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Effect of plant growth regulators on rooting of henna (*Lawsonia inermis L.*)

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ABSTRACT

Studies have shown that rooting substrate is one of the effective factors at rooting of hard rhizogenetic plant such as Henna. The purpose of this study is to determine an appropriate concentration of Naphthalene Acetic Acid (NAA), Indole Butyric Acid (IBA) and salicylic acid (SA) on Rooting of Henna. Present study showed that there was a great variation in most of the measured characters at P< 0.05 percent level. The obtained results show that hormonal treatments have caused the increase of percent of rooting. The use of SA caused a positive effect on rooting. The maximum leaf was obtained in 2000 $ml.L^{-1}$ NAA + 200 $ml.L^{-1}$ SA. This study shows that Plant Growth Regulators have a profound influence on Rooting of Henna.

Key words: Cuttings, Henna, IBA, NAA, Rooting, Salicylic acid.

INTRODUCTION

Henna (Lawsonia inermis L.) is a medicinal plant because of Lawson material and its therapeutic properties (Hartmann & Kester., 1975). Cutting is the best methods for Henna propagation. The cutting of this plant is hard rhizogenetic, hence the need to suitable environmental conditions for maximize the rooting in this plant. Many environmental and internal factors involved in rooting cuttings that among these, attention to a factor such as the suitable rooting substrate can be useful for the cuttings of this hard rhizogenetic plant. Application of growth regulators materials is an effective factor in rooting of stem cuttings that among these, auxin materials have special position (Hartmann et al., 1997). Indolebutyric acid (IBA) application has been reported to enhance rooting in olive cuttings (Loreti & Hartmann, 1964). Poor rooted cultivars may not respond well to exogenous IBA (Nahlawi et al., 1975). Insensitivity to applied IBA in olive cuttings was explained by the differences in metabolism and transport of IBA (Wiesman & Epstein, 1987). IBA has long been used to promote the rooting in cuttings of a wide range of plant species (Hartmann et al., 2002). However, naphthalene acetic acid (NAA) was found to be more effective than IBA in some plants which respond unsatisfactorly to IBA (Hartmann et al., 2002). The effects of NAA particularly on difficult-to-root olive cuttings have not been well investigated so far (Fabbri et al., 1994). There are compounds (growth retardants/inhibitors, polyamines, phenolics) that

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modify main hormone effects on rooting (Hartmann et al., 2002). Salicylates, which are involved in phenolic compounds, have been considered as phytohormones (Raskin, 1992). In some woody and herbaceous plant species, salicylic acid (SA) highly promoted the In vivo rooting of cuttings when applied particularly with auxin (Bojarczuk & Jankiewicz, 1975; Kling & Meyer, 1983). SA inhibited IAA-induced rooting of apple stem slices In Vitro by enhancing oxidation of IAA during the auxin sensitive phase (24-96 h) (De Klerk et al., 1997). Adventitious root formation comprises three successive interdependent physiological phases (induction, initiation and expression) (Gaspar et al., 1992). It suggested that phenolic compounds which are known to inhibit root formation might actually enhance root formation if applied during the appropriate phase of rhizogenesis (Berthon et al., 1993). Thus, applications of salicylic acid after IBA might be more effective on the auxin to induce root formation than simultaneous treatments of both substances. However, it is very difficult to estimate the proper application time of SA In vivo cuttings due to the lack of uniformity or stability in propagation material. Therefore, initial applications of SA to cuttings may also give useful results. The objectives of this study were to determine the effects of NAA and SA on the rooting of Henna cuttings when applied alone or in combination with IBA.

MATERIALS AND METHODS

The completely randomized design was used in this experiment. Four replicates were carried out for this study (n=4). Ten semi-hard cuttings of Henna were used for each replicate. In first week of March 2012, the cuttings were collected from current year branches of the same plants. After remove the lower leaves of cuttings and stab in under of cuttings, samples uniformly were cultured in treatments. The cuttings initially were immersed in 3% benomyl solution for 30 minutes in order to treat and then immediately placed in growth regulators of Salicylic Acid (200 and 400 $ml.L^{-1}$) for 24 hours After short time , cuttings immersed in Indole Butyric Acid (2000 $ml.L^{-1}$) Naphthalene Acetic Acid (2000, 3000 4000 $ml.L^{-1}$) for 5 seconds. Finally planted into sand (Hartmann et al., 2002). Three months after rooting, Some traits are determined that they were including rooting percent, stem length, number of roots, number of leaves, number of stems, average root length, largest root length, wet weigh of stem, wet weigh of root and dry weigh of stem.

Analysis was performed on data using SPSS 16. Comparisons were made using one-way analysis of variance (ANOVA) and Duncan's multiple range tests. Differences were considered to be significant at $P < 0.05$.

