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The Effects of Different Grafting Methods on Success Grafting in Different Kiwifruit (*Actinidia deliciosa*, A. chev) Cultivars

Hamdi Zenginbal
Faculty of Agriculture, Department of Horticulture,
University of Ondokuz Mayıs, Samsun, Turkey

Abstract: The objective of this study was to determine the most suitable different kiwifruit cultivar grafting scions. In this study, Hayward seedling was used rootstock in the field conditions. Hayward, Bruno female and Matua, Tomuri male kiwifruit cultivars were used grafting scions. This study were whip grafting and chip budding used as grafting methods. The graftings were done 15 th May in 2002 and 2003. Bud take rate, bud sprouting rate, graft shoot diameter and shoot length were determined after grafting. According to the results of this trial that all cultivars and grafting types gave sufficient values for bud-take and sprouting success. The Bruno cv. gave the lowest results. Sufficient values for graft diameter and length shoot were obtained from all cultivars and grafting types. It can be concluded that among grafting types, whip graftings were superior than chip buddings and among cultivars, Matua and Tomuri were superior than the others in terms of graft shoot quality.

Key words: Kiwifruit cultivars, grafting methods, nursery

INTRODUCTION

Kiwifruit production is carried out in twenty one provinces in the Mediterranean, Aegean, Black Sea and Marmara regions of Turkey. While the Black Sea region has the biggest kiwifruit production with 1582 tons, this region is followed by Marmara region with 835 tons and the Aegean and Mediterranean regions with 52 and 31 tons, respectively (Anonymous, 2002; Özcan and Zenginbal, 2003).

Turkey and especially the Black Sea region is searching to diverse its range of products and to find alternatives for them. In Black Sea region, some projects have been developed which are not currently under progress concerning decreasing of tea and nut production areas since producer for these crops do not get sufficient income occationaly. Therefore, there has been an increase in interest for new crops. In this connection, kiwifruit has attacted considerable and increasing interest from producer (Özcan and Zenginbal, 2003).

In order to meet the demand for the kiwifruit, it is important to procure its shoots and to present them to the producer. The kiwifruit can be propagated by using the generative and vegetative methods. In addition, vegetative methods are preferable like many other fruit species. The fruit can be propagated vegetatively either through cutting (softwood and hardwood) or grafting and budding (Sale, 1985; Lawes, 1992). Root quality of shoots propagated by cutting method is worse than that of shoots propagated by grafting and budding methods (Diaz Hernandez and Garcia Berrios, 1997). As a result, very less number of plants is produced which are relatively negligible against a very huge demand. Seedlings have also vigor and long roots than cuttings (Özcan, 2000).

The grafting success could be affected by several factors such as temperature, hygiene, pest and disease, humidity, developing capability of both scions (bud) and rootstock, grafting time and conservation of healing union against water loss and drying (Kaşka and Yılmaz, 1974; Hartmann *et al*., 1990; Tanimoto, 1994).

Therefore, the study was conducted to search out the success of cultivar types doing in spring time and find out the usability of whip grafting and chip budding operations in kiwifruit propagation.

MATERIALS AND METHODS

This study was carried out in the experimental area of Horticultural Department of Faculty of Agriculture, University Ondokuz Mayıs during 2002-2003 in Samsun/Turkey. The three years old kiwifruit seedlings having uniform girth were used as stock plant. They were grown in two gallons pot including an equal volume of soil, sand and farmyard manure. Sand had no organic material while farmyard manure contained 83.8% water, 0.29% nitrogen, 0.17% phosphorus, 0.10% potassium and 0.34% calcium. Scion woods (Hayward, Bruno, Matua and Tomuri) were selected in previous winter from vigorous productive plants grown in the kiwi orchard of Atatürk, Tea and Horticultural Plants Research Institute in Rize/Turkey. They were packed in dumpy sawdust and stored in cold storage at 0-1°C for days to initiation of study (Strik and Cahn, 1996). Whip grafting and chip-budding were made by both hand. All budding and grafting were done at the 15 th May. The white and soft plastic taypes were used for wrapping the budding and grafting. The maximum, minimum and mean temperature (°C) and relative humidity (%) were recorded during two months after grafting (Fig. 1 and 2).

