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Standardization of grafting method and time in kiwifruit under temperate conditions of Kashmir

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Abstract
The present studies entitled "Standardization of grafting method and time in kiwifruit under temperate conditions of Kashmir" was carried out in the experimental farm, Division of Fruit Science during 2017 and 2018. The experiment was laid out in a Completely Randomized block Design with three replications. In this experiment, three methods of grafting (cleft, tongue and whip) were performed on three different dates (3rdweek of February, 1st week of March and 3rd week of March) with Hayward/Tomuri grafted on 2 years old seedling rootstock under field conditions. The results indicated that leaf width(8.57cm) were significantly better with cleft grafting. Leaf area (94.45 cm^2) was recorded highest in tongue grafting and specific leaf area(127.63cm^2) was recorded highest with whip grafting. Leaf area (91.90 cm^2) and Leaf width(8.54cm) was found highest during 3rd week of March and specific leaf area(143.82cm^2/g) with 3rd week of February. Cleft grafting performed during 3rd week of March with Hayward resulted in the highest value of leaf chlorophyll(2.23mg/g). The interaction between method and type of scion was found significant for different parameters under study. From this experiment it can be concluded that among different methods, time and scion type used, cleft grafting performed during 3rd week of February with Hayward cultivar significantly influenced specific leaf area.

Keywords: vegetative propagation, hayward, grafting, tomuri

Introduction
The kiwifruit, also known as Chinese gooseberry (*Actinidia deliciosa* Chev.), is a member of family *Actinidiaceae* with the chromosome number 2n= 58. It is a deciduous, dioecious vine fruit crop. The first recorded description of the kiwifruit dates back to the 12th century in China during Song dynasty. It is among the very few recent introductions which have surpassed in popularity due to its tremendous commercial potential in the sub-Himalyan region. Kiwifruit flavour is similar to a blend between strawberry and pineapple. It has refreshing and delicate flavour, pleasing aroma, high nutritive value and medicinal importance. It is rich source of vitamin C and minerals like potassium, calcium, phosphorous and low in calories. The fibre and the potassium in kiwifruit support heart health. An increase in potassium intake along with a decrease in sodium can help to reduce the risk of cardiovascular diseases. It has laxative property and is also used as a tonic for growing children and for women after childbirth. Slightly under ripe fruits, which are high in pectin are used for making jam, jelly and chutney.
Area under kiwifruit in Jammu and Kashmir state is 7 ha, out of which 6 ha are in Kashmir province and 1ha in Jammu (Anonymous, 2016). In Kashmir Division, it is cultivated in Baramulla and Pulwama districts, however in Jammu Division, it is cultivated in district Reasi. Among the different cultivars of kiwifruit, Hayward is most promising cultivar for mid hill zone of India comprising of Jammu and Kashmir, Uttrakhand, Arunachal Pradesh and other kiwifruit growing states. Fruit size and quality of this cultivar is better than other cultivars. This cultivar was developed by Hayward Wright in Avondale New Zealand. There is huge demand for nursery plants of this cultivar. In order to meet the increasing demand of kiwifruit the present study was conducted to propagate kiwifruit through grafting to standardize grafting method and time.

Materials and Methods

The present investigations on "Standardization of grafting method and time in kiwifruit under temperate conditions of Kashmir" were carried out at experimental fields of Division of Fruit Science, Sher-e-Kashmir University of Agricultural Science and Technology of Kashmir, Shalimar Campus, during the year 2017-2018. Plant material used for the studies consists of Bruno cultivar of kiwifruit used as rootstock. The scion wood was collected from semi-mature current season's shoots of Hayward and Tomuri cultivar of kiwifruit. These bud sticks were defoliated immediately after collection from the trees. Tongue grafting, cleft grafting and whip grafting were performed as methods of grafting on three different dates and 1-1.5 cm wide strips of 400 gauge alkathane were used as the tying material in all the treatments.

