

CHARACTERISTICS FOR THE CLONAL PROPAGATION OF *EUCALYPTUS GLOBULUS* LABILL.

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REFERENCES

- AGBO C. U., OBI I. U. (2007). Variability in propagation potentials of stem cuttings of different physiological ages of *Gongronema latifolia* Benth. *World Journal of Agricultural Sciences*, 3: 576-581.
- AL-SALEM M. M., KARAM N. S. (2001). Auxin, wounding, and propagation medium affect rooting response of stem cuttings of *Arbutus andrachne*. *Journal of Horticultural Science*, 36: 976-988.
- ANAND V. K., HEBERLEIN G. T. (1975). Seasonal changes in the effects of auxin on rooting in stem cuttings of *Ficus infectoria*. *Physiologia Plantarum*, 34: 330-334.
- BHUSAL R. C., MIZUTANI F., MOON D. G., RUTTO K. L. (2001). Propagation of citrus by stem cuttings and seasonal variation in rooting capacity. *Pakistan Journal of Biological Sciences*, 4: 1294-1298.
- BORRALHO N. M. G., WILSON P. J. (1994). Inheritance of initial survival and rooting ability in *Eucalyptus globulus* Labill. stem cuttings. *Silvae Genetica*, 43: 238-242.
- CORREA L. D. R., FETT-NETO A. G. (2004). Effects of temperature on adventitious root development in microcuttings of *Eucalyptus saligna* Smith and *Eucalyptus globulus* Labill. *Journal of Thermal Biology*, 29: 315-324.
- DE KLERK G. J., VAN DER KRIEKEN W., DE JONG J. (1999). The formation of adventitious roots: new concepts, new possibilities. *In Vitro Cellular & Developmental Biology-Plant*, 35: 189-199.
- DENISON N. P., KIETZKA J. E. (1993). The development and utilisation of vegetative propagation in mondi for commercial afforestation programmes. *South African Forestry Journal*, 166: 53-60.
- DÍAZ K., VALIENTE C., MARTÍNEZ M., CASTILLO M., SANFUENTES E. (2009). Root-promoting rhizobacteria in *Eucalyptus globulus* cuttings. *World Journal of Microbiology and Biotechnology*, 25: 867-873.
- EPSTEIN E., LAVEE S. (1984). Conversion of indole-3-butyric acid to indole-3-acetic acid by cuttings of grapevine (*Vitis vinifera*) and olive (*Olea europaea*). *Plant and Cell Physiology*, 25: 697-703.
- FADL M. S., HARTMANN H. T. (1967). Endogenous root promoting and root inhibiting factors in pear cuttings in relation to bud activity. *Proceedings of the International Plant Propagator's Society*, 17: 62-72.
- FELKER P., MEDINA D., SOULIER C., VELICCE G., VELARDE M., GONZALEZ C. (2005). A survey of environmental and biological factors (*Azospirillum* spp. *Agrobacterium rhizogenes*, *Pseudomonas aurantiaca*) for their influence in rooting cuttings of *Prosopis alba* clones. *Journal of Arid Environments*, 61: 227-247.
- FETT-NETO A. G., FETT J. P., VIEIRA GOULART L. W., PASQUALI G., TERMIGNONI R. R., FERREIRA A. G. (2000). Distinct effects of auxin and light on adventitious root development in *Eucalyptus saligna* and *Eucalyptus globulus*. *Tree Physiology*, 21: 457-464.
- FOGAÇA C. M., FETT-NETO A. G. (2005). Role of auxin and its modulators in the adventitious rooting of eucalyptus species differing in recalcitrance. *Plant Growth Regulation*, 45: 1-10.
- HANSEN J. (1986). Influence of cutting position and stem length on rooting of leaf-bud cuttings of *Schefflera arboricola*. *Scientia Horticulturae*, 28: 177-186.
- HARTNEY V. J. (1980). Vegetative propagation of the eucalypts. *Australian Forest Research*, 10: 191-211.
- HOWARD B. H. (1968). Effects of bud removal and wounding on rooting of hardwood cuttings. *Nature*, 220: 262-264.
- HOWARD B. H., RIDOUT M. S. (1991). Rooting potential in plum hardwood cuttings. II. Relationships between shoot variable and rooting in cuttings from different sources. *Journal of Horticultural Science*, 66: 681-687.
- KAWASE M. (1972). Centrifugation and rooting of cuttings. *Rivista Ortoflorofrutt Italia*, 60: 96-112.
- LUNGO A. L., BALL J., CARLE J. (2006). Global planted forests thematic study: results and analysis. *Planted forests and trees working paper 38*. Rome, iii + 168 pp.
- MANKESSI F., SAYA A., TOTO M., MONTEUUIS O. (2011). Cloning field growing *Eucalyptus urophylla* × *Eucalyptus grandis* by rooted cuttings: age, within-shoot position and season effects. *Propagation of Ornamental Plants*, 11: 3-9.
- MARQUES C. M., VASQUEZ-KOOL J., CAROCHA V. J., FERREIRA J. G., O'MALLEY D. M., LIU B. H., SEDEROFF R. (1999). Genetic dissection of vegetative propagation traits in *Eucalyptus tereticornis* and *E. globulus*. *Theoretical and Applied Genetics*, 99: 936-946.
- MORI Y., MIYAHARA F., GOTO S. (2004). The usefulness of rooted cuttings for producing nematode-resistant Japanese black pine plantlets. *Journal of the Japanese Forest Society*, 86: 98-104.
- PATON D. M., WILLING R. R., NICHOLLS W., PRYOR L. D. (1970). Rooting of stem cuttings of *Eucalyptus*: a rooting inhibitor in adult tissue. *Australian Journal of Botany*, 18: 175-183.
- PELOSI A., LEE M. C. S., CHANDLER S. F., HAMILL D. J. (1995). Hormonal control of root primordia differentiation and root formation in cultured explants of *Eucalyptus globulus* seedlings. *Australian Journal of Plant Physiology*, 22: 409-415.

