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Effect of different time and methods of propagation on various characters of peach (*Prunus persica* L.) Under western U.P. conditions

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Abstract
An Investigation consisting the impact of time and method of propagation on several parameters of peach *i.e.,* Shoot diameter (cm), Shoot length (cm), Number of leaves, Leaf area, Height (cm), Survival (%), Mortality (%) and Treatments were allotted with two different factors *viz* factor A and factor B. This were observed on the basis of comprehensive study that amongst Wedge grafting and T-budding during the duration of January to March Wedge grafting was found superior over T-budding for maximum shoot diameter, shoot length, number of leaves, leaf area, height, survival percentage, mortality percentage. Thus, that there was the significant impact of suitable technique and time of propagation of peach. The best result was found with wedge grafting under 30 January and their combination may be suggested for propagation of peach under Subtropical Conditions. Accordingly, Sharbati seedling performed better in wedge grafting it revealed maximum shoot diameter, shoot length, number of leaves, survival percentage. Hence, Wedge grafting recommended as successful commercial propagation of Peach under Western Uttar Pradesh conditions.

Keywords: Grafting, budding, propagation, time and peach

1. Introduction
The peach (*Prunus persica* L.) is the third most important temperate fruit crop grown in the hilly regions of India and is known for its outstanding appearance and quality. It belongs to family Rosaceae having somatic chromosome number (2n=16) Peach is known to have originated from China. China is the leading producer of peach accounting for 50 per cent of world production. It moved from China to western part of the world by sea via India and mid-east by the silk route via Persia (presently Iran) (Janick, 2003) [7]. Peaches are considered a good source of vitamins and minerals especially rich in carotene and thiamine. As per the area and production, peaches are the leading stone fruits followed by plums, apricots, almonds and cherries. In India, it is grown on a commercial scale in mid hills of Himachal Pradesh, Jammu & Kashmir, Uttarakhand and Subtropical plains of North India in an area of 18,000 hectares with a production of 1,23,000 metric tonnes (Anonymous, 2018) [1].
Peach is commercially propagated through budding and grafting on peach seedling rootstock. On a limited scale, it is clonally propagated through rooting of hardwood cuttings. In budding and grafting methods, the rootstock becomes fit for operation after one year and it takes about 2 years before the plants become ready for transplanting in the orchard. Simultaneous grafting and rooting have been successfully tried on the cuttings of peach rootstock 'Sharbati'. The fruits of peach are attractive, delicious and highly nutritious. They are very rich source of potassium, iron, fibre, vitamin-A, vitamin-C and also contains high concentration of phytochemicals such as carotenoid, flavanols and anthocyanins (Byrne, 2002) [4].
The climatic conditions of mid hills of Himachal Pradesh are affable for the commercial cultivation of peaches and are cultivated on an area of 5090 hectares with a production of 7262 metric tonnes (Anonymous, 2017) [2]. The productivity is low in comparison to average world standards and can be attributed to several factors.
In India, peaches are being cultivated over an area of 18000 hectares with the production of 107,000 MT (Anonymous, 2018) [1] whereas, Uttarakhand leads in the peach production with an area of 78.55 thousand hectare and an annual production of 57.93 thousand MT (Anonymous, 2017) [2]. Peach is a delicate, juicy and fleshy stone fruit of phenomenal appearance and quality with rich source of different sugar, vitamins and minerals.

With the advancement of breeding endeavours, low chilling peach cultivars have been developed and their cultivation extends from temperate regions to subtropical areas. The sub-tropical peaches have come out as a promising fruit crop in North Western plains due to availability of required chilling hours (Gangwar 2003) [5].

The development of new fruit cultivars has generally been based on genetic resources. Germplasm collection, evaluation and characterization are essential stages of breeding programs and are also the decisive factors for its adoption by the orchardists. Main germplasm collection and characterization is performed by describing phenological, pomological and morphological characteristics (Yilmaz *et al*., 2009) [10].

