Comunicação

Influence of leaf retention on cutting propagation of *Lavandula dentata* L.

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ABSTRACT

Vegetative propagation of lavender offers several advantages over sexual propagation, among them crop homogeneity and yield of higher quality essential oil. However, *Lavandula* species have been propagated mostly by seeds and are said to be recalcitrant to rooting when propagated by cuttings. During cutting propagation, one of the important variables that influence the rooting capacity of cuttings is the leaf retention. The objective of this work was to evaluate the influence of leaf retention on rooting of *L. dentata* cuttings. Apical cuttings of *L. dentata* of 10 cm in length, keeping approximately 1/3, 1/2 or 2/3 of their leaves were planted in commercial substrate Plantmax HT® under intermittent mist. After two months, averages of root number, length of the longest root, root fresh and dry weights, and the survival percentage were evaluated. Root length and fresh weight were statistically greater with 2/3 of leaf retention and when fewer leaves were kept on the cuttings, lower means of root dry weight was observed. Under the conditions applied in this study, greater leaf retention was better for rooting of *L. dentata* cuttings.

Key words: Lavender, rooting, vegetative propagation,.

RESUMO

Influência da retenção foliar na estaquia de *Lavandula dentata* L.

A propagação vegetativa da alfazema oferece muitas vantagens comparada à propagação sexuada entre elas, homogeneidade da lavoura e produção de óleo essencial de melhor qualidade. Todavia, espécies de *Lavandula* têm sido propagadas principalmente por sementes e são consideradas recalcitrantes ao enraizamento na propagação por estaquia. Durante a propagação por estaquia, uma das importantes variáveis que influenciam na capacidade de enraizamento das estacas é a retenção foliar. O objetivo deste trabalho foi avaliar a influência da retenção de folhas no enraizamento de estacas de *L. dentata*. Estacas apicais de *L. dentata* de 10 cm de comprimento, mantendo 1/3, 1/2 ou 2/3 de suas folhas, foram plantadas em substrato comercial Plantmax HT® sob nebulização intermitente. Após dois meses, médias de número de raízes, comprimento da raiz mais longa, massas fresca e seca de raízes e percentagem de sobrevivência foram avaliados. Comprimento e massa de matéria fresca das raízes foram estatisticamente superiores sob 2/3 de retenção foliar, e quando menos folhas foram mantidas, menor média de massa de matéria seca de raízes foi observada. Nas condições utilizadas, a maior retenção de folhas causou melhor desenvolvimento das raízes de estacas de *L. dentata*.

Palavras-chave: Alfazema, enraizamento, propagação vegetativa.

Recebido para publicação em julho de 2009 e aprovado em abril de 2010

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INTRODUCTION

Lavandula dentata, a herbaceous small shrub belonging to the Labiaceae family (Cavanagh & Wilkinson, 2002), is a very productive *Lavandula* species, rich in 1,8-cineol, fenchol and camphor (Echeverrigaray *et al*., 2005). The disinfectant and medicinal properties of lavender can be used in different market sectors, such as the cosmetics and industrial fragrance industries, among others (Al-Amier *et al.*, 1999; Shellie *et al.*, 2002; Moss *et al.*, 2003; Beus, 2006; Chemat *et al.*, 2006; Dob *et al*., 2006; Singh *et al.*, 1997).

Unfortunately, the commercial oil composition of *Lavandula* varies tremendously mostly because of the great genetic variation due to segregation caused by sexual propagation (Nogueira & Romano, 2002), since the species have been propagated mostly by seeds because of the well known rooting recalcitrance of cuttings, which has been attributed to the genus (Dias *et al.*, 2002; Nogueira & Romano, 2002; Sousa *et al*., 2005; Tyub *et al.*, 2007). Nevertheless, these are herbaceous plants and according to Hartmann *et al.* (2002), rooting tends to be easily induced in herbaceous species.

Vegetative propagation offers several advantages compared to the sexual propagation, among them the homogeneity of plant material, crop and subproducts, rate of plant development and productivity since healthy, superior adult stock plants are used and the clonal propagation of the plant material increases the chances of obtaining higher quality essential oil (Tyub *et al.*, 2007).

Cutting propagation has been used to propagate many aromatic and medicinal plants (Biasi & Costa, 2003; Bona *et al.*, 2004, Bona *et al.*, 2005; Sousa *et al.*, 2005; Carvalho *et al.*, 2007; Costa *et al.*, 2007; Maia *et al*., 2008). During cutting propagation, one of the important variables which is supposed to influence the rooting capacity of cuttings is leaf retention, because leaves hold auxin, a small signaling molecule which is translocated to the cutting base, allowing production of carbohydrates by photosynthesis (Hartmann *et al.*, 2002; Bordin *et al.*, 2005), and acting as a trigger to the developmental process of rhizogenesis (Robert & Friml, 2009). However, the foliar area left on the cutting, if excessive, may cause an undesirable effect on rooting due to possible dehydration of cuttings caused by excessive evaporation, even under mist (Hartmann *et al.*, 2002; Lima *et al.*, 2006).

