Original Research Article

Optimizing the time of grafting in Jackfruit in subtropical environment of Assam

Abstract

An experiment was carried out at instructional cum research farm, Department of Horticulture, BNCA, AAU, Biswanath Chariali during 2019-2020 to check the best time of grafting in Jackfruit in the subtropical conditions of Assam. Grafting was done in March (T_1), April (T_2), May (T_3), June (T_4), July (T_5), August (T_6) and September (T_7). Mother plants of desirable traits were selected for the experiment. Scions of about 10-15 cm length with thickness of 5-7 mm and free from pest and diseases were collected from one season (4-5 months) old terminal shoots. The selected scion shoots were defoliated (pre-cured) 7-10 days prior to grafting. Wedge grafting was adopted in the present study. Further, wedge grafting was performed with compatible rootstocks in the different months stated above and conclusions were made that the period from March to June could be considered as the suitable time for producing jackfruit grafts by wedge grafting method in Assam.

1.Introduction

The Jackfruit is a popular fruit in most of the tropical and sub-tropical which is regarded as "poor man's fruit" in India. It is one of the most suitable fruit crops for dryland horticulture. Seed propagation is common and easier method of propagation of jackfruit, but this method of propagation is not desirable due to highly heterozygous and cross-pollinated nature of the crop, which results in immense variation among populations for yield, size, shape, flesh colour, quality of fruit and maturity period. The significance of vegetative propagation in the maintenance of genetic uniformity and preservation of identity of an elite clone or cultivar is well recognized in horticultural crops. Therefore, there is immense need to find out a suitable method of vegetative propagation, for quick multiplication of selected jack plants. Grafting is a method of propagation, generally practised in some states like Tripura, Karnataka, West-Bengal etc, however, this is not generally practised in the state of Assam. It has been established that the success of grafting is solely dependent upon the weather conditions and thus may vary from region to region in a season. It is therefore, a study was

conducted to identify the time of grafting with reference to weather parameters for successful propagation of the crop.

2. Materials and methods

The experiment was carried out at Biswanath Chariali Assam (26° 26′ N latitude, 93° 30′ E longitude and 86.70 m altitude) with seven treatments, *viz*. Grafting in March (T_1), April (T_2), May (T_3), June (T_4), July (T_5), August (T_6) and September (T_7). Six to seven months old, vigorously growing uniform seedlings of Jackfruit grown from the seeds were selected as rootstocks. A mother plant having desirable traits like uniform size of fruits and uniform maturity was selected for collection scions. Scions of about 10-15 cm length with thickness of 5-7 mm and free from pest and diseases were collected from one season (4-5 months) old terminal shoots. The selected scion shoots were defoliated (pre-cured) 7-10 days prior to grafting. Wedge grafting was adopted in the present study.

3. Results and discussions

Results revealed that during the period of experimentation the monthly mean minimum and maximum temperature varied from 15.19 (March) to 25.16°C (August) and 27.22 (March) to 34.73°C (August), respectively (Table 1). Minimum temperature increased from 8.3 to 27.7°C, while maximum temperature increased from 21.1 to 37.1°C from beginning of the March to August, while both maximum and minimum stated to reduce from beginning of the October.

3.1 Highest success rate

It was found that success of grafting percentage was the highest (83.10%) when grafting done in March (T1), followed by April (80.49%) and May (76.36%), while success percentage of the grafting reduced drastically from 59.92 to 36.19 per cent as grafting was delayed from June to October. Prevailing temperature during March and April and other associate weather conditions might be favorable for accumulation of carbohydrates initiated the formation of the callus making the graft successful. Increase in both maximum and minimum temperatures from May onwards might increase rate of evapotranspiration from scions resulted in drying as well as non-union of scions with rootstocks. The highest success in March was also probably due to availability of dormant scion with swollen bud in bulging condition at that time. Thus, the maximum rates of success in March and April grafted jackfruit might be probably associated with prevailing congenial ambient temperature along

Comment [r1]: For the enrichment of the article, we recommend the authors to introduce a classic map or GIS to locate the areas where the experiments were done on the territory of India and details of the area if possible (see Fig. R1, attached by he reviewer at the end of the reviewed manuscript).

