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To Study the Different Type of Healing Chambers and Stages for Acclimatization in Chilli Grafts-A Review

M. C. Bhoite[1*], L. K. Gabhale[2] and V. S. Uttekar[1]

[1]*Department of Horticulture, Dapoli, Maharashtra, India*
[2]*Vegetable Breeder, Agriculture research station Palghar, Maharashtra, India*

**Corresponding author*

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A B S T R A C T

The literature on "To study the different type of healing chambers and stages for acclimatization in Chilli grafts" has been well documented in this article, efforts have been made to review the literature available on Humidity (%), Light intensity (Lux), Temprature (ºC) Number of days required for graft union, survival rate of grafts, girth at graft union, girth of rootstock and girth of scion, number of days required for development of new leaves and number of leaves.

Introduction

Chilli (*Capsicum annum* L.) is one of the important commercial vegetable crop in India as well as important spice and condiment crop all over the world. It belongs to the family Solanaceae and the chromosome number of chilli is 2n=2x=24.

After grafting, the plants were placed in the mist chamber to facilitate the healing process. The mist chamber had intermittent mist applied to the healing chamber after 1-2 hr for 30 sec. Grafted plants were maintained in the mist chamber for 7 to 14 days before moving them onto a greenhouse with air temperatures between 24 and 32C during the 24-hour cycle.

Acclimatization of grafts is the foremost operation after the healing of these grafts and this will be finished through steadily exposing the grafts to low humidity (decrease than RH in restoration chamber), high light intensity and temperature after 5th day of grafting up to the absolutely acclimatized to the ambient environment.

Humidity (%), Light intensity (Lux), Temprature (ºC)

Denna (1962) reported that, to increase humidity, reduce light intensity and promote the healing process in grafted seedlings, for 5–7 days after grafting. Grafts were covered with black plastic sheet or 0.01 mm black polyethylene film.

Nobuoka *et al.,* (1996) reported that, high humidity and low light, which is slightly higher than the light compensation point, prevent wilting of tomato grafts and promote healing of the cut surfaces of grafts.

De Ruiter (2006) reported that, for healing of grafted tomato the optimal temperature range should be 21 to 22°C with a maximum temperature range of 28 to 29°C.

Lee (2007) studied that, under suboptimal temperature and low relative humidity, callusing and healing at the graft union take more time, resulting decreases grafting success rate. Success of graft union increases where relative humidity was 95 % or higher and 25ºC- 30ºC temperature, which protect the wounded tissues from desiccation.

Oda (2007) observed that, for tomato and cucurbit plants the optimum temperature range required for healing the grafts should be 28 to 30°C and relative humidity should be 85%-100%.

Davis *et al.,* (2008) reported that, for both tomato and cucurbit grafts. the healing condition should be maintained between 85 % and 100 % RH.

Hassell *et al.,* (2008) revealed that, temperature required for healing of the cucurbit grafts was 28 to 30 ^{0}C temperature.

Kumar *et al.,* (2015) studied that, for healing of vegetable graft temperature range of 25-30 ºC, RH of 85-90 % and low light intensity inside healing chamber was required.

Bie *et al.,* (2017) observed that, in hole insertion grafting, splice grafting, cleft grafting and pin grafting methods in vegetable crops first 48 hrs very high humidity (95 %) is required and 27–28°C temperature should be maintained.

Kumar *et al.,* (2017) observed that, for graft union formation the grafted vegetables should be maintained in healing chamber having 25^{0}C temperature and 100 % relative humidity for 3 days after grafting. Bantis *et al.,* (2019) reported that, 7 days required for grafting, healing and acclimatization of grafted watermelon seedlings in a healing chamber for first 4 days after grafting relative humidity (98 %), for 5th day (93 %), and for 6th and 7th day (89 %) was required,, After 7 days in the healing chamber the grafted seedlings were transfer into a glass greenhouse 60 ± 10 µmol m^{-2} s $^{-1}$ PPFD emitted by HPS lamps for an 18 hrs photoperiod) and temperature 25 ºC, recirculating air. After 7 days in the healing chamber the grafted seedlings were shifted in a glass greenhouse with minimum night temperature of 21.5 ºC.

