

**INOCULATIONS WITH PLANT GROWTH PROMOTING RHIZOBACTERIA (PGPR)
STIMULATE ADVENTITIOUS ROOT FORMATION ON SEMI-HARDWOOD STEM CUTTINGS
OF *FICUS BENJAMINA* L.**

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REFERENCES

- BASSIL N. V., PROEBSTING W. M., MOORE L. W., LIGHTFOOT D. A. (1991). Propagation of hazelnut stem cuttings using *Agrobacterium rhizogenes*. HortScience, 26: 1058-1060.
- BULUT S. (2013). Evaluation of yield and quality parameters of phosphorous-solubilizing and N-fixing bacteria inoculated in wheat (*Triticum aestivum* L.). Turkish Journal of Agriculture and Forestry, 37: 545-554.
- CAKMAKCI R., DÖNMEZ M. F., AYDIN A., ŞAHİN F. (2006). Growth promotion of plants by plant growth-promoting rhizobacteria under greenhouse and two different field soil conditions. Soil Biology and Biochemistry, 38: 1482-1487.
- CAKMAKCI R., ERAT M., ERDOĞAN U., DÖNMEZ M. F. (2007). The influence of plant growth-promoting rhizobacteria on growth and enzyme activities in wheat and spinach plants. Journal of Plant Nutrition and Soil Science, 170: 288-295.
- COUVILLON G. A. (1998). Rooting responses to different treatments. Acta Horticulture, 227: 187-196.
- DANTHU P., SOLOVIEV P., GAYE A., SARR A., SECK M., THOMAS I. (2002). Vegetative propagation of some west african ficus species by cuttings. Agroforestry Systems, 55: 57-63.
- ELKOCA E., KANTAR F., SAHİN F. (2008). Influence of nitrogen fixing and phosphorus solubilizing bacteria on the nodulation, plant growth, and yield of chickpea. Journal of Plant Nutrition, 31: 157-171.
- ERCİSLİ S., ESİTKEN A., SAHİN F. (2000). The effect of IBA and bacteria (*Agrobacterium rubi*) on the rooting of cutting of sour cherry cv. Kütahya. Bahçe 29: 75-80.
- ERCİSLİ S., ESİTKEN A., CANGI R., SAHİN F. (2003). Adventitious root formation of kiwifruit in relation to sampling date, IBA and *Agrobacterium rubi* inoculation. Plant Growth Regulation, 41:133-137.
- ERCİSLİ S., ESİTKEN A., SAHİN F. (2004). Exogenous IBA and inoculation with *Agrobacterium rubi* stimulate adventitious root formation on hardwood stem cuttings of two rose genotypes. HortScience, 39: 533-534.
- ERTURK Y., ERCİSLİ S., SEKBAN R., HAZNEDAR A., DÖNMEZ M. F. (2008). The effect of Plant Growth Promoting Rhizobacteria (PGPR) on rooting and root growth of tea (*Camellia sinensis* var. Sinensis) cuttings. Romanian Biotechnological Letters, 13: 3747-3756.
- ERTURK Y., ERCİSLİ S., HAZNEDAR A., CAKMAKCI R. (2010). Effects of plant growth promoting rhizobacteria (PGPR) on rooting and root growth of kiwifruit (*Actinidia deliciosa*) stem cuttings. Biological Research, 43: 91-98.
- ESİTKEN A., ERCİSLİ S., SEVİK I., SAHİN F. (2003). Effect of Indole-3-butyric acid and different strains of *Agrobacterium rubi* on adventitious root formation from softwood and semi-hardwood wild sour cherry cuttings. Turkish Journal of Agriculture and Forestry, 27: 37-42.
- FIGUEIREDO M. V. B., MARTINEZ C. R., BURITY H. A., CHANWAY C. P. (2008). Plant growth-promoting rhizobacteria for improving nodulation and nitrogen fixation in the common bean (*Phaseolus vulgaris* L.). World Journal of Microbiology and Biotechnology, 24: 1187-1193.
- HALL J. A., PEIRSON D., GHOSH S., GLICK B. R. (1996). Root elongation in various agronomic crops by the plant growth promoting Rhizobacterium *Pseudomonas putida* GR12-2. Israel Journal of Plant Sciences, 44: 37-42.
- HATTA M., BEYL C. A., GARTON S., DINER A. M. (1996). Induction of roots on jujube softwood cuttings using *Agrobacterium rhizogenes*. Journal of Horticultural Science, 71: 881-886.
- KAYMAK H. C. (2011). Potential of PGPR in agricultural innovations. In: Maheshwari D. K. (Ed.). Plant growth and health promoting bacteria, vol.18, Springer: 45-79.
- KAYMAK H. C., YARALI F., GÜVENÇ I., DÖNMEZ M. F. (2008). The Effect of inoculation with plant growth rhizobacteria (PGPR) on root formation of mint (*Mentha piperita* L.) cuttings. African Journal of Biotechnology, 7: 4479-4483.
- KAYMAK H. C., DÖNMEZ M. F., CAKMAKCI R. (2013). N₂-fixing plant growth promoting rhizobacteria: As a potential application to increase yield, growth and element contents of leaves in *Mentha piperita* L. European Journal of Plant Science and Biotechnology, 7: 38-42.
- KLOEPPER J. W., SCHROTH M. N. (1978). Plant growth-promoting rhizobacteria on radishes. Proceedings of the fourth international conference on plant pathogen bacteria, vol. 2, INRA, Tours, France Angers: 879-882.
- KRAVANJA N. (2006). Significant perceptual properties of outdoor ornamental plants. Acta Agriculturae Slovenica, 87: 333-342.
- KSHATRI B. B., KEMP P. D., HODGSON J., DEVKOTA N. R. (2005). Vegetative propagation of *Ficus benjamina* using non-sterile sand and hardwood cuttings. Agronomy New Zealand Journal, 35: 19-22.

- LARRABURU E. E., CARLETTI S. M., RODRIGUEZ CACERES E. A., LLORENTE B. E. (2007). Micropropagation of photinia employing rhizobacteria to promote root development. *Plant Cell Reports*, 26: 711-717.
- MIA M. A. B., SHAMSUDDIN Z. H., ZAKARIA W., MARZIAH M. (2005). High-yielding and quality banana production through plant growth promoting rhizobacterial inoculation. *Fruits*, 60: 179-185.
- ORHAN E., ESITKEN A., ERCISLI S., SAHIN F. (2007). Effects of indole-3-butyric acid (IBA), bacteria and, radicle tip-cutting on lateral root induction in *Pistacia vera*. *Journal of Horticultural Science and Biotechnology*, 82: 2-4.
- RAASCH L. D., BONALDO S. M., DE OLIVEIRA A. A. F. (2013). *Bacillus subtilis*: Rooting and growth of eucalyptus mini-cuttings in the municipality of Sinop, northern of Mato Grosso state, Brazil. *Bioscience Journal*, 29: 1446-1457.
- RIBAUDO C. M., KRUMPHOLZ E. M., CASSAN F. D., BOTTINI R., CANTORE M. L., CURA J. A. (2006). *Azospirillum* sp promotes root hair development in tomato plants through a mechanism that involves ethylene. *Journal of Plant Growth Regulation*, 25: 175-185.
- SAHIN U., ANAPALI O., ERCISLI S. (2002). Physico-chemical and physical properties of some substrates used in horticulture. *Gartenbauwissenschaft*, 67: 55-60.
- SIDDIQUI M. I., HUSSAIN S. A. (2007). Effect of indole butyric acid and types of cuttings on root initiation of *Ficus hawaii*. *Sarhad Journal of Agriculture*, 23: 919-925.