Journal of Pharmacognosy and Phytochemistry
Available online at www.phytojournal.com

E-ISSN: 2278-4136
P-ISSN: 2349-8234
www.phytojournal.com
JPP 2021; 10(2): 1432-1436
Received: 04-01-2021
Accepted: 06-02-2021

Pooja K
Department of Fruit Science, College of Horticulture, Dr. YS Parmar University of Horticulture and Forestry, Nauni, Himachal Pradesh, India

Neena C
Department of Fruit Science, College of Horticulture, Dr. YS Parmar University of Horticulture and Forestry, Nauni, Himachal Pradesh, India

Sajan S
Department of Fruit Science, College of Horticulture, Dr. YS Parmar University of Horticulture and Forestry, Nauni, Himachal Pradesh, India

Corresponding Author:
Pooja K
Department of Fruit Science, College of Horticulture, Dr. YS Parmar University of Horticulture and Forestry, Nauni, Himachal Pradesh, India

Effect of different methods and time of budding on sweet cherry (*Prunus avium* L.) nursery plants

Pooja K, Neena C and Sajan S

Abstract
The aim of this study was to determine the best time and methods for commercial sweet cherry propagation. The study consisted of four budding methods *viz,* chip budding, shield budding, annular budding and patch budding as main plot treatments and nine budding dates *viz,* 15th May, 30th May, 14th June, 29th June, 14th July, 29th July, 13th August, 28th August and 12th September as sub plot treatments. The results showed that, of the four methods of budding, chip budding had the highest success rate in terms of bud-take (52.21%). Among different dates of budding, plants budded on 30th May recorded maximum bud-take success (68.99%) and values recorded for growth parameters like scion girth (7.52 mm), number of leaves (53.16) and leaf area (23.37 cm^2) during 15th may and 30th May were also appreciable. Based on budding performance chip budding performed between the 15th and the 30th of May thus be recommended for cherry propagation.

Keywords: budding, cherry, propagation

Introduction
Sweet cherry (*Prunus avium* L.), belongs to the family Rosaceae is cultivated commercially in more than forty countries of the world, in the temperate Mediterranean and subtropical regions (Webster, 1996) [9]. It is one of the world's most valuable temperate fruit crop. Cherry is gaining popularity in temperate regions of the world due to its importance. Cherries requires an altitude of about 1600 to 2700 m above mean sea level with 1000 to 1500 hours of the chilling period during winters (Webster, 1996) [9]. In India, its cultivation is bound to Jammu and Kashmir, Himachal Pradesh and Uttarakhand.

Cherry cultivars in the characteristics of their fruits are generally heterozygous and trees raised from seed often show little similarity with the parent trees. Consequently, if selected cherry scion cultivars are to be reproduced true to type, propagation must be by some vegetative methods. All the major growing cultivars of sweet cherry are either budded or grafted for propagation purposes. The major aim of all field grafts is to join rootstock and scion together, in an effective and long-lasting union for successful propagation. The time of season will largely govern which type of propagation techniques used to create a new plant (Yazdani *et al.*, 2016) [10].

The tongue grafting process was once the only way to propagate cherries, but it is no longer used. However, the major draw-back of tongue grafting is that it cannot be performed on the recently transplanted rootstock as its roots will not get established as the time gap between transplanting and tongue grafting is very short. Now a day, budding is preferred over grafting as it is easier and quicker to perform. The most appropriate time for budding is when cambial growth is active and sap flows are favourable and budding can easily be done during the same year thus help in advancing the planting stock maturity in one year. Chip budding differs from the other budding because it can be done when the bark of the rootstock is not slipping so, an extension of the budding season is potentially possible by the use of this budding method. The flexibility of timing is one of the major advantage of chip budding. Summer chip budding is now preferred to shield budding, as it leads to the better and quicker formation of the union, thereby minimizing the risk of cold damage (Webster, 1996) [9]. Similarly, annular budding has been found to give highly promising results in propagation of fruits like apricot (Mir *et al.*, 1992) [4] and walnut (Ananda and Bans, 1992) [1]. The success rate of various propagation methods has been observed to vary not only from year to year, but also from one place to another. Therefore, there is an urgent need to standardize the propagation technique for cherry, which could be adopted by the nurserymen for large scale multiplication of nursery plants of superior cultivars.

