Original Research Article

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

Abstract

An experiment was carried out at the instructional cum research farm, Department of Horticulture, BNCA, AAU, Biswanath Chariali during 2019-2020. The objective of the experiment was to check the best time of wedge grafting in Jackfruit in the subtropical conditions of Assam. A total of seven treatments were taken, *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. Mother plants of desirable traits were selected for the experiment. Scions of about 10-15 cm in length with a thickness of 5-7 mm and free pests and diseases were collected from one season (4-5 months) old terminal shoots. The selected scion shoots were defoliated (pre-cured) 7-10 days before 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. 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 the success of grafting in terms of success percentage of stock and scion union, the time required for spouting, several buds developed and length of the scion on 90 days after grafting. While the temperature gradually rose 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.

Key word: Rootstocks, grafting , Jackfruit

1. Introduction

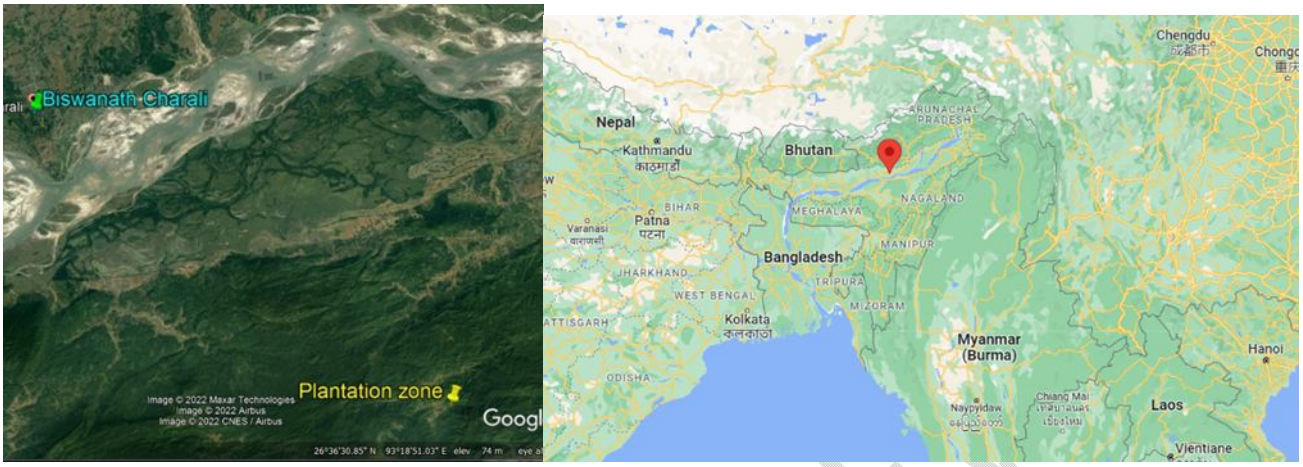
The Jackfruit is a popular fruit in most tropical and sub-tropical wandered as "the poor man's fruit" in India. It is one of the most suitable fruit crops for dryland horticulture. Jackfruit can be used in different ways and all the parts of the plant have different uses therefore, the jackfruit plant is considered a multi-purpose tree species (MPTS). The immature fruits are popularly used as vegetables in all jackfruit-growing areas. Ripe fruits are considered rich sources of carbohydrates, minerals and β-

carotene. The juicy pulp is eaten fresh or used for the preparation of jam and jelly. The pulp is also used in the preparation of pickles, chips, dehydrated leather, and thin papad. Seeds of jackfruit can be used in many culinary preparations as boiled or roasted items. Seed propagation is s common and easier method of propagation of jackfruit, but this method of propagation is not desirable due to the highly heterozygous and cross-pollinated nature of the crop, which results in immense variation among populations for yield, size, shape, flesh color, quality of fruit and maturity period. The significance of vegetative propagation in the maintenance of genetic uniformity and preservation of the identity of an elite clone or cultivar is well recognized in horticultural crops. Therefore, there is an immense need to find out a suitable method of vegetative propagation, for the quick multiplication of selected jack plants. Grafting is a method of propagation, generally practiced in some states like Tripura, Karnataka, West Bengal, etc, however, this is not generally practiced 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. In grafting, the attached method of grafting-like approach grafting has shown greater success (Nazeem *et al*., 1984) but later this method was found to be cumbersome, laborious, and costlier. Therefore, the present study has been envisaged to determine the suitable time for propagation of jackfruit by grafting concerning 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) Fig. R1 The prevailing climatic condition of Biswanath Chariali which is located in the center of the North Bank Plain Zone of Assam is subtropical with warm and humid summer, cold winter and high relative humidity. Summer is expected from May to August and the cold winter from December to January whereas, a mild winter is experienced from September to November and February to April. The rainy season and the summer seasons are overlapping and rainfall increases gradually from March and reaches a maximum in the month of July and then rainfall gradually decreases up to November.

