INTERNATIONAL JOURNAL OF AGRICULTURE & BIOLOGY
ISSN Print: 1560–8530; ISSN Online: 1814–9596
10–668/AWB/2011/13–4–628–630
http://www.fspublishers.org

Short Communication

Comparison of Green Grafting Techniques for Success and Vegetative Development of Grafted Grape Cultivars (*Vitis* Spp.)

ALI SABIR[1]
Selcuk University Agriculture Faculty Horticulture Department Konya, Turkey
[1]Corresponding author's e-mail: asabir@selcuk.edu.tr

ABSTRACT

Grafting incorporates a new grapevine cultivar onto the root system of a desired rootstock variety. Recently, many grafting methods have been used in grapevine propagation. A glasshouse trial was conducted to assess three different methods of green grafting (cleft, modified cleft & whip) using Alphonse Lavallée and Perlette cultivars and 99 R rootstock. The highest callusing rates were observed in whip graft type in both Alphonse Lavallée (3.95) and Perlette (3.92). However, modified cleft grafting generally gave better results for most of the growth parameters in both cultivars. For instance, the values relevant to shoot length (62.6 cm & 48.6 cm for Alphonse Lavallée & Perlette, respectively), shoot lignification length (24.7 cm & 16.5 cm for Alphonse Lavallée & Perlette, respectively) and leaf number per shoot (19.9 & 23.0 for Alphonse Lavallée & Perlette, respectively) were higher for both cultivars when modified cleft method was applied.

Key Words: Grapevine; Rootstock usage; Propagation; Green grafting

INTRODUCTION

Increasing market potential for wine and grapes has resulted in shortfall in desired planting materials. The demands for planting materials could be matched by the improvement and effective employment of techniques that allow the rapid expansion of propagating stock. On the other hand, phylloxera that has so viciously attacked the European grapevine cultivars (*Vitis vinifera* L.) worldwide continues to munch its way from vine to vine. In order to fight against this pest, a variety of rootstocks with their phylloxera-resistant root systems are being improved. Today, growers have to graft susceptible *V. vinifera* cultivars onto rootstocks bred from various North American species (Baydar & Ece, 2005; Lowe & Walker, 2006).

With increased awareness about the use of rootstocks in overcoming the adverse effects of biotic and abiotic stress factors, growers started using rootstocks for grape cultivation. Grafting incorporates a new grapevine cultivar (called the scion), onto the root system of a desired rootstock variety. Grafting grapes serves various aims. For instance, certain cultivars are more productive or adapt better to contrasting ecological conditions (phylloxera, nematode, saline soil, calcareous soil) when cultivated on a particular grapevine rootstock (Celik, 1998). Grafting also allows growers to change the existing grape cultivar in vineyard to a new one. Among such techniques, green-grafting offers growers to propagate the desired cultivars during the growing period after the time for grafting with dormant scions has ended. In this method, succulent green current-season growth is used as scions that are grafted on the new growth of rootstock variety. Green grafting can be performed early as shoots are large and firm enough to handle. The method has been successfully adopted in many countries, where grape cultivation is common (Kaserer *et al.,* 2003). Green grafting technique has many advantages such as easiness for application, relatively higher success rate and capability of overcoming the graft incompatibility sometimes experienced between distantly related *Vitis* species (Bouquet & Hevin, 1978; Sabir & Kara, 2004). This technique is currently being used for rapid and routine indexing of grapevine virus diseases (leafroll, fleck, corky bark, vein mosaic, vein necrosis) and more recently as a means of evaluating virus presence in certification programs (Walker & Meredith, 1990; Walter *et al.,* 1990; Pathirana & McKenzie, 2005). However, this method is time-consuming and labor-intensive in certain cases.

Currently, employment of concrete grafting types has gained important for obtaining successful result, although little data exist regarding the advantages and disadvantages of different green-grafting methods. Previously, the results of a relatively new green grafting technique have been reported (Pathirana & McKenzie, 2005). However, this method has not been adopted in most of the viticulture region worldwide probably, because of little awareness on capability of such grafting type. Therefore, the present study was conducted on the comparative evaluation of different green-grafting techniques using Alphonse Lavallée and Perlette cultivars and 99 R rootstock.

To cite this paper: Sabir, A., 2011. Comparison of green grafting techniques for success and vegetative development of grafted grape cultivars (*Vitis* spp.). *Int. J. Agric. Biol.*, 13: 628–630

MATERIALS AND METHODS

The trial was established in an experimental glasshouse of Selcuk University, Agriculture Faculty, Horticulture Department, Konya, Turkey. Own rooted 99 Richter (*V. berlandieri* x *V. rupestris*) vines were planted during the month of February 2010 into plastic pots containing peat and perlite in equal volume. After a three-moth vegetative development stage, grapevine cultivars Alphonse Lavallée and Perlette were grafted on the rootstock 99 R by three different types of green-grafting technique.

