survival of grafts
Final survival of grafts	-0.885	0.994**	0.999**	0.994**	0.896**	-----
Leaf area	-0.587	0.844**	0.891**	0.937**	-----	
Number of leaves	-0.831	0.977**	0.993**	-----		
Shoot length	-0.890	0.995**	------			
Graft take percentage	-0.929	-------				
Days required for bud Sprouting	-----					

* Correlation is significant at the 0.01 level of probability; ** Correlation is significant at the 0.05 and 0.01 level of probability

Correlations :

In the present correlation studies in guava, its revealed that as green quadrangular terminal shoot used as scion (immature scion) concerned there was a noticeable correlations among all characters under study. Close perusal of the Table 2 revealedthat, there was a significant and highly positive correlation between graft take percentage with number of days required for sprouting (r=0.949**). Scion length was showed significantly positive association with number of days required for sprouting(r =0.964**) and also graft take percentage (r=0.998**).There was a significant and highly positive correlation between number of leaves with days required for bud sprouting (r=0.925**), graft take percentage (r=0.997**) and scion length(r=0.992**).The leaf area was found to be significant and positively correlated with days required for bud sprouting (r=0.998**), graft take percentage (r=0.927**), scion length (r=0.946**) and number of leaves per graft (r= 0.899**).The final survival of guava grafts were positively and significantly correlated with days required for bud sprouting (r=0.845**), graft take percentage (r=0.970**), scion length (r=0.956**) number of leaves (r=0.984**) and leaf area (r=0.809*).The results are in conformity with Chipojola *et al.*(2013) in cashew.

It is clear from Table 3 that,there was a wide variation in correlation relation of characters under studied when brown corky shoot (mature scion) used as scion. Number of days required for bud sprouting was negative correlated and non significant with graft take percentage (r= -929), scion length (r= -890), number of leaves (r= -0.831), leaf area(r= -0.587) and final survival of grafts (r=-0.885), respectively. Scion length was showed significantly positive association with graft take percentage (r=0.995**).There is a significant and highly positive correlation between number of leaves with graft take percentage(r=0.977**) and scion length (r=0.993**). The leaf area was found to be significant and positively correlated with graft take percentage (r=0.844**),scion length (r=0.891**) and number of leaves per graft (r= 0.937**). Final survival of guava grafts were positively and significantly correlatedgraft take percentage (r=0.994**), scion length(r=0.999**) number of leaves (r=0.994**) and leaf area (r=0.896*). The results arein agreement with Chipojola *et al.* (2013) in cashew. They revealed that correlation analyses in selected scion types *viz*., immature and matured one, significantly correlated positively with number of days to sprout, leaf number and shoot height ($p \leq 0.05$). The number of days to sprout correlated strongly with leaf number, leaf size and shoot height, leaf number and leaf size, and shoot height as well as leaf size and shoot height ($p \leq 0.01$). The correlation between scion type and days to sprout, number of leaves and leaf size indicate that as scions mature, sprouting may be prolonged.

Conclusion :

Among the different nature of scion, brown corky wood used as scion showed the best results under all the parameters studied. But there was found to be a highly positive and significant correlation among the parameters *viz.*, days required for bud sprouting, graft take percentage, scion length, leaf area, number of leaves and final survival of grafts in relation with green quadrangular shoot used as scion.

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