



ISSN (E): 2277- 7695  
ISSN (P): 2349-8242  
NAAS Rating: 5.23  
TPI 2022; 11(1): 1875-1878  
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[www.thepharmajournal.com](http://www.thepharmajournal.com)

Received: xx-10-2021

Accepted: xx-12-2021

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## Effect of type of healing chamber and stage for acclimatization in chilli grafts

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### Abstract

The field experiment was conducted at Department of Vegetable Science, College of Horticulture, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli (M.S.) during the *rabi* season 2020-21. In experiment Factor A consisted two healing chambers i.e C<sub>1</sub>: Polycarbonated polyhouse and C<sub>2</sub>: Shade net and Factor B consisted four stages of starting of acclimatization i.e. D<sub>1</sub>: 4 DAG, D<sub>2</sub>: 5 DAG, D<sub>3</sub>: 6 DAG and D<sub>4</sub>: 7 DAG. The effect of treatment combination of healing chamber and starting of acclimatization was significantly differ in number of days required for graft union, survival percentage, girth at graft union, girth of scion and rootstock, number of days required for development of new leaves and number of leaves recorded in treatment combination (C<sub>2</sub>D<sub>1</sub>). The shade net healing chamber (C<sub>2</sub>) with starting of acclimatization (D<sub>1</sub>) 4 DAG was appropriate for chilli graft with maximum survival rate.

**Keywords:** Chilli, graft, healing chamber, acclimatization, rootstock, scion

### Introduction

Chilli (*Capsicum annum* L.) belongs to the family solanaceae having diploid species with 2n=2x=24 chromosomes. Grafting, a propagation technique that consists of joining one plant to already rooted another plant. A grafted plant having rootstock that generally has no essential agronomic value, but carries valuable biotic (King *et al.*, 2010) [3] and abiotic (Zhao *et al.*, 2011) [30] tolerance or resistance genes and the scion, which is part of stem of another plant that is joined to the rootstock so that branches, leaves, flowers and fruits are develops.

An average of 5 to 8 days are required for the graft union of an herbaceous plant to develop vascular connectivity between rootstock and scion (Fernandez-Garcia *et al.*, 2004). During this time, the scion is not able to uptake water from the rootstock. Therefore, it is essential to maintain proper healing conditions to avoid transpiration losses from the scion and help in rapid formation of the graft union. Survival of grafted plants will be higher if plants are kept in a controlled environment with high RH (>95) and optimal temperatures of 25°C to 28°C (Hassell *et al.*, 2008) [10].

Acclimatization of grafts is the major operation after the healing of those grafts and this can be done by gradually exposing the grafts to low humidity (lower than RH in healing chamber), high light intensity and temperature after fifth day of grafting upto the fully acclimatized to the ambient environment.

### Material and Method

The experiment was conducted at High-Tech Unit, College of horticulture, Dapoli, District Ratnagiri (M.S.). In this experiment the two healing chambers and four stages of acclimatization are considered for study in split plot design with three replication. Splice grafting method was used for grafting. Diurnally changes in Humidity (%), temperature (°C) and light intensity (Lux) was observed at 6 am, 2.30 pm and 6.30 pm with help of temperature and humidity meter, Lux meter upto 21<sup>th</sup> day after grafting. The observation like number of days required for graft union and development of new leaves was recorded from the day of the grafting while survival percentage (%), girth at graft union (mm), girth of scion and rootstock (mm) and number of leaves on graft were recorded at 7<sup>th</sup>, 14<sup>th</sup>, 21<sup>th</sup> days after grafting. The data obtained for all the parameters were analysed statistically as per the method prescribed by Panse and Sukhatme (1995) [21].

### Results and Discussions

#### 1) Humidity (%), Light lintensity (Lux) and Temperature (°C0)

There was diurnal variation in humidity in C<sub>1</sub> - Polycarbonated polyhouse and mean humidity was recorded 99% up to the 1-3 days after grafting.