Comment [r2]: To enrich the article, we recommend the authors to insert photos containing:
1) the plantation on which the experiments were carried out (if possible, at different times, i.e. a photo from March, one from April, etc., possibly also photos of the same grafted plant, at different times of development);
2) Photos showing the method of grafting (pin);
3) photos of the final stage of development for each plant variant (T1...T7), possibly so that the reader can compare the quality.

with sufficient rainfall which helps in maintaining suitable relative humidity during the time of the experiment. The result is in conformity the finding of Razzaque (2005).

3.2 Number of new shoots per graft

The number of new shoots per graft at 90 days after grafting was highest (1.91) in T_2 (April) which might be due to prevailing thermal environment with a good quantum of rainfall (>100 mm) with good amount of bright sun-shine hour. However, as grafting was delayed from April, number of new shoots per graft at 90 days after grafting reduced gradually and became minimum (1.08) in T_7 (September). Though temperatures increased from April onward, prevailing low bright sun-shine hours and higher relative humidity due to occurrence of higher rainfall resulted in reduction of development of new shoots on scions.

3.3 Longest length of scion

The experiment revealed that length (at 90 days after grafting) of scion was the longest (13.25 cm) when grafting was done during march (T_1), which reduced successively as the grafting time was delayed and became minimum (11.53 cm) in case September (T_7) grafted plants. Similarly, time required for bud sprouting in scions varied significantly with the time of grafting. The sprouting was the fastest (19.33 days) in grafts that were done in March (T_1), while the the longer period (24.55 days) was required to bud sprouting in case of September grafted plants (T_7). The reason behind early sprouting of graft during early months attributed to the suitable weather condition in terms lower temperature, good amount of rainfall and higher bright sun-shine hours prevailed during early months of grafting.

4. Conclusions

From the above discussion it can be concluded the period from March to June could be considered as the suitable time for producing jackfruit grafts by wedge grafting method in Assam. However, March and April are the best months for grafting jackfruit, as weather conditions in terms of temperatures with daily maximum (21.1 -35.6°C) and minimum temperature (8.3 to 23.0°C), rainfall more than 100 mm, comparatively higher bright sun-shine hours are congenial from success of grafting in terms of

success percentage of stock and scion union, time required for spouting, number of buds developed and length of the scion on 90 days after grafting. While the temperature gradually raised from June onwards up to September and there was also quite a reduction in the amount of rainfall, due to which the moisture content present in the leaves of the scions dried up because of evapotranspiration and decreased in the percentage of graft success.

Table 1: weather conditions and effect of time of grafting on success of stock scion union, bud sprouting, number of buds and scion length in Jackfruit during 2019

Treatments	Monthly mean Maximum Temp (^{0}C)	Monthly mean Minimum Temp (^{0}C)	Total Rainfall (mm)	Days required for bud sprouting after grafting	Number of buds sprouting at 90 DAG	Scion length (cm) at 90 days after bud sprouting	% of Success at 90 DAG
T1	27.22	15.19	100.0	19.33	3.04	13.25	83.10
T2	28.74	18.82	204.8	19.50	2.81	12.99	80.49
T3	28.13	20.44	453.6	20.23	2.69	12.78	76.63
T4	32.26	24.08	183.6	20.90	2.54	12.15	59.92
T5	31.80	24.08	317.9	21.33	2.38	11.92	51.19
T6	34.73	25.16	166.4	22.60	2.18	11.63	43.26
T7:	31.69	23.41	81.8	24.55	2.02	11.53	36.19
CD (P=0.05)	---	---	---	2.85	0.44	0.44	3.11

DAG: Days after grafting

References

Pandey, V. and Singh, J. N. (2001). Effect of meteorological factors and their relationship of quality parameters in stone grafting of mango.*Orissa J. of Hortic.*, **29**(2): 58- 60.

Patel, B. M. and Amin, R. S. (1981). Investigation in to the best period for softwood grafting of mangoes in situ. *South Indian Hortic.*, **29**: 90-93.

Razzaque (2005). Effect of stock-leaf retention and time of operation on the success and survivability of cleft grafting in mango.Mymensingh: Bangladesh Agricultural University.

Swamy, G. S. K. (1993). Standardization of vegetative propagation techniques in jack fruit (*Artocarpus heterophyllus* Lam.). Ph.D (Ag.) Thesis submitted to University of Agricultural Sciences, Bangalore.