Materials and Method

The present experiment was carried out at Regional Horticultural Research and Training Station Mashobra, Dr. Yashwant Singh Parmar University of Horticulture and Forestry, Nauni, Solan (Himachal Pradesh), during the year 2018-19. With an average rainfall of 1515 mm, the experimental area is located in a typical temperate zone. The planting material consisted of Durone Nero-2 cultivar of sweet cherry as a scion and colt as a rootstock. The experiment was laid out in split plot design with four replications having 15 numbers of grafts per replication. Four methods of budding *viz.* chip budding, shield budding, annular budding and patch budding were tried on nine different dates - 15th May, 30th May, 14th June, 29th June, 14th July, 29th July, 13th August, 28th August and 12th September to find out the most suitable method and time for budding. In case of summer budding (15th May- 13th August) observations were recorded at the end of growing season and in the case of autumn budding (28th August and 12th September), the data was recorded during the next growing season.

The five budded plants were observed for recording the data on various parameters, *viz.* bud-take success which was measured by calculating percentage of the survival of plants after two months of budding, number and length of feathers were recorded by counting the total number of feathers per plant and their length was taken from the base to the tip and expressed as average length of feathers per plant in centimeters. The data on the number and length of internodes were recorded during the month of November. The number of internodes was calculated by counting the nodes borne on the scion part of the budded plants and internodal length was calculated by dividing the scion length with the number of internodes and was expressed in centimeters. All the cultural practices like manuring, weeding and irrigation were carried out uniformly.

Results and discussion

Bud-take success

It is evident from the data that bud-take success was influenced significantly by different methods, times of budding as well as their interaction (Table 1). Chip budding method showed the highest percentage of bud-take success (52.21%) which was closely followed by shield budding (51.71%). Whereas, patch budding recorded the lowest bud-take success (45.74%) which was statistically at par with annular budding (46.53%) but significantly lower than chip and patch budding.

Among different dates, the highest percentage of success was obtained when budding was performed on 30th of May (68.99%). Whereas, the lowest percentage (19.80%) of bud-take success was obtained with the plants budded on 12th September. The interaction resulted that the highest bud-take success (73.87%) was obtained with chip budding performed on 30th of May which was at statistically par with shield budding performed on same date. Whereas, the lowest bud-take success (16.49%) was obtained with annular budding performed on 12th September which was at statistically at par with patch budding performed on same date.

In the present study, chip budding method registered the highest bud-take success, this may be due to the fact that in chip budding there is less necrotic tissue in blanking between rootstock and scion so better cambial continuity and vascular integration occurred. These results are in conformity with those of Rayya *et al.* (2009) [6], who reported the highest percentage of success (89.39%) with chip budding in almond *cv.* Neplus Ultra. The results are also in accordance with Yordanov and Tabakov (2009) [11], who noted the highest bud-take success (98.20%) with chip budding in persimmon. Jatinder *et al.* (2006) [2] also found that among the four methods of summer budding, chip budding was found to be highly superior to other methods and gave 92 per cent bud-take success in May. The reason for success of chip budding is the production of great volume of callus around the bud union (Vatankhah *et al*. 2015) [8]. Similarly, Anjana (2000) [3] recorded higher bud-take success (52.70%) with chip budding method performed in apricot in the month of May. The higher bud-take success during the months of May and June might be due to the presence of cell sap in rootstock and scion which is important for the union between stock and scion. The low success rate of bud-take in September budded plants may be due to the tendency of budded plants towards dormancy.

Radial growth of scion

The perusal of data presented in (Table 2) indicates that the radial growth of scion was significantly influenced by different methods of budding which varied from 6.87 mm to 8.17 mm. The shield budded plants had maximum radial growth of scion (8.17 mm) which was significantly higher than all other methods of budding whereas, annular budding had minimum radial growth of scion (6.87 mm) which was followed by patch budding but was significantly lower than all other methods of budding.

The time of budding also showed a significant effect on radial growth of scion. The highest radial growth (9.74 mm) was obtained when plants were budded on 12th September which was significantly higher than all other dates of budding. The minimum (5.89 mm) was recorded on 14th July which was followed by 29th July (6.10 mm) and 29th June (6.28 mm) but was significantly lower than all other budding dates.

Interaction between methods and dates of budding was also found to be statistically significant. The maximum radial growth (10.22 mm) was recorded with shield budding performed on 12th September which was statistically at par with chip budding performed on same date whereas, the minimum (5.29 mm) was obtained with annular budding on 14th July which was closely followed by annular budding performed on 29th of June and 29th July and statistically at par with each other.