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After 3 days of grafting there was decrease in humidity at 7:30 am, 2.30 am and 6.00 pm. The humidity decreases from 98.67% in 4-6 DAG to 78.67% in 19-21 DAG in morning at 7:30 am, 96.44% in 4-6 DAG to 74.22 at 19-21 DAG at 2:30 pm and 98.33 to 82.44% at 6:00 pm whereas, humidity in the C<sub>2</sub> - Shade net was changes diurnal and mean humidity of 94% was recorded in 1-3 DAG. Then decreases from 94.78% in 1- 3 DAG to 85.11% in 19-21 DAG at 7:30 am, 93.78% in 4-6 DAG to 83.89% in 19-21 DAG at 2:30 pm and 91.56% in 4-6 DAG to 82.78% in 19-21 DAG at 6:00 pm.

The very high humidity near to the saturation was recorded in C<sub>1</sub> - Polycarbonated polyhouse during the healing period which was negatively effect on the graft union and causes the decrease in survival rate. The similar observations recorded by Nobuoka *et al.* (1996) [18] in tomato grafting, Lee *et al.* (2007) [15], Oda (2007) [19], Davis *et al.* (2008) [6] for tomato and cucurbits, Johnson and Miles (2011) [12] in eggplant, tomato, and watermelon grafting, Bie *et al.* (2017) [3], Bantis *et al.* (2019) [2], Pardo-Alonso *et al.* (2020) [22].

In C<sub>1</sub> - Polycarbonated polyhouse the light intensity was varied diurnally and low light intensity was recorded. It was between the 0 to 8 Lux at 7.30 am from 19-21 DAG to 1-3 DAG, 6.67 to 15.00 Lux at 2.30 pm from 7-10 DAG to 1-3 DAG and 0 to 9 lux at 6 pm from 19-21 DAG to the 1-3 DAG whereas in C<sub>2</sub> - Shade net light intensity was higher and ranges 5.81 to 63.22 lux at 7:30 am from 1-3 DAG to 19-21 DAG, 7.38 to 81.33 lux at 2:30 pm from 7-10 DAG to 13-15 DAG and 3.57 to 57.33 lux at 6:00 pm from 7-10 DAG to 16-18 DAG.

The light intensity affect the grafting success as light intensity and ventilation directly affect the temperature in the chamber. Relatively high intensity with good ventilation in healing chamber in first 1-3 day was observed beneficial for early graft union and high success rate in C<sub>2</sub> - Shade net as compare to C<sub>1</sub> - Polycarbonated polyhouse. The findings are supported by Lee *et al.* (2010) [14], Johnson and Miles (2011) [12] in eggplant, tomato and watermelon, Bantis *et al.* (2019) [2] in watermelon and Tirupathamma *et al.* (2019) [29].

In C<sub>1</sub> - Polycarbonated polyhouse temperature was between 22.17 to 23.83 °C from 1-3 DAG to 4-6 DAG at 7:30 am, 25.56 to 28.98 °C from 1-3 DAG to 19-21 DAG at 2:30 pm and 24.14 to 26.91 °C from 1-3 DAG to 10-12 DAG at 6:00 pm whereas in C<sub>2</sub> - Shade net temperature was lower as compared with C<sub>1</sub> - Polycarbonated polyhouse and ranged 20.79 to 25.83 °C at 7:30 am from 4-6 DAG to 19-21 DAG, 25.72 to 28.40 °C at 2:30 pm from 19-21 DAG to 4-6 DAG and 23.50 to 26.53 °C at 6:00 pm from 4-6 DAG to 1-3 DAG.

Optimal temperature range for healing of grafted chilli is 21 to 22°C with a maximum temperature range of 28 to 29°C. In which the grafted plant didn't show the wilting and this range was also helpful for maintaining the proper humidity. There was same range recorded in the C<sub>2</sub> - Shade net healing chamber up to the 4 DAG which resulted in the early graft union and higher survival rate. The same observations also reported by De Ruiter Seeds (2006) [7], Oda (2007) [19], Lee *et al.* (2007) [15], Hassell *et al.* (2008) [10] in cucurbits, Johnson and Miles (2011) [11] in eggplant, tomato and watermelon and Bantis *et al.* (2019) [2] in watermelon.

## 2) Days required for graft union

Significantly minimum days required for graft union (4.93) in the interaction C<sub>2</sub>D<sub>1</sub> whereas, maximum days required for graft union (8.20) in C<sub>1</sub>D<sub>4</sub> at 21<sup>th</sup> days after grafting.