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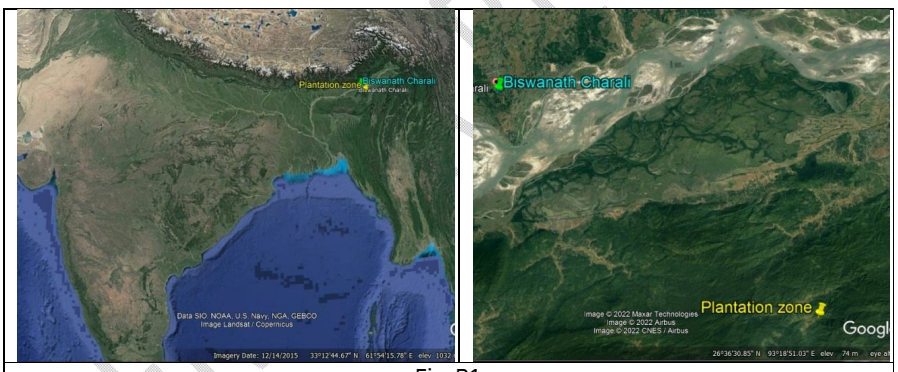

Fig. R1

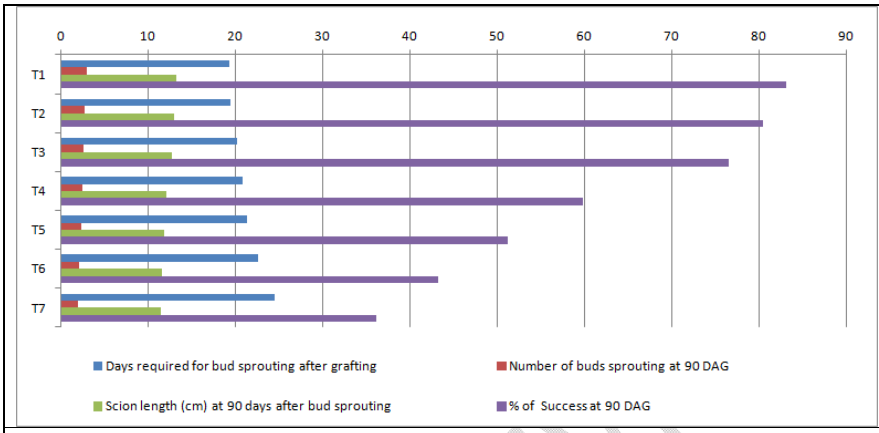

Fig. R2 The variation of the three main characteristics of the plants obtained after the alternation at the 7 moments of time of plants grafting (T1-T7).

The variation of the four objective functions of the empirical theoretical optimization process is presented comparatively in fig. R2. It is easy to see that only Days required for bud sprouting after grafting is increasing depending on the month of grafting, the other three being decreasing. The graphical representations in figures R7-R10 demonstrate this statement for each objective function, separately.

Figures R3-R6 graphically represent the evolution of the minimum average value and the maximum average temperature value, in relation to the values of the four objective functions: Days required for bud sprouting after grafting, Number of buds sprouting at 90 DAG, Scion length at 90 days after bud sprouting, % of Success at 90 DAG. It is obvious from these representations, that the minimum value of Days required for bud sprouting after grafting and the maximum values of the other three objective functions, are reached at the low temperatures of the studied time interval, these values being recorded in the months of March, April and May, corresponding to T1, T2 and T3 grafting treatments.

Graphical representations similar to those in figures R3-R6 can be made for the dependencies between the amount of precipitation and the four objective functions (see figures R11-R14).

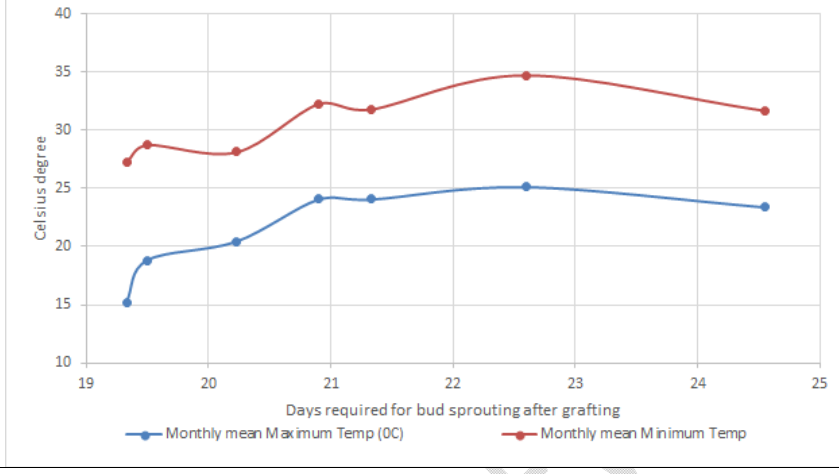

Fig. R3 Dependence of Days required for bud sprouting after grafting on the time of grafting.