Fig. R1



A total of seven treatments were taken, *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). Fig R2. Six to seven months old, vigorously growing uniform seedlings of Jackfruit grown from the seeds were selected as rootstocks. Jackfruit seeds were collected manually from fully ripened healthy fruits from the orchard of BNCA. Big size seeds possess high germination potential and can produce more vigorous seedlings. Seeds were extracted from the ripe fruits and cleaned. Jackfruit seeds are slightly acidic in nature and so the seeds were soaked in clean water for an hour. Black polythene bags of 200 gauge thickness and 8" x 10" size were used for raising jackfruit rootstocks. The bag mixture was prepared by mixing soil, sand, and vermicompost in equal proportion. The selectedlarge-sized seeds were sown in polybags and kept in the net house till germination. After 15-20 days when the seedlings emerged out from the rooting medium, the seedlings were kept in sunny conditions for better growth.

Watering was done regularly for the seeds that were sown in the poly bags. Weeding was done whenever the weeds were observed. DAP @ 5-6 g per seedling was applied in the rooting medium to encourage the better growth of the seedlings. Plant protection sprays were given with pesticides and fungicides as and when required.

Trees with good quality fruits were selected for scion material at the ICR farm of the Department of Horticulture, Biswanath College of Agriculture. Selection of proper scion material is

very crucial for getting a high percentage of graft success. Scions of about 10-15 cm in length with a thickness of 5-7 mm and free from pests and diseases were collected from one season (4-5 months) old terminal shoots. The selected scion shoots were defoliated (pre-cured) 7-10 days before grafting. As per the experimental treatments, immediately after separation of the scions from mother trees, they were wrapped in a moist cloth and carried in polythene cover to the site of grafting. To remove latex, which interferes with the graft union, the scion sticks were immersed in water for about 30 minutes as suggested by Swamy (1993). The terminal portion of the rootstock was decapitated at a height of 15-20 cm from the surface of the rooting medium retaining two pairs of bottom leaves on the rootstocks, then a cleft of 5-6 cm deep was made on the rootstock. The pre-cured scion was selected and it was mended into a wedge shape of 5-6 cm in length by chopping off a little portion of wood and bark on either side and taking care to retain some bark on the remaining two sides. The wedge of the scion was inserted into the cleft of rootstock and the graft joint was secured firmly by wrapping with a polythene strip of 30 cm length, 2.0 cm width, and 100 gauge thickness. A white tube-like polythene cap of 20 cm x 4 cm was inserted over the scion and kept in the shed house for 15-20 days. Sprouting initiation takes place within 7-10 days, after completion of sprout initiation, polythene caps were removed from the grafted plants. This way the grafting was done at an interval of one month up to September.

2.1 The total number of grafts under each treatment in each replication was recorded and finally a percentage of success of grafting was calculated as follows.

$$\text{Success of grafting (\%)} = \frac{\text{Total no. of grafts survived in each treatment}}{\text{Total number of grafts of each treatment}} \times 100$$

2.2 Number of bud sprouting

A number of buds sprouted in 5 grafts of each treatment was counted 90 days after grafting and the average of each treatment was recorded.

2.3 Number of new shoots per graft at 90 days after grafting

A number of new shoots which emerged in each graft of each treatment after the grafting operation were counted at 90 days after grafting and the average was considered for each treatment.

2.4 Scion length

The length of the new shoot in randomly selected 5 grafts of each treatment was recorded with the help of a meter scale and the average was worked out at 90 days after bud sprouting and expressed in cm.