The green shoots chosen for grafting had a diameter of 5–8 mm, and were at 3–6 nodes below the active bud. The leaves on these shoots were trimmed to about half their original size before grafting (Walter *et al.,* 1990). Three methods of green-grafting were assessed; cleft, modified cleft and whip (tongue) grafting. In each grafting the scion cuttings, having one bud, were grafted hand. For cleft and modified cleft grafting, a slit was made down the centre of either the rootstock (cleft) or scion (modified cleft) by a razor blade and a long tapered wedge was made on the opposing piece. For all grafts, the shoots of both rootstock and the scion had the same diameter at the point of contact so that the cambium layers of the union matched (Martelli *et al.,* 1993). As for whip graft, the cut surface was three times the diameter of the stock or scion. A sloping cut was made for the stock and scion. For both materials, the tongue cut was made with a slow, slightly rocking motion of the knife and the tongue was gently bend out. The stock and scion was placed together with the tongues interlocking (Jackson, 2008). The assembled grafts were wrapped with commercial plastic bandage tape. The graft union was healed under condition of moderate light, high humidity (between 60-80%) and good air circulation. The grafted plants were kept under tulle curtain with mean daily temperature in the glasshouse ranged between 23 and 30°C during the experiment over three weeks. Then, the curtain was removed to allow the scion shoot to harden. Fungal diseases were controlled with fungicides.

The following parameters were examined to assess grafting methods, as illustrated by Celik (2000), Baydar and Ece (2005): callus formation rate (0 to 4 was used, 0=no callus, 1=25%, 2=50%, 3=75% and 4=100% callus formation on graft union surface); shoot length (the length (cm) of the scion shoot was measured with a sensitivity of 1 mm); shoot diameter (measured by digital compass at a point 1 cm above the second node); shoot lignification length (the length of the scion shoot, where complete lignification occured); leaf number (average number of leaves on scion shoots) and graft take percentage (percentage of grapevines that had an adequate or all-around callus ring formation on the surface of the graft union).

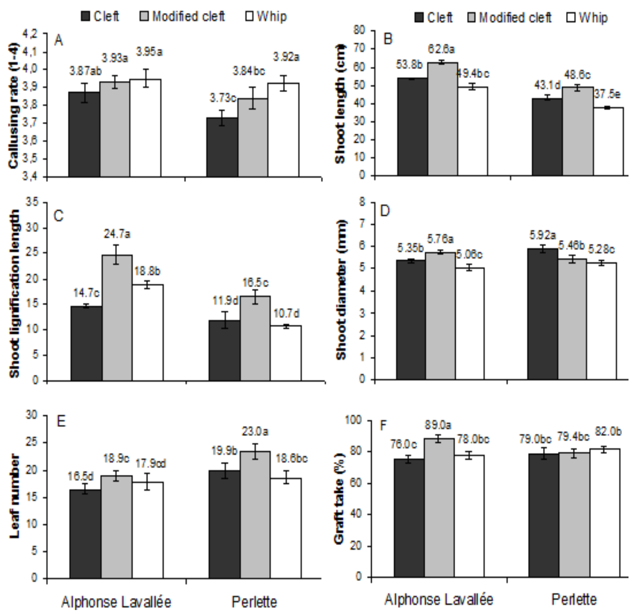
The study design was a complete randomized block with three replicates. Each replicate consisted of 10 grafted plants. A two-way ANOVA was used to analyze the interactions between grape cultivars and grafting methods. Tukey's student tests were used to separate means when statistically significant effects ($P<0.05$) were detected. Data were analyzed using SPSS program version 13.0 (SPSS Inc., Chicago, IL).

RESULTS AND DISCUSSION

Interactions between cultivars and grafting methods are presented in (Fig. 1A-F). As can be seen in Fig. 1A, the highest callusing rates were observed in whip graft type in both Alphonse Lavallée (3.95) and Perlette (3.92), while cleft grafts gave the least values for both of the cultivars. This result show that adhesion level of the rootstock and scion was better in whip graft than the others. This is most likely because whip grafting method provides larger union surface than other grafting types as previously stated by Jackson (2008). However, it should be further emphasized that cambial continuity after callusing between graft partners has an essential role in graft success. As for shoot length (Fig. 1B), the highest value was obtained from modified cleft graft type of Alphonse Lavallée (62.6 cm) and Perlette (48.6 cm). Similarly, application of modified cleft grafting type resulted in the formation of the highest shoot lignification length in Alphonse Lavallée and Perlette (Fig. 1C). Shoot diameter varied significantly according to the graft combinations (Fig. 1D). The thickest shoots were investigated in cleft budding of Perlette (5.92 mm) and modified cleft budding of Alphonse Lavallée (5.76 mm). On the other hand, whip budding method gave the least values for both cultivars. As seen in Fig. 1E, the numbers of leaves per shoots were the highest when modified cleft method was used for both cultivars Alphonse Lavallée (19.9) and Perlette (23.0). The leaf number of Perlette grafted by modified cleft method was markedly higher than those of other methods. This grafting method also gave the highest graft take (final take) percentage in Alphonse Lavallée (89%) although the graft take percentages for Perlette were quite similar (Fig. 1F). This percentage is quite similar to those of Pathirana and McKenzie (2005) who performed modified cleft grafting for use in viral indexing of grapevines Cabernet franc and Cabernet sauvignon, reaching an overall graft-take success rate of 83.8%. On the other hand, Borgo *et al.* (1998), using a micrografting technique, recorded 65–68% graft-take on Kober 5 BB and 59% on 1103 P rootstocks using Chardonnay and Merlot scions. Such differences might be attributed to the different response of genotypes to grafting methods.

