Effect of Different Season and Deblading on Wedge Grafting in Guava (*Psidium guajava* L.) Cv. Lucknow -49

THESIS

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In

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Horticulture (Fruit Science)

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2015

CERTIFICATE - I

This is to certify that the thesis entitled **"*Effect of Different Season and Deblading on Wedge Grafting in Guava (Psidium guajava L.) Cv. Lucknow -49*"** *submitted in partial fulfilment of the requirement for the degree of* ***MASTER OF SCIENCE in Agriculture, Horticulture, Fruit Science*** *of Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur is a record of the bonafide research work carried out by* ***Ms. Sweeti chouksey*** *under my guidance and supervision. The subject of the thesis has been approved by the Student's Advisory Committee and the Director of Instructions.*

All the assistance and help received during the course of the investigation have been acknowledged by her.

Place: Jabalpur

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CERTIFICATE - II

*This is to certify that the thesis entitled "**Effect of Different Season and Deblading on Wedge Grafting in Guava (Psidium guajava L.) Cv. Lucknow -49**" submitted by Ms. Sweeti Chouksey to the Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur in partial fulfilment of the requirements for the degree of Master of Science in Agriculture, Horticulture (Fruit Science) in the Department of Horticulture has been, after evaluation, approved by the External Examiner and by the Student's Advisory Committee after an oral examination on the same.*

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DECLARATION AND UNDERTAKING BY THE CANDIDATE

I, Sweeti Chouksey D/o Shri R. S. Chouksey certify the work embodied in thesis entitled “Effect of Different Season and Deblading on Wedge Grafting in Guava (*Psidium guajava* L.) Cv. Lucknow -49” is my own first hand bonafide work carried out by me under the guidance of Dr. B. P. Bisen at Department of Horticulture (Fruit Science) College of Agriculture, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur (M. P.) during 2014-15.

The matter embodied in the thesis has not been submitted for the award of any other degree/diploma. Due credit has been made to all the assistance and help.

I, undertake the complete responsibility that any acts of misinterpretation, mistakes, errors of fact are entirely of my own.

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Place : Jabalpur

Date : **Sweeti Chouksey**

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LIST OF ABBREVIATION AND SYMBOLS

%	:	Percentage
et al.	:	and other co-worker
etc.	:	Etcetera
C.D	:	Critical difference
Cv.	:	Cultivar
/	:	Per
ºC	:	Degree centigrade
Max.	:	Maximum
Min.	:	Minimum
RH	:	Relative Humidity
No.	:	Number
Ha	:	Hectare
Fig	:	Figure
Cal	:	Calculated
Mm	:	Millimeter
Cm	:	Centimeter
TSS	:	Total Soluble Solid
Gm	:	Gram
Vol	:	Volume
DAG	:	Days after grafting
Cv	:	Cultivar
‘F’ value	:	Fisher value
d.f	:	Degree of freedom
CRD	:	Completely Randomized Design
ANOVA	:	Analysis of Varience
Tab.	:	Tabulated
MSS	:	Mean sum of square
S.Em ±	:	Standard error of means
SS	:	Sum of square

INTRODUCTION

Guava (*Psidium guajava L.*) is one of the dominant fruit crop of tropical and sub-tropical regions of India, which belongs to family Myrtaceae. Guava is hardy, drought tolerant, high yield potential and has diverse uses of fruits and also helps in developing a good ecological system in addition to improve the rural economy as well as nutritional standard to greater extent.

At present, it is the fifth most important fruit crop in India after mango, banana, citrus and papaya with annual production of 3.60 million tones from 0.26 million hectare area accounting to about 4.1% and 3.7% of total production and area respectively. The most important guava growing states are Madhya Pradesh, Bihar, Uttar Pradesh, Haryana, Gujarat, Maharashtra, Andhra Pradesh and Rajasthan. Madhya Pradesh is the leading guava producing state (22.9%) with 22,400 ha. area, 8,41,100 million tones production and 37.6MT/ha. productivity (NHB 2013-2014).

Guava has been popularly known as “Poor man’s apple” because of its plenty availability to every person at a very low price. It excels most of the fruit crops in productivity, hardiness, adaptability and vitamin C content (Tandon et al. 1983).

Guava fruits are used both for fresh consumption and processing purposes. In recent years, guava is getting popularity in the international trade due to its nutritional value and processed products (Singh 2005). Guava fruit is relished when mature or ripe, excellent salad and pudding are prepared from the shell of ripe fruit. Guava Jelly is well known to all and Jam, sharbat, ice-cream, cheese, canned fruit, RTS, nectar, squash and guava powder are also prepared.

The greatest handicapped in guava plantation are discriminate multiplication of plant from unreliable sources by nurserymen. Trust worthy initial planting material is the basic requirement on which the final crop depends both in quality and quantity. Non availability of quality planting material and consequent substitution of poor quality seedlings have adversely affected the guava production and productivity (Singh et al. 2005). Although a

large number of nurseries have been established there, is an acute shortage of quality planting material is the basic requirement on which the final crop depend both in quality and quantity.

Guava plants have been propagated through seeds for a long time. Propagation from seeds results in considerable variation in the size, shape and quality of fruits. Vegetative propagation in guava results in true to type crop with short juvenile phase. Though guava is propagated through budding (Gupta and Malhotra 1985; Kaundal et al. 1987), air layering (Singh and Singh 1970, Sharma et al. 1978; Manna et al. 2004), stooling (Rathor 1984, Pathak and Saroj 1988) and inarching (Mukherjee and Majumdar 1983).These are still not commercially viable due to varying rate of success, absence of tap root system and cumbersome process.

Recently, rapid multiplication through wedge method of grafting utilizing polyethylene cap (PC) has been recommended by Singh et al. (2007) for enhancing the production of quality planting material throughout the year. Since defoliation time of scion has not been studied for higher success of grafts, the present experiment was planned to evaluate scion defoliation time for early sprout with better success of grafts.

Keeping the above facts in view, present investigation entitled "**Effect of different season and deblading on wedge grafting in Guava (*Psidium guajava* L.) Cv. Lucknow-49"** was conducted at Fruit Research Station, Imalia, Department of Horticulture, JNKVV, Jabalpur (MP) during the year 2014-15 with the following objectives.

1. To study the effect of seasons on wedge grafting
2. To find out the effect of deblading on wedge grafting
3. To determine the effect of dates of deblading on wedge grafting
4. To assess the vegetative growth and physiological response of grafted plants

REVIEW OF LITERATURE

The success of any programme mainly depends on the right selection of material and its skillful management. It is only possible when we possess knowledge of previous work done in the concerned field. In guava substantial contribution has been made to the literature regarding to propagation in the recent years. The literature pertaining to the various aspects of the present study has been reviewed under the following heads:

2.1 Effect of season on grafting

2.2 Effect of condition on grafting

2.3 Physiological parameter

2.1 Effect of season on grafting

Patel and Amin (1976) reported that wedge grafting gave the highest percentage of grafts success (64.64%), while whip, tongue and splice grafting gave 57.86, 54.29 and 51.43 percent success respectively. Highest success was in July and lowest was in october in mango.

Dhandar(1985) recorded that 92% success of grafting during the rainy season with wedge grafting. The best result (75%) were obtained under mist on 8 month old seedlings grafted in march in cashew nut.

Gunjate (1989) conducted an experiment at regional FRS Vengurla, India and studied the factors affecting the success of graft union establishment in wedge grafting of Alphonso mango into newly germinated mango seedlings. Grafting in the warm humid months of june and july gave the highest survival (72.78%).

Shankar et al. (1991) carried out wedge grafting on one year old seedling raised from local mango trees at fortnightly intervals in february and march 1987. They found highest percentage of sprouting (88.66%) obtained with grafting during the second fortnight of March.

Haldankar and Jadhav (2001) observed that the maximum success of grafts was observed during the month of july (37%), followed by september (32%). The highest survival of grafts was observed during the month of july

when the difference between mean minimum and maximum temperatures was less than 3ºC and humidity was above 87%. This indicated the importance of grafting period on the success of clove grafts on Jamun. Analysis of the growth performance of clove grafts at 180 days after grafting showed that the maximum total number of leaves was observed when grafts were prepared during the month of march, followed by august, february and may. Grafts produced the least number of leaves when grafting was done during november, december and january. The length and breadth of leaves and the length of new shoots during different months were not significantly different. However, grafts prepared during july, august and march showed higher values for these parameters compared with other grafts. Analysis of field performance revealed that the grafts showed excellent growth. The mean height, number of leaves, leaf length and leaf breadth were increased by 97.91%, 290.34%, 93.82%, 18.03% and 22.02%, respectively within one year of its field planting.

Pandey and Singh (2001) conducted an experiment on the effect of scion cultivars, date of grafting and level of anti transparent on success and survival of stone grafting (wedge grafting method) of mango under Varanasi condition of UP during 1994-95 and 1995. They found that the maximum sprouting of scion (68.44% and 73.11%) and subsequent survival (39.78 and 45.75%) of stone grafted plants was observed in 16th august followed by 1st august and 31st August dates of grafting.

Patil (2004) conducted an experiment to standardize the most suitable time and method of propagation technique in aonla (*Emblica officinalis*) under semiarid condition of maharashtra, an experiment with 2 methods of propagation, i.e. wedge grafting and patch budding was conducted during mid- June, mid-July, mid-August and mid-September 1997 in Pune. In each case, 10 plants were taken as a unit. One year old seedlings were used as rootstock. Activated but unsprouted scion buds and scion sticks, 10 cm. long were taken from matured shoots of aonla cv. Banarasi. The maximum success was achieved through wedge grafting (91.6%) in mid- august followed by patch budding (85.0%). In general, mid- august wedge grafting initiated the earliest sprout with maximum success followed by July.

Ahmad et al. (2006) evaluated the effectiveness of time of grafting and point of insertion of scion into the rootstock in grafting of jackfruit. The treatments comprised grafting on 15 february, 15 march, 15 april, 15 may, 15 june, 15 july, 15 august and 15 september; insertion at the brown portion, light portion and green portion of the rootstock. March was most favorable for grafting while insertion of the scion into the light brown portion of the jackfruit seedling gave the best result. The highest success in grafting was observed in March when the scion was inserted into the light brown portion of the seedling.

Bharad et al. (2006) revealed that the bud-take percent, days required for bud-sprouting, bud-sprouting percentage, linear scion growth, number of leaves and final survival recorded maximum values under softwood grafting over the patch budding. Bud sprouting, scion diameter and final survival of grafts / buddings. However softwood grafting done during march recorded maximum vegetative growth with highest bud sprouting and final survival percentage of grafts / budding.

Giri and Lenka (2007) conducted an experiment in which grafting operation was done from october 04 to september 05 taking each month as a treatment each replicated thrice. From the investigation, it was revealed that the graft success percent was highest in may (93.66%). The days taken to sprouting were 8.66 days in june which was minimum. In rest of the month the success percent was more than 70%.

Chandra R. (2009) found that wedge grafting technique has tremendous potential for multiplying guava plants throughout the year in green house as well as in open.

Kudmulwar et al. (2008) conducted that softwood grafting was performed in Aurangabad, Maharashtra, India, at fortnightly interval from 1st January 2005 to 15th may 2005 on a local rootstock of custard apple (*Annona squamosa*), using one year-old seedlings of uniform growth (pencil thickness). The custard apple cultivar Balanagar was used as the scion. The scion bud of the last season growth before sprouting from a single mother plant was taken for softwood grafting. The grafting performed on 15th february recorded the

highest success percentage (88.87), maximum length of scion (2.38cm), highest number of leaves (21.93) and maximum diameter of scion (0.26cm). The lowest number of days to sprouting was recorded in plants grafted on 1st and 15th february.

Singh R.K. (2010) reported maximum bud sprouting during 2nd week of march and the number of leaves on scion were found maximum in softwood grafting done during 2nd week of may in jamun.

Chandra et al. (2011) conducted an experiment on two grafting methods (wedge and tongue grafting) and five dates (15 december, 30 december, 15 january, 30 january and 15 february). One year old seedlings of 'Phule arakta' were used as a rootstock for the present study. Significantly higher scion sprouting was recorded with wedge grafting done in the last week of january after 15 (90.00%) and 21 (96.67%) days of grafting. Consequently maximum graft success (85.00%) was recorded after 90 days of grafting with wedge grafting done on 30 january.

Ghojage et al. (2011) recorded maximum grafting success during february (81.66%), which is at par with october (80.00%). The minimum grafting success was recorded during december (35.00%). Maximum graft survival was recorded during february (95.97%) followed by october (95.83%), september (93.97%) and june (93.02%) which are at par with each other. The lowest survival percentage was recorded during december (61.90%). Regarding the growth parameters, the number of leaves was maximum in february (9.33) which was at par with march and september (9.00) and july (7.33), while the minimum number of leaves was recorded in december (3.00). In case of number of sprouts, again february (2.33) had the highest value, while the minimum was recorded in december (0.66). When graft height was considered october recorded the highest graft height (20.66 cm), which was on par with february (18.66 cm) and august (17.66 cm). On the other hand, december recorded the lowest height (12 cm). The graft girth was maximum in september (8.24 mm) which was significantly different from all other months while minimum graft girth was recorded in january (4.08 mm). With this study it is concluded that february and october were the most favorable months for softwood grafting in Jamun.

Bhat et al. (2014) carried out a study during three successive seasons (2009, 2010 and 2011) on walnut (*Juglans regia* L.) seedlings. Grafting was done by wedge method on 9 dates (5 january, 15 january, 25 january, 5 february, 15 february, 25 february, 5 march, 15 march and 25 march). The pooled data showed that, highest success percentage of grafting was obtained on 25 january and lowest was recorded on 25 march. The maximum number of shoots / scion and leaves / scion was observed on 25 january. The highest value for scion diameter (0.94 cm) was found on seedlings grafted on 25 january while the lowest scion diameter of 0.45cm from grafts, grafted on 25 march. The highest proportion of salable plants was observed on 15 january and lowest proportion was found on 25 march. The best time for grafting is january under polyhouse condition.

Mahore (2014) observed that the 5th march to 5th april are the best season for wedge grafting in jamun. During these period bud sprouting %, success percentage, sprout length, diameter and physiological parameters were significantly maximum.

Jadia et al. (2015) conducted an experiment on wedge grafting in guava and concluded that the most suitable period for wedge grafting at polyhouse condition from 20th november to 5th january and in open field condition most suitable period was obtained from 5th january to 5th february at Chitrakoot region in India. The maximum percentage of graft survival obtained at polyhouse condition was (94.08%) in the month of december and open field condition was (77.33%) in the month of january. The wedge grafting given best performance under polyhouse (protected) condition obtained in the month of december and open field condition the best performance was obtained in the month of january.