The experiment was laid out in a randomized block design with 3 replications and 20 plants per replication. Fully expanded leaves were selected randomly from the grafted plants in the month of July. The leaf width was measured with the help of ruler and was expressed as cm per leaf. Fully expanded leaves were randomly selected from the grafted plants in the month of July. The leaf area was measured with the help of leaf area meter and was expressed as cm^2per leaf. The total number of leaves were counted from ten randomly selected grafted plants, and was expressed as average number of leaves per plant**.** Specific leaf area was calculated from leaf area which was obtained through leaf area meter and dry mass of that leaves. It was calculated by dividing the leaf area of leaf with its dry mass and was expressed in cm/g.

Results and Discussion

1. Leaf width

The data on effect of time, method of grafting and scion type on leaf width is presented in Table 1. From the data, it is evident that leaf width was significantly influenced by time of grafting, method of grafting and scion type. The data in the table indicate that grafting performed during 3rd week of March resulted in the maximum leaf width (8.54cm) which was statistically at par with grafting performed during 1st week of March(8.42cm) and the minimum leaf width (8.14cm) was reported in grafting performed during 3rd week of February. It may be due to favorable environmental conditions during this time, resulting in early callus formation. This is in conformity with Dimiri *et al.* (2002) [2] who recorded that grafting performed during 1st week of March resulted in maximum leaf width in apple.

Method of grafting indicate a significant influence on leaf width. Cleft grafting recorded the highest value of leaf width (8.57cm) followed by tongue grafting (8.41cm) and the minimum value was observed with whip grafting (8.10cm). This may be due to the maximum cambial contact between scion and stock that results in more vegetative growth. This is in conformity with Upadhyay *et al.* (2017) [4] who recorded that cleft grafting in walnut resulted in maximum leaf area

The scion type also had a significant influence on leaf width. The highest value of leaf width (8.79cm) was observed with scion Hayward (S_1). It may be due to the early vegetative growth and rapid callus formation in Hayward than in Tomuri. These results are in conformity with Zenginbal (2007) [5] who recorded the similar results in kiwifruit.

Interaction between time and method had a significant influence on leaf width. The maximum value of leaf width was recorded with cleft grafting performed during 1st week of March (8.89cm) and the lowest value of leaf width (7.98cm) was observed with whip grafting performed during 3rd week of February. These results are in conformity with Dimiri *et al.* (2002) [2] and Upadhyay *et al.* (2017) [4].

A significant effect was observed in the interaction between method and scion type with the maximum value of leaf width in (9.44cm) grafting with scion Hayward (S_1) and the minimum value of leaf width (7.72cm) in cleft grafting with Hayward (S_1) These results are in conformity with Upadhyay *et al.* (2017) [4] and Zenginbal (2007) [5]. Interaction between time x scion x method and time x scion showed non-significant effect on leaf width.

Table 1: Effect of time, method of grafting and scion type on leaf width (cm) in kiwifruit

Method Scion Time	G_1 (Tongue grafting)	Submean	G_2 (Cleft grafting)	Submean	G_3 (Whip grafting)	Submean	Mean	Factor mean
	S_1 S_2		S_1 S_2		S_1 S_2			S_1 S_2
T_1 (3rd week of Feb.)	8.30 8.03	8.16	9.06 7.53	8.29	7.90 8.06	7.98	8.14	8.42 7.87
T_2 (1st week of March)	8.50 8.10	8.30	9.76 8.03	8.89	8.16 7.96	8.06	8.42	8.80 8.03
T_3 (3rd week of March)	8.93 8.66	8.79	9.50 7.60	8.55	9.00 7.56	8.28	8.54	9.14 7.94
Mean	8.57 8.26	8.41	9.44 7.72	8.57	8.35 7.86	8.10		8.79 7.94