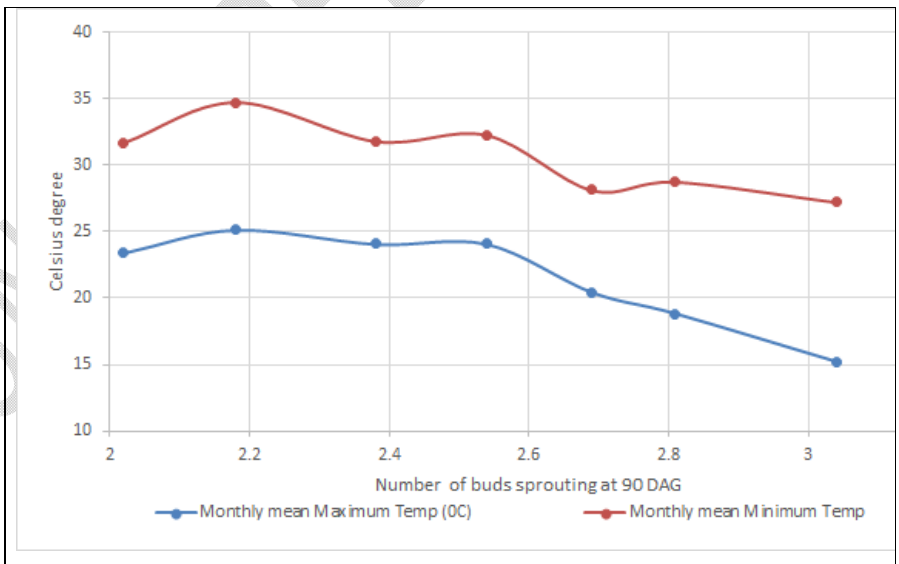

Fig. R4 Dependence of number of buds sprouting at 90 DAG on the time of grafting.

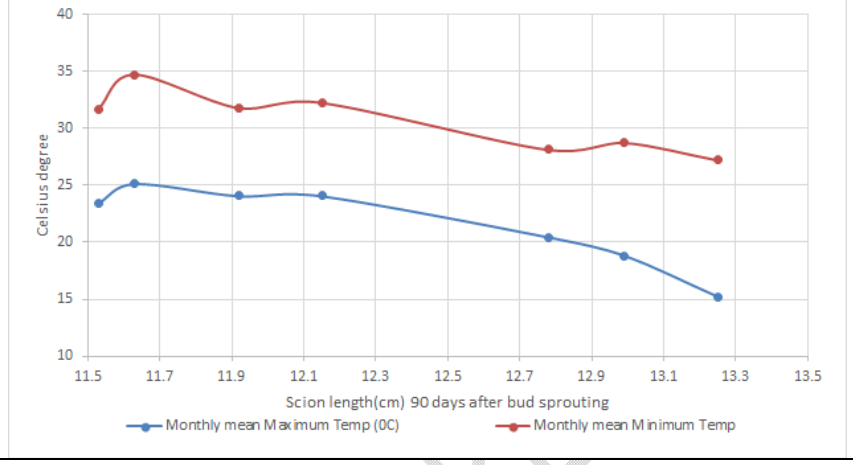

Fig. R5 Dependence of Scion length (cm) at 90 days after bud sprouting on the time of grafting.