2.2 Effect of condition in grafting :

Desai and Patil (1984) carried out a study on local mango stones germinated and Alphonso scion defoliated 7 days earlier and were grafted on 7 days old seedlings (soft wood grafting) or one year old seedling (hard wood grafting) at 15 days intervals between 1st july and 15th september in a greenhouse and in the open. They found that the soft wood grafting on 1st july in the greenhouse gave the highest (70%) success followed by 40% for both soft wood grafting and hard wood grafting on 1st July in open.

Dhakad and Hoda (1987) reported that the scion shoots of the cv. Langra were taken immediately after defoliation at 5, 7, 10 and 15 days. In another trial, scion shoots taken 5 days after defoliation were stored for 3, 5, 7 or 10 days. The age of the rootstock and scion were 12 and 6 months, respectively and shoot diameter at the graft union was 1-1.5 cm. in the first trial, grafting 10 days after defoliation gave the best results, viz 95% initial success and 75% survival after 6 months. In the second trial, storing for 3 days gave the best results viz 90% initial success and 80% survival after 6 months.

Patil et al. (1991) prepared the stone grafts for each of 7 mango cultivars (Mallika, Baneshan, Dashehari, Totapari, Mulgoa, Pairi and Alphonso) during the 1st week of july using 7-10 days old rootstock. The scion shoots were defoliated 8-10 days prior to grafting. Mulgoa gave 100% successful grafts and was significantly superior to other cultivars. Mulgoa shows maximum height and number of leaves one month after grafting.

Mankar et al. (1999) conducted an experiment at Sabour with the mango cultivars Amrapali. Wedge grafting onto 10-12 days old seedlings gave better results than splice grafting for both methods. Defoliation of the bud wood for 3 days prior to grafting gave the best results in terms of grafting success, survival and overall plant growth.

Shete et al. (1999) describes a method in which rootstocks are grown *insitu* for a year or more and grafted at the site of the developing terminal shoot. The scion wood should be defoliated 10 days before grafting and should be of the same thickness as the terminal shoot. The method resulted in 100% success with *Grewia asiatica*. 91% success with *G*. *sapodilla* and at least 70% success were achieved with guava, cashew and *Phyllanthus emblica*.

Singh et al. (2005) conducted an experiment on wedge grafting technique in greenhouse condition at CISH, Lucknow (UP) and reported that the rate of success of graft was in range of 70 to 90% during december to january. However, in greenhouse condition maximum success rate of graft was 93 to 95% when grafts covered with polythene cap from october to february with polythene cap and 37 to 77% without polythene cap during december to January.

Bandenawaj (2007) revealed that under open condition on 15th day after graft success, maximum length of sprout was observed during september and minimum during november followed by december and january. Number of leaves was maximum in the month of june while minimum was noted in the month of august and november.

Singh et al. (2007) conducted an experiment at CISH Lucknow (UP) reported that wedge grafting in guava (*Psidium guajava* L.) cultivars Allahabad safeda and Sardar under greenhouse as well as open field condition for three years reported that, the grafting operation performed in greenhouse gave higher success of grafts (64.56 - 94.33) as compared to open field conditions (51.30 - 78.63) in both the cultivars. However maximum success of graft was obtained in greenhouse (88.63 - 94.33) as well as in open field conditions (66.6 - 78.63) when grafting was carried out during november to february in both cultivars grafting under greenhouse significantly reduced the time taken (11- 13 days) for sprouting than those grafted in open field conditions. Interaction effect of variety × green house × month, variety × open field condition × month and variety × factors (GH/OFC) × month had significant effect on success of grafts and earliness in grafts sprouting when grafting was performed in winter months. The temperature range of 20°C to 25°C and RH 70 - 80% were found most conductive for maximum (>70%) success.

Balkrishan (2009) observed that the most suitable period for wedge grafting at polyhouse condition from 15th november to 1st january and in open field condition most suitable period should be obtained in the month from 1st january to 1st february.

Visen et al. (2010) observed that wedge grafting method with guava cultivars Allahabad safeda, Lucknow 49 and Lalit performed in greenhouse with polycap gave significantly higher success of grafts compared with other conditions of wedge grafting in all taken cultivars. However, maximum success of grafts was obtained in greenhouse (81.71%) and minimum in open field conditions (when grafting was carried out during september to december in all three cultivars). Grafting under greenhouse significantly reduced the time taken (12 - 13 days) for sprouting than those grafted in open field conditions. The temperature range of 24 to 26º C and 70 to 80 per cent RH were found most conductive for achieving maximum success.

Singh et al. (2011) conducted an experiment with three defoliation time of scion i.e. 0 (day on the grafting), 4 and 8 days prior to grafting. Out of three periods of scion defoliation prior to grafting operation, not much significant difference was observed in respect of success percentage of grafts either in greenhouse as well as open field conditions. However, defoliation of scion on the day of grafting and 8 days prior to grafting gave better success over the scion defoliated 4 days prior to grafting. In case of scion defoliated 8 days prior to grafting, the success ranged between 90-99 per cent in the month of october to march. Among the different varieties, the maximum success of grafts was observed in Sardar closely followed by Allahabad Safeda and Lalit respectively. Similarly, among different months of grafting operations, when the grafting operation was performed during april, may, october, november, december, january and february gave higher successes (94.5-99.9%) specially on scion defoliated on the day of grafting followed by 8 days prior to grafting in green house.

Richhariya (2012) found that mango cv. Dashehari responded to preconditioning of scion and height of grafting. Deblading of scion shoot 8 days prior to grafting and 20 cm height of grafting was found significantly superior for bud sprouting %, bud success%, length of sprout, number of leaves per plant and new shoot girth.

Shashi et al. (2012) revealed that when scion of guava cv. Sardar were precured for 3, 6, 9 or 12 days by cutting leaves and retaining the leaf petiole on the mother tree and soft wood grafting was conducted and the grafting success, survival percentage and growth parameters of the grafts were evaluated at monthly interval. The greatest graft success and graft survival were recorded for scions cured 9 days (84.00 and 88.09%) respectively.

Shyamal et al. (2012) was conducted an experiment to find out the efficacy of wedge grafting on three guava cultivars during different months of year. Wedge grafting was tried in four months, *viz*. july (M1), august (M2), september (M3) and october (M4) on three varieties, namely Allahabad Safeda, Lucknow - 49 and Allahabad Surkha under two different conditions, namely, polyhouse, and open field conditions. Wedge grafting in the month of july gave better result in polyhouse (77.17%) as well as in open field condition

(66.43%). Polyhouse gave better response than open field conditions with respect to number of days taken to sprout, graft survival, number of leaves and length of sprouted shoot.

Abbas et al. (2013) conducted an experiment to standardize asexual propagation methods in guava (*Psidium guaj*ava L.) by different grafting techniques i.e. T-budding, T-grafting and cleft grafting. Maximum success percentage (59.26) was achieved in plants budded by T-grafting followed by T-budding (22.58%). The plants in T- grafting sprouted in 35.9 days and produced 26.47 cm sprouting length and 16.75 number of leaves as compared to the plants grafted via cleft grafting (7.54% success). Cleft grafting technique showed minimum performance in other parameters also.

Beer et al. (2013) carried out an experiment to appraise the effect of grafting time and environment on the graft success of guava (*Psidium guajava* L.) under wedge grafting. It was found that controlled environment (when scion shoot covered with poly tube) was best in all the attributes. It was found that maximum per cent graft sprouting and per cent graft survival was obtained in15th february grafting under controlled environment and minimum days taken to graft sprouting in15th april under open field condition.

2.3 Physiological parameter

Welbank et al. (1966) observed that the LAI could be integrated over time to take into the account persistence to leaf area. This integral value was termed as LAD and was found to be closely related to DMP and yield.

Deshmukh and Patil (1995) observed the significant positive correlation values for mean LAI with CGR (crop growth rate). This indicates the importance of leaf area in increasing the rate of photosynthesis.

Timmannavar and Patil (2000) observed that the leaf photosynthetic rate and leaf area index appeared to be major determinants of crop growth rate.

Rajan et al. (2001) conducted a study on 26 important Indian mango cv. to examine their foliage density and canopy diffuse non interceptance. Indirect measurement of LAI and diffuse non interceptance (DNI) made using output of concentric silicon detectors, placed at five zenith angles on sensing

head of LAI – 2000 recorded significant variability in foliage density (LAI = 1.18-4.48). DNI value also exhibited large variation and ranged from 0.02 – 0.36.

ShuZenHong et al. (2001) observed that the light increased SSC (soluble solid concentration) and anthocyanin but reduce the increase in weight and diameter. Increasing the temperature limited increase in diameter and anthocyanin content. Weight, SSC and anthocyanin contents increased in a linear fashion with concentration of sucrose in the culture solution. However, non of three factors played a unique role in anthocyanin synthesis in wax apple. Among the 18 combinations, light/20 degrees C/6% sucrose gave the highest SSC and anthocyanin content, while dark/20 degrees C/6% sucrose produced the largest diameter.

Jamil et al. (2006) reported in garden pea that the cultivar and sowing date significantly affected the crop growth rate.

Oguntunde et al. (2011) evaluated that the effects on allometric characteristics and xylem sap flow in a mixed varieties plantation. Tree age explained more than 90% of the variation in stem diameter, over 96% of the variation in height, over 92% of the variation in crown diameter and more than 97% of the variation in leaf area index of the 60 mango sampled.

Richhariya (2012) conducted an experiment with 5 defoliation time of scion ie. 0 (day on the grafting), 2, 4, 6 and 8 days prior to grafting and 4 heights of incision. Out of 5 periods of scion defoliation prior to grafting operation, defoliation of scion 8 days prior to grafting gave better success over the other dates and the chlorophyll index (25.39) and leaf area index (7.79) were significantly maximum over other dates.

Mahore (2014) observed that the 5^{th} march to 5^{th}april are the best season for wedge grafting in jamun. Observations were taken 120 days after grafting for physiological characters and recorded that chlorophyll index (44.53), leaf area index (2.90), light transmission ratio (0.50%), PAR interception (124mol/m^2/sec) and leaf area duration were significantly maximum when grafting was performed at this period.

MATERIAL AND METHODS

This chapter comprises the details about the material used and the methods adopted during the present investigation entitled “Effect of different season and deblading on wedge grafting in Guava (*Psidium guajava* L.) Cv. Lucknow- 49” was carried out during the year 2014-2015.

3.1 Experimental site:

The experiment was conducted at Fruit Research Station, Imalia, Department of Horticulture, College of Agriculture, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur (M.P.).

3.1.1 Soil:

The soil of the experimental field was medium black, clay loam with good drainage and uniform texture with average NPK status. It is tenaciously sticky when wet and hard when dry.

3.1.2 Climate and weather conditions:

Jabalpur is situated on “Kymore plateau” agro-climatic region of Madhya Pradesh at 23.91º North latitudes and 79.5 º East longitudes. The altitude of the place is 411.8 meters above the mean sea level. The tropic of cancer passes through the middle of the district. The climate of region is tropically semi-arid and sub-tropical having extreme winter and summer. The average annual rainfall is about 1350 mm, which is mainly received during mid June to first week of October from South-West monsoon. The average maximum temperature is 46ºC and minimum temperature 6.8ºC. The average annual relative humidity is 74 percent.

The data related to weekly maximum and minimum temperature, relative humidity, rainfall (mm), sunshine hours and wind velocity (km/hr) were recorded at Meteorological Observatory, Krishi Nagar, J. N. K. V. V. Jabalpur are presented in the Table 3.1

Table 3.1 Meteorological information (week wise) during entire crop season of the year 2014-15 at Jabalpur

Months	Meteo. Weeks	Temperature		Relative humidity		Rainfall (mm)	No. of rainy days	Sunshine (hrs.)
		Max.	Min.	Max.	Min.			
October	40	32.3	23.5	89	55	11.8	1	8.5
	41	33.3	21	86	53	5	1	9.4
	42	32.5	20.4	86	55	36.6	2	8.4
	43	31.6	16.6	89	41	0	0	8.8
	44	27.9	14.4	87	29	0	0	8.6
November	45	28.2	13.9	87	29	0	0	8.2
	46	28.6	14.4	83	26	0	0	6
	47	27.9	8.9	82	20	0	0	8.6
	48	28.4	10.2	85	24	0	0	8.6
December	49	28.7	8	88	24	0	0	8.7
	50	29	11.8	89	52	3.2	1	6.8
	51	25.3	5.6	86	32	0	0	7.6
	52	23.8	4.8	87	32	0	0	8.5
January	1	20.5	11.7	90	61	37.7	3	6.5
	2	22.1	5.3	87	38	0	0	8.5
	3	22.2	5.3	91	37	0	0	8.3
	4	21	12.1	89	75	10.2	2	3.7
February	5	22.5	8.7	85	44	10.8	2	9.8
	6	24.2	10.2	88	52	14.4	1	7.1
	7	26.8	10.4	88	40	6.2	1	9.1
	8	30.6	12	86	33	0	0	9.7
March	9	26.7	14.5	85	54	64.8	3	6.8
	10	28	12	85	39	0	0	9.5
	11	26.5	14.3	88.1	53.9	3.4	0	4.3
	12	32.7	14.5	80.1	26	0	0	10.5
	13	35.2	17.3	72.3	22.6	0.4	0	8.5
April	14	30.9	19.4	61.3	23.4	0	0	9.2
	15	33.1	18.5	71.3	36.3	1.6	0	7.4
	16	39.2	21.3	54.3	15.4	0.9	0	9.7
	17	38.9	21.7	43.1	17.6	0	0	9.2
May	18	40.4	23.5	44	14	0	0	8.3
	19	41.9	24	37	14	4.4	1	9
	20	40.2	25.8	51	23	0	0	7.5
	21	42.8	27.5	37	16	6.2	1	9.4
June	22	43	27	40	17	0	0	8.9
	23	41.6	28.7	46	20	0	0	8.3
	24	36.5	25.8	72	49	16.6	3	4.2
	25	37.8	26.3	73	52	1.6	0	7

Source: Dept. of Physics and Agro-meteorology, College of Agricultural Engineering. J.N.K.V.V., Jabalpur (M.P.)

3.2 Experimental material:

The experiment was laid out in the Asymmetrical Factorial Completely Randomized Design with three replications. Each replication was comprised of 30 plants. The details are given below:

(A) Date of wedge grafting (six) :

D_1 - 1st date (10/10/14) of grafting

D_2 - 2nd date (25/10/14) of grafting

D_3 - 3rd date (10/11/14) of grafting

D_4 - 4th date (20/02/15) of grafting

D_5 - 5th date (05/03/15) of grafting

D_6 - 6th date (20/03/15) of grafting

(B) Condition of grafting (two) :

1. C_1 on 6th day after deblading

2. C_2 on 8th day after deblading

Treatment combinations (Twelve) :

S. No.	Symbol	Treatments
T_1	D_1C_1	1st date (10/10/14), on 6th day after deblading.
T_2	D_1C_2	1st date (10/10/14), on 8th day after deblading.
T_3	D_2C_1	2nd date (25/10/14), on 6th day after deblading.
T_4	D_2C_2	2rd date (25/10/14), on 8th day after deblading.
T_5	D_3C_1	3rd date (10/11/14), on 6th day after deblading.
T_6	D_3C_2	3rd date (10/11/14), on 8th day after deblading.
T_7	D_4C_1	4th date (20/02/15), on 6th day after deblading.
T_8	D_4C_2	4th date (20/02/15), on 8th day after deblading
T_9	D_5C_1	5th date (05/02/15), on 6th day after deblading.
T_{10}	D_5C_2	5th date (05/02/15), on 8th day after deblading.
T_{11}	D_6C_1	6th date (20/03/15), on 6th day after deblading.
T_{12}	D_6C_2	6th date (20/03/15), on 8th day after deblading.

