Madras Agric. J., 100 (4-6): 310-313, June 2013
https://doi.org/10.29321/MAJ.10.001297

Standardization of Time and Method of Budding of Peach (cv. Shan-e- Punjab) on Different Rootstocks

Shah, Rafiq Ahmad, Sharma Arti*, V.K. Wali. and S. Hussain
Sher-e-Kashmir University of Agricultural Sciences and Technology Jammu,
Fruit Plant Nursery, Udheywalla, Jammu & Kashmir

Peach cv. Shan-e-Punjab was budded on seedling rootstocks of peach, plum and apricot by T, inverted T and Patch budding from 15th June to 1st August at 15 days interval. Inverted 'T' budding took minimum days for full sprouting in plum and apricot rootstock whereas; in peach T budding took minimum number of days for the same. Maximum number of days to full sprouting were taken by patch budded plants. Among different dates, plants budded on 15th July took minimum number of days to full sprouting, while budding on 1st July gave maximum bud take success. Inverted T budded plants recorded maximum scion length and girth after 120 days of budding at all the dates except on 15th June and was followed by 'T' budding.

Key words: Peach, budding, scion length, scion girth, sprouting, bud take.

Peach the "queen" of temperate fruits ranks second to the apple among deciduous tree fruits in production and value. In India peach cultivation is confined to mid hills zones of Himalayas extending from J&K to Khasi hills at an altitude of 1500-2000 above MSL. With the introduction of low chilling cultivars in Jammu region made the cultivation area under stone fruits has increased considerably. In Jammu region peach (*Prunus persica* (L.) is cultivated in an area of 1810.85 ha with a production of 1922.56 MT (Anonymous, 2011). In Jammu region peach is propagated mainly by tongue or cleft grafting during Jan. - Feb. In Jammu subtropics, stone seeds for raising rootstocks are collected during June-July and sown in winter season which germinate in April -May and the seedlings become graftable by next winter. These grafted seedlings are ready for sale by next six months. As the stone seedlings are not planted in active growth stage to avoid transplanting shock, so the grafted seedlings are kept in the nursery for another six months till they become dormant and are sold bare rooted in the winter months. Therefore, the total nursery period for getting a saleable stone fruit plant is approximately two years. However, if these seeds are sown in the month of December after proper pre-sowing treatments their seedlings reach buddable size by July-August. These seedlings can be budded in July-August so that plants become saleable by December- January. Thus, the total nursery period for raising saleable stone fruit plants can be reduced to one year. Peach seeds are widely used for raising rootstock for peach, but due to its poor seed germination and non uniform seedling growth the nursery men are unable to get uniform sized budding stocks which offers a great handicap for its propagation and cultivation. However peach can also be budded or grafted on plum and apricot rootstocks which show comparatively high seed germination. But without standardization of method and time of propagation it is very difficult to get the highest success and good plant growth. Keeping in view all the above factors, the present studies were undertaken to standardize the time and method of budding of peach (cv. Shan-e-Punjab) on peach, plum and apricot rootstock

Materials and Methods

The present investigations were carried out at Fruit plant nursery, Division of Fruit Science, Faculty of Agriculture, Sher-e-Kashmir University of Agricultural Sciences and Technology of Jammu, Udheywalla Campus, during the year 2010-2011.The seedlings were raised from peach, plum and apricot seeds of local cultivar and were budded at the age of one year. Bud wood was collected from ten year old healthy, disease free peach trees of Shan-e-Punjab. Three methods of budding *viz.* T, Inverted -T and Patch budding were tried on four different dates (starting from 15thJune to 1st August) at 15 days interval to find out the most suitable method and time for budding of peach (cv. Shan-e-Punjab) on peach, plum and apricot rootstock. Ninety seedlings were selected for budding by each method on every date with 30 seedlings per replicate. The budded plants were observed for recording the data on various parameters *viz*., number of days taken to full sprouting, bud take success, linear and radial growth. The data on bud sprouting of individual plants were recorded on alternate days upto the completion of the sprouting

*Corresponding author email: drartisharma02@ gmail.com

and the number of days taken to full sprouting from the date of budding were calculated for every method and date. The data on bud take success of budded plants were recorded after the full sprouting of the buds and expressed in percentage of sprouted plants. The data on scion length and girth were recorded at 60, 75, 90, 105 and 120 DAB (Days after budding). Fifteen plants were selected randomly from each treatment. The linear shoot growth was measured with the help of scale, from the point of bud union to the tip of the main axis and was expressed as average per plant in centimetre (cm).

