ROOTING CAPABILITY OF OLIVE CUTTINGS, CV. GORDAL: INFLUENCE OF THE PRESENCE OF LEAVES AND BUDS

M.P. Suárez and
E.P. López-Rivarés
EUITA. Cortijo de Cuarto
P.O. Box 11043
41014 Sevilla
Spain

S. Lavee
Institute of Horticulture
Volcani Center
Bet Dagan and Hebrew
University
Rehovot Israel

A. Troncoso
Instituto de Recursos
naturales y Agrobiología
(CSIC).P.O. Box 1052
41080 Sevilla
Spain

Keywords: *Olea europaea* L., propagation.

Abstract

The influence of leaves and buds on the rooting ability of cv. Gordal olive cuttings, under mist was studied. Presence of leaves significantly favoured callus and root formation and decreased or inhibited the outgrowth of buds to shoot. Lack of leaves significantly decreased or inhibited the rooting and enhanced shooting of buds, even when lateral buds were detached. Presence of lateral buds did not affect the rooting process.

1. Introduction

Mist rooting techniques are widely used in the propagation of olive plants. Nevertheless, there are cultivars, such as 'Gordal', that are very difficult to root (Troncoso *et al.*, 1975; Del Río and Caballero, 1986) and consequently present troubles to be used with this method. Indolic 3-butyric acid (IBA) applications to the difficult-to-root cuttings do not significantly change their rooting response and in addition to a low rooting response, few and weak roots are formed (Weisman and Lavee, 1994).

Troncoso *et al.* (1975,1976), Mazuelos *et al.* (1978), Bartolini *et al.* (1979), Caballero and Nahlawi (1979), Troncoso *et al.* (1981) and Weissman and Lavee (1995), considered the influence of nutritional factors on the rooting of olive cuttings. Leaves and buds produce necessary cofactors to root and then the presence of these organs in the cutting is important (Hartmann 1994). Fontanazza and Rugini(1977) also studied the influence of the presence of leaves on the rooting ability of easy-to-root olive cuttings.

The aim of the present work is to know the influence of leaves and buds on 'Gordal' (difficult-to-root) olive cuttings.

2. Material and methods

Two experiments (spring and autumn) were carried out using cv. Gordal olive cuttings, of 18 cm in length and 4-6 mm in diameter. Cuttings were divided into the following groups and for every group 6 replication of 10 cuttings were used:

- Normal cuttings with 2-3 pairs of leaves and lateral buds.
- Cuttings with 2-3 pairs of leaves but with lateral buds removed.
- Cuttings without leaves with lateral buds intact.
- Cuttings with both leaves and buds, removed.

All the cuttings were treated with IBA 8000 ppm immersion of the cutting base for 5 seconds in a 50:50 (v/v) hydroalcoholic solution. After auxin treatment, the cuttings were put in a mist propagation system for 60 days on a perlite substrate at 25°C basal heating. During the experiment the following factors were measured: number of cuttings with callus, rooted cuttings, number of roots per cutting, length of the roots and lateral shoots number and length.

3. Results and discussion

Callus formation at the base is the first activity of the cutting put to root under mist propagation as an initial process leading to rooting (Troncoso *et al.*, 1975). The percentage of cutting forming callus in the first spring experiment was generally high (figure 1). Three groups of cuttings (with leaves and buds, with leaves and without buds and without leaves and buds) developed callus in high proportions (81% average, without significant differences among them) and the group without leaves but with buds reached only 62% of cuttings with callus. In consequence, it was not possible in this experiment to establish any relationship between the presence or absence of leaves or buds and the callus formation.

In the autumn experiment, there was a very clear relationship between the presence or absence of leaves and callus development. On the contrary, presence or absence of lateral buds did not influence the callus formation. The cuttings with leaves produced callus in 88% of the cases while those without leaves showed callus on only 30% of the cuttings (figure 1). The cuttings with leaves but without buds produced callus on 90% of the cuttings without a significant difference between those with leaves and buds (86%).

The influence of the presence or absence of leaves on the rooting capability of the cuttings was very clear. In the first experiment, cuttings with leaves and buds showed 23% of rooting. This number, according to the results of Troncoso *et al.* (1975) and Del Río and Caballero (1986) means a high rooting level for this cultivar. Cuttings with leaves but without buds reached 18% of rooting with no significant differences from the first group, indicating the low influence of the presence or absence of lateral buds on the rooting. The groups of cuttings with no leaves, independently of the presence or absence of lateral buds, practically did not root (Figure 2). A similar influence of leaves on rooting was obtained by Fontanazza and Rugini (1977), working with other olive cultivars and using only cuttings with leaves and buds and cuttings without any organs.

The rooting obtained in the second experiment (autumn) confirmed the influence of leaves on rooting. Despite a decrease of the percentage of rooting in the group of cuttings with leaves and buds, the cuttings with leaves showed a higher rooting ability than those without leaves which did not root (figure 2).