3.3 Experimental Details :

3.3.1 Detail of Experiment

The experiment was conducted with 12 treatment combinations. The experimental details are as follows:

Place	:	Fruit Research Station, Imalia, Department of Horticulture, College of Agriculture, JNKVV, Jabalpur
Crop	:	Guava (*Psidium guajava* L.)
Variety	:	Lukhnow 49
Experimental Design	:	Asymmetric factorial CRD
Control condition	:	Net house
No. of Replication	:	3
No. of graftings per replication	:	30
No. of Treatment	:	12
Total no. of graftings in the experiment	:	1080
Observations recorded	:	at 30, 45, 60, 90 days after grafting

3.3.2 Preparatory Conditions

3.3.2.1 Collection of seeds:

Fully matured seeds of guava fruits were collected from Fruit Research Station, Imalia. Seeds were washed and cleaned thoroughly to remove the pulpy material clinging to the seeds. Guava seeds take long time to germinate because of a hard coating over the endocarp. Therefore, seeds were soaked in water for 12 hours prior to sowing to facilitate germination and then dipped in captan / thiram (0.2%) for two minutes.

3.3.2.2 Raising of the Stocks:

Polythene bags of 27.5 × 20cm size of 300 gauge thicknesses were used for raising rootstock. The bags were filled with a pot mixture of soil, sand and farmyard manure (2:2:1 v/v), phorate powder was mixed with potting mixture prior to sowing of seeds, as preventive measure against termite attack. Selected healthy seeds were sown immediately. The polybags holding the seeds were maintained in the nursery with all necessary care.

3.3.2.3 Care of Rootstocks:

The seeds sown in the polythene bags were watered regularly. Germination of seeds was noticed three weeks after sowing. The polythene bags were kept under shade to protect the seedlings from direct solar radiation. General prophylactic plant protection measures were taken by spraying with pesticides and fungicides to control the pests and diseases. The side shoots arising from the main stem were removed regularly. Weeding was done as and when required.

3.3.2.4 Selection of rootstock:

Vigorously growing uniform seedlings of specified age and thickness were used in different treatments.

3.3.2.5 Selection of mother tree for scions:

Clonal trees were selected for scion material at Horticulture Complex Maharajpur, Department of Horticulture, JNKVV, Jabalpur. The scion selected was free from pest and diseases.

3.3.2.6 Preconditioning of Scion Sticks:

3 – 4 months old semi hard wood shoots were selected for preparing scions. For preconditioning of scion shoots, they were debladed 6 and 8 days prior to grafting operation by removing leaves by left a small piece of petiole on the scion stick for storing food material which facilitate the grafting success.

3.3.2.7 Preparation of Scion Shoots:

As per the experimental treatments, the scion shoots were collected from mother trees in the early morning hours (7 to 9 am) on the day of grafting. Immediately after separation of the scions from mother trees, they were wrapped in moist cloth and carried in polythene cover to the site of grafting. Grafting was performed on the day of separation of scion from mother tree. Pencil size thickness scion selected, scion stick having 8 healthy buds on it. The average length of scion stick was 18 cm.

3.3.2.8 Grafting technique:

The healthy, disease free rootstock seedlings raised in polythene covers were selected and the top growth was decapitated with a sharp knife. Care was taken while selecting the scion material to match the girth of the stock. The soft wood of stock split vertically in the form of cleft to a length of 4-5 cm downward with a sharp knife. The cleft looked like a fork or letter ‘V’. Scion was prepared by giving a cut into gently sloping wedge of about 5 cm to the morphological base of the scion, by removing the bark and little wood from opposite sides of scion. Care was taken to retain some bark on the remaining two sides of the scion. The wedge shaped scion thus prepared was inserted into the ‘V’ shaped slit of the stock.

3.3.2.9 Tying operation:

After insertion of wedge shaped scion into the cleft of stock plant, precaution were taken to see that the scion and the stock come in close contact with each other. The joint (union) was tied firmly with 1.5 cm wide and 40 cm long stretchable transparent polythene strip of 200 gauge. A little more portion above and below the joint was also wrapped with polythene strip. Then the scions were covered with a small polycap to avoid deccication of the scion by creating humidity near and above the graft union.

3.3.2.10 After care of grafts:

In order to achieve maximum success and growth of grafts, the following necessary measure were undertaken. Grafts were watered daily with required quantity of water. New sprouts (side shoots) arising from any portion

of rootstock were removed regularly. Necessary plant protection measures were employed to combat the disease and pest incidence as and when required.

3.4 Observation and its procedure:

Sampling was done at 30 days interval for observation. Five plants were randomly selected from each treatment and replication for the study.

Observation recorded:

(A) Growth parameters:

3.4.1 Bud sprouting (%):

Bud sprouting was recorded at 30, 45, 60 and 90 days after grafting and then percentage was calculated for bud sprouting percent.

3.4.2 Bud take success / Graft survival (%):

Numbers of grafts success were counted in each treatment and replication and then percentage was calculated for bud success percentage at 30, 45, 60 and 90 days after grafting.

3.4.3 Days taken for 50% sprout:

Number of days taken to the appearance of 50% sprout was recorded from the date of grafting.

3.4.4 Shoot length (cm):

The length of new shoot in randomly selected plants was recorded with the help of meter scale and average was worked out at 30, 45, 60 and 90 days after grafting.

3.4.5 Shoot diameter (mm):

The diameter of new shoots in randomly selected plants was recorded with the help of Digital vernior calipers and average was worked out at 30, 45, 60 and 90 days after grafting.

3.4.6 Number of leaves per graft:

Number of leaves per graft was recorded under each treatment at 30, 45, 60 and 90 days after grafting from randomly selected five grafts and the average was calculated.

(B) Physiological parameter :

Chlorophyll index:

It was measured with the help of handhold chlorophyll meter. It was observed at 90 days after grafting of randomly selected plants in each treatment. One top leaf of every plant was inserted in the equipment, which gives the chlorophyll percentage present in the leaf. Each leaf was clamped in the chlorophyll meter for a fraction of second than chlorophyll meter gave the value in SPAD on digital display of screen. The value of chlorophyll content (SPAD) shows relative distribution of chlorophyll in leaves.

PAR interception (µmol/m^2/sec):

PAR designated the spectral range (wave band) of solar radiation from 400 - 700 nanometers that photosynthetic organisms are able to use in the process of photosynthesis. It can be calculated as –

PAR = Total incident PAR – Transmitted PAR

Leaf area index:

LAI is the area (A) or the assimilatory surface area over a certain ground area (P) and is calculated by the formula (given by Watson, 1952) at 45, 60 and 90 days after grafting.

$$LAI = A / P$$

Where,

A = Leaf area

P = Ground area

Light transmission ratio (%):

It is the ratio of light intensities at base of the canopy crown to total incoming radiation and it can be calculated as –

$$LTR = I / I_0 \times 100$$

Where,

I = light at the base of the canopy

I_0= total incoming solar radiation

Energy interception (Ei) (Cal / cm^2/ min):

It is the difference between total energy interception and energy interception at the base of the canopy.

$$Ei_0 – Ei$$

Where,

Ei_0 = Energy interception at the top of canopy

Ei = Energy interception at the base of the canopy

Leaf Area Duration (cm^2/ day)

It is a measure of the ability of plant to produce and maintain leaf area. It is calculated by integrating the leaf area over crop growth period.

$$LAD = LA \times N$$

Where,

LA = leaf area

N = no. of days

3.5 Statistical methodology

The data obtained in respect of all the characters has been subjected to the following statistical analysis.

3.5.1 Mean: It was calculated by using following formula.

$$\text{Mean}=\frac{\sum x}{n}$$

Where,

Σx = The sum of all the observation

n = Number of observations

3.5.2 Analysis of variance:

The data based on the mean of individual plants selected for observation were statistically analyzed to find out overall total variability present in the material under study for each character and for all the populations. The first and foremost step is to carry out analysis of varience as

recommended by Pansey and Sukhatme (1967) and to test the significance of differences among the population. The skeleton of variance used was as follows:

Table 3.5.2 : ANOVA for Asymmetrical Factorial Completely Randomized Design

Source of Variation	D.F.	Sum of Square	Mean Sum of Square	F value	F_t 5% or 1% table value
Date of grafting	D-1	DSS	DMS	DMS/EMS	-
Condition of grafting	C-1	CSS	CMS	CMS/EMS	-
Interaction	(D-1)(C-1)	ISS	IMS	IMS/EMS	
Error	(r-1) DC	ESS	EMS	-	-
Total	**rt-1**	**TSS**	**-**	**-**	**-**

Where,

D = Number of date of grafting

C = Condition of grafting

D.F. = Degree of Freedom

DSS = Date of grafting Sum of square

CSS = Condition sum of square

ISS = Interaction sum of square

ESS = Sum of square due to error

TSS = Total sum of square

DMS = Date of grafting mean sum of square

PMS = Condition mean sum of square

IMS = Interaction mean sum of square

EMS = Error mean sum of square

A significant value of F test indicates that the test entries differ significantly among themselves, which requires computing.

$$C.V. = \frac{\sqrt{EMS}}{GM} X100$$

1. Standard error of mean for date of grafting

$$SEm\pm = \sqrt{\frac{EMS}{RXP}}$$

$$SE_{diff} = \sqrt{\frac{2EMS}{RXP}}$$

2. Standard error of mean for Condition of grafting

$$SEm\pm = \sqrt{\frac{EMS}{RXD}}$$

$$SE_{diff} = \sqrt{\frac{2EMS}{RXD}}$$

3. Standard error of mean for interaction

$$SEm\pm = \sqrt{\frac{EMS}{RXD}}$$

$$SE_{diff} = \sqrt{\frac{2EMS}{RXD}}$$

CD at 5% prob. Level = SE diff x $t_{5\%}$ table value

where,

C.V.%	=	Coefficient of variation percentage
SEm ±	=	Standard error of means
S E diff	=	Standard error of difference
GM	=	Grand mean
C.D.	=	Critical difference
$t_{5\%}$	=	t, table value 5% probability level at error d.f.

RESULTS

The present investigation entitled “Effect of different season and deblading on wedge grafting in guava (*Psidium guajava L.*) Cv. Lucknow - 49” was conducted at Fruit Research Station, Imalia, Department of Horticulture, JNKVV, Jabalpur, during the year 2014-2015. The result obtained during the course of investigation has been described in this chapter under appropriate headings. The observations recorded during study are summarized in the form of tables and illustrated through figures where ever found necessary; analysis of variance table for the characters studies has been appended for reference in appendices.

4.1 Growth parameters

4.1.1 Bud sprouting (%)

The bud sprouting was recorded at 30, 45 and 60 days after wedge grafting and have been presented in Table 4.1a, 4.1b and 4.1c.

At 30 days after wedge grafting, bud sprouting was significantly influenced due to various treatments of date of grafting and conditioning of grafting in guava. The significantly maximum (32.95%) bud sprouting % were recorded under the treatment D_5 (5^{th} date 05.03.15 of grafting) while the minimum bud sprouting % (10.79%) was exhibited in D_3 (3^{rd} date 10.11.14 of grafting).

Between condition of grafting, the significantly highest bud sprouting (23.46%) was found in C_2 (8^{th} day after deblading) and minimum bud sprouting (21.48%) was exhibited in C_1 (6^{th} day after deblading). The interaction effect of treatment combinations was not significant. However, The treatment combination D_5C_2 (5^{th} date 05.03.15 of grafting on 8^{th} day after deblading) recorded maximum (34.41%), followed by D_5C_1 (5^{th} date 05.03.15 of grating on 6^{th}day after debladding) (31.48%) while the minimum (9.76%) bud sprouting % was recorded in the treatment combination of D_3C_1 (3^{rd} date 10.11.14 of grafting on 6^{th} day after debladding).

Table 4.1a: Effect of date and conditioning of wedge grafting on bud sprouting (%) after 30 days

Treatments		Bud sprouting (%)		Mean
Date of grafting		**C_1**	**C_2**	
D_1- 1st date (10.10.14)		17.39	19.43	18.41
D_2- 2nd date (25.10.14)		16.95	18.13	17.54
D_3- 3rd date (10.11.14)		9.76	11.83	10.79
D_4- 4th date (20.02.15)		24.32	26.94	25.63
D_5- 5th date (05.03.15)		31.48	34.41	32.95
D_6- 6th date (20.03.15)		26.97	30.89	28.93
Mean		21.48	23.46	
	Date of grafting	**Condition**		**Interaction**
SEm±	1.21	0.69		1.71
CD at 5% levels	3.55	2.05		NS

In regard to 45 days after grafting, significant response of various treatments on date of grafting and condition of grafting in guava on bud sprouting was recorded. The treatment D_5 (5th date 05.03.15 of grafting) was significantly superior (39.19%) bud sprouting and at par with D_4 (4th date 20.02.15 of grafting) (35.67%). The lowest bud sprouting (15.14%) was noted in D_3 (3rd date 10.11.14 of grafting).

Table 4.1b: Effect of date and conditioning of wedge grafting on bud sprouting (%) after 45 days

Treatments		Bud sprouting (%)		Mean
Date of grafting		**C_1**	**C_2**	
D_1- 1st date (10.10.14)		25.10	27.25	26.17
D_2- 2nd date (25.10.14)		24.78	26.51	25.64
D_3- 3rd date (10.11.14)		14.21	16.07	15.14
D_4- 4th date (20.02.15)		34.72	36.61	35.67
D_5- 5th date (05.03.15)		38.28	40.10	39.19
D_6- 6th date (20.03.15)		31.89	35.55	33.72
Mean		28.16	30.35	
	Date of grafting	**Condition**		**Interaction**
SEm±	1.23	0.71		1.73
CD at 5% levels	3.61	2.08		NS

In case of condition of grafting the treatment C_2 (8^{th} day after deblading) recoded highest bud sprouting (30.35%) and lowest bud sprouting (28.16%) was recorded in C_1 (6^{th} day after deblading).

At 60 days after wedge grafting the treatment D_5 (5^{th} date 05.03.15 of grafting) and D_4 (4^{th} date 20.02.15 of grafting) were recorded significantly maximum bud sprouting (44.76% and 41.29%) respectively and were at par with each other. Whereas, lowest (19.59%) bud sprouting was noted in D_3 (3^{rd} date 10.11.14 of grafting).