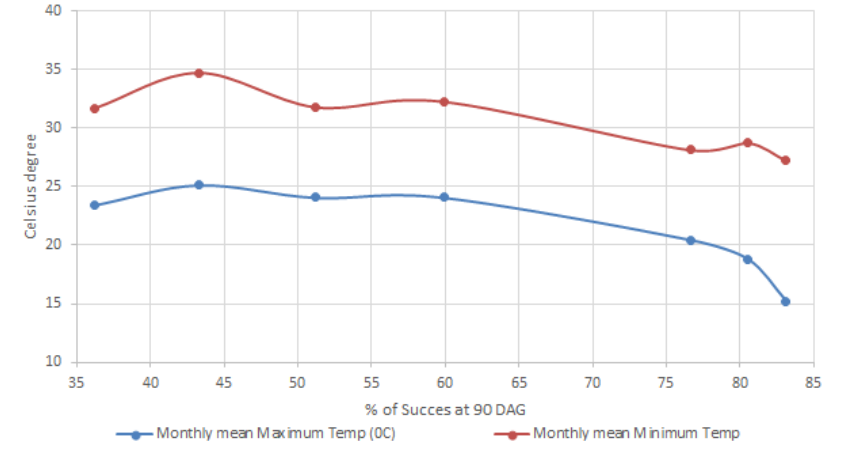

Fig. R6 Dependence of % of Success at 90 DAG on the time of grafting.

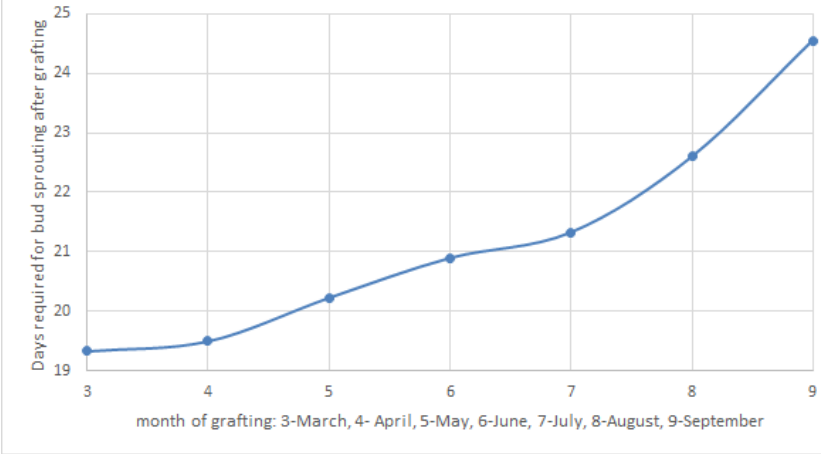

Fig. R7 Dependence of Days required for bud sprouting after grafting on the time of grafting.

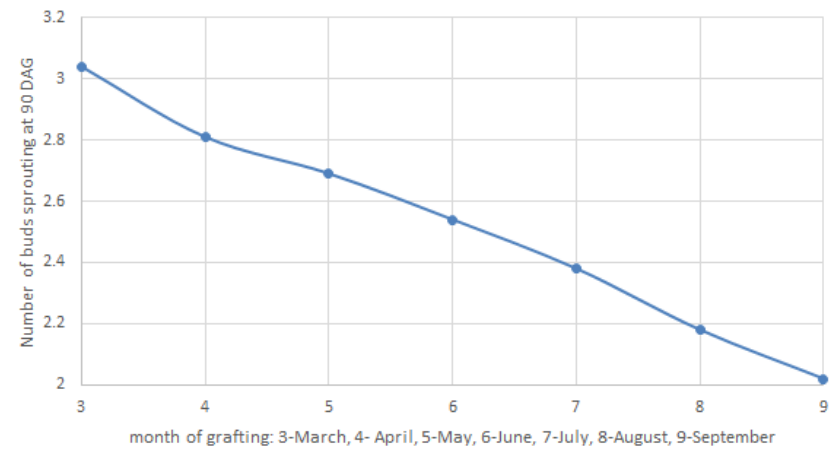

Fig. R8 Dependence of number of buds sprouting at 90 DAG on the time of grafting.