The scion girth (mm) was measured with the help of a digital vernier's calliper 1 cm above the bud union. The data generated during the investigations were subjected to statistical analysis as prescribed by Panse and Sukhatme (2000) under factorial randomized block design with three replications.

Results and Discussion

Minimum number of days taken to full sprouting (13.88, 14.66 and 14.21 days in peach, plum and apricot, respectively) were recorded when the budding was performed on 15th July which was at par with 1st July. Whereas irrespective of budding method maximum bud take success (93.33%, 86.66%, and 86.66% in peach, plum and apricot, respectively) was obtained in budding performed on 1st July which was at par with 15th July (Tables 1, 2). These results are in conformity with the results of Dwiviedi and Brahama (1999) they found that the maximum bud take (80%) and number of days taken for sprouting (14 days) on 15th July with shield method of budding in apricot. Similar results were obtained by Pathak *et al.* (1996) in July in Aonla.

Table 1. Effect budding method and time on full sprouting of peach, plum and apricot cv. Shan-e-Punjab on apricot seedling

Time of budding	Full sprouting (days) in peach				Full sprouting (days) in plum				Full sprouting (days) in apricot			
	Budding method				Budding method				Budding method			
	T	Inverted T	Patch	Mean	T	Inverted T	Patch	Mean	T	Inverted T	Patch	Mean
15th June	26.00	26.33	28.66	26.99	25.33	24.66	29.33	26.44	28.00	25.33	27.66	26.99
1st July	13.66	14.66	16.33	14.88	14.33	14.66	15.66	14.88	13.33	14.33	15.33	14.33
15th July	12.33	14.33	15.00	13.88	13.33	14.00	16.66	14.66	14.33	13.66	14.66	14.21
1st Aug	18.33	19.33	21.67	19.77	19.33	18.66	20.66	19.55	17.66	19.66	22.33	19.88
Mean	17.58	18.66	20.41		18.08	17.99	20.57		18.33	18.24	20.00	
Factors		C.D.(0.05)				C.D.(0.05)				C.D.(0.05)		
Method of budding		1.21				1.29				1.21		
Time of budding		1.39				1.50				1.39		
Method X Time		N.S				N.S				N.S		

Table 2. Effect of budding method and time on bud take success of peach cv. Shan-e-Punjab on peach, plum and apricot seedling

Time of budding	Full sprouting (days)				Bud take success (%)				Bud take success (%)			
	Budding method				Budding method				Budding method			
	T	Inverted T	Patch	Mean	T	Inverted T	Patch	Mean	T	Inverted T	Patch	Mean
15th June	60.00	80.00	80.00	73.33	70.00	80.00	70.00	73.33	70.00	70.00	80.00	73.33
1st July	100.00	90.00	90.00	93.33	90.00	90.00	80.00	86.66	80.00	90.00	90.00	86.66
15th July	90.00	80.00	90.00	86.66	90.00	70.00	80.00	80.00	80.00	80.00	80.00	80.00
1st Aug	80.00	70.00	70.00	73.33	60.00	70.00	60.00	63.33	60.00	70.00	70.00	66.66
Mean	82.50	80.00	82.50		77.50	77.50	72.50		72.50	77.50	80	
Factors		C.D.(0.05)				C.D.(0.05)				C.D.(0.05)		
Method of budding		N.S				N.S				N.S		
Time of budding		9.43				9.04				7.66		
Method X Time		N.S				N.S				N.S		

Among the different budding methods *viz*., T, inverted -T and Patch tried , the T and inverted T budding recorded maximum shoot length and girth after 120 DAB. The shoot length ranged from 36.73 cm to 41.76 cm in peach, 37.34 cm to 37.73 cm in plum and 30.43 cm to 32.83 cm in apricot. Shoot girth after 120 DAB in T and inverted T budding was 5.30 cm and 5.16 cm in peach, 4.85 cm and 4.98 cm in plum and 5.10 cm and 5.09 cm in apricot, respectively. These results are in accordance Dwivedi *et al*. (2000) in apricot, who reported better