2.5 Month-wise meteorological observation during the study

The meteorological data were collected from the Department of Agricultural Meteorology, Biswanath College of Agriculture, AAU, Biswanath Chariali. The meteorological data during the course of the investigation period was recorded in respect of maximum temperature (^{0}C) and minimum temperature (^{0}C), rainfall (mm), and humidity (%).

Fig. R2

Sowing of seeds in polybag

Covering the seeds with growing medium

Initial stage of seed germination

Seedling one week after germination

Seedlings three weeks after germination

Six months old rootstocks

Rootstock ready for grafting

Preparation of scion

Preparation of rootstock for grafting

Interlocking of scion and stock

Wrapping with white polythene strip

Covering of scion with poly cap

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 6). The minimum temperature increased from 8.3 to 27.7°C, while the maximum temperature increased from 21.1 to 37.1°C from the beginning of March to August, while both maximum and minimum started to reduce from the beginning of October. The current study's finding is also in accordance with the findings obtained by Razzaque (2005).

3.1 Highest success rate

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

maximum rates of success in March and April grafted jackfruit might probably be associated with prevailing congenial ambient temperature along with sufficient rainfall which helps maintain suitable relative humidity during the experiment. The result confirms the finding of Razzaque (2005).

Fig. R3

Graft in the month of March (T1)

Graft in the month of April (T2)

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 the prevailing thermal environment with a good quantum of rainfall (>100 mm) and with a good amount of bright sun-shine hour. However, as grafting was delayed from April, several new shoots per graft at 90 days after grafting reduced gradually and became minimum (1.08) in T_7 (September). Fig R4. Though temperatures increased from April onward, prevailing low bright sun-shine hours and higher relative humidity due to the occurrence of higher rainfall resulted in a reduction of development of new shoots on scions. There were minimum favorable climatic conditions during September while March was most favorable for bud sprouting. The temperature that causes high cell activity is necessary for better graft union. The wedge grafting dwas onea the time when fathe vorable temperature could be expected and when the plant tissues, especially the cambium was in a naturally active state and the same reason might have resulted in higher bud sprouting in the

present investigation. This could also be attributed to the vigorous growth of stock which increased the growth and leads to a maximum accumulation of stored metabolites at the time of grafting. These findings are in agreement with the findings of Ram and Akhilesh (2005), Bharad *et al.* (2006) and Selvi *et al.* (2008) also reported earlier that grafting in March-April showed better results with bud-sprouting.

Fig R4

New shoots per graft in T2 (April)

New shoots per graft in T7 (September)

3.3 Longest length of scion

The experiment revealed that the length (at 90 days after grafting) of the scion was the longest (13.25 cm) when grafting was done during the march (T_1) fig R5, which reduced successively as the grafting time was delayed and became minimum (11.53 cm) in case September (T_7) grafted plants. Similarly, the 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 longer period (24.55 days) was required to bud sprouting in the case of September grafted plants (T_7). The reason behind the early sprouting of graft during the early months is attributed to the suitable weather condition in terms of lower temperature, a good amount of rainfall, and higher bright sun-shine hours prevailing during the early months of grafting.