The present study indicates that maximum scion girth was recorded in shield budding during September. This may be attributed to the longer duration of the growing period, as September budded plants sprouted in the month of March and has got full season for growth. These results are in resemblance to the findings of Anjana (2000) [3] who observed maximum radial growth of scion (6.18 mm) with shield budding in apricot. Similarly, Rayya *et al.* (2009) [6] reported the highest significant diameter of scion (0.98 and 0.74 cm) in almond in the month of September. Shah *et al.* (2017) [7] also reported maximum scion girth (5.30 mm) with T- budding method in peach.

Number of feathers

It is self explanatory from the data presented in (Table 3) that the maximum number of feathers (2.42) was recorded with chip budding and minimum number of feathers (1.51) was obtained with annular budding which was statistically at par with patch budding method. The plants budded on 12th September had the maximum number of feathers (2.82) which was significantly higher than all other budding dates. The intermediate number of feathers was recorded in plants budded on 15th May, 30th May and 14th June. The minimum number of feathers (1.21) was recorded with plants budded on 29th July which was closely followed by plants budded on 14th July. Interaction between methods and dates of budding were also found to be statistically significant. The maximum number of feathers (3.22) was obtained with chip budded plants done on 12th September which was statistically at par with same method on 28th August and shield budding performed on same date. The minimum number of feathers (0.90) was obtained with annular budded plants on 29th July which was statistically at par with annular budding done on 14th July, 29th and 14th June, 15th and 30th May and patch budding performed on 14th and 29th of July.

The results are similar to the earlier findings of Vatankhah *et al.* (2015) [8] who also obtained the highest number of feathers by employing chip budding in sour cherry. Rayya *et al.* (2009) [6]also reported significantly highest number of lateral shoots per plant with chip budding method in Neplus Ultra almond Yordanov and Tabakov (2009) [11] also obtained the maximum number of lateral shoots (2.25) in persimmon with chip budding method in month of August.

Length of feathers

It can be drawn from (Table 3) that the maximum length of feathers (8.17 cm) was recorded with chip budding method which was significantly higher than all other methods of budding. The minimum length of feathers was obtained with annular budding (6.38 cm) which was statistically at par with patch budding method (6.44 cm).

Similarly, the dates of budding also exhibited a significant effect on length of feathers. Among different dates, highest length of feathers (10.65 cm) was obtained with plants budded on 12th September which was statistically at par with those budded on 28th and 13th August and significantly higher than all other dates of budding. The lowest length (4.38 cm) was recorded with plants budded on 29th July which was significantly lower than all other dates of budding.

The interaction between methods and time of budding exerted a significant effect on length of feathers. The maximum length of feathers (11.22 cm) was attained with chip budding method performed on 12th September which was statistically at par with same method performed on 28th and 13th August, shield budding done on 13th, 28th August, 12th September and annular budding on 12th September. The minimum length of feathers (3.21 cm) was recorded with annular budding performed on 29th July which was statistically at par with same method performed on 14th July.

In respect of the length of laterals these results are in conformity with Kamalsheel (1995) [5] who observed that chip budding recorded the maximum number and length of laterals in apple, almond and plum. Nevertheless, the dates of propagation exerted a significant effect on length of feathers and plants budded on 12th September attained the maximum length of feathers. The greater length of feathers in September budded plants may be due to the reason that the budded plants do not sprout during the same year but sprout during the following spring and make total growth than early budded plants.

Number of Internodes

The perusal of data presented in the (Table 4) reveals that the highest number of internodes (12.40) was recorded with chip budding. Whereas, the minimum (11.07) was found with patch budding which was significantly lower than all other methods of budding. The time of budding also showed a significant effect on the number of internodes. However, the maximum number of internodes (13.24) were obtained with plants budded on 12th September which was significantly higher than all other dates of budding. The minimum number of internodes (9.22) was obtained with plants budded on 29th July which was significantly lower than all other dates of budding.

Interaction between methods and dates of budding was also found to be statistically significant. Maximum number of internodes (14.10) was obtained from chip budding method performed on 12th September which was statistically at par with same method performed on 28th August, whereas, minimum number of internodes (8.94) was obtained with patch budding method performed on 29th July which was statistically at par with shield budding performed on same date.

Length of Internodes

The examination of data presented in (Table 4) shows that different methods of budding exhibited a significant effect on the length of internodes of budded plants. The maximum internodal length (4.00 cm) was attained with chip budding and the minimum length (3.49 cm) was obtained with patch budding which was statistically at par with annular budding method and significantly lower than all other methods of budding.