Maurya *et al.,* (2019) recorded that, for 5–7 days the healing chamber environment should be maintained at temperature range 28-29^{0}C with 95 % relative humidity in partially shaded place to promotes callus formation at union in vegetable grafting.

Nagma Surve (2019) reported that, to ensure high grafting success in brinjal grafts in the mist chambers, for five to six days relative humidity should be maintained of 85-95 % to allow the graft union to heal, then acclimatization started by increasing light gradually automatically relative humidity was decreased.

Tirupathamma *et al.,* (2019) reported that the light intensity can be increased or decreased by different degrees of shading and for acclimatization treatment takes 7-10 days and in chamber the temperature should be 25-30°C, RH should be minimum 85 % and suitable low light intensity (3–5 Klux).

Pardo-Alonso *et al.,* (2020) recorded that, for starting days the relative humidity (RH) was between 95 % and 75 %. It was then gradually reduced as acclimatization in splice grafting started.

Uttekar (2021) recorded that in shade net mean humidity of 94 % was recorded in 1-3 DAG then gradually decreases. In C_2 - 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. Tupe (2021) recorded that in shade net mean humidity of 93 % was recorded in 1-3 DAG then gradually decreases. In C_2 - Shade net light intensity was higher and ranges 1.33 to 42.33 lux at 7:30 am from 7-10 DAG to 19-21 DAG, 11.67to 95.33 lux at 2:30 pm from 7-10 DAG to 19-21 DAG and 2.67 to 55.00 lux at 6:00 pm from 7-10 DAG to 19-21 DAG.

Growth observations

Number of days required for graft union, survival rate of grafts, girth at graft union, girth of rootstock and girth of scion, number of days required for development of new leaves and number of leaves was reviewed here.

Number of days required for graft union

Onduso (2014) reported that, in tomato grafts took 5 days for healing and relative humidity 80 % ensured high graft success.

Tejaswini Rathod (2017) recorded that, in brinjal grafts take 4-5 days for graft healing and graft success was about 85 to 87 %. At 90 DAT highest number of leaves (371.00) recorded in 'Lalitha' as compared to other treatments followed by grafted brinjal 'Mahyco-9' (341.80). Whereas, in self-rooted 'Sharpova' recorded lowest number of leaves (206.13).

Nagma Surve (2019) reported that, in brinjal 20 days old scion and rootstock less number of days required for healing (7.60) whereas,when 30 days old scion grafted on 25 days old rootstock maximum days required for healing (8.20). In 25 days old scion grafted on 25 days old rootstock highest grafting success (77.33 %) at 20thday after grafting was observed. While, in 30 days old scion grafted on 30 days old rootstock lowest grafting success (72.67 %) was observed. One month after grafting in 20 days old scion grafted on 20 days old rootstock and highest lowest girth at graft union (2.76 mm) was recorded and highest (4.14 mm) in 30 days old scion grafted on 30 days old rootstock. Lowest girth at collar region (1.81 mm) in 25 days old scion grafted on 20 days old rootstock and highest (3.57 mm) in 25 days old scion grafted on 30 days old rootstock. In brinjal maximum number of leaves (9)in Control (Seedlings) and minimum (5.47) in 20 days old scion grafted on 20 days old rootstock.