Fig R5

Longest Scion length (T1) March

4. Conclusions

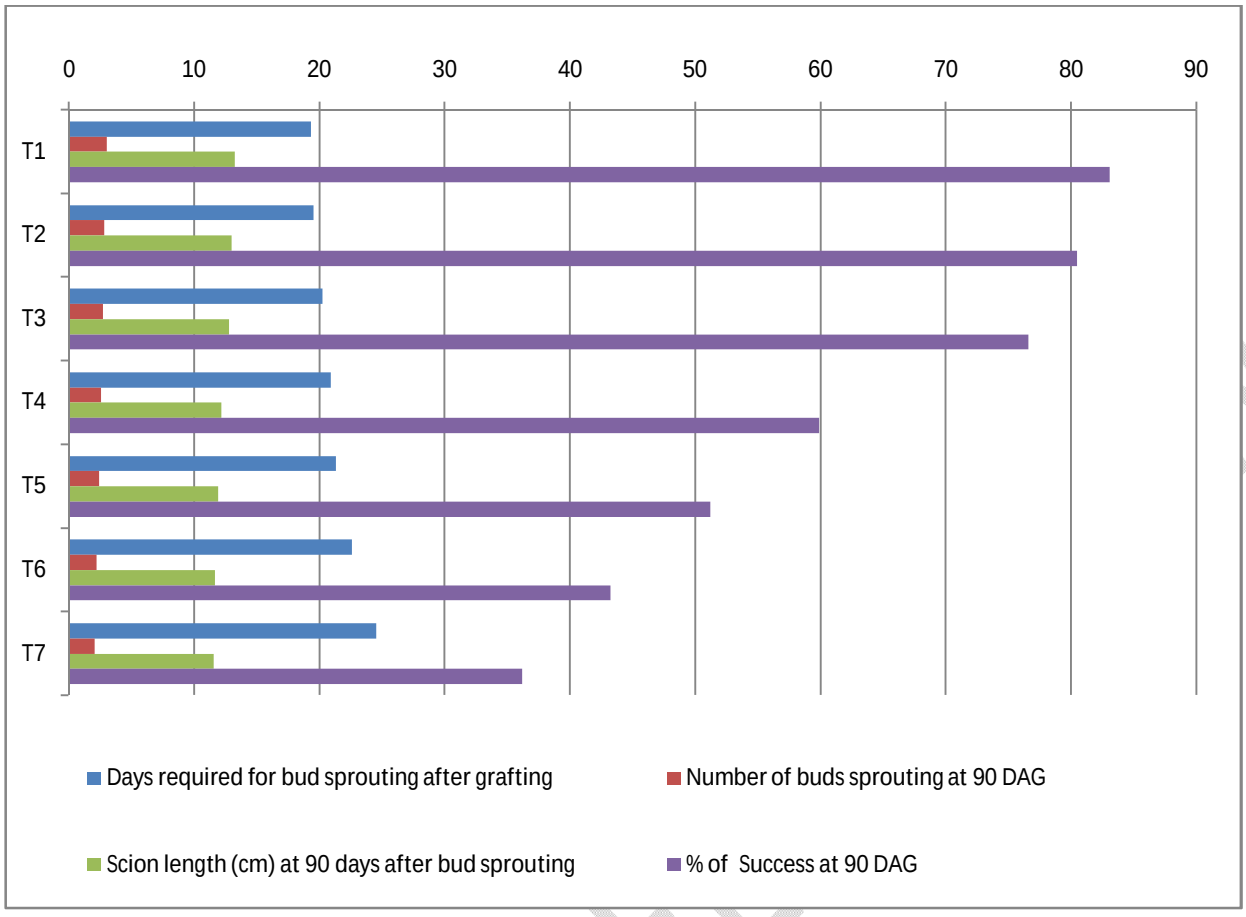
From the above discussion, it can be concluded the period from March to June could be considered as the suitable time for producing jackfruit grafts by wedge grafting method in Assam. However, March and April are the best months for grafting jackfruit, as weather conditions in terms of temperatures with 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 the success of grafting in terms of success percentage of stock and scion union, the time required for spouting, several buds developed and length of the scion on 90 days after grafting. While the temperature gradually rose from June onwards up to September and there was also quite a reduction in the amount of rainfall, the moisture content in the leaves of the scions dried up because of evapotranspiration and decreased the percentage of graft success. Grafting done in March required the shortest period for bud sprouting and the period gradually longer till September. In the present study, graft success, survival percentage of grafts and growth of scions after grafting were observed to be better in the grafts produced from March to June.