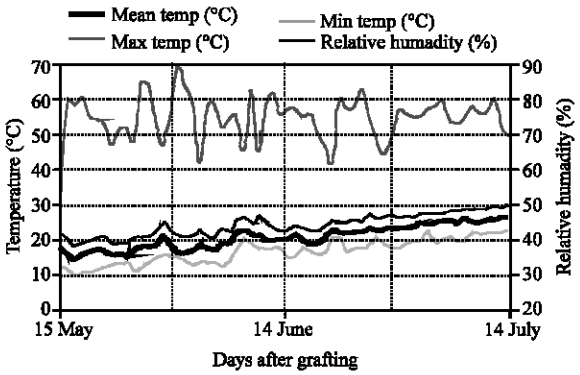

Fig. 1: The mean, maximum and minimum temperatures (°C) and relative humidity (%) changes during the days after budding in 2002

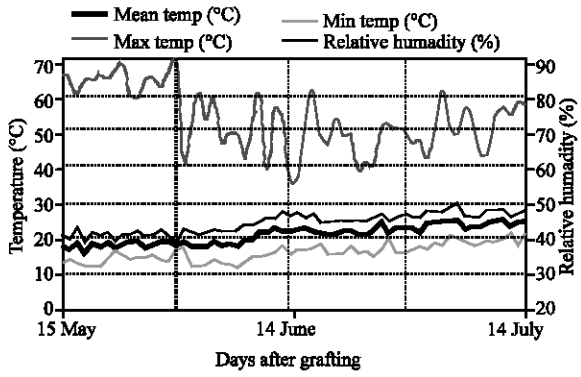

Fig. 2: The mean, maximum and minimum temperatures (°C) and relative humidity (%) changes during the days after budding in 2003

The experiment was laid out in a randomized block design with 3 replications and 20 plants per replication. Cultural operations such as irrigation, weeding and removal of sucker below graft bud union were followed with regular intervals. Data on sprouting were recorded after bud-burst, while bud-take success was recorded 3 months after graft budding. Observations on shoot length and diameter were recorded in December. Data as percentage were transformed using the arc-sin√x transformation and statistical analyses were applied over these transformed data by using MSTAT-C pocket program (Russell D. Freed, Crop and Soil Sciences Department, Michigan State University). Duncan's Multiple Range Test was used to indicate the differences between the average data.

RESULTS AND DISCUSSION

As shown in Table 1 kiwifruit cultivars had a significant effect on bud-take and sprouting success in both years. Although, sufficient bud-take and sprouting success rates were obtained from all cultivars, the highest bud-take was obtained from Hayward (98.34%) in 2002 and Tomuri (100%) in 2003 and the highest sprouting success was obtained from Matua (94.17%) in 2002 and Tomuri (100 %) in 2003. Bruno supplied the lowest bud-take and sprouting success in both years. The effect of grafting method on bud-take and sprout success varied with years. The effect was found to be insignificant in 2002 but significant in 2003. Similarly, the effect of grafting method on sprouting success was significant in 2002 but insignificant in 2003. While chip buddings gave the best results in terms of bud-take rates (93.75% in 2002 and 97.50 in 2003); in 2002 whip graftings and in 2003 chip

Table 1: The effect of chip budding and whip grafting methods on bud - take, sprouting and growth of grafts in different kiwifruit cultivars

Kiwi cultivars	Grafting methods	Bud-take (%)		Sprouting (%)		Shoot diameter (mm)		Shoot Length (cm)	
		2002	2003	2002	2003	2002	2003	2002	2003
Hayward	Chip b.	96.67ab[1]	100.00a	90.00	93.33				
		(83.85)[2]	(90.00)	(71.56)	(77.71)	6.36	7.31b	53.33	62.81
	Whip g.	100.00a	96.67a	96.67	90.00				
		(90.00)	(83.85)	(83.85)	(75.00)	8.95	8.64a	122.73	116.33
	Mean	98.34a	98.33a	93.34a	91.66a				
		(86.93)	(86.93)	(77.71)	(76.35)	7.65a	7.97a	88.03 b	89.57
Bruno	Chip b.	88.33c	90.00bc	83.33	85.00				
		(70.11)	(71.56)	(65.95)	(67.71)	5.41	5.54d	57.59	55.69
	Whip g.	85.00c	83.33c	80.00	75.00				
		(67.21)	(65.95)	(63.55)	(60.00)	8.21	8.52a	108.53	108.39
	Mean	86.67b	86.67c	81.67b	80.00c				
		(68.66)	(68.75)	(64.75)	(63.60)	6.81b	7.03c	83.06b	82.04
Matua	Chip b.	100.00a	100.00a	91.67	96.67				
		(90.00)	(90.00)	(73.40)	(81.38)	6.59	5.81d	70.52	70.73
	Whip g.	95.00bc	93.33b	96.67	93.33				
		(77.08)	(75.24)	(83.85)	(75.24)	9.12	9.03a	127.32	120.32
	Mean	97.50a	96.66b	94.17a	95.00ab				
		(83.54)	(82.62)	(78.63)	(78.31)	7.86a	7.42bc	98.92a	95.53
Tomuri	Chip b.	90.00c	100.00a	85.00	100.00				
		(71.56)	(90.00)	(67.21)	(90.00)	6.32	6.52c	75.12	75.75
	Whip g.	90.00c	100.00a	85.00	100.00				
		(71.56)	(90.00)	(67.21)	(90.00)	9.14	8.97a	120.15	116.84
	Mean	90.00b	100.00a	85.00b	100.00a				
		(71.56)	(90.00)	(67.21)	(90.00)	7.73a	7.75ab	97.64a	96.29
Overall mean	Chip b.	93.75	97.50 a	87.50 a	93.75	6.17 b	6.29 b	64.14 b	66.24b
	Whip g.	92.50	93.33 b	89.59 b	89.58	8.86 a	8.79 a	119.68 a	115.47a
Method		NS	1%	5%	NS	1%	1%	1%	1%
LSD cultivar		1% = 6.75	1% = 6.86	1% = 9.01	1% = 12.04	1% = 0.79	1% = 0.42	1% = 13.36	NS
LSD method×cultivar		1% = 9.55	5% = 6.99	NS	NS	NS	1% = 0.59	NS	NS