S_1 = Hayward, S_2 = Tomuri
Main effect and interaction effect
CD (P=0.05
Time (T) = 0.715
Method (M) = 0.175
Scion (S) = 0.143
Time x Method (T x M) = 0.303
Time x Scion (T x S) = NS
Method x Scion (M x S) = 0.247
Time x Method x Scion (T x M x S) = NS

2. Leaf area

The data on effect of time, method of grafting and scion type on leaf area is presented in Table 2. From the data, it is evident that leaf area was significantly influenced by time, method of grafting and scion type. The data in the table indicate that grafting performed during 1st week of March

resulted in the maximum leaf area (91.90cm^2) which was statistically at par with grafting performed during 3rd week of March (90.40cm^2) and the minimum leaf area (78.60cm^2) was recorded in grafting performed during 3rd week of February. It may be due to favorable environmental conditions during this time, resulting in early callus formation which is in conformity with Dimiri *et al.* (2002) [2] who found that maximum leaf area was obtained when grafting was performed in March.

Method of grafting indicates a significant influence on leaf area. Tongue grafting reported the highest value of leaf area (94.45cm^2) which was statistically at par with whip grafting (93.03cm^2) and the lowest value of leaf area (73.41cm^2) was observed with cleft graftingThis may be due to the maximum interlocking of scion and stock that results in more vegetative growth. This results are in conformity with Upadhyay *et al.* (2017) [4] who recorded that tongue grafting in walnut resulted in maximum leaf area.

Interaction between method and scion showed significant effect on leaf area. Tongue grafting with scion Hayward (S_1) showed the maximum leaf area (95.70cm^2) which was statistically at par with whip grafting (93.94cm^2) with scion Hayward (S_1) and the minimum leaf area (67.37cm^2) was observed with cleft grafting with Tomuri (S_2). These results are in conformity with Upadhyay *et al.* (2017) [4].

The scion type and the interaction between time x scion, time x method and time x method x scion showed non-significant influence on leaf area.

Table 2: Effect of different grafting methods, dates of grafting and scion type on leaf area (cm^2) in kiwifruit.

Method Scion Time	G_1 (Tongue grafting)		Submean	G_2 (Cleft grafting)		Submean	G_3 (Whip grafting)		Submean	Mean	Factor Mean	
	S_1	S_2		S_1	S_2		S_1	S_2			S_1	S_2
T_1 (3rd week of Feb.)	94.90	90.60	92.75	64.60	60.60	62.60	80.33	80.60	80.46	78.60	79.94	77.26
T_2 (1st week of March)	111.70	111.00	111.35	61.40	61.00	61.20	103.90	102.40	103.15	91.90	92.33	91.46
T_3 (3rd week of March)	80.60	77.90	79.25	112.4	80.50	96.45	97.60	93.40	95.50	90.40	96.86	83.93
Mean	95.70	93.16	94.45	79.45	67.37	73.41	93.94	92.13	93.03		89.71	84.21

S_1 = Hayward, S_2 = Tomuri
Main effect and interaction effect
CD (P=0.05
Time (T) = 9.21
Method (M) = 9.21
Scion (S) = NS
Time x Method (T x M) = NS
Time x Scion (T x S) = NS
Method x Scion (M x S) = 13.03
Time x Method x Scion (T x M x S) = NS

3. Specific leaf area

The data on effect of time, method of grafting and scion type on Specific leaf area is presented in Table 3. From the data, it is evident that specific leaf area was significantly influenced by time of grafting, method of grafting and scion type. The data in the table indicate that grafting performed during 3rd week of February resulted in the maximum specific leaf area (143.82cm^2/g) followed by grafting performed during 1st week of March (132.40cm^2/g) and minimum specific leaf area (95.49cm^2/g) was recorded in grafting performed during 3rd week of March. The highest specific leaf area in grafting performed during February may be due to early and good contact of cambial layers of stock and scion and favorable environmental conditions during February, resulting in early callus formation which is in conformity with Upadhyay *et al.* (2017) [4] who found that highest value of specific leaf area in grafting performed during February in walnut.