Growth of lateral shoots was also influenced by the presence or absence of leaves in the cutting. When the leaf was present, the corresponding axillary bud did not grow to form a shoot (figure 3). On the contrary, when the leaves were detached, the axillary buds showed a high activity, quickly forming at least one shoot with active growth. This shoot formation happened also in the cuttings where the leaves and lateral buds had been both removed, indicating a quick and high activation of the latent buds (figure 3).

In consequence, when no leaves were present, the priority of the cutting was to form new shoots with new young leaves, probably to assure photosynthesis. This process which requires a high energy consumption is possibly in competition with the rooting process, which is also in need of a high quantity of metabolites (Troncoso *et al.*, 1975 and 1981). This competition could explain, at least partially, the lack of rooting observed when no leaves were on the cutting, particularly with a difficult-to-root cultivar such as Gordal. Although Weissman and Lavee (1995) indicate that carbohydrates related to the rooting process belong to the cutting reserves rather than to the photosynthesis of the cuttings leaves, the leaf could produce some product necessary for the rooting.

Hartmann (1994) indicates that buds could also produce some cofactor necessary for the rooting but, according to our results, the presence or absence of axillary buds did not influence callus formation, rooting or length of roots (data not shown).

In consequence, presence or absence of leaves in the cutting was totally determinant for the rooting of cv. Gordal olive cuttings (considered as difficult-to-root) and clearly inhibited the lateral bud growth to form a shoot. The presence or absence of axillary buds did not affect the rooting process.

References

- Bartolini, G., Troncoso, A. and Fiorino, P. 1979. Radicazione di talee di olivo cv. Frangivento provenienti da piante madri allevate in ambienti diversi. *Ortoflorofrutticoltura Italiana*. IV: 109-118.
- Caballero, J.M. and Nahlawi, N. 1979. Influencia de los hidratos de carbono y del lavado con agua en el enraizamiento por estaquillado semileñoso del cultivar Gordal de olivo (*Olea europaea* L.). *Anales Instituto Nacional de Investigaciones Agrarias*. Madrid, p. 219-230.
- Del Río, C. and Caballero J.M. 1986. Influencia del tipo de estaquilla y del AIB sobre la variación estacional del enraizamiento de los cultivares de olivo 'Picual' y 'Gordal Sevillana'. *Olea* 17: 23-26.
- Fontanazza, G. and Rugini, E. 1997. Effect of leaves and buds removal on rooting ability of olive tree cuttings. *Olea* : December. 9-28.
- Hartmann, T.H. and Kester, D.E. 1994. *Propagación de plantas*. CECSA. México. 760 pp.
- Mazuelos, C., Troncoso, A., Prieto, J., Nicolás, A. and Liñán, J. 1978. Rooting Responses and Nutritive Status of Olive Cuttings. Edimburgo. Federation of European Societies of Plant Physiology.
- Troncoso, A., Bartolini, G., Nicolás, A. and Mazuelos, C. 1981. Radicazione di talee di olivo cv. Frangivento provenienti da diversi ambienti. 2) Relazione con lo stato nutrizionale della talea. *Ortoflorofrutticoltura Italiana*. Tomo III: 219-229.
- Troncoso, A., Chaves, M., Nicolás, A., Prieto, J. and Liñán, J. 1976. Multiplicación de plantas de olivo por nebulización. I) Influencia del estado nutritivo de la planta madre y de la evolución de nutrientes en el ramo. *Gante*. IV Coloquio Internacional sobre el control de la nutrición de las plantas cultivadas.
- Troncoso, A., Mazuelos, C., Nicolás, A., and Prieto, J. 1975. Evolución de nutrientes y azúcares en el anillo cortical basal de estaquillas de '*Olea europaea*' L. durante la estancia en nebulización. 1975. Córdoba. II Seminario Oleícola Internacional. Ministerio de Agricultura.
- Troncoso, A., Valderrey, J., Prieto, J. and Liñán, J. 1975. Algunas observaciones sobre la capacidad de enraizamiento de variedades de *Olea europaea* L. bajo técnicas de nebulización. I. Respuesta a la emisión de raíces y estructura anatómica. *Anal. Edaf.* Tomo XXXIV. 7-8: 461-471.
- Weisman, Z. and Lavee, S. 1995. Enhancement of IBA stimulatory effect on rooting of olive cultivar stem cuttings. *Sciencia Horticulturae* 62: 89-198.

Figure 1. The effect of leaves and buds on callus formation during rooting initiation under mist of cv. Gordal cuttings (the cuttings were pretreated with IBA 8000 ppm). In each experiment numbers followed by the same letter are nonsignificantly different using Tukey's HDS test ($p \leq 0.05$).

Figure 2. The effect of leaves and buds on the rooting ability of cv. Gordal cuttings. In each experiment numbers followed by the same letter are nonsignificantly different using Tukey's HDS test ($p \leq 0.05$).

Figure 3. The effect of leaves and buds on shoot development of cv. Gordal cuttings in a mist rooting bench. In each experiment numbers followed by the same letter are nonsignificantly different using Tukey's HDS test ($p \leq 0.05$).