Table 1: weather conditions and effect of time of grafting on the 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

Table 1



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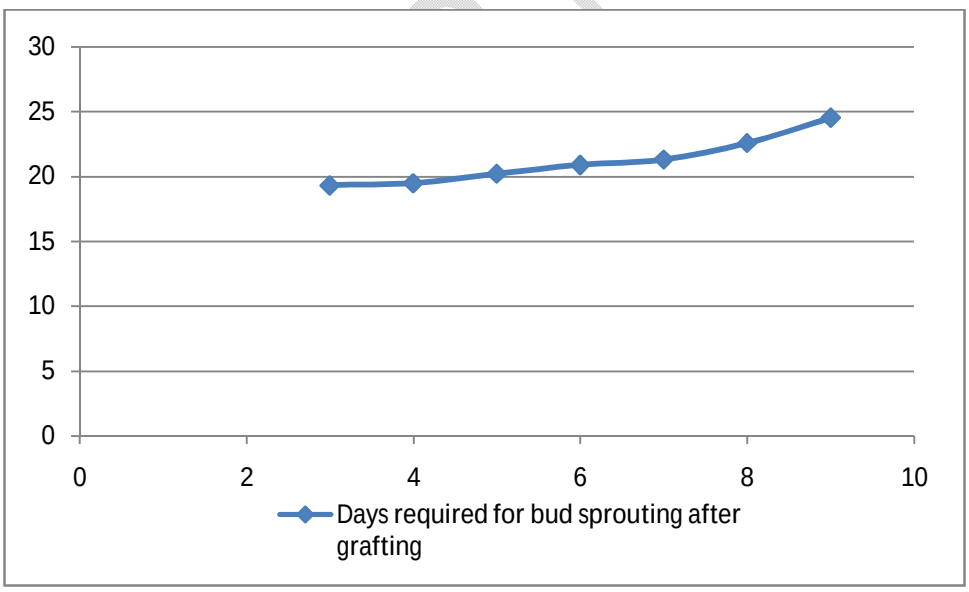

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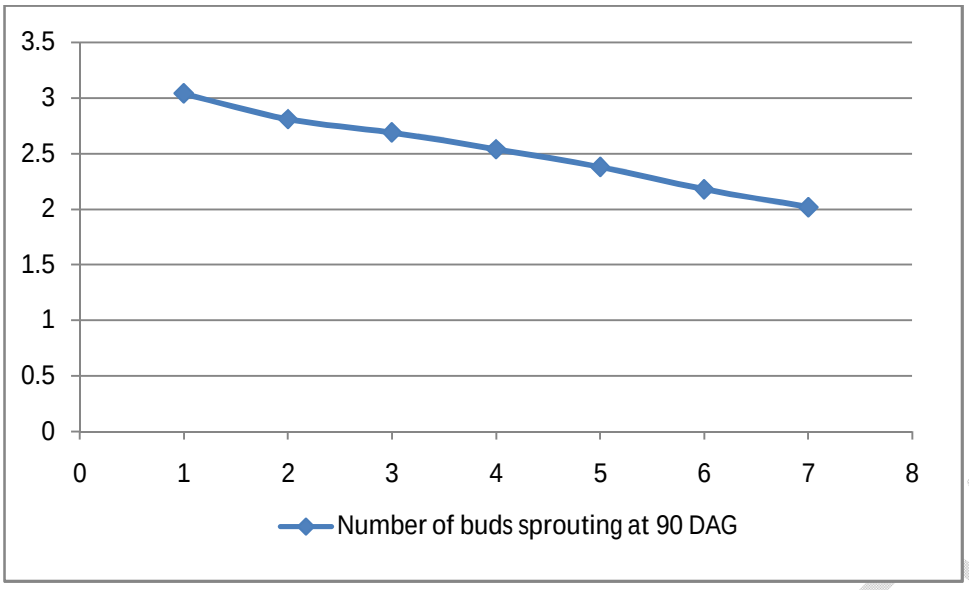