It is evident from the findings of present and previous (Celik & Odabas, 1998; Pathirana & McKenzie, 2005) studies that the graft take percentage and subsequent vegetative development of scion cultivar is highly depend on grafting methods. Proper transmission of plant nutrition matters and photosynthesis products between the rootstock and scion cultivar is solely depend on optimum formation of

Fig. 1: Callusing rates (A), shoot lengths (B), shoot lignification lengths (C), shoot diameters (D), leaf numbers (E) and graft takes (F) of grapevine cultivars grafted on 99 R rootstock



graft union. However, this formation must be maintained until the stock and scion are firmly grown together to ensure mechanical rigidity.

CONCLUSION

Of the three different green grafting methods tested in this study, modified cleft grafting generally gave better results in terms of shoot length, shoot diameter, shoot lignification length, leaf number per shoot and graft take parameters. Therefore, this method could be recommended when green grafting was considered to apply under similar conditions.

REFERENCES

Baydar, N.G. and M. Ece, 2005. Comparison of different scion/rootstock combinations in the production of grafted grapevines in Isparta condition. *Suleyman Demirel Universitesi Fen Bilimleri Enstitusu Dergisi*, 9: 49–53

Borgo, M., A. Calo, A. Costacurta, M. Gardiman and G. Malacchini, 1998. La propagation rapide de la vigne par microgreffage ‘‘ISV Conegliano’’. *Riv Viticoltura e di Enol*., 51: 3–14

Bouquet, A. and M. Hevin, 1978. Green-grafting between Muscadine grape (*Vitis rotundifolia* Michx.) and bunch grapes *(Euvitis* spp.) as a tool for physiological an pathological investigations. *Vitis*, 17: 134–138

Çelik, S., 1998. *Bagcilik (Ampeloloji), Cilt-1, Trakya Universitesi, Tekirdag Ziraat Fakultesi*. Bahce Bitkileri Bolumu, Tekirdag, p. 426

Celik, H. and F. Odabas, 1998. The effects of the grafting time and types on the success of the grafted grapevine production by grafting under nursery conditions. *Turkish J. Agric. For*., 22: 281–290

Celik, H., 2000. The effects of different grafting methods applied by manual grafting units on grafting success in grapevines. *Turkish. J. Agric. For*., 24: 499–504

Jackson, R.S., 2008. *Wine Science, Principles and Applications*, 3rd edition, p: 769. Elsevier Academic Press, Burlington, MA 01803, USA

Kaserer, H., W. Leonhardt, A. Grahsl and H. Gangl, 2003. Report on efficient scheme to develop certified clonal propagating material in Austria. *Acta Hortic*., 603: 127–129

Lowe, K.M. and M.A. Walker, 2006. Genetic linkage map of the interspecific grape rootstock cross Ramsey (*Vitis champinii*) x Riparia Gloire (*Vitis riparia*). *Theor. Appl. Genet*., 112: 1582–1592

Martelli, G.P., V. Savino and B. Walter, 1993. Indexing on *Vitis* indicators. *In*: Martelli, G.P. (ed.), *Graft Transmissible Diseases of Grapevines*, pp: 137–155. Food and Agriculture Organization of the United Nations, Rome

Pathirana, R. and M.J. McKenzie, 2005. A modified green-grafting technique for large-scale virus indexing of grapevine (*Vitis vinifera* L.). *Sci. Hortic*., 107: 97–102

Sabir, A. and Z. Kara, 2004. Performance and success of green-grafting technique in some American rootstocks. *Alatarim*, 3: 28–32

Walker, M.A. and C.P. Meredith, 1990. "The genetics of resistance to grapevine fanleaf virus (GFV) in *Vitis vinifera*". *Vitis,* 1990: 228–238

Walter, B., P. Bass, R. Legin, C. Martin, R. Vernoy, A. Collas and G. Vesselle, 1990. The use of a green–grafting technique for the detection of virus–like diseases of the grapevine. *J. Phytopathol*., 128: 137–145

(Received 06 December 2010; Accepted 16 December 2010)