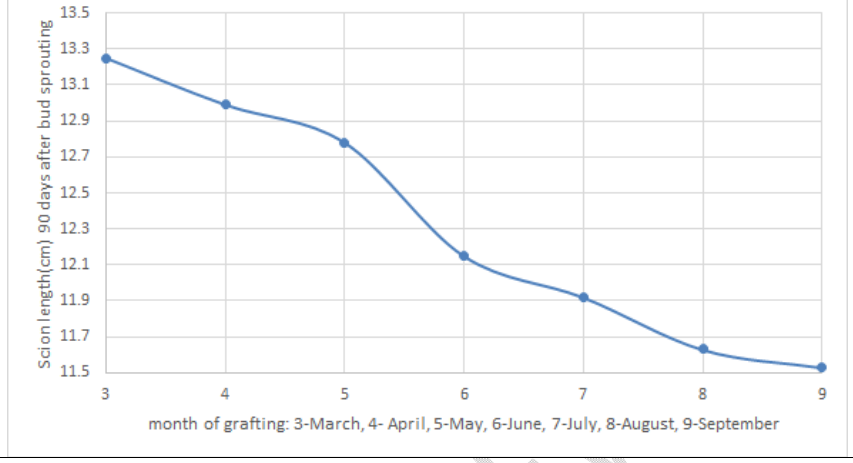

Fig. R9 Dependence of Scion length (cm) at 90 days after bud sprouting on the time of grafting.

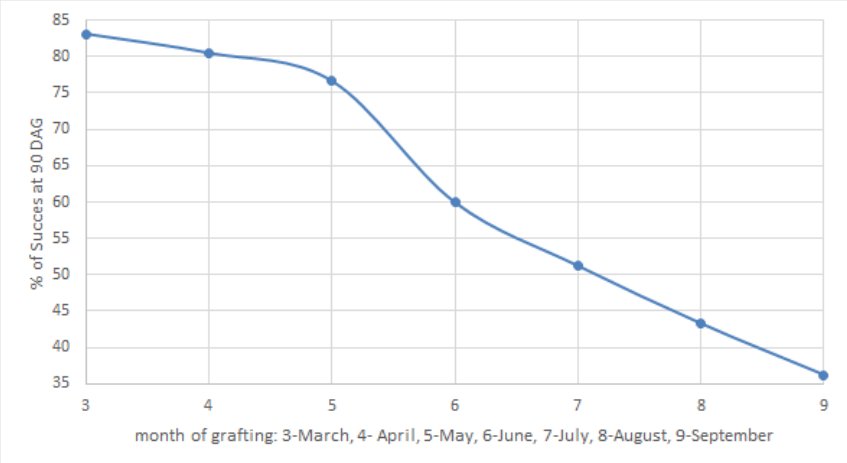

Fig. R10 Dependence of % of Success at 90 DAG on the time of grafting.

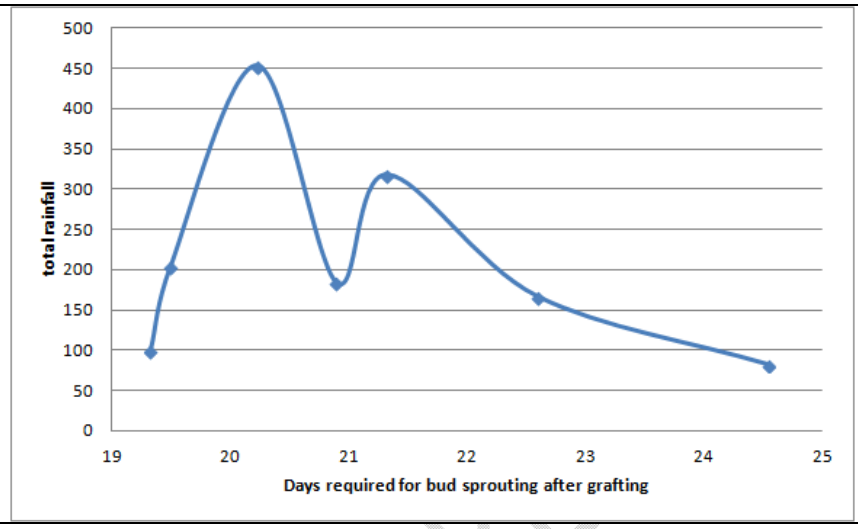

Fig. R11 Dependence of Days required for bud sprouting after grafting on the total rainfall.