Table 3. Effect of budding method and time on scion length (cm) of peach cv. Shan-e-Punjab (on peach seedling rootstock)

Time of budding	60DAB				75DAB				90DAB				105 DAB				120 DAB			
	Budding method			Mean	Budding method			Mean	Budding method			Mean	Budding method			Mean	Budding method			Mean
	T	InvertedT	Patch		T	InvertedT	Patch		T	InvertedT	Patch		T	InvertedT	Patch		T	InvertedT	Patch	
15thJune	27.39	25.38	17.06	23.27	29.43	28.55	19.86	25.94	32.16	30.12	22.89	28.39	34.66	32.98	26.42	31.35	38.93	34.62	31.82	35.12
1stJuly	28.05	32.87	25.27	28.73	31.95	36.05	29.24	32.41	33.72	40.95	33.21	35.96	38.34	44.25	36.43	39.67	48.47	58.42	40.82	49.23
15th July	18.38	19.34	16.75	18.15	22.72	24.38	19.41	22.17	26.08	26.48	22.11	24.89	28.92	30.71	26.08	28.57	31.58	41.01	32.58	35.05
1stAug	16.76	18.76	13.08	16.20	20.59	21.86	15.05	19.16	23.89	24.82	18.35	22.35	26.96	27.89	21.61	26.48	27.98	32.99	22.65	27.87
Mean	22.64	24.08	18.04		26.17	27.71	20.89		28.96	30.59	24.14		32.22	33.95	28.11		36.73	41.76	31.96	
DAB: Days after budding.																				
Factors		C.D.(0.05)				C.D.(0.05)				C.D.(0.05)				C.D.(0.05)				C.D.(0.05)		
Budding method		0.71				0.96				1.11				1.72				0.93		
Time of budding		0.82				1.11				1.29				1.99				1.08		
Method x Time		1.42				1.92				2.23				3.45				1.87		

Table 4. Effect of budding method and time on scion length (cm) of peach cv. Shan-e-Punjab (on plum seedling rootstock)

Time of budding	60DAB				75DAB				90DAB				105 DAB				120 DAB			
	Budding method			Mean	Budding method			Mean	Budding method			Mean	Budding method			Mean	Budding method			Mean
	T	InvertedT	Patch		T	InvertedT	Patch		T	InvertedT	Patch		T	InvertedT	Patch		T	InvertedT	Patch	
15th-June	27.39	25.13	17.06	23.19	28.55	26.80	20.37	25.24	32.27	29.90	23.99	28.71	34.77	30.73	29.69	31.73	38.04	33.37	33.09	34.83
1st-July	34.05	38.47	31.27	34.59	36.95	41.80	34.24	37.66	41.84	44.70	40.21	42.21	42.43	49.00	43.35	44.92	46.82	51.17	46.47	48.15
15th -July	20.76	23.09	20.79	21.54	25.02	26.13	23.45	24.86	29.08	29.23	27.15	28.48	31.92	31.86	30.93	31.57	35.58	35.35	32.95	34.62
1st-Aug	18.26	20.01	15.58	17.95	21.09	22.91	17.55	20.51	25.39	26.07	20.85	24.10	27.92	28.14	21.11	25.72	28.94	31.03	21.15	27.04
Mean	25.11	26.67	21.17		27.90	29.41	23.90		32.14	32.47	28.02		34.26	34.93	31.27		37.34	37.73	33.41	
DAB: Days after budding.																				
Factors	C.D.(0.05)				C.D.(0.05)				C.D.(0.05)				C.D.(0.05)				C.D.(0.05)			
Budding method	1.22				1.12				0.90				1.08				1.31			
Time of budding	1.41				1.30				1.04				1.24				1.52			
Method x Time	2.44				2.25				1.81				2.16				2.63			

sprouting and bud take success, linear growth as well as radial growth in 'T' budding as compared to patch budding. Adhesion between the rootstock and the scion is aided by a "cement" or binding material that is a combination of pectins, carbohydrates and proteins. Wound-repair xylem is generally the first differentiated tissue to bridge the bud union. It is usually followed by wound-repair phloem and the vascular cambium forms last. The formation of new vascular tissue is influenced by the cells of the graft