Rayker (2020) revealed that, in brinjal 25 days old scion was grafted on 70 days old rootstockless number of days (8.07) was required for graft union while, 25 days old scion was grafted on 25 days old rootstock required highest number of days (8.53) for graft union. Maximum success rate at 8th day after grafting (97.93 %) when 30 days Konkan prabha rootstock + 25 days Bandhtiware local scion and mimimum (92.67 %) where 60 days *Solanum torvum* rootstock + 25 days Bandhtiware local scion and 30 days Konkan prabha rootstock + 25 days Manjiri scion. Maximum girth at graft union and girth below graft union was recorded in 25 days Bandhtiware local scion grafted on70 days *Solanum torvum* rootstock 2.51 mm and 2.10 mm respectively while, lowest in 25 days Manjiri scion grafted on 25 days Konkan prabha rootstock 1.74 mm an 1.43 mm at 31 DAG in brinjal respectively. Maximum number of leaves (5.93) was recorded in + 25 days Bandhtiware local scion grafted on70 days *Solanum torvum* rootstock and minimum (3.13) in seedling of Manjiri in brinjal.

Uttekar (2021) reported that, significantly minimum days (6.07 days) required for graft union in C_2 - Shade net and maximum (7.49 days) in C_1 - Polycarbonated polyhouse.

Tupe (2021) reported that, significantly minimum days (7.03 days) required for graft union in C_2 - Shade net and maximum (8.23 days) in C_1 - Polycarbonated polyhouse.

Survival rate of grafts

Bletsos *et al.,* (2003) reported that, in 1998 the percentage of graft success of cv. Tsakoniki on *Solanum torvum* was 84.4 % and and in 1999

success was 80.8 %, while on S. *sisymbrifolium* graft success was 77.2 % and 74.8 % in brinjal.

Yetisir and Sari (2003) recorded that, Lagenaria type rootstocks gives maximum survival rate (95 %) and cucurbita type rootstocks gives minimum survival rate (65 %) in cucurbits. recorded highest average number of leaves per plant (287) was recorded when watermelon cultivar 'Crimson Tide' was grafted on rootstock 'Gold Tosa' (GT) whereas, the lowest number of leaves (109) was recorded in control at 50 days after transplanting.

Nina and Joze (2004) observed that, by using the cleft grafting method in tomato transplants grafted on 'Beaufort' and 'PG 3' rootstocks the survival rate was 100 % with cv. 'Monroe' and 92 to 93 % with cv. 'Belle' whereas, with the tube grafting method, the survival rate was 79 to 92 % with cv. 'Monroe' and 88 % with cv. 'Belle'.

Gisbert *et al.,* (2011) revealed that, graft success were recorded in self-grafted cv. 'Black Beauty','Black Beauty' on *S. torvum* was 98 %, Black Beauty on *S. macrocarpum* was 100 %, 'Black Beauty' on *Solanum incanum* × *S. melongena* was 90 % and 'Black Beauty' on *S. melongena* × *S. aethiopicum* was 100 %.

Johnson and Miles (2011) recorded that, mean survival of eggplant, tomato, and watermelon was significantly different and did not change for each crop from day 6 to day 14; tomato had the highest survival (98%), eggplant was intermediate (80%), and watermelon had the lowest survival (7%).

Hsiu-fung and Yung- fu (2013) reported that, in cucumber cv. Tainan No. 1 was grafted by approach grafting onto *Cucumis* rootstock then Survival rate was 80 % and Tainan No. 1 was grafted by approach grafting onto *Cucurbita* Survival rate was 78 %.

Nkansanh *et al.,* (2013) recorded that, the tropimech tomato cultivar grafted on green eggplant cultivar recorded 96.07 % graft success. Bizhen *et al.,* (2014) reported that, graft survival increased by 92 % in all eighteen tomato commercial rootstocks and five scion varieties with a study wide average of 97 %.

Kumar *et al.,* (2017) studied that, in brinjal when (T_1) *Solanum torvum* was used as rootstock and Pusa hybrid used as a scion then grafts gave maximum survival percent (67.35 %) and recorded maximum number of leaves in treatment T_1.While, minimum plant height was observed in control (seedlings).

Rida Draie (2017) recorded that, cleft grafting method was superior with 95 % survival rate. While hole grafting method gave (90 %) survival rate and tube grafting method gave the lowest (85 %) survival rate.