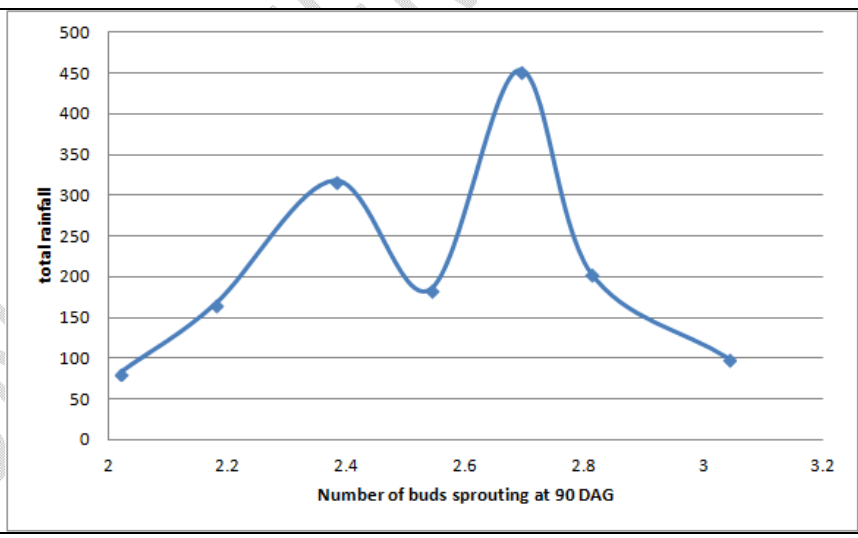

Fig. R12 Dependence of number of buds sprouting at 90 DAG on the total rainfall.

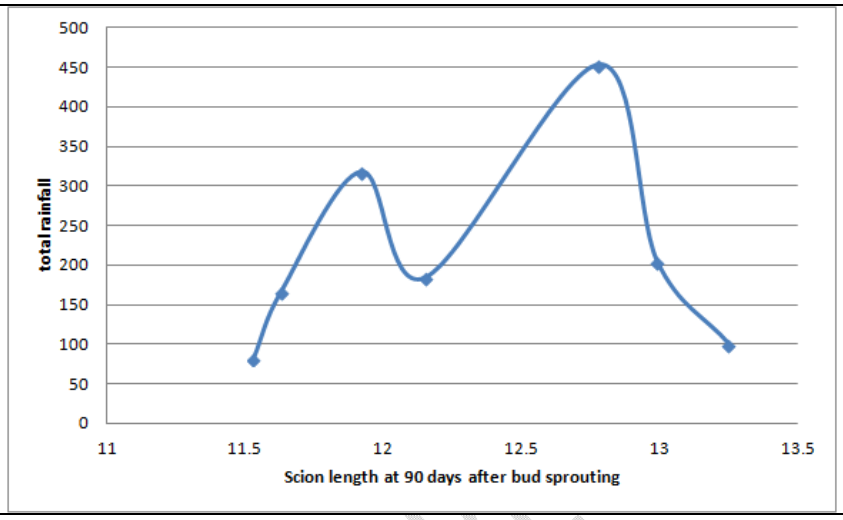

Fig. R13 Dependence of Scion length (cm) at 90 days after bud sprouting on the time of grafting.

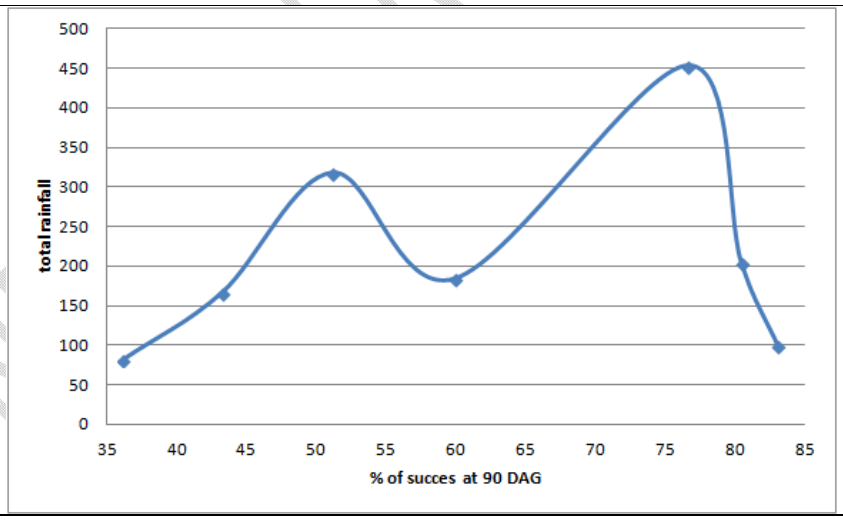

Fig. R14 Dependence of % of Success at 90 DAG on the time of grafting.