Peach rootstocks are mainly raised from the seeds of desi peach trees though plum, apricot, almond, peach almond hybrid, Behmi can also be used. Rootstocks not only improve the scion vigour but also enhance the nutrient uptake and yield efficiency. Therefore, proper selection of rootstock is important for obtaining high yield and good quality fruits as stionic interaction is responsible for water relations, gaseous exchange, nutrient uptake, tree size, blossoming period, fruit set, fruit quality and yield efficiency (Nielsen and Kappel, 1996); (Goncalves *et al.*, 2003)] [9, 6]. The factors like rootstock, method and time of propagation influence the success of plant propagation. Sub-tropical peaches are mainly propagated by grafting during the winter season. In peach, grafting is practiced during November-January in plains of the country. Thickness of both rootstock as well as scion determines the method of grafting to be employed. Tongue grafting can be performed if both scion and rootstock are of equal thickness. But if the rootstock is having more thickness than the scion, wedge grafting should be practiced for better success.

Although peach is a very popular fruit crop, yet its cultivation in our country has remained in state of neglect. The non-availability of the quality planting materials (rootstock and bud-wood) and lack of efficient propagation techniques and other information on the performance of cultivars under different agroclimatic condition of tropical and subtropical region are the major constraints in the expansion of peach cultivation in India.

2. Material and Methods

The research trial was conducted under field conditions of fruit nursery, Department of Fruit Science, Sardar Vallabhbhai University of Agriculture and Technology, Modipuram, Meerut, Uttar Pradesh. The experiment was conducted to find out suitable time of budding, Grafting and to standardize appropriate budding and grafting method for peach under Western Uttar Pradesh conditions. Plant material i.e., the mother stools of Prunus sp. rootstocks were established at a spacing 90×45 cm in the nursery area. Scion has been taken from Saharanpur Prabhat variety of peach.

2.1 Experimental Design and Treatments

The experimental design laid out in a Factorial Randomized Block Design with three replications and the treatments consisted into two factors viz., Factor A (Grafting Method) and Factor B (Grafting Time). Under factor A there are two grafting method named as Wedge grafting (A_1) and T-Budding (A_2) and under factor B consisting 7 different grafting time as treatment like T_1(30 December), T_2(15 January), T_3(30 January), T_4 (15 February), T_5(1 March), T_6(15 March), T_7(30 March).

Budding was started in the month of December and January, as the standard practice for propagation of temperate fruits like-peach. For this purpose, one-year old shoots having healthy buds were collected as bud stick from plum, budding, grafting operation was performed at 15 days interval, starting from December- 31- 2021 then on 15 January 2022, and finally on January-31-2022 budding method use in peach is T-budding and grafting method use is wedge grafting. These buds were tied by an alkathene tape in order to avoid desiccation of the bud union. Grafts are also tied by using alkathene tape as scion (Saharanpur Prabhat) is tied by using the skills of tying the graft. Regular pinching was done to control the unwanted growth of shoots from the seedlings, below bud union. Various cultural operations were followed in this field like- weeding, hoeing and control of insect, pest and disease time to time.

2.1.1 Rootstock selection

One-year old pencil thickness seedling rootstock of uniform size and vigour were selected for experiment. These rootstocks were procured and planted in the bed having 2.5 ×1.5m size at a spacing of 30 × 45 cm leaving a space of 0.50 meter after every third row. The other cultural operations were similar in all the treatments.

2.1.2 Preparing Scion

Try to procure the scion from an established, mature peach tree. Branches that are about 2 inches in diameter are ideal for obtaining healthy scions. This is best done during the winter. Trees are dormant during this time. Thus, the bruising caused due to slicing stem does minimal damage. The scion should be about 1½ inches long and about ¼ inch wide. Choose a stem that has minimal knots. Presence of some buds within the scion is crucial. Your scion should include a minimum of three buds. For making accurate cuts, use a grafting chisel instead of shears. Making horizontal cuts is recommended to minimize bruising on the branch.