Table 4.1c: Effect of date and conditioning of wedge grafting on bud sprouting (%) after 60 days

Treatments	**Bud sprouting (%)**		**Mean**
Date of grafting	**C_1**	**C_2**	
D_1- 1^{st} date (10.10.14)	25.10	27.15	26.17
D_2- 2^{nd} date (25.10.14)	24.78	26.60	25.69
D_3- 3^{rd} date (10.11.14)	18.96	20.23	19.59
D_4- 4^{th} date (20.02.15)	41.25	41.33	41.29
D_5- 5^{th} date (05.03.15)	41.07	48.44	44.76
D_6- 6^{th} date (20.03.15)	31.88	35.90	33.89
Mean	30.51	33.29	

	Date of grafting	**Condition**	**Interaction**
SEm±	1.24	0.72	1.76
CD at 5% levels	3.66	2.11	NS

Between the condition of grafting C_2 (8^{th} day after deblading) noted significantly maximum (33.29%) and minimum (30.51%) bud sprouting was observed in C_1 (6^{th}day after deblading). Treatment combinations were non significant for bud sprouting percentage.

4.1.2 Bud takes success percent

Result on success percentage of bud have been presented in Table 4.2a, 4.2b and 4.2c indicating that the bud success percentage in guava was responded significantly due to various treatments of date of grafting and condition of grafting.

At 30 days after wedge grafting D_4 (4^{th}date 20.02.15 of grafting) observed significantly superior as compared to other dates of grafting and recorded highest (55.73%) success percentage followed by D_5 (5^{th} date 05.03.15 date of grafting) (38.36%). While the lowest (26.30% and 28.40%) success was found in D_3 (3^{rd} date 10.11.14 of grafting) and D_2 (2^{nd} date 25.10.14 of grafting), respectively and which were at par with each other.

Table 4.2a: Effect of date and conditioning of wedge grafting on bud success (%) after 30 days

Treatments		**Bud success (%)**		**Mean**
Date of grafting		**C_1**	**C_2**	
D_1- 1^{st} date (10.10.14)		30.25	34.60	32.42
D_2- 2^{nd} date (25.10.14)		26.13	30.66	28.40
D_3- 3^{rd} date (10.11.14)		24.48	28.13	26.30
D_4- 4^{th} date (20.02.15)		51.55	59.92	55.73
D_5- 5^{th} date (05.03.15)		31.94	44.77	38.36
D_6- 6^{th} date (20.03.15)		30.55	38.18	34.36
Mean		32.48	39.38	
	Date of grafting	**Condition**		**Interaction**
SEm±	**1.11**	**0.64**		**1.57**
CD at 5% levels	**3.27**	**1.89**		**NS**

As regards with condition of grafting, the treatment C_2 (8^{th} day after deblading was significantly superior and recorded maximum success percentage (39.38%) and minimum was recorded (32.48%) in C_1 (6^{th} day after deblading). The interaction effect of treatment combinations was non significant.

At 45 days after wedge grafting the maximum success percentage of bud (63.55%) was exhibited in treatment D_4 (4^{th} date 20.02.15 of grafting) and was significantly superior as compared to other treatments. While, lowest (30.01% and 30.92%) bud success percent was recorded under the treatment D_3 (3^{rd} date 10.11.14 of grafting) and D_2 (2^{nd} date 25.10.14 of grafting) respectively and which were at par with each other.

Table 4.2b: Effect of date and conditioning of wedge grafting on bud success (%) after 45 days

Treatments	**Bud success (%)**		**Mean**
Date of grafting	**C_1**	**C_2**	
D_1- 1^{st} date (10.10.14)	33.54	36.96	35.25
D_2- 2^{nd} date (25.10.14)	28.44	33.41	30.92
D_3- 3^{rd} date (10.11.14)	28.39	31.64	30.01
D_4- 4^{th} date (20.02.15)	58.51	68.60	63.55
D_5- 5^{th} date (05.03.15)	43.71	54.30	49.00
D_6- 6^{th} date (20.03.15)	40.96	47.05	44.01
Mean	38.92	45.32	

	Date of grafting	**Condition**	**Interaction**
SEm±	**1.09**	**0.63**	**1.55**
CD at 5% levels	**3.22**	**1.86**	**NS**

Significantly maximum (45.32%) bud success was observed in C_2 (8^{th} date after deblading) and minimum (38.92%) in C_1 (6^{th} day after deblading). The interaction effect of treatment combination was non significant.

At 60 days after wedge grafting, significantly maximum bud success percent (69.08%) was observed in D_4 (4^{th} date 20.02.15 of grafting). Minimum bud success (31.33%) was recorded in D_3 (3^{rd} date 10.11.14 of grafting) which were at par with D_2 (2^{nd} date 25.10.14 of grafting) (33.39%).

In case of condition of grafting, the treatment C_2 (8^{th} day after deblading) was recorded maximum (48 35%) bud success than that treatment C_1 (6^{th} day after deblading) (43.23%). Treatment combinations were not significant due to interaction. Whereas, the maximum (73.23%) bud success was recorded in treatment combination D_4C_2 (4^{th} date 20.02.15 of grafting on 8^{th} day after deblading) and in treatment combination D_3C_1 (3^{rd} date 10.11.14 of grafting on 6^{th} day after deblading), bud success was minimum (30.69%).

Table 4.2c: Effect of date and conditioning of wedge grafting on bud success (%) after 60 days

Treatments		**Bud success (%)**		**Mean**
Date of grafting		**C_1**	**C_2**	
D_1- 1^{st} date (10.10.14)		34.10	39.33	36.71
D_2- 2^{nd} date (25.10.14)		32.76	34.02	33.39
D_3- 3^{rd} date (10.11.14)		30.69	31.98	31.33
D_4- 4^{th} date (20.02.15)		64.92	73.23	69.08
D_5- 5^{th} date (05.03.15)		55.94	62.44	59.19
D_6- 6^{th} date (20.03.15)		41.01	49.11	45.06
Mean		43.23	48.35	
	Date of grafting	**Condition**		**Interaction**
SEm±	**1.10**	**0.63**		**1.55**
CD at 5% levels	**3.23**	**1.86**		**NS**

4.1.3 Days taken to 50% sprouting

The data indicated that days taken to 50% sprouting were significantly affected by different treatment of date and conditioning of wedge grafting. It is depicted in Table 4.3

Earliest 50% sprouting (23.60 days) was observed in D_4 (4^{th} date 20.02.15 of grafting) followed by D_5 (5^{th} date 05.03.15 of grafting) (24.37%) and D_6(6^{th}date 20.03.15 of grafting) (24.84%) which were at par with each other. While it was taken maximum time (35.24 days) in D_3 (3^{rd} date 10.11.14 of grafting) for 50% sprouting.

Table 4.3: Effect of date and conditioning of wedge grafting on days taken to 50% sprouting

Treatments	Number of days		Mean
Date of grafting	**C_1**	**C_2**	
D_1- 1st date (10.10.14)	27.69	26.86	27.28
D_2- 2nd date (25.10.14)	29.29	28.49	28.89
D_3- 3rd date (10.11.14)	35.90	34.58	35.24
D_4- 4th date (20.02.15)	24.01	23.20	23.60
D_5- 5th date (05.03.15)	24.67	24.07	24.37
D_6- 6th date (20.03.15)	25.04	24.64	24.84
Mean	27.76	26.97	

	Date of grafting	**Condition**	**Interaction**
SEm±	0.17	0.10	0.24
CD at 5% levels	0.508	0.29	NS

It was also recorded that treatment C_2 (8thday after deblading) exhibites early (26.97 days) 50% sprouting, while the maximum time was taken by C_1 (6th day after deblading) (27.76%). Interaction of both the factors for days taken to 50% sprouting was non significant. Treatment combination D_4C_2 (4th date 20.02.15 of grafting on 8th day after deblading) takes minimum days (23.20 days) while maximum days (35.90days) was taken by treatment combination D_3C_1 (3rd date 10.11.14 of grafting on 6th day after deblading).

4.1.4 Shoot length (cm)

The data on average length of shoot per plant recorded at 30, 45, 60 and 90 days after wedge grafting are presented in Table 4.4a, 4.4b, 4.4c and 4.4d. It is evident from data that there was a sharp increase in length of newly emerged shoot of grafted plants.

Table 4.4a: Effect of date and conditioning of wedge grafting on Shoot length (cm) after 30 days

Treatments		Shoot length (cm)		Mean
Date of grafting		C_1	C_2	
D_1- 1st date (10.10.14)		1.70	1.84	1.78
D_2- 2nd date (25.10.14)		1.62	1.78	1.71
D_3- 3rd date (10.11.14)		1.24	1.49	1.36
D_4- 4th date (20.02.15)		2.95	3.26	3.11
D_5- 5th date (05.03.15)		1.78	1.89	1.83
D_6- 6th date (20.03.15)		1.73	1.83	1.78
Mean		1.83	2.02	
	Date of grafting	**Condition**		**Interaction**
SEm±	0.10	0.06		0.15
CD at 5% levels	0.31	0.18		NS

At 30 days after wedge grafting, length of shoot was affected significantly due to date of grafting, condition of grafting and interaction of both the factors exhibit non significant. It is evident from Table 4.4a that grafting on D_4 (4th date 20.02.15 of grafting) was significantly superior over other dates of grafting and recorded maximum (3.11 cm) shoot length. While the lowest (1.36 cm) shoot length observed in D_3 (3rd date 10.11.14 of grafting) which was significantly lower than other treatments.

In case of condition of grafting, the treatment C_2 (8thday after deblading) recorded significantly maximum shoot length (2.02 cm) and minimum was recorded (1.83cm) in C_1 (6th day after deblading). The interaction effect of treatment combination did not exhibit any significant effect on shoot length.

The treatment combination D_4C_2 (4th date 20.02.15 of grafting on 8th day after deblading) recorded maximum (3.26 cm), followed by D_4C_1(4th date 20.02.15 of grating on 6thday after deblading) (2.95cm) while the minimum (1.24 cm) shoot length was recorded in the treatment combination of D_3C_1 (3rd date 10.11.14 of grafting on 6th day after deblading).

At 45 days after wedge grafting, the maximum length of shoot (4.25 cm) was recorded in D_4 (4^{th} date 20.02.15 of grafting) which was significantly superior to others. While it was observed lowest (2.76 cm) in D_3 (3^{rd} date 10.11.14 of grafting). In case of condition of grafting, it was significantly maximum (3.71cm) in C_2 (8^{th} day after deblading) and minimum (3.48cm) in treatment C_1 (6^{th} day after deblading).

The treatment combination D_4C_2 (4^{th} date 20.02.15 of grafting on 8^{th} day after deblading) recorded maximum (4.48cm), while the minimum (2.56cm) shoot length was recorded in the treatment combination of D_3C_1 (3^{rd} date 10.11.14 of grafting on 6^{th} day after deblading).

Table 4.4b: Effect of date and conditioning of wedge grafting on shoot length (cm) after 45 days

Treatments	**Shoot length (cm)**		**Mean**
Date of grafting	C_1	**C_2**	
D_1- 1^{st} date (10.10.14)	3.34	3.55	3.44
D_2- 2^{nd} date (25.10.14)	3.36	3.48	3.42
D_3- 3^{rd} date (10.11.14)	2.56	2.96	2.76
D_4- 4^{th} date (20.02.15)	4.02	4.48	4.25
D_5- 5^{th} date (05.03.15)	3.86	3.97	3.91
D_6- 6^{th} date (20.03.15)	3.78	3.84	3.81
Mean	3.48	3.71	

	Date of grafting	**Condition**	**Interaction**
SEm±	0.11	0.06	0.15
CD at 5% levels	0.32	0.19	NS

At 60 days after wedge grafting D_4 (4^{th} date 20.02.15 of grafting) was significantly superior over other date of grafting and was recorded maximum (8.32 cm) followed by D_5 (5^{th} date 05.03.15 of grafting) (6.50 cm). While it was lowest (5.29 cm) in D_3 (3^{rd} date 10.11.14 of grafting) which was at par with D_2 (2^{nd} date 25.10.14 of grafting) (5.39 cm) and D_1 (1^{st} date 10.10.14 of grafting) (5.53 cm).

Table 4.4c: Effect of date and conditioning of wedge grafting on Shoot length (cm) after 60 days

Treatments	Shoot length (cm)		Mean
Date of grafting	**C_1**	**C_2**	
D_1- 1st date (10.10.14)	5.43	5.64	5.53
D_2- 2nd date (25.10.14)	5.29	5.49	5.39
D_3- 3rd date (10.11.14)	5.19	5.39	5.29
D_4- 4th date (20.02.15)	8.20	8.45	8.32
D_5- 5th date (05.03.15)	6.39	6.61	6.50
D_6- 6th date (20.03.15)	5.93	6.13	6.03
Mean	6.07	6.28	

	Date of grafting	**Condition**	**Interaction**
SEm±	0.11	0.06	0.15
CD at 5% levels	0.32	0.18	NS

Between conditions of grafting, the treatment C_2 (8th day after deblading) recorded maximum (6.28 cm) shoot length while minimum (6.07 cm) recorded in treatment C_1 (6th day after deblading). Interaction between the factors was non significant while maximum (8.45 cm) shoot length recorded in treatment combination D_4C_2 (4th date 20.02.15 of grafting on 8th day after deblading) and the treatment combination D_3C_1 (3rd date 10.11.14 of grafting on 6th day after deblading) had the minimum (5.19 cm) shoot length.

At 90 days after wedge grafting, the maximum (14.00 cm) shoot length was observed in D_4 (4th date 20.02.15 of grafting) which was significantly superior than other dates followed by D_5 (5th date 05.03.15 of grafting) (11.83 cm). Whereas, it was minimum (9.61cm) in D_3 (3rd date 10.11.14 of grafting).

Table 4.4d: Effect of date and conditioning of wedge grafting on Shoot length (cm) after 90 days

Treatments		Shoot length (cm)		Mean
Date of grafting		C_1	C_2	
D_1- 1st date (10.10.14)		9.96	10.21	10.09
D_2- 2nd date (25.10.14)		9.91	10.15	10.03
D_3- 3rd date (10.11.14)		9.52	9.70	9.61
D_4- 4th date (20.02.15)		13.83	14.17	14.00
D_5- 5th date (05.03.15)		11.69	11.98	11.83
D_6- 6th date (20.03.15)		9.90	10.10	10.00
Mean		10.80	11.05	
	Date of grafting	**Condition**		**Interaction**
SEm±	0.11	0.06		0.15
CD at 5% levels	0.32	0.18		NS

Between conditions of grafting, the treatment C_2 (8th day after deblading) was recorded maximum (11.05 cm) and minimum (10.80 cm) shoot length was obtained in C_1 (6th day after deblading). Interaction between both the factors were non significant for shoot length. While the maximum (14.17 cm) shoot length was recorded in treatment combination D_4C_2 (4th date 20.02.15 of grafting on 8thday after deblading) and minimum (9.52cm) in D_3C_1 (3rd date 10.11.14 of grafting on 6th day after deblading).