RESULTS AND DISCUSSION

Statistical results showed that the hormonal treatments increased rooting percentages. Also the maximum percent of rooting was related to 2000 $mg.L^{-1}$ IBA and 3000 $mg.L^{-1}$ NAA treatments respectively. Application of SA was promoted the rooting of Populus cuttings depending on varieties and concentrations (Bojarczuk & Jankiewicz, 1975). However it was ineffective in rooting of Tillia clones (Smith, 1975). The minimum number of root created in 2000 $mg.L^{-1}$ + 400 $mg.L^{-1}$ SA, 200 $mg.L^{-1}$ NAA + 400 $mg.L^{-1}$ SA and 400 mg/l SA treatments respectively. Several studies showed that SA synergistically acted with IAA and promoted the root formation in mung bean cuttings**.** But it was no effect on Acer cuttings **(**Kling & Meyer, 1983). SA combined with NAA synergistically promoted the root number and root lengths of the cuttings of several Populus spp. Although this effect had seemed to be in relation with the clonal differences and cutting time rather than concentration and treatment methods (Bojarczuk & Jankiewicz, 1975). maximum root length created in 4000 $mg.L^{-1}$ NAA + 200 $mg.L^{-1}$ SA, 2000 mg.L-1 IBA + 200 $mg.L^{-1}$ SA and 4000 $mg.L^{-1}$ NAA + 400 $mg.L^{-1}$ SA treatments. The use of SA caused a

positive effect on rooting. This result previously reported in clones of different Populus spp (Bojarczuk & Jankiewicz, 1975). Maximum number of leaves created in 2000 $mg.L^{-1}$ NAA + 200 $mg.L^{-1}$ SA treatments. The remarkable point is that the use of SA in 200 $mg.L^{-1}$ concentration to 400 $mg.L^{-1}$ was caused positive effect on the number of stem. The promotive effects of chlorogenic and ferulic acid on the formation of root meristemoids during the initiative phase coincides demonstrated by Smith & Thorpe (1977). SA found to be inhibitory on In vitro rooting of stem discs of apple when applied before auxin (Van Der Krieken et al., 1997). This effect was attributed to enhanced oxidation of IAA during the auxin sensitive phase by SA (De Klerk et al., 1997). IBA, NNA and SA showed significant effect on all traits. Results show that application of IBA, NAA and SA at mentioned levels has caused the significant increase of rooting percent (Blythe et al, 2004). The cause of positive effect of these materials on rooting can be attributed to the effect of auxines at provocation of division of the initial starter cells of root (Berthon et al, 1993).

Conclusion

The use of SA caused a positive effect on Rooting. SA + IBA treatment showed the highest content of rooting. This study shows the importance of this compound for root formation**.** Also, post-applications of of SA increased rooting percentages. Our future investigations will be focused on estimate the proper application time of SA on the rooting process.

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Table 1 - Effect of concentration of NAA, IBA and SA on rooting cuttings of semi-rigid Hana (*Lawsonia inermis L.*)

Treatments	Rooting percentage (%)	Root number	Leaf number	Stem number	Largest Root length (cm)	Mean Root length (cm)	Root fresh weight (g)	Stem fresh weight (g)	Root dry weight (g)	Stem dry weight (g)
2000IBA	75a	16ab	8.83ab	2.50ab	11.62ab	10.31abc	1.20bc	2.54b	0.20c	0.28ab
2000NAA	45abcde	16.18ab	9.77ab	4.66ab	15.50ab	12.07abc	1.41bc	1.69b	0.44abc	0.51ab
3000NAA	70ab	18.05a	12.45ab	4.44ab	16.25ab	11.82abc	1.12bc	2.30b	0.30bc	0.94ab
4000NAA	25def	9abc	6.29b	2.87ab	7b	5.05bc	0.78bc	1.09b	0.18c	0.38ab
200SA	40abcdef	5.12bc	11.16ab	4.95ab	24a	15.24ab	1.54bc	3.02b	0.40abc	0.85ab
400SA	30cdef	3.58c	15.12ab	4.58ab	12.37ab	10.70abc	1.08bc	2.71b	0.25bc	0.79ab
2000IBA+200SA	30cdef	9.50abc	15.37ab	6a	21.75a	16.97a	1.21bc	3.52b	0.28bc	1.11ab
2000IBA+400SA	5f	2.25c	9.62ab	1.25b	6.25b	4.87c	0.72c	1.43b	0.35abc	0.77ab
2000NAA+200SA	60abcd	13.35abc	18.06a	4.50ab	18ab	15.06abc	2.43bc	4.06ab	0.15c	0.29b
3000NAA+200SA	45abcde	10.58abc	12.20ab	3.75ab	17.37ab	11.87abc	0.82bc	1.88b	1.18ab	0.58ab
4000NAA+200SA	35bcdef	17.83a	16.20ab	6.33ab	21.75a	18.10a	4.80a	6.72a	1.24a	1.49a
2000NAA+400SA	25def	3.50c	8.95ab	2.33ab	6.50b	6ab	0.67c	0.84b	0.24bc	1.31ab
3000NAA+400SA	20ef	9.25abc	9ab	3ab	14.50ab	10.83abc	1.54bc	2b	0.24bc	0.44ab
4000NAA+400SA	65abc	7.50abc	9.87ab	3.87ab	22.12a	16.96a	2.84b	2.42b	0.51abc	0.91ab
Control	25def	9.68abc	14.87ab	4.72ab	19.50ab	15.30ab		2.34b	0.61abc	0.42ab

*Means separated by Duncans multiple ranges test at the P< 0.05 level.