Table 5. Effect of budding method and time on scion length (cm) of peach cv. Shan-e-Punjab on (apricot seedling rootstock)

Time of budding	60DAB				75DAB				90DAB				105 DAB				120 DAB			
	Budding method			Mean	Budding method			Mean	Budding method			Mean	Budding method			Mean	Budding method			Mean
	T	InvertedT	Patch		T	InvertedT	Patch		T	InvertedT	Patch		T	InvertedT	Patch		T	InvertedT	Patch	
15th-June	26.64	24.50	18.31	23.15	28.06	25.08	19.96	24.36	30.44	26.65	20.72	25.93	32.69	27.51	22.07	27.42	34.75	30.56	23.77	29.69
1st-July	27.37	31.85	24.52	27.91	29.82	33.51	26.50	29.94	32.70	36.96	28.98	32.88	35.12	39.28	31.51	35.30	38.32	42.36	35.07	38.58
15-July	16.63	19.46	16.02	17.37	19.45	22.48	17.35	19.76	20.48	25.03	19.70	21.73	21.90	27.43	21.68	23.67	24.23	31.38	23.93	26.51
1st-Aug	16.01	17.88	14.83	16.24	18.42	20.83	16.81	18.68	20.07	23.91	18.11	20.69	23.43	25.98	19.37	22.92	24.44	27.03	20.77	24.08
Mean	21.66	23.42	18.42		23.93	25.47	20.15		25.92	28.13	21.87		28.28	30.05	23.65		30.43	32.83	25.88	
DAB: Days after budding.																				
Factors	C.D.(0.05)				C.D.(0.05)				C.D.(0.05)				C.D.(0.05)				C.D.(0.05)			
Budding method	0.67				1.13				1.13				1.18				1.07			
Time of budding	0.77				1.31				1.30				1.36				1.23			
Method x Time	1.34				2.27				2.26				2.36				2.14			

partners adjacent to the cambium. This process of vascular development has to occur before new leaf development arises from buds on the scion in order to provide water necessary for growth. Best results with 'T' budding and significantly lower rate of success in patch budding might be due to the formation of better bud union resulting in better contact of cambial layers of stock and scion in 'T'

Table 6. Effect of budding method and time on scion girth (mm) of peach cv. Shan-e-Punjab (on peach seedling rootstock)

Time of budding	60DAB				75DAB				90DAB				105 DAB				120 DAB			
	Budding method			Mean	Budding method			Mean	Budding method			Mean	Budding method			Mean	Budding method			Mean
	T	InvertedT	Patch		T	InvertedT	Patch		T	InvertedT	Patch		T	InvertedT	Patch		T	InvertedT	Patch	
15th-June	2.70	2.62	1.93	2.41	3.13	2.77	2.41	2.77	3.98	3.08	3.11	3.39	4.71	3.63	3.46	3.93	6.08	4.33	4.24	4.88
1st-July	2.94	3.03	2.70	2.89	3.19	4.02	3.09	3.43	4.44	4.75	4.18	4.45	5.68	5.94	4.56	5.39	6.29	6.38	6.21	6.29
15th -July	2.45	2.76	2.43	2.54	2.57	3.35	2.53	2.81	4.05	4.23	3.92	4.06	4.58	4.88	4.34	4.60	5.12	5.34	4.73	5.06
1st-Aug	2.36	2.48	2.35	2.39	2.54	2.69	2.48	2.57	3.10	4.02	3.00	3.37	3.37	4.27	3.12	3.58	3.72	4.61	3.23	3.85
Mean	2.61	2.72	2.35		2.85	3.20	2.62		3.89	4.02	3.55		4.58	4.68	3.87		5.30	5.16	4.60	
DAB: Days after budding.																				
Factors	C.D.(0.05)				C.D.(0.05)				C.D.(0.05)				C.D.(0.05)				C.D.(0.05)			
Budding method	0.11				0.09				0.08				0.12				0.06			
Time of budding	0.13				0.11				0.10				0.14				0.07			
Method x Time	0.23				0.19				0.17				0.24				0.13			

budding (Pathak, 1991). Kumar *et al*. (1994) attributed poor growth of patch budded plants to some gap left in longitudinal incisions of bark and at corners which would have resulted in poor success rate.