4.1.5 Shoot diameter (mm)

It is evident from the data presented in Table 4.5a, 4.5b 4.5c and 4.5d that there was a sharp increase in shoot diameter of newly emerged shoot of grafted guava.

At 30 days after wedge grafting, treatment D_4 (4th date 20.02.15 of grafting) has significantly maximum shoot diameter (1.99 mm), followed by D_5 (5th date 05.03.15 of grafting) (1.53 mm) and D_6 (6th date 20.03.15 of grafting)

(1.49mm) which were at par with each other. Minimum shoot diameter (1.29 mm) was observed in D_3 (3rd date 10.11.14 of grafting) which was at par with D_2 (2nd date 25.10.14) (1.31 mm) and D_1 (1st date 10.10.14 of grafting) (1.33 mm).

Table 4.5a: Effect of date and conditioning of wedge grafting on Shoot diameter (mm) after 30 days

Treatments	**Shoot diameter (mm)**		**Mean**
Date of grafting	**C_1**	**C_2**	
D_1- 1st date (10.10.14)	1.26	1.39	1.33
D_2- 2nd date (25.10.14)	1.25	1.37	1.31
D_3- 3rd date (10.11.14)	1.22	1.36	1.29
D_4- 4th date (20.02.15)	1.92	2.06	1.99
D_5- 5th date (05.03.15)	1.42	1.65	1.53
D_6- 6th date (20.03.15)	1.42	1.55	1.49
Mean	1.41	1.56	

	Date of grafting	**Condition**	**Interaction**
SEm±	0.07	0.04	0.10
CD at 5% levels	0.22	0.12	NS

In case of condition of grafting, significantly maximum (1.56 mm) shoot diameter was exhibited in C_2 (8th day after deblading), while it was minimum (1.41 mm) in C_1 (6th day after deblading). The interaction between date and condition of grafting on shoot diameter was found to be non significant. The treatment combination D_4C_2 (4th date 20.02.15 of grafting on 8th day after deblading) was recorded maximum (2.06 mm) shoot diameter followed by D_4C_1 (4th date 20.02.15 of grafting on 6th day after deblading) (1.92 mm), while minimum (1.22 mm) shoot diameter was recorded in the treatment combination D_3C_1 (3rd date 10.11.15 of grafting on 6th day after deblading).

Table 4.5b: Effect of date and conditioning of wedge grafting on Shoot diameter (mm) after 45 days

Treatments		Shoot diameter (mm)		Mean
Date of grafting		C_1	C_2	
D_1- 1st date (10.10.14)		1.54	1.83	1.69
D_2- 2nd date (25.10.14)		1.42	1.72	1.57
D_3- 3rd date (10.11.14)		1.43	1.50	1.46
D_4- 4th date (20.02.15)		1.97	2.10	2.04
D_5- 5th date (05.03.15)		1.62	1.73	1.67
D_6- 6th date (20.03.15)		1.65	1.80	1.72
Mean		1.60	1.78	
	Date of grafting	**Condition**		**Interaction**
SEm±	0.07	0.04		0.10
CD at 5% levels	0.22	0.12		NS

At 45 days after wedge grafting, significantly maximum shoot diameter (2.04 mm) was recorded in D_4 (4th date 20.02.15 of grafting). While it was minimum (1.46 mm) in D_3 (3rd date 10.11.14 of grafting) which was at par with D_2 (3rd date 25.10.14 of grafting) (1.57 mm) and D_1 (1st date 10.10.14 of grafting) (1.69 mm).

In case of condition of grafting, the significantly maximum (1.78 mm) shoot diameter was observed in C_2 (8th day after deblading) with minimum (1.60 mm) in treatment C_1 (6th day after deblading). Therefore, non significant differences were obtained due to interaction. The treatment combination D_4C_2 (4th date 20.02.15 of grafting on 8th day after deblading) was recorded maximum (2.10 mm) diameter of shoot, while minimum (1.42 mm) in D_2C_1 (2nd date 25.10.14 of grafting on 6th day after deblading).

Table 4.5C: Effect of date and conditioning of wedge grafting on Shoot diameter (mm) after 60 days

Treatments		Shoot diameter (mm)		Mean
Date of grafting		C_1	C_2	
D_1- 1st date (10.10.14)		1.77	1.92	1.84
D_2- 2nd date (25.10.14)		1.75	1.84	1.79
D_3- 3rd date (10.11.14)		1.64	1.74	1.69
D_4- 4th date (20.02.15)		2.03	2.26	2.15
D_5- 5th date (05.03.15)		1.94	2.06	2.00
D_6- 6th date (20.03.15)		1.81	2.01	1.91
Mean		1.82	1.97	
	Date of grafting	**Condition**		**Interaction**
SEm±	0.07	0.04		0.10
CD at 5% levels	0.22	0.12		NS

At 60 days after wedge grafting, significantly maximum shoot diameter (2.15 and 2.00 mm) were recorded in D_4 (4th date 20.02.15 of grafting) and D_5 (5th date 05.03.15 of grafting) respectively and which were at par with each other. While it was noted minimum (1.69, 1.79 and 1.84 mm) shoot diameter in D_3 (3rd date 10.11.14 of grafting), D_2 (2nd date 25.10.14 of grafting) and D_1 (1st date 10.10.14 of grafting) respectively and which were also at par with each other.

Condition of grafting C_2 (8th day after deblading) was recorded maximum (1.97 mm) shoot diameter. While it was observed minimum (1.82 mm) in treatment C_1 (6th day after deblading). The interaction effect of treatment combination did not exhibit any significant effect on shoot diameter.

At 90 days after wedge grafting, maximum (2.40 mm) shoot diameter was recorded in D_4 (4th date 20.02.15 of grafting) which was at par with D_5 (5th date 05.03.15 of grafting) (2.33 mm), D_1 (1st date 10.10.14 of grafting) (2.32 mm), D_6 (6th date 20.03.15 of grafting) (2.26 mm) and D_2 (2nd date 25.10.14 of grafting) (2.22 mm). While the shoot diameter of D_3 (3rd date 10.11.14 of grafting) was significantly lowest (1.82 mm).

Table 4.5d: Effect of date and conditioning of wedge grafting on Shoot diameter (mm) after 90 days

Treatments	Shoot diameter (mm)		Mean
Date of grafting	**C_1**	**C_2**	
D_1- 1st date (10.10.14)	2.24	2.40	2.32
D_2- 2nd date (25.10.14)	2.14	2.29	2.22
D_3- 3rd date (10.11.14)	1.74	1.91	1.82
D_4- 4th date (20.02.15)	2.35	2.46	2.40
D_5- 5th date (05.03.15)	2.26	2.41	2.33
D_6- 6th date (20.03.15)	2.24	2.28	2.26
Mean	2.16	2.29	

	Date of grafting	**Condition**	**Interaction**
SEm±	0.07	0.04	0.10
CD at 5% levels	0.22	0.12	NS

Condition of grafting exhibited significantly maximum (2.29 mm) shoot diameter in C_2 (8th day after deblading) and minimum (2.16 mm) in treatment C_1 (6th day after deblading). The interaction effect of treatment combination did not exhibit any significant effect on shoot diameter.

4.1.6 Number of leaves per graft

The mean number of leaves per graft recorded at 30, 45, 60 and 90 days after wedge grafting are given in Table 4.6a, 4.6b, 4.6c and 4.6d. Its ANOVA is given in Appendix-1.

The number of leaves per graft increased with the increase in stages of growth in different treatment combinations. At 30 days after wedge grafting, significantly highest (5.04) number of leaves per graft was noted in treatment D_4 (4th date 20.02.15 of grafting), followed by D_5 (5th date 05.03.15 of grafting) (4.30). While it was recorded minimum (2.14) in treatment D_3 (3rd date 10.11.14 of grafting).

Table 4.6a: Effect of date and conditioning of wedge grafting on number of leaves after 30 days

Treatments	Number of leaves		Mean
Date of grafting	**C_1**	**C_2**	
D_1- 1st date (10.10.14)	3.44	3.76	3.60
D_2- 2nd date (25.10.14)	3.06	3.21	3.14
D_3- 3rd date (10.11.14)	1.90	2.38	2.14
D_4- 4th date (20.02.15)	4.93	5.16	5.04
D_5- 5th date (05.03.15)	4.01	4.59	4.30
D_6- 6th date (20.03.15)	3.66	3.97	3.82
Mean	3.50	3.84	

	Date of grafting	**Condition**	**Interaction**
SEm±	0.17	0.10	0.25
CD at 5% levels	0.52	0.30	NS

In case of condition of grafting, significantly maximum number of leaves (3.84) per graft was observed in treatment C_2 (8th day after deblading). While it was recorded minimum (3.50) in C_1 (6th day after deblading). The interaction effect of treatment combination did not exhibit any significant effect on number of leaves per graft. Maximum (5.16) number of leaves observed in treatment combination D_4C_2 (4th date 20.02.15 of grafting on 8th day after deblading). While minimum (1.90) was observed in D_3C_1 (3rd date 10.11.14 of grafting on 6th day after deblading) treatment combination.

At 45 days after wedge grafting, on D_4 (4th date 20.02.15 of grafting) and D_5 (5th date 05.03.15 of grafting recorded significantly maximum leaves per graft (8.33 and 7.78) respectively and were at par with each other. While it was recorded minimum (4.29) in D_3 (3rd date 10.11.14 of grafting). In case of condition of grafting, it was recorded significantly maximum (6.67) in treatment C_2 (8th day after deblading) and minimum (6.33) in C_1 (6th day after deblading). The interaction between date and condition is not exhibit for number of leaves per graft

Table 4.6b: Effect of date and conditioning of wedge grafting on leaves per graft after 45 days

Treatments		Number of leaves		Mean
Date of grafting		**C_1**	**C_2**	
D_1- 1st date (10.10.14)		5.30	5.69	5.50
D_2- 2nd date (25.10.14)		5.20	5.61	5.40
D_3- 3rd date (10.11.14)		4.18	4.40	4.29
D_4- 4th date (20.02.15)		8.17	8.49	8.33
D_5- 5th date (05.03.15)		7.62	7.95	7.78
D_6- 6th date (20.03.15)		7.50	7.91	7.70
Mean		6.33	6.67	
	Date of grafting	**Condition**		**Interaction**
SEm±	0.19	0.11		0.27
CD at 5% levels	0.57	0.33		NS

At 60 days after grafting, the significantly maximum (11.84 and 11.30) leaves per graft observed in D_4 (4th date 20.02.15 of grafting) and D_5 (5th date 05.03.15 of grafting) respectively and were at par with each other followed by D_6 (6th date 20.03.15 of grafting) (9.60). While it was recorded lowest (6.06) in D_3 (3rd date 10.11.14 of grafting).

Condition of grafting was recorded significantly maximum (9.16) leaves per graft in condition C_2 (8th day after deblading) with minimum (8.78) in treatment C_1 (6th day after deblading). Therefore non significant differences were obtained due to interaction. The treatment combination D_4C_2 (4th date 20.02.15 of grafting on 8th day after deblading) was recorded maximum (11.97) leaves per graft followed by D_4C_1 (4th date 20.02.15 of grafting on 6th day after deblading) (11.72), while the minimum (5.98) leaves per graft was recorded in the treatment combination of D_3C_1 (3rd date 10.11.14 of grafting on 6th day after deblading).

Table 4.6c: Effect of date and conditioning of wedge grafting on leaves per graft after 60 days

Treatments	Number of leaves		Mean
Date of grafting	**C_1**	**C_2**	
D_1- 1st date (10.10.14)	7.20	7.70	7.48
D_2- 2nd date (25.10.14)	7.42	7.70	7.56
D_3- 3rd date (10.11.14)	5.98	6.14	6.06
D_4- 4th date (20.02.15)	11.72	11.97	11.84
D_5- 5th date (05.03.15)	10.92	11.69	11.30
D_6- 6th date (20.03.15)	9.44	9.77	9.60
Mean	8.78	9.16	

	Date of grafting	**Condition**	**Interaction**
SEm±	0.20	0.11	0.28
CD at 5% levels	0.59	0.34	NS

At 90 days after grafting, the significant highest leaves per graft (18.40) was recorded in D_4 (4th date 20.02.15 of grafting) followed by D_5 (5th date 05.03.15 of grafting) (17.33), while it was recorded lowest (11.69) in D_3 (3rd date 10.11.14 of grafting).

In case of condition of grafting, C_2 (8th day after deblading) was recorded significantly maximum (15.40) leaves per graft, while minimum (15.06) leaves per graft was observed in treatment condition C_1 (6th day after deblading). There were non significant differences due to interaction. The treatment combination D_4C_2 (4th date 20.02.15 of grafting on 8th day after deblading) recorded maximum (18.56) leaves per graft followed by D_4C_1 (4th date 20.02.15 of grafting on 6th day after deblading) (18.24), while the minimum (11.57) leaves per graft was recorded in the treatment combination D_3C_1 (3rd date 10.11.14 of grafting on 6th day after deblading).

Table 4.6d: Effect of date and conditioning of wedge grafting on leaves per graft after 90 days

Treatments	Number of leaves		Mean
Date of grafting	**C_1**	**C_2**	
D_1- 1st date (10.10.14)	13.90	14.16	14.03
D_2- 2nd date (25.10.14)	13.46	13.95	13.70
D_3- 3rd date (10.11.14)	11.57	11.81	11.69
D_4- 4th date (20.02.15)	18.24	18.56	18.40
D_5- 5th date (05.03.15)	17.18	17.49	17.33
D_6- 6th date (20.03.15)	16.02	16.43	16.22
Mean	15.06	15.40	

	Date of grafting	**Condition**	**Interaction**
SEm±	0.18	0.10	0.26
CD at 5% levels	0.54	0.31	NS

Physiological parameters

4.2.1 Chlorophyll index

Chlorophyll content in leaf was estimated in relation to various treatments of date of grafting and condition of grafting have been summarized in Table 4.7

It is obvious from the Table 4.7 that the average chlorophyll index was significantly influenced by date of grafting. Grafting on D_4 (4th date 20.02.15 of grafting) recorded significantly higher chlorophyll index (18.08) followed by grafting D_5 (5th date 05.03.15 of grafting) (16.60) and were at par with each other. While the lowest chlorophyll index (11.39) was recorded in D_3 (3rd date 10.11.14 of grafting).

The data presented in Table 4.7 clearly indicated that the significantly higher chlorophyll index (16.03) was recorded in C_2 (8th day after deblading), however the lowest (14.24) chlorophyll index was observed in C_1 (6th day after deblading) condition.