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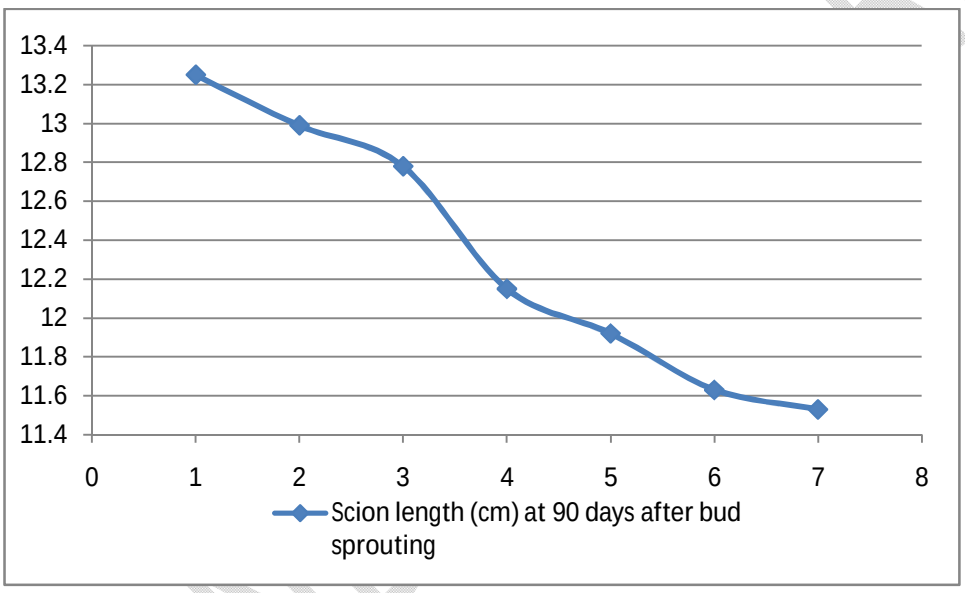