2.1.2 Storing Scion

Ensure that the scion is immediately wrapped in a moist paper towel. The wrapped scion can be further placed in a plastic bag. Ensure that the temperature is maintained within a range of 32 to 34 degrees ^{0}F.

2.1.4 Bud stick collection

The bud sticks were obtained from young trees of mother block section of Saharanpur Prabhat, having healthy buds from one-year old branch, during the time of budding. All plants parts were separated from branches of peach tree with the help of secateurs and pencil size scion is selected for proceeding the procedure of grafting. Then these plants parts were oven dried for several days at 48°C and dry weight was taken till the constant weight. All these observations were recorded after 150 days of grafting of tagged plants.

2.2 Parameters of Study

2.2.1 Shoot diameter (mm)

The length of main shoot was measured with a measuring scale in the month of December. The length was measured from the point of the emergence on the cutting to the tip of the shoot and expressed as centimetre (mm).

2.2.2 Number of leaves
Number of leaves is selected on the basis of healthy leaves present in plant selected manually.

2.2.3 Leaf area (cm^2)
The leaf area was recorded by means with a digital leaf area meter, ten leaves were selected randomly from each of the tagged budded and grafted plants and their average leaf area was calculated and multiplied with average number of leaves per plant to obtain the total leaf area.

2.2.4 Plant height (cm)
Plant height was recorded by using meter scale from ground level to top at 90 days after grafting, budding for six representative plants in each replication counted and averaged.

2.2.5 Shoot length (cm)
Shoot length is measured with the help of measuring scale in three plots by taking 5 representative plants from each row.

2.2.6 Survival percent (%)
Plants survived during the phase of experiment in respective plots are as in plot 1 plant survived are 0.19% in plot 2 plant survived are 0.32% in plot 3 plant survived are 0.39%.

2.2.7 Mortality percent%
Plants survived during the experimental phase during the duration of 30 December 2021 to March 2022 in respective plots are as follows in Plot 1s 0.19% Plot 2 0.32% Plot 3 0.39%.

3. Results and Discussion
The study finds out the best grafting method and its relative performance with grafting time. The data was statistically analysed to determine the degree of variance caused by the various treatments under the examination. The behaviour of Peach crop under the various treatments has been incorporated in sign tables and substantiated with appropriate figure at appropriate locations. The experimental observations, results have been recorded and efforts are made to support it with scientific relationship and heading to discuss following main out line:

3.1 Shoot diameter (mm): Shoot diameter was significantly affected by grafting method and grafting time. The average maximum shoot diameter (6.30 mm) was obtained with wedge grafting (A_1) which was found significantly superior over the treatments and the average minimum shoot diameter (6.20 mm) was noted in T budding (A_2). Grafting time has the significant impact on shoot diameter. The average maximum shoot diameter (6.68 mm) was found to be significantly higher under T_3 (30 January). Whereas, the minimum shoot diameter (5.90 mm) was recorded under T_7 (30 March).

3.2 Shoot length (cm): The grafting method and grafting time significantly influenced the shoot length. The average maximum shoot length (80.25 cm) was obtained with wedge grafting (A_1) which was found significantly superior over the treatments and the average minimum shoot length (70.41 cm) was noted in T budding (A_2). Grafting time has the significant impact on shoot length. The average maximum shoot diameter (86.65 cm) was found to be significantly higher under T_3 (30 January). However, the minimum shoot length (76.19 cm) was recorded under T_7 (30 March).

3.3 Number of Leaves: The different grafting method and grafting time significantly influenced the number of leaves. The average maximum number of leaves (12.29) was obtained with wedge grafting (A_1) which was found significantly superior over the treatments and the average minimum number of leaves (11.46) was noted in T budding (A_2). Grafting time has the significant impact on number of leaves. The average maximum number of leaves (12.72) was found to be significantly higher under T_3 (30 January). Whereas, the minimum number of leaves (11.16) was recorded under T_7 (30 March).