The maximum plant growth at 120 DAB with respect to shoot length and girth were obtained when all the budding methods were performed on 1st July. Sharma and Joolka (2005) have also reported that irrespective of the budding method employed, the 2nd July date appeared to be optimum time for budding in walnut.

Budding performed on 1st July and 15th July resulted in significantly high success and subsequent growth probably due to lower mean air temperature and higher humidity that prevailed during 30 days after budding. Tripathi and Kumar (2004) found highest bud take (70%) in bael when budding was done during last week of July and decreased with the advancement of the season. This might be due to favourable environment conditions for cambium growth of scion and rootstock. The effect of environmental factors seems

to be mediated through enzyme activation to elongate and differentiate the cambium to form shoot primordia. So, optimum condition of temperature and humidity prevailing during July gave comparatively higher success. Similar results have been reported by Singh and Singh (1986). The probable cause of the decreased bud take success with the advancement of the season might be due to low temperature and reduced sap flow in rootstock, stressed callus formation and suppressed activity

Table 7. Effect of budding method and time on scion girth (mm) of peach cv. Shan-e-Punjab (on plum seedling rootstock)

Time of budding	60DAB				75DAB				90DAB				105 DAB				120 DAB			
	Budding method			Mean	Budding method			Mean	Budding method			Mean	Budding method			Mean	Budding method			Mean
	T	InvertedT	Patch		T	InvertedT	Patch		T	InvertedT	Patch		T	InvertedT	Patch		T	InvertedT	Patch	
15th-June	2.65	2.54	1.66	2.28	3.23	2.81	2.27	2.77	3.54	3.19	2.84	3.19	4.29	3.74	3.55	3.86	5.02	4.45	4.32	4.59
1st-July	3.07	3.47	2.98	3.17	3.34	4.46	3.40	3.73	4.18	4.68	3.99	4.28	5.35	5.79	4.31	5.15	6.01	6.23	5.97	6.07
15th -July	2.83	3.14	2.87	2.94	3.23	3.73	3.02	3.32	3.86	4.29	3.69	3.94	4.40	4.95	4.09	4.48	4.91	5.37	4.48	4.92
1st-Aug	2.28	2.44	2.30	2.34	2.56	2.66	2.63	2.61	2.95	3.27	3.03	3.08	3.21	3.57	3.23	3.33	3.48	3.88	3.90	3.75
Mean	2.70	2.89	2.45		3.09	3.41	2.83		3.63	3.85	3.38		4.31	4.51	3.79		4.85	4.98	4.66	
DAB: Days after budding.																				
Factors	C.D.(0.05)				C.D.(0.05)				C.D.(0.05)				C.D.(0.05)				C.D.(0.05)			
Budding method	0.22				0.10				0.28				0.26				0.16			
Time of budding	0.26				0.12				0.33				0.30				0.19			
Method x Time	N.S.				0.20				0.57				0.53				0.33			

of hydrolyzing enzymes that favours inadequate mobilization of reserve food material. Proper temperature and humidity could also facilitate the union between stock and scion(Imran *et al.*, 2012) This has been confirmed by Hartmann and Kester (1986). Singhrot *et al*. (1980) reported maximum success when 'T' budding was done during June to August in ber and attributed this to more growth activity of the rootstock and scion amply supported by high atmospheric humidity and temperature

Table 8. Effect of budding method and time on scion girth (mm) of peach cv. Shan-e-Punjab (on apricot seedling rootstock)