Table 4.7: Effect of date and conditioning of wedge grafting on chlorophyll index

Treatments		Chlorophyll index		Mean
Date of grafting		C_1	C_2	
D_1- 1st date (10.10.14)		14.88	16.01	15.44
D_2- 2nd date (25.10.14)		14.64	15.21	14.92
D_3- 3rd date (10.11.14)		10.48	12.30	11.39
D_4- 4th date (20.02.15)		16.37	19.80	18.08
D_5- 5th date (05.03.15)		16.13	17.07	16.60
D_6- 6th date (20.03.15)		12.95	15.81	14.38
Mean		14.24	16.03	
	Date of grafting	**Condition**		**Interaction**
SEm±	0.68	0.39		0.96
CD at 5% levels	2.00	1.15		NS

The interaction effect of treatment combination did not exhibit any significant effect on chlorophyll index. While it was varies from maximum 19.80 to minimum 10.48 in treatment combinations D_4C_2 (4th date 20.02.15 of grafting on 8th day after deblading) and D_3C_1 (3rd date 10.11.14 of grafting on 6th day after deblading) respectively as compared to other treatments.

4.2.2 Leaf Area Index

The leaf area index was recorded and has been presented in Table 4.8a, 4.8b and 4.8c.

At 45 days after wedge grafting, D_4 (4th date 20.02.15 of grafting) was recorded significantly maximum (2.71) leaf area index followed by D_5 (5th date 05.03.15 of grafting) (2.47). While minimum (1.02) was recorded in treatment D_3 (3rd date 10.11.14 of grafting). The maximum (2.06) leaf area index was recorded in grafting done with C_2 (8th day after deblading) condition and minimum (1.81) in C_1 (6th day after deblading) condition.

The treatment combination of date of grafting and condition of grafting recorded significantly maximum (2.79) leaf area index in treatment combination D_4C_2 (4^{th} date 20.02.15 of grafting on 8^{th} day after deblading), while it was recorded minimum (0.99) in treatment combination D_3C_1 (3^{rd} date 10.11.14 of grafting on 6^{th} day after deblading).

Table 4.8a: Effect of date and conditioning of wedge grafting on Leaf area index after 45 days

Treatments	**Leaf area index**		**Mean**
Date of grafting	**C_1**	**C_2**	
D_1- 1^{st} date (10.10.14)	2.10	2.49	2.29
D_2- 2^{nd} date (25.10.14)	1.60	1.90	1.75
D_3- 3^{rd} date (10.11.14)	0.99	1.06	1.02
D_4- 4^{th} date (20.02.15)	2.64	2.79	2.71
D_5- 5^{th} date (05.03.15)	2.24	2.71	2.47
D_6- 6^{th} date (20.03.15)	1.31	1.42	1.36
Mean	1.81	2.06	

	Date of grafting	**Condition**	**Interaction**
SEm±	0.01	0.01	0.02
CD at 5% levels	0.05	0.03	0.07

At 60 days after grafting, the significantly maximum (3.64) leaf area index was recorded in D_4 (4^{th} date 20.02.15 of grafting), followed by treatment D_5 (5^{th} date 05.03.15 date of grafting) (3.47). While it was recorded minimum (2.11) in treatment D_3 (3^{rd} date 10.11.15 of grafting). In case of condition, significantly maximum (2.95) leaf area index was observed in condition C_2 (8^{th} day after deblading), while minimum (2.79) leaf area index recorded in condition C_1 (6^{th} day after deblading).

In different treatment combinations, maximum (3.73) leaf area index was recorded in D_4C_2 (4^{th} date 20.02.15 of grafting on 8^{th} day after deblading) followed by treatment combination D_5C_2 (5^{th} date 05.03.15 of grafting on 8^{th}

day after deblading) (3.62) and D_4C_1 (4th date 20.02.15 of grafting on 6th day after deblading) (3.56) which were at par with each other. While minimum (2.07) leaf area index was recorded in treatment combination D_3C_1 (3rd date 10.11.14 of grafting on 6th day after deblading) which were at par with D_3C_2 (3rd date 10.11.14 of grafting on 8th day after deblading) (2.14).

Table 4.8b: Effect of date and conditioning of wedge grafting on Leaf area index after 60 days

Treatments		**Leaf area index**		**Mean**
Date of grafting		**C_1**	**C_2**	
D_1- 1st date (10.10.14)		2.81	2.98	2.90
D_2- 2nd date (25.10.14)		2.55	2.73	2.64
D_3- 3rd date (10.11.14)		2.07	2.14	2.11
D_4- 4th date (20.02.15)		3.56	3.73	3.64
D_5- 5th date (05.03.15)		3.33	3.62	3.47
D_6- 6th date (20.03.15)		2.41	2.52	2.46
Mean		2.79	2.95	
	Date of grafting	**Condition**		**Interaction**
SEm±	0.02	0.01		0.02
CD at 5% levels	0.05	0.03		0.08

At 90 days after grafting, significantly highest leaf area index (5.35) found in D_4 (4th date 20.02.15 of grafting), followed by D_5 (5th date 05.03.15 of grafting) (5.04). Whereas the lowest leaf area index (3.69) was observed in treatment D_3 (3rd date 10.11.14 of grafting). In case of condition, the maximum leaf area index (4.71) was noted in condition C_2 (8th day after deblading), while minimum (4.63) in condition C_1 (6th day after deblading).

Interaction between both the factors was observed significant. The treatment combination D_4C_2 (4th date 20.02.15 of grafting on 8th day after deblading) was recorded significantly maximum (5.40) leaf area index. While it was recorded minimum (3.61) in D_3C_1 (3rd date 10.11.14 of grafting on 6th day after deblading) treatment combination.

Table 4.8c: Effect of date and conditioning of wedge grafting on leaf area index after 90 days

Treatments		Leaf area index		Mean
Date of grafting		C_1	C_2	
D_1- 1st date (10.10.14)		4.83	4.95	4.89
D_2- 2nd date (25.10.14)		4.76	4.84	4.80
D_3- 3rd date (10.11.14)		3.61	3.78	3.69
D_4- 4th date (20.02.15)		5.31	5.40	5.35
D_5- 5th date (05.03.15)		5.01	5.07	5.04
D_6- 6th date (20.03.15)		4.28	4.20	4.24
Mean		4.63	4.71	
	Date of grafting	**Condition**		**Interaction**
SEm±	0.01	0.00		0.02
CD at 5% levels	0.04	0.02		0.06

4.2.3 Light transmission ratio (%)

The data on various treatments with respect to the light transmission ratio are summarized in Table 4.9 and the analysis of variance are presented in Appendix-1 indicated that the treatments give the significant impact on the characters.

The data presented in Table 4.9 clearly indicated that the significantly lowest (36.71%) light transmission ratio was recorded in treatment D_4 (4th date 20.02.15 of grafting) followed by treatment D_1 (1st date 10.10.14 of grafting) (39.00%). While the highest (50.33%) light transmission ratio was observed in D_3 (3rd date 10.11.14 of grafting).

In case of condition of grafting, the minimum (41.57%) light transmission ratio was recorded in C_2 (8th day after deblading) condition and maximum (43.30%) was observed in condition C_1 (6th day after deblading). In treatment combinations of date and condition of grafting, significantly minimum (36.01% and 37.42%) light transmission ratio was recorded under

the treatment combinations D_4C_2 (4^{th} date 20.02.15 of grafting on 8^{th} day after deblading) and D_4C_1 (4^{th} date 20.02.15 of grafting on 6^{th} day after deblading) respectively, which were at par with each other. However it was observed maximum (53.22%) in D_3C_1 (3^{rd} date 10.11.14 of grafting on 6^{th} day after deblading) treatment combination.

Table 4.9: Effect of date and conditioning of wedge grafting on Light transmission ratio (%)

Treatments		**Light transmission ratio**		**Mean**
Date of grafting		**C_1**	**C_2**	
D_1- 1^{st} date (10.10.14)		39.36	38.65	39.00
D_2- 2^{nd} date (25.10.14)		43.70	43.10	43.41
D_3- 3^{rd} date (10.11.14)		53.22	47.43	50.33
D_4- 4^{th} date (20.02.15)		37.42	36.01	36.71
D_5- 5^{th} date (05.03.15)		40.56	41.88	41.22
D_6- 6^{th} date (20.03.15)		45.50	42.36	43.93
Mean		43.30	41.57	
	Date of grafting	**Condition**		**Interaction**
SEm±	0.58	0.33		0.82
CD at 5% levels	1.71	0.99		2.42

4.2.4 PAR interception (μ mol/m^2/sec)

The data for various treatments with respect to PAR interception are summarized in Table 4.10.

PAR interception was recorded significantly maximum (105.79) in treatment D_4 (4^{th} date 20.02.15 of grafting), followed by D_5 (5^{th} date 05.03.15 of grafting) (104.07) and were at par with each other. While it was minimum (64.82) in D_3 (3^{rd} date 10.11.14 of grafting). The maximum (96.01) PAR interception was observed in grafts with condition C_2 (8^{th} day after deblading), while minimum (90.74) in condition C_1 (6^{th} day after deblading).

Table 4.10: Effect of date and conditioning of wedge grafting on PAR interception (μ mol/m^2/sec)

Treatments		PAR interception		Mean
Date of grafting		C_1	C_2	
D_1- 1st date (10.10.14)		99.03	102.95	100.99
D_2- 2nd date (25.10.14)		98.29	101.49	99.89
D_3- 3rd date (10.11.14)		61.86	67.79	64.82
D_4- 4th date (20.02.15)		102.53	109.05	105.79
D_5- 5th date (05.03.15)		101.35	106.80	104.07
D_6- 6th date (20.03.15)		81.39	87.99	84.69
Mean		90.74	96.01	
	Date of grafting	**Condition**		**Interaction**
SEm±	0.92	0.53		1.30
CD at 5% levels	2.70	1.56		NS

The interaction effect of treatment combination did not exhibit any significant effect on PAR interception. However, the treatment combination D_4C_2 (4th date 20.02.15 of grafting on 8th day after deblading) showed maximum (109.05) PAR interception and minimum (61.86) was recorded in D_3C_1 (3rd date 10.11.14 of grafting on 6th day after deblading).

4.2.5 Energy interception (cal $cm^{-2}min^{-1}$)

Energy interception was estimated in relation to various treatments of date and condition of grafting have been summarized in Table 4.11.

In case of conditions of grafting data shows significant difference for energy interception. Significantly maximum (0.282) energy interception was observed in condition C_2 (8th day after deblading), while minimum (0.258) recorded in condition C_1 (6th day after deblading). The interaction between date and condition of grafting on energy interception was found to be non significant.

Table 4.11: Effect of date and conditioning of wedge grafting on Energy interception (cal $cm^{-2}min^{-1}$)

Treatments		Energy interception		Mean
Date of grafting		C_1	C_2	
D_1- 1st date (10.10.14)		0.250	0.271	0.260
D_2- 2nd date (25.10.14)		0.211	0.226	0.218
D_3- 3rd date (10.11.14)		0.178	0.191	0.185
D_4- 4th date (20.02.15)		0.351	0.397	0.374
D_5- 5th date (05.03.15)		0.317	0.321	0.319
D_6- 6th date (20.03.15)		0.243	0.289	0.266
Mean		0.258	0.282	
	Date of grafting	**Condition**		**Interaction**
SEm±	0.011	0.007		0.016
CD at 5% levels	0.034	0.019		NS

4.2.6 Leaf area duration (cm^2/day)

The mean leaf area duration of different treatments of date of grafting and condition of grafting is given in Table 4.12a and4.12b at 60 and 90 days after wedge grafting.

At 60 days after wedge grafting, the significantly maximum leaf area duration (8373.16) was observed under the treatment D_4 (4th date 20.02.15 of grafting). While it was lowest (4228.16) in treatment D_3 (3rd date 10.11.14 of grafting). Significantly maximum leaf area duration (6694.83) was recorded in treatments with condition C_2 (8th day after deblading). However it was minimum (6154.88) in treatments with C_1 (6th day after deblading) condition.

The interaction between both the factors was not significant with respect to leaf area duration. However, between interaction of both treatment, the treatment combination D_4C_2 (4th date 20.02.15 of grafting on 8th day after deblading) was observed highest (8604.66) leaf area duration and minimum (4035.00) was recorded in D_3C_1 (3rd date 10.11.14 of grafting on 6th day after deblading) treatment combination.

Table 4.12a: Effect of date and conditioning of wedge grafting on Leaf area duration (cm^2/day) at 60 days after wedge grafting

Treatments		Leaf area duration		Mean
Date of grafting		**C_1**	**C_2**	
D_1- 1st date (10.10.14)		6,624.33	7,192.33	6,908.33
D_2- 2nd date (25.10.14)		5,366.00	6,099.00	5,732.50
D_3- 3rd date (10.11.14)		4,035.00	4,421.33	4,228.16
D_4- 4th date (20.02.15)		8,141.66	8,604.66	8,373.16
D_5- 5th date (05.03.15)		7,350.00	7,937.00	7,643.50
D_6- 6th date (20.03.15)		5,412.33	5,914.66	5,663.50
Mean		6,154.88	6,694.83	
	Date of grafting	**Condition**		**Interaction**
SEm±	105.43	60.87		149.11
CD at 5% levels	309.58	178.73		NS

At 90 days after grafting, the significant maximum (23578.33) leaf area duration was observed under the treatment D_4 (4th date 20.02.15 of grafting), followed by grafting on D_5 (5th date 05.03.15 of grafting) (22486.67) as compared to other treatments. While, the lowest (15381.67) leaf area duration was recorded in treatment D_3 (3rd date 10.11.14 of grafting).

Significantly maximum leaf area duration (20144.95) was recorded in treatments with condition C_2 (8th day after deblading) and minimum (19667.89) in treatments with C_1 (6th day after deblading) condition.

The interaction effect of both the factors was not significant for leaf area duration. The treatment combination D_4C_2 (4th date 20.02.15 of grafting on 8th day after deblading) was recorded maximum (23756.67) leaf area duration, while minimum (15148.33) leaf area duration was observed in D_3C_1 (3rd date 10.11.14 of grafting on 6th day after deblading) treatment combination.

Table 4.12b: Effect of date and conditioning of wedge grafting on Leaf area duration (cm^2/day) at 90 days after wedge grafting

Treatments		Leaf area duration		Mean
Date of grafting		C_1	C_2	
D_1- 1st date (10.10.14)		20,126.67	20,925.00	20,525.83
D_2- 2nd date (25.10.14)		19,339.00	20,208.00	19,773.50
D_3- 3rd date (10.11.14)		15,148.33	15,615.00	15,381.67
D_4- 4th date (20.02.15)		23,400.00	23,756.67	23,578.33
D_5- 5th date (05.03.15)		22,338.33	22,635.00	22,486.67
D_6- 5th date (20.03.15)		17,655.00	17,730.00	17,692.50
Mean		19,667.89	20,144.95	
	Date of grafting	**Condition**		**Interaction**
SEm±	104.30	60.22		147.57
CD at 5% levels	306.26	176.82		NS

DISCUSSION

The experimental findings of the present investigation “Effect of different season and deblading on wedge grafting in Guava (*Psidium guajava L.*) Cv. Lucknow -49” was carried out during 2014-15. In this chapter, an attempt has been made to discuss the experimental findings in the light of meteorological factors at the time of grafting and available literatures on this subject.