Method of grafting indicate a significant influence on specific leaf area. Whip grafting resulted in the highest value of specific leaf area (127.63cm^2/g) followed by tongue grafting (125.1cm^2/g) and minimum specific leaf area (118.93cm^2/g) was observed in cleft grafting. It is due to the maximum surface contact between scion and stock which is in conformity with Sedaghathoor (2016) [3] who found that maximum specific leaf area was obtained with whip grafting in kiwifruit. Scion type also had a significant effect on specific leaf area. The highest value of specific leaf area (124.60 cm^2/g) was observed with scion Hayward (S_1). It may be due to the the early vegetative growth and rapid callus formation in Hayward than in Tomuri. These results are in conformity with Zenginbal (2007) [5] who recorded the similiar results in kiwifruit.

Interaction between time and scion has significant effect on specific leaf area. Grafting with scion Hayward (S_1) performed during 3rd week of February showed the highest specific leaf area (144.60 cm^2/g). The lowest specific leaf area (94.20cm^2/g) was observed in grafting with Tomuri (S_2) performed during 3rd week of March. Interaction between method and scion also had a significant influence on specific leaf area. Whip grafting with scion Hayward (S_2) cultivar resulted in the highest value of specific leaf area (127.80cm^2/g). The lowest specific leaf area (117.80cm^2/g) was also observed with cleft grafting with scion Tomuri (S_2). which is in conformity with Sedaghathoor (2016) [3] and Zenginbal (2007) [5].

Interaction between time x method x scion has significant effect on specific leaf area. Cleft grafting with scion Hayward (S1) cultivar performed during 3rd week of February showed the highest specific leaf area (153.32cm^2/g). Minimum value of specific leaf area (80.53 cm^2/g) was observed in cleft grafting with scion Hayward (S_1) cultivar performed during 3rd week of March. which is in conformity with Sedaghathoor (2016) [3], Upadhyay *et al.* (2017) [4] and Zenginbal (2007) [5].

A study of interaction between time x method showed non-significant influence on specific leaf area.

Table 3: Effect of different grafting methods, dates of grafting and scion type on specific leaf area (cm^2/g) in kiwifruit

Method Scion Time	G_1 (Tongue grafting) S_1 S_2	Submean	G_2 (Cleft grafting) S_1 S_2	Submean	G_3 (Whip grafting) S_1 S_2	Submean	Mean	Factor mean S_1 S_2
T_1 (3rd week of Feb.)	140.6 135.5	138.0	153.32 150.5	151.9	140.1 143.0	141.5	143.82	144.6 143.0
T_2 (1st week of March)	125.7 125.5	125.6	126.2 122.2	124.2	145.6 149.1	147.3	132.40	132.5 132.2
T_3 (3rd week of March)	111.7 111.8	111.7	80.53 80.8	80.6	97.7 90.2	93.9	95.40	96.6 94.2
Mean	126.0 124.2	125.1	120.0 117.8	118.93	127.8 127.4	127.63		124.60 123.1

S_1 = Hayward, S_2 = Tomuri
Main effect and interaction effect
CD (P=0.05
Time (T) = 0.8310
Method (M) = 0.339
Scion (S) = 0.339
Time x Method (T x M) = NS
Time x Scion (T x S) = 0.587
Method x Scion (M x S) = 0.479
Time x Method x Scion (T x M x S) =0.497

4. Chlorophyll content(mg/gm)

The data on effect of time, method of grafting and scion type on chlorophyll content is presented in Table. 4 From this data, it is evident that chlorophyll content was significantly influenced by time of grafting, method of grafting and scion type.

The methods of grafting indicate a significant influence on chlorophyll content o leaves. Cleft grafting exhibited the highest value of chlorophyll contentl (2.23) whereas lowest value (1.5) was observed with whip grafting. A study of interaction between time x method showed a significant influence on chlorophyll content. Cleft grafting performed during 3rd week of March showed the highest value (2.76) and lowest value (1.45) was observed with whip grafting performed during 3rd week of March.