Among different dates budding performed on 12th September showed significantly maximum (4.71 cm) intermodal length and the minimum length (2.55 cm) was obtained with plants budded done on 29th of July which was significantly lower than all other dates of budding. The interaction between methods and dates of budding also exerted a significant effect on internodal length. Maximum length (4.89 cm) was obtained with shield budding performed on 12th September which was statistically at par same method done on 28th August and with chip budding performed on 12th September, 13th and 28th August and the minimum (2.14 cm) was obtained with patch budding on 29th July.

The number and length of internodes were closely related to the total linear growth it appears that the effects of propagation methods on the number and length of internodes might also be mediated through their effects on the linear growth of budded plants. Since, the highest linear growth was recorded with chip budding method in present studies so the number and length of internodes were also highest in this method.

Table 1: Effect of methods and time of budding on per cent bud-take success (%)

Time\ Methods	15-May	30-May	14-June	29-June	14-July	29-July	13-August	28-August	12-September	Mean
Chip Budding	67.84 (55.53)	73.87 (59.27)	68.54 (55.92)	57.75 (49.44)	52.78 (46.57)	54.43 (47.52)	43.90 (41.48)	28.29 (32.12)	22.51 (28.31)	52.21 (46.24)
Shield budding	64.06 (53.44)	73.19 58.84)	67.22 (55.33)	60.30 (50.95)	56.40 (48.66)	54.44 (47.53)	40.58 (39.55)	25.89 (30.57)	23.30 (28.85)	51.71 (45.97)
Annular budding	56.97 (49.00)	66.04 (54.35)	64.03 (53.19)	67.98 (55.55)	46.43 (42.93)	45.80 (42.57)	31.05 (33.85)	24.02 (29.33)	16.49 (23.93)	46.53 (42.74)

Patch budding	61.93 (51.99)	62.85 (52.45)	58.48 (49.96)	61.23 (51.54)	48.48 (44.11)	47.10 (43.32)	31.05 (33.85)	23.69 (29.11)	16.90 (24.26)	45.74 (42.29)
Mean	62.70 (52.49)	68.99 (56.23)	64.57 (53.60)	61.81 (51.87)	51.02 (45.57)	50.44 (45.23)	36.64 (37.18)	25.47 (30.28)	19.80 (26.34)	
Methods of budding				1.64						
Time of budding				2.14						
Interaction (time x methods)				4.36						

Table 2: Effect of methods and time of budding on radial growth of scion (mm)

Time\Methods	15-May	30-May	14-June	29-June	14-July	29-July	13-August	28-August	12-September	Mean
Chip Budding	8.00	7.59	6.94	6.39	5.93	6.21	9.34	9.69	9.94	7.78
Shield budding	8.08	7.85	7.16	7.28	6.76	6.97	9.51	9.74	10.22	8.17
Annular budding	6.91	6.58	5.59	5.52	5.29	5.47	8.43	8.90	9.13	6.87
Patch budding	7.11	6.72	6.06	5.93	5.59	5.78	8.74	9.21	9.68	7.20
Mean	7.52	7.18	6.44	6.28	5.89	6.10	9.01	9.38	9.74	
Methods of budding				0.10						
Time of budding				0.13						
Interaction (time x methods)				0.27						

Table 3: Effect of time and methods of budding on number and length of feathers (cm)

Time\Methods	Number of feathers					Length of feathers (cm)				
	Chip budding	**Shield budding**	**Annular budding**	**Patch budding**	**Mean**	**Chip Budding**	**Shield budding**	**Annular budding**	**Patch budding**	**Mean**
15-May	2.7	2.2	1.1	1.35	1.84	7.4	7.31	5.31	5.63	6.41
30-May	2.55	2.05	1	1.25	1.71	7.57	7.03	4.92	4.83	6.09
14-June	2.48	1.85	1	1.2	1.63	7	6.7	4.64	5.05	5.84
29-June	2.1	1.55	1	1.25	1.48	6.8	6.48	4.5	4.29	5.52
14-July	1.6	1.2	0.95	1.15	1.23	6.43	5.83	4.41	3.96	5.16
29-July	1.35	1.45	0.9	1.15	1.21	5.56	4.7	4.06	3.21	4.38
13-August	2.78	2.63	2.5	2.19	2.52	10.72	10.64	9.74	10.34	10.36
28-August	2.972	2.83	2.54	1.32	2.66	10.88	10.44	9.83	10.19	10.33
12-September	3.22	2.94	2.64	2.47	2.82	11.22	10.93	10.03	10.43	10.65
Mean	2.42	2.08	1.51	1.59		8.17	6.38	6.38	6.44	
C.D.	Methods of budding = 0.12, Time of budding = 0.13, Interaction (Time x Method) = 2.27					Methods of budding = 0.22, Time of budding = 0.39, Interaction (Time x Method) = 0.80 (Data in parenthesis are angular transformed values)				