Time of budding	60DAB				75DAB				90DAB				105 DAB				120 DAB			
	Budding method			Mean	Budding method			Mean	Budding method			Mean	Budding method			Mean	Budding method			Mean
	T	InvertedT	Patch		T	InvertedT	Patch		T	InvertedT	Patch		T	InvertedT	Patch		T	InvertedT	Patch	
15th-June	2.56	2.49	1.92	2.32	3.07	2.63	2.33	2.67	3.90	3.01	3.54	3.48	4.65	3.56	4.97	4.39	6.12	4.27	5.74	5.37
1st-July	2.86	3.03	2.38	2.75	3.13	4.02	2.80	3.31	4.17	4.81	3.94	4.30	5.34	5.92	4.26	5.17	6.00	6.36	5.92	6.09
15th -July	2.34	2.63	2.35	2.44	2.53	3.22	2.50	2.75	3.71	4.15	3.85	3.90	4.34	4.81	4.25	4.46	4.85	5.23	4.64	4.90
1st-Aug	2.29	2.37	2.23	2.29	2.52	2.59	2.41	2.50	2.96	3.96	2.89	3.27	3.17	4.19	3.01	3.45	3.44	4.50	3.12	3.68
Mean	2.51	2.63	2.15		2.81	3.11	2.51		3.68	3.98	3.55		4.37	4.62	4.12		5.10	5.09	4.85	
DAB: Days after budding.																				
Factors	C.D.(0.05)				C.D.(0.05)				C.D.(0.05)				C.D.(0.05)				C.D.(0.05)			
	N.S				0.16				0.27				0.21				0.18			
Time of budding	N.S				0.19				0.31				0.25				0.21			
	N.S				0.33				0.54				0.43				0.37			

prevailing during that period. Success in 'T' budding depends on the bark slipping which means that the vascular cambium is actively dividing, producing young, thin-walled cells on each side of the cambium. These newly formed cells separate easily from each other so the bark slips easily (Hartmann *et al*., 2007). Thus 'T' and inverted 'T' budding done on 1st and 15th July gave best results in terms of scion growth.

References

Dwivedi, S.K. and Singh, B. 1999. Studies on top working of apricot (*Prunus armeniaca* L.) in Ladakh. *Prog. Hortic.,* **31**: 1-2.

Dwivedi, S.K., Attery, D.P. and Elipaljor. 2000. Standardisation of budding in apricot (*Prunus armeniaca* L.*)* in cold arid conditions of Ladakh. *Prog. Hortic.*, **32**: 117-120.

Hartman, H.T. and Kester, D.E. (4th ed.). 1986. In: *Plant Propagation: Principles and Practices*, Prentice Hall of India Private Limited, New Delhi.

Hartman, H. T., Kester, D.E., Davies, F. T. and Geneve, R.L. (7th ed.).2007. *Plant Propagation: Principles and Practices*, pp. 199-248, Prentice-Hall,(India) Private Limited, New Delhi.

Imran Ahmad, Zhihui Cheng, Tongjin Liu, Wu Cui Nan, Muhammad Ejaz, Muhammad Ali khan and Humaira Wasila 2012. Effect of different time of budding on the bud take success of peach on peach rootstock. *Adv. Environmental. Bio.* **6**: 1848-52.

Kumar, D., Phatak, R.K. and Ali, W. 1994. Studies on effect of duration and methods of budding in bael. *Indian J. Hortic.*, **51**: 150-153.

Panse, V.G. and Sukhatme, P.V. 2000. Statistical Methods for Agricultural Workers. *Publication and Information Division, ICAR*, New Delhi.

Patak, R.K., Ali, Wahid and Dwivedi, R. 1996. Top working in Aonla. *Indian Horticulture,* **40**: 27-28.

Pathak, R. K. 1991. Propagation of Fruit Plants, Indian Council of Agricultural Research, New Delhi.

Sharma, M. K. and Joolka, N. K. 2005. Comparison of budding techniques in walnut (*Juglans regia* L.) propagation. *Acta Horticulturae*, **696**: 181-183.

Singh, J. and Singh, H. 1986. Effect of budding and plant growth regulation on the bud-take in plums (*Prunus salicina* Lindl.). *Res. Develop. Rep.,* **3**: 60-67

Singhrot, R.S., Makhija, M. and Chauhan, K.S. 1980. Vegetative propagation of ber (*Zizyphus mauritiana* Lamk.) IV. A note on the effect of different times of budding performance. *Haryana J. Hortic. Sci.,* **9**: 40-42.

Tripathi, A. and Kumar, R. 2004. Studies on the effect of method and time of budding in bael (*Aegle marmelos* L.). *Haryana J. Hortic. Sci.*, **33**: 195-198.

Received: December 11, 2012; Accepted: May 13, 2013