[1]Original data [2]Transformed data; NS: Non significant

buddings gave the best results concerning sprouting success (89.54 and 93.75%, respectively). Grafting methods×cultivars was found to be significant for bud-take, insignificant for sprouting success in both years. The highest bud-take was obtained from Hayward grafted by whip grafting and Matua grafted by chip budding (100%) in 2002 and Hayward, Matua and Tomuri grafted by chip budding (100%) in 2003. The results indicate that all cultivars gave sufficient values for bud-take and sprouting success. The insignificant difference between cultivars in terms of bud-take and sprouting success may potentially be attributed to the genetic difference. Likewise, Hartmann *et al*. (1990) reported that genetic factors had a significant effect on grafting success. Among grafting methods, chip budding gave better results than whip grafting in terms of bud-take and sprout success. This may be due to grafting times. The increasing water transportation and beginning of leaf formation on grafted plant (Özcan, 1995) had a negative effect on bud-take and sprout success. Grafting success was also affected by bleeding around grafted area and the bigger grafting area in whip grafting. Kaşka and Yılmaz (1974), Hartmann *et al*. (1990) and Zenginbal and Özcan (2000) reported that grafting success was affected negatively by the bleeding derived from grafting.

As shown in Table 1, the effect of cultivars on shoot diameter was found to be significant in both years, although its effect on shoot length was significant in 2002 but insignificant in 2003. In general male cultivars Matua and Tomuri gave better results concerning diameter and length on graft shoot. The lowest results were obtained from Bruno. Grafting methods affected diameter and length on graft shoot significantly in both years. The highest diameter (8.86 mm in 2002 and 8.79 mm in 2003) and length shoot (119.68 cm in 2002 and 115.47 cm in 2003) were obtained from whip grafting. Grafting methods ×cultivar for diameter shoot was found to be insignificant in 2002 but significant in 2003; the same interaction for length shoot was found to be insignificant in both years. Sufficient values for diameter and length on graft shoot were obtained from all cultivars and grafting types. It can be concluded that among grafting types, whip graftings were superior than chip buddings and among cultivars, Matua and Tomuri were superior than the others in terms of graft shoot quality. The results are in accordance with those of Hartmann *et al*. (1990) and Zenginbal and Özcan (2003) reporting that grafting produced better graft shoot quality when compared to buddings. Zenginbal and Özcan (2000) also reported that cultivars has a significant effect on graft shoot quality and the presence of flower and fruit bud on graft scion encourage the generative development and thus, suppress the vegetative development. According to Sale (1985), the vegetative development of male kiwi cultivars are faster than that of female ones. Our results are supported by those of Zenginbal and Özcan (2000) reporting that graft shoot quality of Matua are superior than that of Hayward.

CONCLUSION

Based on the results of the present study, it can be concluded that because of its higher graft shoot quality, whip grafting should be preferred for kiwi production by grafting although sufficient grafting success can be obtained from all cultivars and grafting types. It is also possible to generalize the present results for a long period of times because climatic data for the years when the study was conducted are similar those of prevalent years of Samsun.

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