Table 4: Effect of time and methods of budding on number and length of internodes (cm):

Time\Methods	Number of internodes					Length of internodes (cm)				
	Chip budding	**Shield budding**	**Annular budding**	**Patch budding**	**Mean**	**Chip Budding**	**Shield budding**	**Annular budding**	**Patch budding**	**Mean**
15-May	12.83	12.23	11.49	11.23	11.94	4.17	4.08	3.9	3.6	3.94
30-May	12.31	11.94	11.44	11.07	11.69	4.03	3.96	3.72	3.57	3.82
14-June	13.05	12.85	12	11.49	12.34	4.18	4.18	4.08	3.89	4.08
29-June	11.67	11.52	10.96	10.37	11.13	3.5	3.24	3.32	3.08	3.29
14-July	10.39	10.08	9.62	9.61	9.92	2.99	2.63	2.61	2.72	2.74
29-July	9.59	9	9.34	8.94	9.22	2.84	2.77	2.45	2.14	2.55
13-August	13.79	12.78	12.26	11.91	12.68	4.71	4.56	4.07	3.8	4.28
28-August	13.92	12.91	12.6	12.26	12.92	4.68	4.77	4.37	4.13	4.49
12-September	14.1	13.24	12.89	12.74	13.24	4.87	4.89	4.58	4.52	4.71
Mean	12.4	11.84	11.4	11.07		4	3.9	3.68	3.49	
C.D.	Methods of budding = 0.11, Time of budding = 0.14, Interaction (Time x Method) = 0.30					Methods of budding = 0.80, Time of budding = 0.12 Interaction (Time x Method) = 0.24 (Data in parenthesis are angular transformed values)				

Conclusion

The current research indicates that by considering the potential for budding success, chip budding performed during 15th May and 30th May can be recommended for commercial propagation of sweet cherry.

References

1. Ananda SA, Bans VP. Comparative performance of different methods of budding in walnut propagation. In: Emerging trends in Temperate Fruit Production in *India* (Krishan LC, Uppal DK, Awasthi RP and Ananda SA eds). NHB Technological Communication, Gurgaon 1992, 98-101.
2. Anjana C. Effect of time and methods of grafting and budding in apricot (*Prunus armeniaca* L.). M.Sc. Thesis. Department of Fruit Science. Dr YS Parmar University of Horticulture and Forestry, Solan 2000, 91.
3. Jatinder SC, Gautam DR, Naveen CS. Chip budding: an excellent method of propagation of walnut (*Juglans regia* L.). Acta Horticulturae 2006;705:335-39.
4. Mir NS, Dar MA, Sofi AA. Study on vegetative propagation of apricot (*Prunus armeniaca*) under the cold arid conditions of Ladakh region I-Budding. In: Emerging trends in temperate fruit production in India. (Chadha KL, Uppal DK, Awasthi RP and Ananda SA eds). NHB Technological Communication, Gurgaon 1992, 102-05**.**
5. Kamal Sheel N. Evaluation of chip budding in temperate fruit plant propagation. M.Sc. Thesis. Department of

Fruit Science. Dr YS Parmar University of Horticulture and Forestry, Solan 1995, 92p.

6. Abou R, MS, Kasim E, Shaheen MA, Yehia TA, Ali EL. Morphological and anatomical evaluation of different budding and grafting methods and times of neplus ultra almond cultivar. Journal of Applied Sciences Research 2009;5(3):253-62.
7. Shah RA, Sharma A, Wali VK, Bakshi P, Kumar R, Gupta R. Response of budding methods and time on bud success and budding growth of peach (*Prunus persica*) on different rootstocks. Indian Journal of Agricultural Sciences 2017;87:669-76.
8. Maryam V, Mehrdad J, Majid S. Effect of time, method of budding and type `of scion on bud take of sour cherry scions onto Mahaleb rootstocks. International Journal of Agronomy and Agricultural Research 2015;6(4):233-39.
9. Webster AD. Propagation of sweet and sour cherries. In: Cherries: Crop Physiology, Production and Uses (Webster AD and Looney NE eds). CAB International, England 1996, 193-95.
10. Yazdani Z, Mehrdad J, Shams Majid S. Effect of scion source, budding method and graft union height on sweet cherry budding compatibility on mahaleb rootstock. Trends in Horticultural Research 2016;6(2):1-4.
11. Yordanov AI, Tabakov SG. Comparision of different methods of propagation of persimmon trees. Acta Horticulturae 2009;833(6):187-92.