3.4 Leaf Area (cm^2): that different grafting method and grafting time significantly influenced the leaves area. The average maximum leaves area (34.43 cm^2) was obtained with wedge grafting (A_1) which was found significantly superior over the treatments and the average minimum leaves area (32.07 cm^2) was noted in T budding (A_2). Grafting time has the significant impact on leaves area. The average maximum leaves area (37.40 cm^2) was found to be significantly higher under T_3 (30 January). However, the minimum leaves area (30.71 cm^2) was recorded under T_7 (30 March).

3.5 Plant Height (cm): The plant height was significantly affected by grafting method and grafting time. The average maximum plant height (134.53 cm) was obtained with wedge grafting (A_1) which was found significantly superior over the treatments and the average minimum plant height (132.71 cm) was noted in T budding (A_2). Grafting time has the significant impact on plant height. The average maximum plant height (135.85 cm) was found to be significantly higher under T_3 (30 January). Whereas, the minimum plant height (125.87 cm) was recorded under T_7 (30 March).

3.6 Mortality (%): The grafting method and grafting time significantly influenced the mortality. The average minimum mortality (28.97%) was obtained with wedge grafting (A_1) which was found significantly superior over the treatments and the average maximum mortality (64.70%) was noted in T budding (A_2). Grafting time has the significant impact on mortality. The average minimum mortality (41.19%) was found to be significantly higher under T_3 (30 January). However, the maximum mortality (51.49%) was recorded under T_7 (30 March).

3.7 Survival (%): The plant height was significantly affected by grafting method and grafting time. The average maximum survival (71.02%) was obtained with wedge grafting (A_1) which was found significantly superior over the treatments and the average minimum survival (35.29%) was noted in T budding (A_2). Grafting time has the significant impact on survival. The average maximum survival (57.17%) was found to be significantly higher under T_3 (30 January). Whereas, the minimum survival (49.85%) was recorded under T_7 (30 March).

Table 1: Effect of Different Time and Methods of Propagation on Various Characters of Peach

Treatments	Shoot diameter (mm)		Shoot length (cm)		Number of Leaves		Leaf Area (cm^2)		Plant Height (cm)		Mortality (%)		Survival (%)	
	A_1	A_2	A_1	A_2	A_1	A_2	A_1	A_2	A_1	A_2	A_1	A_2	A_1	A_2
30 December	6.15	5.59	79.40	69.65	12.15	11.34	33.92	31.45	133.25	135.33	29.75	65.50	70.25	34.96
15 January	6.22	6.06	80.35	70.61	12.30	11.49	34.35	31.87	134.90	132.98	28.76	64.50	71.24	35.38
30 January	6.63	6.48	86.14	75.99	13.11	12.33	38.60	36.21	143.78	143.52	23.41	58.97	76.59	37.76
15 February	6.31	6.15	81.50	71.78	12.64	11.67	34.81	32.37	136.76	134.95	27.64	63.32	72.36	35.29
1 March	6.21	6.05	78.15	70.41	12.26	11.46	34.23	31.78	134.46	132.65	29.02	64.72	70.98	34.53
15 March	6.08	5.91	76.60	68.68	12.04	11.19	33.53	31.03	131.71	128.69	30.67	66.49	69.33	80.51
30 March	5.86	5.69	80.25	65.79	11.57	10.75	31.63	29.80	126.89	124.86	33.58	69.40	66.42	33.28
Mean	6.20	6.30	80.25	70.41	12.29	11.46	34.43	32.07	134.53	132.71	28.97	64.70	71.02	35.29
SEM (±)	0.019	0.035	0.293	0.548	0.060	0.112	0.259	0.485	0.395	0.738	0.293	0.548	0.312	0.583
CD at 5%	0.054	0.101	0.851	1.593	0.173	0.324	0.754	1.411	1.147	2.146	0.851	1.593	0.906	1.695

*A_1: Wedge grafting, A_2: T-Budding

4. Conclusion

A conclusion that can be drawn from the experiment described above is that the timing and propagation technique for peach, the best result was found with wedge grafting under 30 January and their combination may be suggested for propagation of Peach under western Uttar Pradesh Conditions.

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