Days required for graft union are dependent on the prevailing conditions in acclimatization chamber. The results might be due to the proper healing condition in C<sub>2</sub> – Shade net for first 1-4 days therefore which caused early graft union where acclimatization was started earlier i.e. Acclimatization 4 DAG which resulted in higher survival rate. Similar results were given by Onduso (2014) [20] in tomato, Tejashwini Rathod (2017), Nagma Surve (2019) [17] in brinjal and Rayker (2020) [27] in brinjal.

## 3) Survival percentage (%)

Significantly highest survival rate was noticed at 21<sup>th</sup> DAG (75.50%) in C<sub>2</sub>D<sub>1</sub>. Whereas, minimum (30.25%) in C<sub>1</sub>D<sub>3</sub> at 21<sup>th</sup> days after grafting.

The low survival rate in treatment C<sub>1</sub> – Polycarbonated polyhouse might be due to the high temperature and poor air circulation as compared to C<sub>2</sub> - Shade net chamber at the time of starting of acclimatization (4 DAG). The above results are in confirmative with Gisbert *et al.* (2011) in brinjal, Johnson and Miles (2011) [12] in eggplant, tomato and watermelon, Bizhen *et al.* (2014) in tomato grafting, Nagma Surve (2019) [17] in brinjal, Rana *et al.* (2019) [26], Rayker (2020) [27] in brinjal and Tejashwini Rathod (2017) in brinjal.

## 4) Girth at graft union (mm)

Effect of interaction was significantly highest girth at graft union was recorded in C<sub>2</sub>D<sub>1</sub> (2.64 mm) While, the lowest was recorded in C<sub>1</sub>D<sub>3</sub> (2.25 mm) at 21<sup>th</sup> days after grafting.

Girth of graft union might be affected by vascular callusing and growth of graft. It was recorded maximum in C<sub>2</sub> - Shade net and starting of acclimatization for 4 DAG might be due to the early graft union and maximum growth of diameter of scion and rootstock. The similar data also recorded by Nagma Surve (2019) [17] in bringal, Bantis *et al.* (2020) [1] in watermelon scion and squash rootstock and Rayker (2020) [27] in brinjal.

## 5) Girth of scion and rootstock

Girth of scion was significantly maximum in treatment combination C<sub>2</sub>D<sub>1</sub> (2.48 mm) which was at par with C<sub>2</sub>D<sub>4</sub> (2.47 mm) whereas minimum in C<sub>1</sub>D<sub>3</sub> (1.77 mm) at 21<sup>th</sup> days after grafting. The highest girth of rootstock was recorded in interaction C<sub>2</sub>D<sub>1</sub> (2.59 mm) which was at par with C<sub>2</sub>D<sub>3</sub> (2.50 mm) and C<sub>2</sub>D<sub>4</sub> (2.58 mm) whereas minimum in C<sub>1</sub>D<sub>3</sub> (2.11 mm) at 21<sup>th</sup> days after grafting.

The girth of scion and rootstock might be depends on the translocation of the nutrients and water absorption by chilli grafts after healing. The higher magnitudes in C<sub>2</sub> - Shade net and D<sub>1</sub> -starting of acclimatization at 4 DAG could be due to the early graft union gives more translocation of the nutrient and water. The similar results also registered by Ioannou *et al.* (2001) [11], Bletsos *et al.* (2003) [5] in brinjal, Leonardi and Giuffrida (2006) [16] in brinjal, Nagma Surve (2019) [17] in brinjal, Bantis *et al.* (2020) [1] in watermelon scion and squash rootstock and Rayker (2020) [27] in brinjal.

## 6) Number of days required for development of new leaves

The number of days required for development of new leaves was significantly minimum (7.63 days) was recorded in interaction C<sub>2</sub>D<sub>1</sub> which was at par with C<sub>2</sub>D<sub>2</sub> (7.83 days) and maximum (10.20 days) in C<sub>1</sub>D<sub>4</sub>.

Days required for development of new leaves might be depend on supply of nutrients and photosynthesis activity

which promote for new leaves development.

### 7) Number of leaves on graft

The highest number of the leaves was recorded in interaction C<sub>2</sub>D<sub>1</sub> at 21<sup>th</sup> days after grafting (5.40) but lowest number of leaves on graft (4.50) in C<sub>1</sub>D<sub>2</sub> at 21<sup>th</sup> days after grafting.