Sudaria *et al.,* (2017) reported that, T1 (Individual acclimatization without humidifier) was comparable with T2 (Individual acclimatization with humidifier) in terms of percentage graftake. However, T2 was higher in terms of percentage survival with 84.3% than with T1 (74.4 %).

Darli *et al.,* (2018) stated that, in tomato grafted on eggplant gave highest grafting survival rate (92.7 %).

Kumar *et al.,* (2019) investigated that, when grafted eggplant cv. 'SuratiRavaiya Pink' grafted on *Solanum torvum* gave96.67% survival percentage and 'SuratiRavaiya Purple' grafted on *Solanum torvum* was gave 97.73 %.

Priyanka *et al.,* (2019) stated that, the tomato cv. PKM 1 was grafted on different solanaceous rootstocks. When PKM 1 was grafted on *Solanum torvum* highest graft success (95 %) was observed.

Rana *et al.,* (2019) observed that, cucumber cultivar Kalaam F_1 grafted onto bottle gourd by splice grafting gave the highest survival (96 %).

Uttekar (2021) reported that, in chilli maximum survival rate was recorded in treatment C_2 - Shade

net at 21th DAG (59.12 %) whereas, minimum was recorded in treatment C_1 - Polycarbonated polyhouse (36.01 %).

Tupe (2021) reported that, in brinjal maximum survival rate was recorded in treatment C_2 - Shade net at 21th DAG (61.11 %) whereas, minimum was recorded in treatment C_1 - Polycarbonated polyhouse (26.77 %).

Girth at graft union, girth of rootstock and girth of scion

Ioannou (2001) stated that, grafted plants had a larger central stem diameter in eggplant and more vigorous than self-rooted ones.

Leonardi and Giuffrida (2006) recorded that, stem diameter of the eggplant grafted onto different tomato rootstocks was equal to larger than that of self-grafted eggplants**.**

Uttekar (2021) reported that, in chilli maximum girth at graft union was recorded in C_2 - Shade net (2.52 mm) whereas, minimum was recorded in C_1 - Polycarbonated polyhouse at 21th DAG (2.33 mm).

Tupe (2021) reported that, in brinjal maximum girth at graft union was recorded in C_2 - Shade net (2.00 mm) whereas, minimum was recorded in C_1 - Polycarbonated polyhouse at 21th DAG (1.93 mm).

Number of days required for development of new leaves and number of leaves

Petropoulos *et al.*, (2014) reported that, the highest leaf number was recorded when "Sugar Baby" grafted onto "Rootstock Molina" (*Lagenaria. siceraria* f. clavata) 34 days after grafting at 8°C and 16°C was 4.5 and 5.6 in first year whereas, onto "Rootstock 841 F_1" number of leaves was recorded about 7.1 and 6.3, respectively in second year. Further the lowest leaf number was observed under control 4.8 and 5.6 in first year whereas, 6.0 and 5.8 in second year at respective temperatures in watermelon.

Sabatino *et al.*, (2016) recorded that, in brinjal 'ecotype B_4' grafted on '*Solanum torvum* Swartz' the highest number of leaves (53 leaves) was observed while, the lowest number of leaves (29.4 leaves).was observed in non-grafted 'B_2 ecotype'.

Uttekar (2021) stated that, in chilli minimum number of days required for the development of new leaves (8.08 days) in C_2 - Shade net and maximum (9.42 days) in C_1 - Polycarbonated polyhouse. And maximum number of the leaves on graft was recorded in C_2 - Shade net (4.98) at 21th DAG whereas minimum in C_1 - Polycarbonated polyhouse (4.71).

Tupe (2021) reported that, in brinjal minimum number of days required for the development of new leaves (7.87 days) in C_2 - Shade net and maximum (9.63 days) in C_1 - Polycarbonated polyhouse. And maximum number of the leaves on graft was recorded in C_2 - Shade net (4.60) at 21th DAG whereas minimum in C_1 - Polycarbonated polyhouse (4.30).

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