5.1 Effect of date and conditioning of grafting on growth parameters of guava

5.1.1 Bud sprouting (%)

The present investigation showed that, bud sprouting was significantly influenced due to various treatments of date of wedge grafting and condition of wedge grafting in guava after 30, 45 and 60 days after grafting. Significantly maximum bud sprouting percent was recorded under the treatment D_5 (5^{th} date 05.03.15 of grafting) and D_4 (4^{th} date 20.02.15 of grafting) and which were at par with each other, while minimum bud sprouting percent was noted in D_3 (3^{rd} date 10.11.14 of grafting).

Between condition of grafting, the significantly highest bud sprouting was found in condition C_2 (8^{th} day after deblading) and minimum bud sprouting exhibited in C_1 (6^{th} day after deblading) condition. Deblading of scion shoot on the mother plant, about 5 to 7 days prior to detachment, at the same time, the apical growing portion of selected shoots was also beheaded, which helps in forcing the dormant bud to swell by accumulation of food material which will help to buds to increase sprouting percentage Similar results have been reported by Desai and Patil (1984), Dhakad and Hoda (1987), Patil et al. (1991), Shete et al. (1999), Ghojage et al. (2011), Shashi et al. (2012), and Beer et al. (2013).

The interaction effect does not exert any significant impact on bud sprouting percent at any stage. Interaction of both the factors for bud sprouting percent varies from maximum to minimum in treatment

combinations D_5C_2 (5^{th} date 05.03.15 of grafting on 8^{th} day after deblading) and D_3C_1 (3^{rd} date 10.11.15 of grafting on 6^{th} day after deblading) respectively. This may be due to favorable climatic conditions during february and march which most favorable for bud sprouting. Temperature has a pronounced effect on the production of callus tissue (Hartman and Kester, 1972). Temperature that will cause high cell activity is necessary for better graft union (Shippy, 1930). The new callus tissue arising from the cambial region is composed of thin walled, turgid cells which can easily become dessicated and die (Hartman and Kester, 1972). The wedge grafting should thus take place at the time when such favorable temperatures can be expected and when the plant tissues, especially the cambium, are in a naturally active state and same reason may be resulted in higher bud sprouting percent in the present investigation also because these conditions occurred in the present investigation during winter months. These findings are in agreement with the findings of Bharad et al. (2006), Singh (2010), Singh et al. (2011), Shyamal et al. (2012).

5.1.2 Bud takes success percentage / Percent graft take

It was found that the percent graft take was significantly superior on D_4 (4^{th} date 20.02.15 of grafting) as compared to other date of grafting followed by D_5 (5^{th} date 05.03.15 of grafting). While lowest graft success percent was observed in D_3 (3^{rd} date 10.11.14 of grafting) after 30, 45 and 60 days of grafting. These results has closed conformity by the findings of Singh (2005), Singh et al. (2007), Ghojage et al. (2011) and Beer et al. (2013).

Between condition of grafting, the treatment C_2 (8^{th} day after deblading) was significantly superior and also recorded maximum success percentage, while it was recorded minimum in C_1 (6^{th} day after deblading). Similar results have been reported by Dhakad and Hoda (1987), Patil et al. (1991), Manker et al. (1999), Singh et al. (2011) and Shashi et al. (2012). Deblading of scion shoot on the mother plant, about 5 to 7 days prior to detachment, at the same time, the apical growing portion of selected shoots was also beheaded, which helps in forcing the dormant bud to swell by accumulation of food material which will help to buds to increase sprouting percentage.

The interaction effect of treatment combination did not exhibit any significant effect on bud take success. It was recorded maximum in treatment combination D_4C_2 (4^{th} date 20.02.15 of grafting on 8^{th} day after deblading) and minimum in D_3C_1 (3^{rd} date 10.11.14 of grafting on 6^{th} day after deblading). Probably this may be due to most favorable temperature and humidity for success and same reason may be resulted in higher success in the present investigation also. This could be attributed to the vigorous growth of stock, which increased the growth and leads to maximum accumulation of stored metabolites at the time of grafting. These findings are in agreement with Singh et al. (2007), Kudmulwar et al. (2008), Ghojage et al. (2011) and Singh et al. (2011) Beer et al. (2013).

5.1.3 Days to 50% sprouting (Number of days taken to 50% graft sprouting)

Date on number of days taken to 50% graft sprouting reveal that it was significantly influenced by date of grafting and conditions of grafting. Early 50% sprouting was observed in D_4 (4^{th} date 20.02.15 of grafting) followed by D_5 (5^{th} date 05.03.15 of grafting) and D_6 (6^{th} date 20.03.15 of grafting) which were at par with one another. However it was significantly late in treatment D_3 (3^{rd} date 10.11.14 of grafting). Similar results have been reported by Singh et al. (2011) and Beer et al. (2013).

Furthermore, between the conditioning treatments, C_2 (8^{th} day after deblading) required significantly minimum days for 50% sprouting and late 50% sprouting was recorded in treatment C_1 (6^{th} day after deblading). These findings are in agreement with Singh et al. (2011).

The interaction effect does not exert any significant impact on days taken to 50% sprouting. The reason behind early 50% sprouting of graft was observed irrespective of dates of grafting and condition of grafting same to be its better adaptability to meteorological conditions existing at the time of grafting on better physiological conditions and more active buds. The emerging sprout is control by the apical dominance and rate of supply of substrates along with presence of appropriate environment viz. temperature, moisture and oxygen. The cell division takes place in the presence of

phytohormones and energy liberated by hydrolysis of carbohydrates and polysaccharides occur through enzymatic pathways is utilized. Many other changes during the sprouting such as hydrolysis of starch involve several types of amylase. Findings are in conformity with the results obtained by Singh et al. (2007) and Kudmulwar et al. (2008).

5.1.4 Shoot length (cm)

The shoot length was significantly affected due to date of grafting and condition of grafting after 30, 45, 60 and 90 days of grafting. It is evident that grafting on D_4 (4^{th} date 20.02.15 of grafting) was significantly superior over other date of grafting and recorded maximum sprouting (length of shoot) might be due to early healing of the graft union. While it was lowest in grafting D_3 (3^{rd} date 10.11.14 of grafting). In case of condition of grafting, the treatment C_2 (8^{th} day after deblading) was recorded maximum sprout length and it was recorded minimum in treatments with condition C_1 (6^{th} day after deblading). Richhariya (2009) also revealed that maximum sprouting, graft success and other vegetative characters were observed in grafts which were grafted with scion which was debladed 8 days prior to grafting as compared to other treatments.

Interaction of both the factor was non significant for length of sprout. Maximum length of shoot was found in treatment combination D_4C_2 (4^{th} date 20.02.15 of grafting on 8^{th} day after deblading) and minimum length was recorded in D_3C_1 (3^{rd} date 10.11.14 of grafting on 6^{th} day after deblading) treatment combination. Probable reason for increase length of shoot might be due to nutritional status of plant essential for protein synthesis, cell reproduction causing vegetative growth. It is also essential constituent of amino acids, plant growth regulators, enzymes, chromosomes, phospholipids and vitamins. Due to its physiological importance in metabolism cannot be ignored. The findings are also in agreement with Bandenawaj (2007) who also recorded minimum shoot length in the month of november followed by december and january and Kudmulwar et al. (2008) who reported maximum shoot length in grafts which performed in the month of february.

5.1.5 Shoot diameter (mm)

The maximum shoot diameter was observed in grafting on D_4 (4^{th} date 20.02.15 of grafting), while it was recorded minimum in D_3 (3^{rd} date 10.11.14 of grafting) after 30, 45, 60 and 90 days of grafting. In case of condition of grafting, the significantly maximum shoot diameter exhibited in C_2 (8^{th} day after deblading), while it was found minimum in C_1 (6^{th} day after deblading) condition. Interaction effect varied from treatment D_4C_2 (4^{th} date 20.02.15 of grafting on 8^{th} day after deblading) to D_3C_1 (3^{rd} date 10.11.14 of grafting on 6^{th} day after deblading) recorded maximum to minimum, respectively. While interaction effect does not exert any significant impact on shoot diameter at any stage. The growth stimulations due to endogenous gibberellins levels appear to be attributed to stimulations of more cell division and cell enlargement. This could be attributed to the vigorous growth of stock which increased the shoot diameter. Similar results have been reported by Kudmulwar et al. (2008) and Richhariya (2012).

5.1.6 Number of leaves per graft

The number of leaves per graft increased with the increase in stages of growth in different treatments. At 30, 45, 60 and 90 days after grafting, the maximum number of leaves per graft was noted in treatment D_4 (4^{th} date 20.02.15 of grafting), followed by D_5 (5^{th} date 05.03.15 of grafting), while it was recorded minimum in treatment D_3 (3^{rd} date of grafting). In case of condition of grafting, significantly maximum number of leaves per graft was observed in condition C_2 (8^{th} day after deblading). While, it was recorded minimum in condition C_1 (6^{th} day after deblading). Similar results have been reported by and Ghojage et al. (2011) and Richhariya (2012).

Interaction of both the factors was non significant in case of number of leaves per graft. It observed maximum in D_4C_2 (4^{th} date 20.02.15 of grafting on 8^{th} day after deblading) and minimum in D_3C_1 (3^{rd} date 10.11.14 of grafting on 6^{th} day after deblading). The development of more sprouts and more meristamatic regions enhanced more number of leaves may be due to activity and better healing of grafts during these months and also due to genetic characters of a variety and vegetative growth enhanced might have been due to activated physiological process by stimulating factor in the metabolism and

growth of the plant. These findings are in agreement with the findings of Ghojage et al. (2011) which shows that the maximum total number of leaves was observed when grafts were prepared during the month of february which was on at par with march, september and july. The graft produced the least number of leaves when grafting was done during december, november and January. Similar results have also been reported by Bandenawaj (2007) and Kudmulwar et al. (2008).

5.2 Effect of date and condition of grafting on physiological parameter of guava

5.2.1 Chlorophyll index

It is obvious that the average chlorophyll content significantly influenced by date of grafting. Grafting on D_4 (4^{th} date 20.02.15 of grafting) was recorded significantly higher chlorophyll index followed by grafting on D_5 (5^{th} 05.03.15 date of grafting). While minimum chlorophyll index was observed in grafting on D_3 (3^{rd} 10.11.14 date of grafting).

In case of condition, data clearly shows that the higher chlorophyll content was recorded in condition C_2 (8^{th} day after deblading). However, the lowest chlorophyll index was observed in C_1 (6^{th} day after deblading) condition. These findings are in agreement with Richhariya (2012), who reported maximum chlorophyll index in mango grafts with deblading of leaves of scion before 8 days of grafting.

The interaction effect of treatment combination did not exhibit any significant effect on chlorophyll content. It varied from 19.80 to 10.48 maximum to minimum in treatment combinations D_4C_2 (4^{th} date 20.02.15 of grafting on 8^{th} day after deblading) and D_3C_1 (3^{rd} date 10.11.14 of grafting on 6^{th} day after deblading) respectively as compared to other treatments. Photosynthesis is the main process that can harvest energy derived from the sun. Photosynthetic pigment like chlorophyll which is responsible for absorbing and trapping light energy in the early steps of photosynthesis. Higher number of leaves results in more production of chlorophyll that ultimately leads to more amount of photosynthesis and hence, higher vegetative and sink yield. These findings are in agreement with the findings of El- Bagoury et al. (2010) and Mahore (2014).

5.2.2 Leaf Area Index

Leaf area influenced the production of biomass in any crop and its relationship with biological yield was well established in crops (Welbank et al. 1966). LAI is an important character depends on leaf orientation. The vertically oriented leaves had a higher photosynthesis rate than those with horizontal leaves.

The present investigation revealed that the grafting date of 20th February was found to be associated with highest leaf area index. The higher LAI during this period may be attributed to the optimum availability of sunshine hours and temperature which might have accelerated cell division and cell enlargement in leaves resulting in increase the leaf area and subsequently leaf area index. On the other hand the planting date 10th November indicated the lowest LAI, which may be attributed to reduced temperature along with the light intensities which might have reduced kinetins of biochemical reactions and physiological mechanism required for leaf growth. These findings were agreement with Jamil et al. (2006), who observed that the cultivar and sowing date significantly affected the leaf area index.

In case of condition of grafting, the maximum leaf area index was recorded in condition C_2 (8th day after deblading) while minimum was observed in C_1 (6th day after deblading) condition. These findings were agreement with Richhariya (2012) who revealed that LAI was significantly maximum in graftings in which preconditioning was done before 8 days.

The treatment combinations of date of grafting and condition of grafting recorded significantly maximum leaf area index in D_4C_2 (4th date 20.02.15 of grafting on 8th day after deblading) treatment combination, while it was observed minimum in D_3C_1 (3rd date 10.11.14 of grafting on 6th day after deblading). The concept of the ratio of leaf area to ground area (LAI) was the basis to growth analysis of community on which the photosynthetic production is based. It is also responsible for yield. When leaf area is more causes the fast growth of top which favoured the root and shoot growth. These findings are in agreement with Rajan et al. (2001) and Oguntunde et al. (2011).

5.2.3 Light transmission ratio (%)

The better use of resources can be supported by observations on LTR. The higher light interception was due to quick and good vegetative cover, which helps in better interception of light (Dhandayuthapani and Latha 2015).

The result gave evidence that treatment D_4 (4^{th} 20.02.15 date of grafting) as compared to other treatments which implies the highest utilization efficiency as compared to other dates. This was due to better spatial use of light by leaf canopy or root system might have better spatial use of nutrients and water. However, it was recorded maximum in treatment D_3 (3^{rd} date 10.11.14 of grafting). In case of condition of grafting, the minimum light transmission ratio was recorded in condition C_2 (8^{th} day after deblading) and maximum in C_1 (6^{th} day after deblading).

The treatment combination of date and condition of grafting was recorded significantly minimum under the treatment D_4C_2 (4^{th} date 20.02.15 of grafting on 8^{th} day after deblading) followed by D_4C_1 (4^{th} date 20.02.15 of grafting on 6^{th} day after deblading) which were at par with each other. While, it was observed maximum in D_3C_1 (3^{rd} date 10.11.15 of grafting on 6^{th} day after deblading. These findings are in agreement with the findings of Mahore (2014), who also revealed that denser canopy and more leaf area index results in less LTR.