The number of leaves on graft might be depends on the rate of growth and development of graft which in turn also affected

by the growing conditions and acclimatization process. The higher number of leaves in C<sub>2</sub> - Shade net and starting of acclimatization D<sub>1</sub>-Acclimatization 4 DAG might be due to prevalence of overall good conditions for growth of graft. Similar results were also reported by the Petropoulos *et al.* (2012) [24] and Petropoulos *et al.* (2014) [23] in watermelon also by Priyanka *et al.* (2019) in tomato.

**Table 1:** Humidity (%), Light intensity (Lux) and Temperature (°C)

Day after grafting	Humidity (%)			Light intensity (Lux)			Temperature (°C)		
	C <sub>1</sub>			C <sub>1</sub>			C <sub>1</sub>		
	7:30 AM	2:30 PM	6:00 PM	7:30 AM	2:30 PM	6:00 PM	7:30 AM	2:30 PM	6:00 PM
1-3	99.00	99.00	99.00	8.00	15.00	9.00	22.17	25.56	24.14
4-6	98.67	96.44	98.33	0.00	6.89	2.00	23.83	28.14	26.08
7-10	92.11	91.00	93.11	0.00	6.67	0.00	22.71	27.78	25.92
10-12	87.22	84.11	87.56	0.00	11.44	0.00	23.01	28.06	26.91
13-15	86.11	82.78	87.33	0.00	7.89	0.00	23.17	28.03	26.48
16-18	81.33	76.67	86.33	0.00	9.67	0.00	23.59	28.46	26.07
19-21	78.67	74.22	82.44	0.00	7.33	0.00	23.36	28.98	25.63
	C <sub>2</sub>			C <sub>2</sub>			C <sub>2</sub>		
1-3	93.67	94.44	94.78	12.44	13.83	12.39	23.09	27.09	26.53
4-6	94.78	93.78	91.56	13.11	15.67	11.72	20.79	28.40	23.50
7-10	96.11	93.44	92.78	5.81	7.38	3.57	21.91	27.47	25.57
10-12	92.56	83.22	84.89	13.33	16.17	11.67	24.32	27.28	27.17
13-15	89.89	86.67	83.33	57.89	81.33	41.11	24.56	27.88	25.67
16-18	86.78	83.22	83.11	60.67	80.00	57.33	25.61	28.17	24.27
19-21	85.11	83.89	82.78	63.22	76.50	57.11	25.83	25.72	24.22

Type of healing chamber
C <sub>1</sub> - Polycarbonate polyhouse
C <sub>2</sub> - Shade net

**Table 2:** Effect of type of healing chamber and starting of acclimatization process on chilli grafts

Treatment	Days required for graft union	Survival percentage (%)	Girth at graft union (mm)	Girth of scion (mm)	Girth of rootstock (mm)	Days required for development of new leaves	Number of leaves on graft
C <sub>1</sub> D <sub>1</sub>	6.60	40.12	2.39	1.92	2.47	9.10	5.23
C <sub>1</sub> D <sub>2</sub>	7.80	38.22	2.31	1.83	2.33	9.63	4.50
C <sub>1</sub> D <sub>3</sub>	7.37	30.25	2.25	1.77	2.11	8.73	4.50
C <sub>1</sub> D <sub>4</sub>	8.20	35.45	2.30	1.86	2.39	10.20	4.60
C <sub>2</sub> D <sub>1</sub>	4.93	75.50	2.64	2.48	2.59	7.63	5.40
C <sub>2</sub> D <sub>2</sub>	6.47	60.50	2.58	2.33	2.36	7.83	5.33
C <sub>2</sub> D <sub>3</sub>	6.37	50.42	2.36	2.10	2.50	8.73	4.53
C <sub>2</sub> D <sub>4</sub>	6.50	50.05	2.50	2.47	2.58	8.10	4.67
Mean	6.78	47.56	2.42	2.09	2.42	8.75	4.85
S.Em	0.11	1.98	0.02	0.03	0.03	0.21	0.13
CD @ 5%	0.35	6.1	0.06	0.09	0.08	0.66	0.42

### Conclusion

Among different healing chamber the structure C<sub>2</sub> i.e. shade net was found superior with respect to various parameters under study and initiating acclimatization 4 days after grafting was superior.

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