From table 4. it is evident that time x scion has significant effect on chlorophyll content of leaves. Grafting on S_1 (Hayward) of kiwifruit performed during 3rd week of March showed the highest value of chlorophyll content (3.5). The lowest value (1.61) was observed with grafting on S_2 (Tomuri) performed during 3rd week of March.

Interaction between method x scion had a significant effect on chlorophyll. Cleft grafting on S_1 (Hayward) of kiwifruit showed the highest value of chlorophyll (2.4). The lowest value (1.32) was observed with whip grafting on S_2 (Tomuri).

From table 4 it is evident that time x method x scion has significant effect on chlorophyll content. Cleft grafting on S_1 (Hayward) of kiwifruit performed during 3rd week of March showed the highest value (3.56). The lowest value (1.29) was observed with cleft grafting on S_2 (Tomuri) performed during 3rd week of March.

The data in the table 4 indicate that grafting done on different times had no significant effect on chlorophyll content of kiwifruit leaves.

From table 4 it is evident that scion type had not any significant influence on chlorophyll content

Table 4: Effect of time of grafting, method of grafting and scion type on chlorophyll content in kiwifruit

Method Time	G_1 (tongue grafting) S_1 S_2	Submean	G_2 (cleft grafting) S_1 S_2	Submean	G_3 (whip grafting) S_1 S_2	Submean	Mean	Factor mean S_1 S_2
T_1 (3rd week of Feb.)	1.72 1.66	1.69	2.18 2.12	2.15	1.73 1.35	1.54	1.79	1.87 1.71
T_2 (1st week of March)	1.84 1.76	1.80	1.60 2.17	1.88	1.75 1.34	1.54	1.74	1.73 1.75
T_3 (3rd week of March)	1.84 1.75	1.79	3.56 1.79	2.67	1.61 1.29	1.45	1.95	3.50 1.61
Mean	1.80 1.72	1.76	2.40 2.02	2.23	1.69 1.32	1.51		1.98 1.69

Main effect and interaction effect
CD (P=0.05
Time (T) = NS
Method (M) = 0.20
Scion (S) = NS
Time x Method (T x M) = 0.34
Time x Scion (T x S) = 0.28
Method x Scion (M x S) = 0.28
Time x Method x Scion (T x M x S) =0. 49

Conclusion

The present investigation on the "Studies on vegetative propagation of kiwifruit in Kashmir conditions" revealed that among the different grafting methods studied, cleft grafting proved significantly better as compared to other methods of grafting. Time of grafting and scion type also showed significant influence on different characters studied. Cultivar Hayward cleft grafted during 3rd week of March showed increased leaf width, leaf area, total number of leaves per plant and specific leaf area. Thus, cleft grafting performed during 3rd week of March should be practiced for large scale multiplication of kiwifruit in Kashmir conditions.

References

1. Anonymous. Area and production of Fruit crops in Jammu and Kashmir, Department of Horticulture, Jammu and Kashmir, 2016.
2. Dimiri DC, Petwal A, Kamboy D. Determination of optimum time for chip budding in apple cv. Red Fuji. Acta Horticuturae. 2002; 696(1):202-206.
3. Sedaghathoor S. Study on different grafting methods of kiwifruit 'Hayward' on, 'Matua' and 'Bruno' rootstocks. International Society of Horticulture Science. 2016; 71(5):275-280.
4. Upadhyay K, Negi M, Thakur N. Studies on different methods and time of grafting in walnut (*Juglans regia*

L.) under different growing conditions. International Journal of Research in Applied Natural and Social Science. 2017; 5(7):69-74.
5. Zenginbal H. The effects of different grafting methods on success grafting in different kiwifruit (*Actinidia deliciosa* Chev) cultivars. International Journal of Agricultural Research. 2007; 2(8):736-740.