- RICCI A., CARRA A., TORELLI A., MAGGIALI C. A., MORINI G., BRANCA C. (2001). Cytokinin-like activity of N,N'-diphenylureas. N,N'-bis-(2,3-methylenedioxyphenyl)urea and N,N'-bis-(3,4-methylenedioxyphenyl)urea enhance adventitious root formation in apple rootstock M26 (*Malus pumila* Mill.). *Plant Science*, 160: 1055-1065.
- RICCI A., CARRA A., ROLLI E., BERTOLETTI C., BRANCA C. (2005). The weak cytokinins N,N'-bis-(1-naphthyl)urea and N,N'-bis-(2-naphthyl)urea may enhance rooting in apple and mung bean. *Plant Cell, Tissue and Organ Culture*, 83: 179-186
- RICCI A., ROLLI E., DRAMIS L., DIAZ-SALA C. (2008). N,N'-bis-(2,3-Methylenedioxyphenyl)urea and N,N'-bis-(3,4-methylenedioxyphenyl)urea enhance adventitious rooting in *Pinus radiata* and affect expression of genes induced during adventitious rooting in the presence of exogenous auxin. *Plant Science*, 175: 356-363.
- RUAUD J. N., LAWRENCE N., PEPPER S., POTTS B. M., BORRALHO N. M. G. (1999). Genetic variation of *in vitro* rooting ability with time in *Eucalyptus globulus*. *Silvae Genetica*, 48: 4-7.
- SACH R. M., LEE C., RIPPERDA J., WOODWARD R. (1988). Selection and clonal propagation of eucalyptus. *California Agriculture*, 42: 27-31.
- SCHWAMBACH J., RUEDELL C. M., DE ALMEIDA M. R., PENCHEL R. M., DE ARAÚJO E. F., FETT-NETO A. G. (2008). Adventitious rooting of *Eucalyptus globulus* × *maidennii* mini-cuttings derived from mini-stumps grown in sand bed and intermittent flooding trays: a comparative study. *New Forests*, 36: 261-271.
- SOUVANNAVONG O. (1992). Development of high-yielding clonal plantations of *Eucalyptus* hybrids in the Congo. *In: Baker F. W. G. (Ed.). Rapid propagation of fast-growing woody species. Wallingford (United Kingdom), CAB International: 109-113.*
- SOTELO M., MONZA J. (2007). Micropropagation of *Eucalyptus maidenii* elite trees. *Agrociencia*, 11: 81-89.
- STENVALL N., HAAPALA T., AARLAHTI S., PULKKINEN P. (2005). The effect of soil temperature and light on sprouting and rooting of root cuttings of hybrid aspen clones. *Canadian Journal of Forest Research*, 35: 2671-2678.
- TETSUMURA T., TAO. R., SUGIURA A. (2001). Factors affecting rooting of Japanese persimmon. hard wood cuttings. *Journal of the Japanese society for Horticultural Science*, 70: 163-169.
- WILKERSON E. G., GATES R. S. (2003). Controlled environment system for studying root zone temperature effects on cutting propagation. *Applied Engineering in Agriculture*, 19: 483-489.
- WILSON P. J. (1993). Propagation characteristics of *Eucalyptus globulus* Labill. ssp. *globulus* stem cuttings in relation to their original position in the parent shoot. *Journal of Horticultural Science and Biotechnology*, 68: 715-724.
- WILSON P. J. (1994). Contributions of the leaves and axillary shoots to rooting in *Eucalyptus grandis* Hill ex Maid. stem cuttings. *Journal of Horticultural Science and Biotechnology*, 69: 999-1007.
- WILSON P. J. (1998). Developing clones from *Eucalyptus globulus* and hybrid seedlings by stem cuttings propagation. *New Zealand Journal of Forestry Science*, 28: 293-303.