5.2.4 PAR interception (mol/m^2/sec)

PAR interception is the difference between IPAR (intercepted PAR) and APAR (absorbed PAR) depends on canopy closure, coverage over the background materials, canopy composition, density and reflectance. PAR interception was recorded significantly maximum in the treatment D_4 4^{th} date 20.02.15 of grafting) followed by D_5 (5^{th} 05.03.15 date of grafting as compared to other treatments. The probable reasons for more PAR interception are more number of leaves and more leaf area index which results in denser canopy. In case of condition of grafting, the maximum PAR interception was recorded in condition C_2 (8^{th} day after deblading and minimum in condition C_1 (6^{th} day after deblading). The treatment combination D_4C_2 (4^{th} date 20.02.15 of grafting on 8^{th} day after deblading) showed maximum PAR interception

while minimum PAR was observed in treatment combination D_3C_1 (3^{rd} date 10.11.14 of grafting on 6^{th} day after deblading). These findings are in agreement with the findings of Inthapan and Fukai (1988) and Corollaro et al. (2015).

5.2.5 Energy interception

All green plants are powered by radiant solar energy which driven photosynthesis and provides heat. Energy interception was observed maximum in treatment D_4 (4^{th} date 20.02.15 of grafting), while treatment D_3 (3^{rd} date 10.11.14 of grafting) showed significantly minimum energy interception. In case of condition of grafting, the maximum energy interception was recorded in condition C_2 (8^{th} day after deblading) while minimum was observed in C_1 (6^{th} day after deblading) condition. Interception of light by a crop canopy is strongly related to total leaf area. A crop will thus intercept more PAR and hence grow faster if it develops leaf area rapidly. Similar findings were reported by Maddonni and Otegui (1996).

The interaction between date and condition of grafting on energy interception was found to be non significant.

5.2.6 Leaf area duration (cm^2/day)

The LAI could be integrated over time to take into the account persistence to leaf area. This integral value was termed as LAD and was found to be closely related to DMP and yield. Welbank et al. (1966) was found it to be increased with increase in daily radiation. The leaves remained open for a prolonged period remobilized it assimilates to the sink during senescence (Gupta and Olugbemi 1978).

Usually the LAD is closely correlated with yield because interception of solar radiation over longer period of time generally means more dry matter production. LAD is fairly easy to measure and since it is related to dry matter yield, can give an indication of crop productivity (Gardner et al. 1985).

LAD is an important parameter which is determined by the leaf area index of two consecutive growth stages is Leaf area duration (LAD), which is a useful parameter, not only for predicting the efficiency of photosynthetic system but also for dry matter production. LAD both for 45 and 90 days after

grafting, was significantly maximum under treatment D_4 (4^{th} date 20.02.15 of grafting) which indicated the influence of main growth factors like temperature, light intensity and availability and minimum in treatment D_3 (3^{rd} date 10.11.14 of grafting) as compared to other treatments. Significantly maximum leaf area duration was recorded in treatments with C_2 (8^{th} day after deblading) condition. However it was minimum in C_1 (6^{th} day after deblading) condition. Interaction between both treatment was non significant. However, highest leaf area duration was recorded in treatment combination D_4C_2 (4^{th} date 20.02.15 of grafting on 8^{th} day after deblading). While. It was recorded minimum in treatment combination D_3C_1 (3^{rd} date 10.11.14 of grafting on 6^{th} day after deblading). These findings are in agreement with Zhang et al. (2007).

SUMMARY, CONCLUSION AND SUGGESTIONS FOR FURTHER WORK

6.1 Summary

Guava is considered as one of the exquisite, nutritionally valuable and remunerative crops. Guava fruits are used for both, fresh consumption and processing. In view of the high return and the potential for processing, there is a tremendous scope for bringing substantial area under guava crop in India. So, a rapid and successful propagation technique is required as the area under crop is expanding and there is a demand to prepare the guava plants throughout the year. A good and reliable vegetative propagation method will serve as the one of the important tool for boosting up the production of quality planting material.

The present investigation “Effect of different season and deblading on wedge grafting in Guava (*Psidium guajava L.*) Cv .Lucknow -49 ” was carried out during the year 2014-2015 at Fruit Research Station, Imalia, Department of Horticulture, College of Agriculture, J.N.K.V.V., Jabalpur (M.P.).The experimental material for present investigation was comprised of 12 treatments combinations (date of grafting – 6 and condition of grafting – 2) in guava. The experiment was laid out in the 6 x 2 Asymmetrical Factorial Completely Randomized Design with three replications. In this investigation, the effect of seasons, deblading and their data on vegetative growth and physiological response of grafted plants were assessed.

Observations were recorded on the basis of the five random competitive plants selected from each treatment separately for growth and physiological parameters were evaluated as per standard procedure. The important findings of the present investigation are summarized as below.

Growth parameters viz. bud sprouting percent, bud take success percentage, early 50% sprouting, length of sprout, shoot diameter and number of leaves per graft were significantly influenced due to various treatments of the date of wedge grafting in guava and these were recorded

significantly maximum under the treatment D_4 (4^{th} date 20.02.15 of grafting) and D_5 (5^{th} date 05.03.15 of grafting) at all the growth stages. Between condition of grafting, the significantly highest bud sprouting, success percentage, early 50% sprouting, length of sprout, sprout diameter and number of leaves per graft were found in C_2 (8^{th} day after deblading).

The data on interaction of date of wedge grafting and condition of grafting in guava clearly indicated that there is non significant difference under various treatment combinations for all growth parameters. However, the maximum bud sprouting, success percentage, early 50% sprouting, length of sprout, shoot diameter and number of leaves per graft were recorded in treatment combination of D_4C_2 (4^{th} date 20.02.15 of grafting on 8^{th} day after deblading) and minimum in D_3C_1 (3^{rd} date 10.11.14 of grafting 6^{th} day after deblading).

The average chlorophyll content was significantly influenced by date of wedge grafting. Grafting on 20.02.15 (D_4) recorded significantly higher chlorophyll content followed by grafting on 05.03.15 (D_5) and in case of condition, the higher chlorophyll content was recorded in condition C_2 (8^{th} day after deblading).

The interaction of treatment combinations did not exhibit any significant effect on chlorophyll content.

Grafting on D_4 (20.02.15) and D_5 (05.03.15) recorded significantly maximum leaf area index, PAR interception, energy interception, leaf area duration and minimum light transmission ratio.

In case of condition of grafting, the maximum leaf area index, PAR interception, energy interception and leaf area duration was recorded maximum while light transmission ratio observed minimum in 8^{th} day after deblading condition. The treatment combination of date of grafting and condition of grafting recorded significantly maximum leaf area index, PAR interception, energy interception, leaf area duration and minimum light transmission ratio in D_4C_2 (4^{th} date 20.02.15 of grafting on 8^{th} day after deblading).

6.2 Conclusion

On the basis of present investigation, it is concluded that the 20th February to 5th March are the best season for wedge grafting in guava. At these period bud sprouting percentage, success percentage, early 50% sprouting, length of sprout, sprout diameter, number of leaves, chlorophyll index, leaf area index, PAR interception and leaf area duration per graft were significantly maximum, while light transmission ratio is significantly minimum.

Deblading of scion shoot 8 days prior to grafting helps in forcing the dormant bud to swell by accumulation of food material which will help to buds to increase sprouting percentage and obtain more success in wedge grafting.

6.3 Suggestions for further work

- The following suggestions are made for further research work on the basis of present study.
- The experiment entitled “Effect of different season and deblading on wedge grafting in Guava (*Psidium guajava* L.) cv. Lucknow- 49" was conducted first time and hence, may be repeated to confirm the findings of the present investigation.
- Performance of wedge grafting should be carried out in greenhouse with polycap as well as in open condition. Findings of the present investigation had to be popularized among the gardeners.
- A study should be conducted on root stock age on graft success with different deblading dates.
- Further investigation should be carried out to evaluate the different methods of propagation viz. Budding (Patch, T budding, Chip budding).

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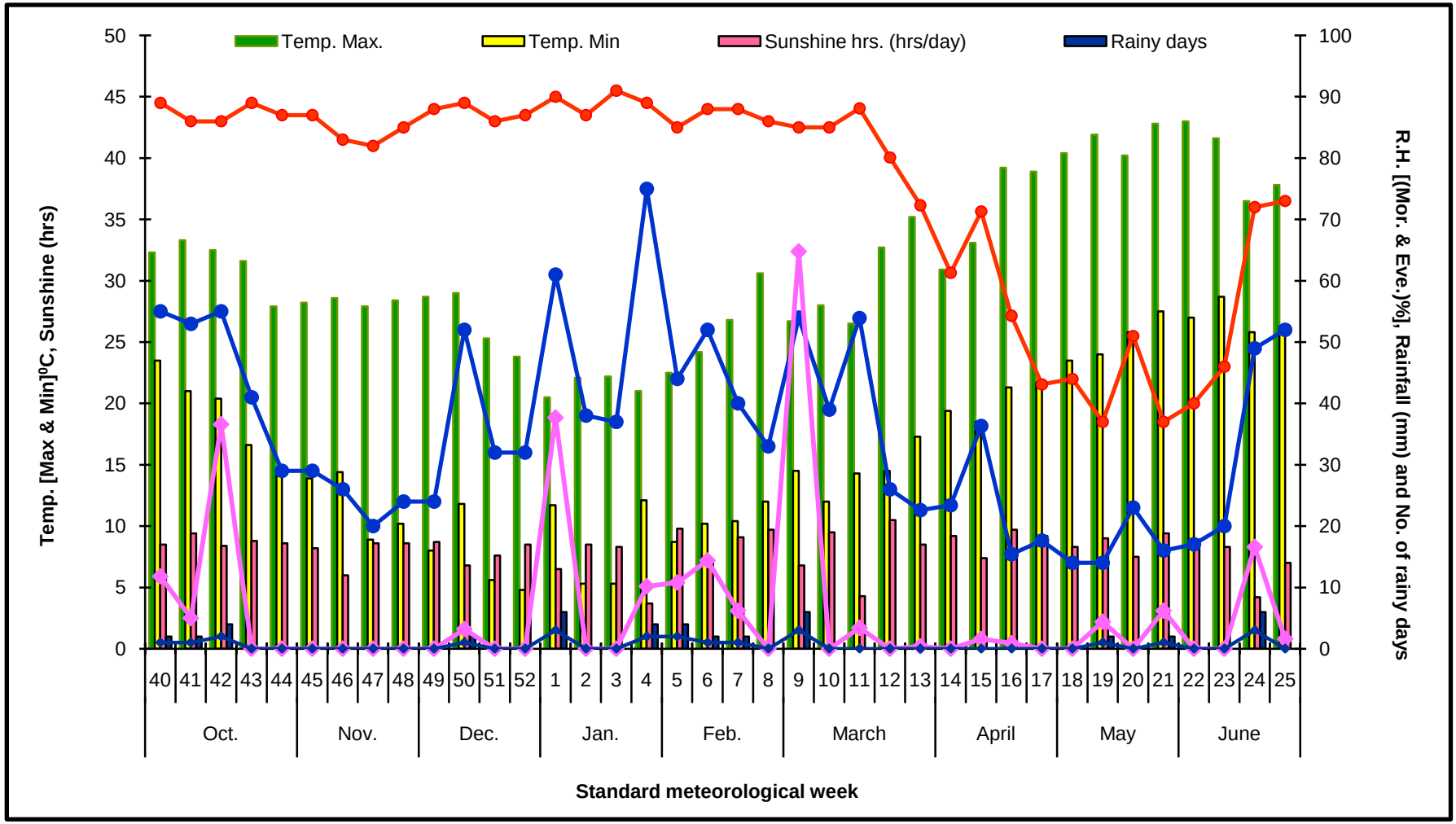

Fig. 1. Weekly meteorological parameters during the crop season (1st October to 24th June)

APPENDICES

APPENDIX – I

Analysis of variance for various growth parameter of guava (mean square)

Source of Variance	d.f.	Bud Sprouting (%) days after grafting (DAG)		
		30DAG	45 DAG	60 DAG
Date of grafting	6	406.378**	457.966**	576.331**
Condition	2	54.437**	43.012**	69.746**
Interaction	12	1.304	0.819	10.047
Error	24	8.805	9.075	9.356

Source of variation	d.f.	Bud take success (%)			Days to 50% sprouting
		30 DAG	45 DAG	60DAG	
Date of grafting	6	674.699**	995.386**	1,401.157**	112.580**
Condition	2	427.589**	368.650**	235.497**	5.664**
Interaction	12	18.168	15.652	15.164	0.142
Error	24	7.473	7.228	7.293	0.180

Source of Variance	d.f.	Shoot diameter (mm)			
		30 DAG	45 DAG	60 DAG	90 DAG
Date of grafting	6	0.417**	0.225**	0.157**	0.254**
Condition	2	0.197**	0.274**	0.198**	0.148**
Interaction	12	0.002	0.013	0.005	0.003
Error	24	0.035	0.035	0.034	0.034

Source of Variance	d.f.	Shoot length (cm)			
		30 DAG	45 DAG	60 DAG	90 DAG
Date of grafting	6	2.178**	1.595**	7.869**	17.259**
Condition	2	0.297**	0.467**	0.405**	0.567**
Interaction	12	0.011	0.040	0.001	0.005
Error	24	0.070	0.075	0.073	0.074

Source of Variance	d.f.	Number of leaves per shoot			
		30 DAG	45 DAG	60 DAG	90 DAG
Date of grafting	6	5.930**	16.245**	32.281**	38.157**
Condition	2	1.058**	1.082**	1.295**	1.023**
Interaction	12	0.039	0.008	0.075	0.014
Error	24	0.188	0.231	0.243	0.208

APPENDIX – II

Analysis of variance for various physiological parameter of guava (maen square)

Source of variation	d.f.	Chlorophyll index	Leaf area index		
			45 DAG	60 DAG	90 DAG
Date of grafting	6	30.703**	2.662**	2.114**	2.174**
Condition	2	28.837**	0.563**	0.237**	0.047**
Interaction	12	1.946	0.041**	0.009**	0.011**
Error	24	2.794	0.002	0.002	0.001

Source of variation	d.f.	Light Transmission ratio (%)	PAR interception (μ mol/m^2/sec)	Energy interception (cal cm^{-2} min^{-1})
Date of grafting	6	133.737**	1511.807**	0.028**
Condition	2	26.760**	250.121**	0.005**
Interaction	12	9.027**	2.978	0.000
Error	24	2.052	5.084	0.001

Source of variation	d.f.	Leaf area duration (cm^2/day)	
		60 DAG	90 DAG
Date of grafting	6	13,679,066.16**	55,100,154.58**
Condition	2	2,623,860.02**	2,048,238.02**
Interaction	12	21,360.96	139,689.02
Error	24	66,701.02	65,280.69

CURRICULUM VITAE

The author of this thesis Ms. Sweeti Chouksey D/o Ms. R. S. Chouksey was born on 23rd December, 1990 at Jabalpur (M.P.). She passed her high school (10th) in the year 2006 from St. Norbert's Girls Higher Secondary School Jabalpur (M.P.) with 80.40% marks and Higher Secondary in the year 2008 from M. L. B. Girls Higher Secondary School Jabalpur (M.P.) with 73.50% marks.

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