Table 5

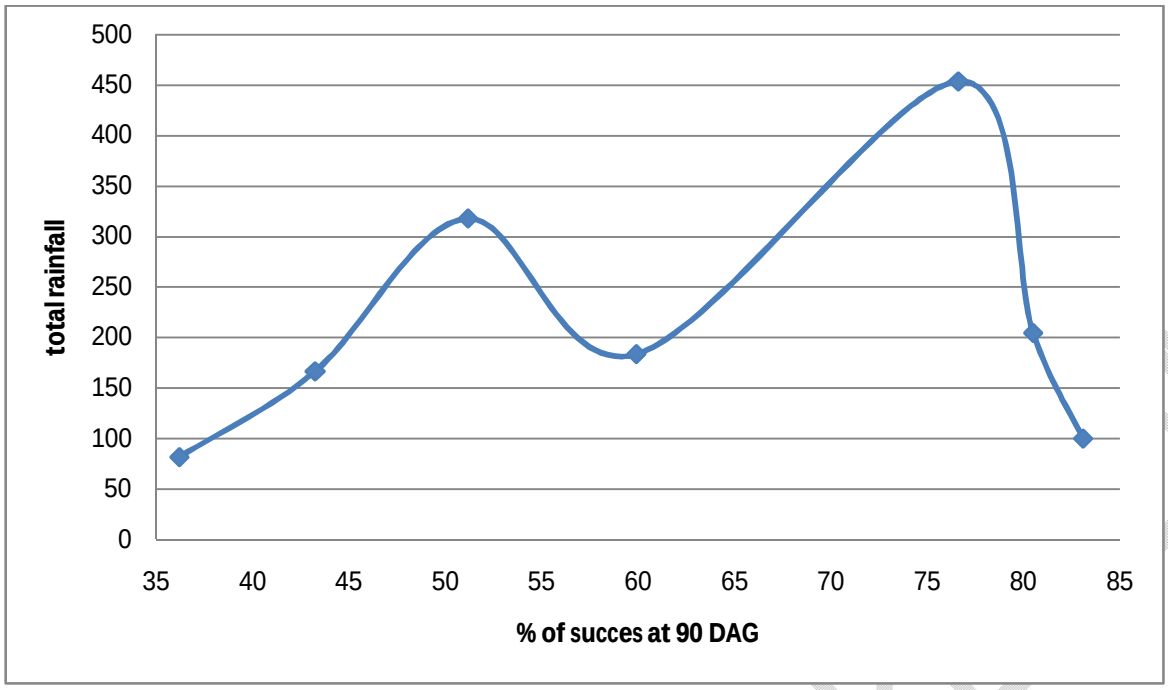
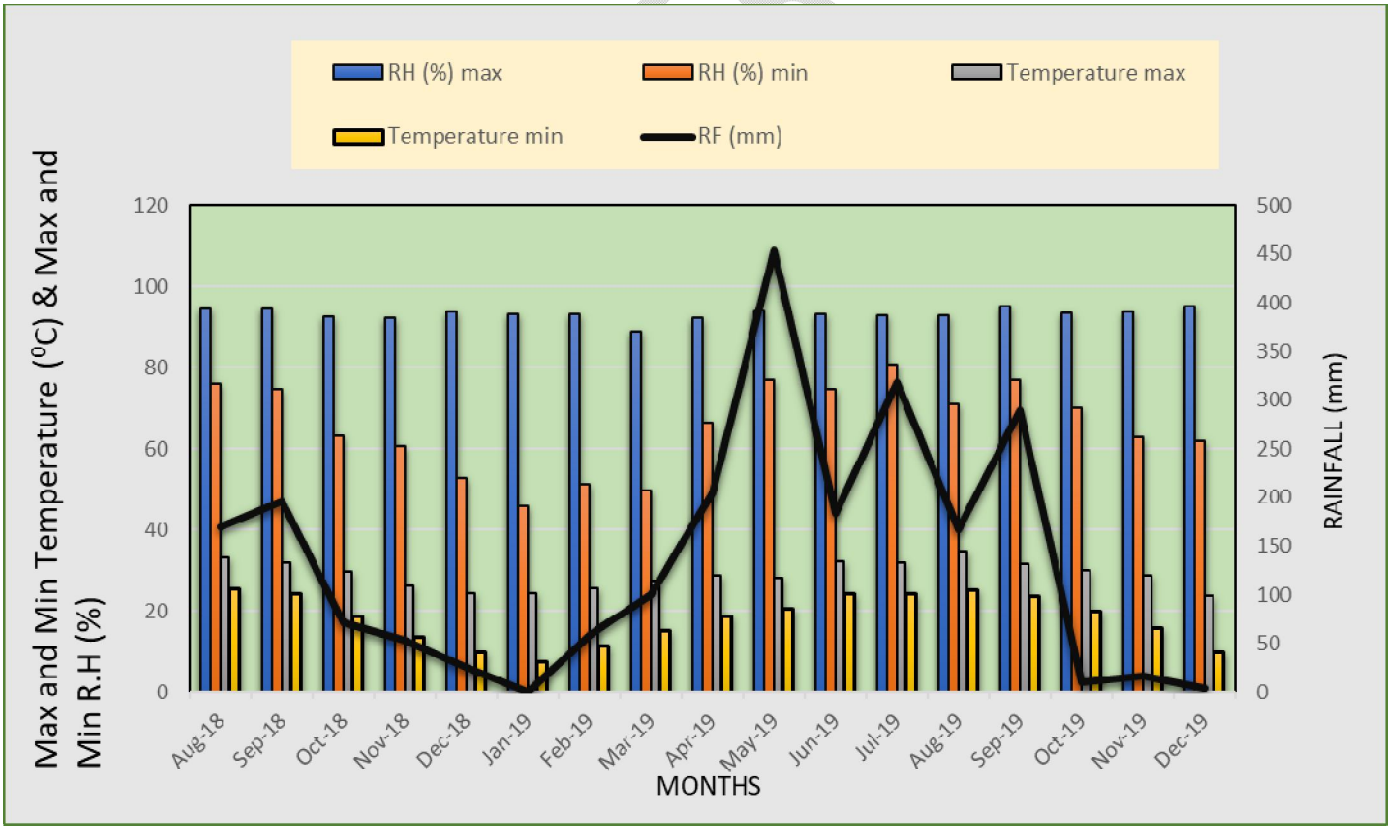

500
450
400
350
300
250
200
150
100
50
0
total rainfall
35
40
45
50
55
60
65
70
75
80
85
% of succes at 90 DAG

Table 6


RH (%) max
RH (%) min
Temperature max
Temperature min
RF (mm)
Max and Min Temperature (°C) & Max and Min R.H (%)
RAINFALL (mm)
120
100
80
60
40
20
0
500
450
400
350
300
250
200
150
100
50
0
Aug-18
Sep-18
Oct-18
Nov-18
Dec-18
Jan-19
Feb-19
Mar-19
Apr-19
May-19
Jun-19
Jul-19
Aug-19
Sep-19
Oct-19
Nov-19
Dec-19
MONTHS

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