The objective of this work was to evaluate the influence of leaf retention on rooting of *L. dentata* cuttings.

MATERIAL AND METHODS

Herbaceous apical cuttings of 10 cm in length and approximately 0.5 cm in diameter were cut at the end of winter from the apical part of stems of adult (approximately two year-old) *L. dentata* stock plants, with 1/3, 1/2, or 2/3 of their top leaves kept intact. The cuttings were placed in commercial substrate Plantmax® in polystyrene foam trays with 128 (cells volume 35 cm^3) and kept under an intermittent mist system (20±7°C and 15 seconds mist with 15 minutes interval from 8:00 to 17:00, 60 minutes interval from 17:00 to 22:00, or 180 minutes from 22:00 to 08:00). A voucher specimen was deposited in the herbarium of the UFPR´s Department of Botany (excicata nº. UPCB 61.305). A total of 96 cuttings (eight cuttings per treatment and four replications) were used. A completely randomized experimental design was applied. After two months, means of root number, length of the longest root, root fresh and dry weight and survival percentage were compared using the Bartlett test to assess equality of variance and Tukey's post-test pd"0.05 using the 2.10 MSTAT-C® software.

RESULTS AND DISCUSSION

One hundred percent of cuttings were rooted in all treatments. Root length and fresh weight were statistically greater with 2/3 of leaf retention, whereas cuttings with fewer leaves had lower mean root dry weight (Table 1) probably due to less carbohydrate production, showing that a greater leaf retention was important for rooting of this genotype, although it is usually propagated with just a few apical leaves left in order to avoid cutting dehydration. The leaf size reduction procedure is quite usual, to reduce water loss. However, retention of the maximum leaf area possible may produce a stronger root system in a shorter period, because root initiation and growth require adequate oxygen supply. Larger leaf areas may allow better photosynthetic performance of cuttings and serve as source of auxin and co-factors to initiate and improve rooting, because differential auxin accumulation is perceived and interpreted, at the level of cells of the wounded tissues by nuclear auxin signaling pathway, which regulates gene expression and reprogramming of cell fates (Robert & Friml, 2009). As a general rule, maximum leaf area should still be retained (Hamilton & Midcap, 2003).

Lack of adequate leaf retention may be one of the reasons why some species are labeled as difficult to root and that might be the case for some *Lavandula* species. Garbuio *et al.* (2007) also observed the importance of leaf retention as leafy patchouli (*Pogostemon cablin*) cuttings showed a greater rooting percentage than leafless cuttings. *Passiflora alata* leafy cuttings showed greater rooting percentage than cuttings with leaves cut by half or leafless (Meletti *et al.*, 2007). Tarragó *et al.* (2005) also reported a strong correlation between leaf retention and rooting on softwood cuttings of *Ilex paraguariensis*.

Table 1. Effect of leaf retention on root number, length, fresh and dry weigths of *L. dentata* cuttings.

Foliar retention	Root number	Root lenght (cm)	Fresh weigth of roots (g)	Dry weight of roots (g)[1]
2/3	20,50 a[2]	12,70 a	4,76 a	0,59 a
1/2	21,35 a	9,77 b	3,43 b	0,27 ab
1/3	14,94 a	9,00 b	1,60 c	0,11 b
C.V.(%)	25,3	9,6	20,5	8,4

[1]Original data transformed into $\sqrt{(x + 1)}$.

[2]Mean values on same column followed by the same letters are not statistically different according to Tukey's test at 5% probability.

Presence of leaves influences rooting, mainly on herbaceous and semi hardwood cuttings, in which a growing shoot tip, or lateral bud, is important, since such cuttings, differently from hardwood cuttings taken during rest periods, have low reserve supplies. Some root promoting compounds (auxin, cofactors) present in buds and leaves travels through the phloem to the base of the cuttings and exerts stimulating effect on rooting. On the other hand, dehydration caused by transpiration may occur when leaves are kept on cuttings (Hartmann et al., 2000; Robert & Friml, 2009).

The rooting observed in this study was probably benefited by translocation of auxin and cofactors, and photosynthetic performance, from leaves kept on the cuttings. Root initiation is dependent on auxin, carbohydrates and nitrogen status, carbon/nitrogen ratio, as well as rooting co-factors (phenolics; possibly an ortho-dyhydroxy phenol and a polyphenol-oxidase) and auxin synergists, which are supplied by leaves and accumulate at the cutting base (Hartmann *et al.*, 2002; Robert & Friml, 2009). As a general rule, presence of leaves is important when using herbaceous or semi-hardwood cuttings for propagation. However, some species may present an opposite response to leaf presence. For instance, *Ligustrum sinenses* leafless semi-hardwood cuttings rooted better than leafy ones (Bona *et al.*, 2002). On the other hand, for *Aristolochia triangularis* herbaceous cuttings, the presence of leaves was indispensable for rooting (Correa & Biasi, 2003).

CONCLUSIONS

L. dentata cuttings root easily.

For the conditions tested in this study, 2/3 leaf retention improved rooting of *L. dentata* cuttings.

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