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Strehl

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(54) **USE OF PSEUDOMONAS DIAZOTROPHICUS AS A SOIL INOCULANT**

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(58) **Field of Classification Search**

None

See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

5,503,652 A * 4/1996 Kloepper A01N 63/00
435/253.3

OTHER PUBLICATIONS

Oliveira et al. (Diazotrophic rhizobacteria isolated from sugarcane can release amino acids in a synthetic culture medium, *Biology and Fertility of Soils*, 2011, 47(8), 957-62, ISSN: 0178-2762). Abs.*

Doty et al. (Diazotrophic endophytes of native black cottonwood and willow, *Symbiosis*, 2009, 47(1), 23-33, ISSN: 0334-5114, English).*

Jha et al. (Isolation, partial identification and application of diazotrophic rhizobacteria from traditional Indian rice cultivars, *European Journal of Soil Biology*, 2009, 45(1), 62-72, ISSN: 1164-5563, English).*

Koomnok et al. (Diazotroph endophytic bacteria in cultivated and wild rice in Thailand, *ScienceAsia*, 2007, 33(4), 429-435, ISSN: 1513-1874, English).*

Mineev et al. (Nitrogen balance in soil under table beet inoculated with bacteria of the genus *Pseudomonas*, *Doklady Vsesoyuznoi Akaemii Sel'skokhozyaistvennykh Nauk imeni V.T. Lenina*, 1992, (3), 7-12, ISSN 0042-9244, Russian).*

Watanabe et al. (A new nitrogen fixing species of pseudomonad: *Pseudomonas diazotrophisus* sp. Nov. Isolated from the root of

wetland rice, *Canadian Journal of Microbiology*, 1987, 33(8), 670-8, ISSN 0008-4166, English).*

Naganandini et al. (Diversity analysis of pseudomonads in rice rhizosphere for multifaceted plant growth promotion, *Acta Microbiologica et Immunologica Hungarica*, 2011, 58940, 247-58, ISSN 1217-8950, English).*

Strehl, *Microbial Soil Enhancement Final Report; Science Fair Project Report*, Jun. 2010.

Taylor, et al.; *Polar lipids of 'Pseudomonas diazotrophicus'*; Oct. 8, 1992.

Watanabe et al.; A new nitrogen-fixing species of pseudomonad: *Pseudomonas diazotrophicus* sp. nov. isolated from the root of wetland rice; *Canadian Journal of Microbiology*; 1987; pp. 670-678.
Pepe, et al.; Dynamic of functional microbial groups during mesophilic composting of agro-industrial wastes and free-living (N₂)-fixing bacteria application; *Waste Management*, vol. 33, Issue 7; 2013; pp. 1616-1625.

Shu, et al.; Abundance and diversity of nitrogen-fixing bacteria in rhizosphere and bulk paddy soil under different duration of organic management; *World Journal of Microbiology and Biotechnology*, vol. 28, Issue 2; 2012; pp. 493-503.

Mirza, et al.; Molecular characterization and PCR detection of a nitrogen-fixing *Pseudomonas* strain promoting rice growth; *Biology and Fertility of Soils*, vol. 43, Issue 1; 2006; pp. 163-170.

Muthukumarasamy, et al.; Natural association of *Gluconacetobacter diazotrophicus* and diazotrophic *Acetobacter peroxydans* with wetland rice; *Systematic and Applied Microbiology*, vol. 23, Issue 3; 2005; pp. 277-286.

Tripathi, et al.; Molecular characterization of a salt-tolerant bacterial community in the rice rhizosphere; *Research in Microbiology*, vol. 153, Issue 9; 2002; pp. 579-584.

Chan, et al., N₂-fixing pseudomonads and related soil bacteria; *FEMS Microbiology Reviews*, vol. 13, Issue 1; 1994; pp. 95-117.

Taylor, et al.; *Polar lipids of a Pseudomonas diazotrophicus a*; *FEMS Microbiology Letters*, vol. 106, Issue 1; 1993; pp. 65-69.

Kennedy, et al.; Biological nitrogen fixation in non-leguminous field crops: Recent advances; *Plant and Soil*, vol. 141, Issue 1; 1992; pp. 93-118.

Pimentel, et al.; Dinitrogen fixation and infection of grass leaves by *Pseudomonas rubrisubalbicans* and *Herbaspirillum seropedicae*; *Plant and Soil*, vol. 137, Issue 1; 1991; pp. 61-65.

Boonjawat, et al.; Biology of nitrogen-fixing Rhizobacteria; *Plant and Soil*, vol. 137, Issue 1; 1991; pp. 119-125.

Khammas, et al.; *Azospirillum irakense* sp. nov., a nitrogen-fixing bacterium associated with rice roots and rhizosphere soil; *Research in Microbiology*, vol. 140, Issue 9; 1989; pp. 679-693.

Khammas, et al.; *Azospirillum irakense* sp. nov., a nitrogen-fixing bacterium associated with rice roots and; *Research in Microbiology*, vol. 140, issue 8; 1989; pp. 679-693.

* cited by examiner

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(57) **ABSTRACT**

The invention provides an inoculant comprising *Pseudomonas diazotrophicus* and a carrier, which is useful for enhancing plant growth. The invention also provides a method of producing a plant which comprises applying an inoculant comprising *Pseudomonas diazotrophicus* and a carrier to plant or the growth medium of the plant.

15 Claims, 5 Drawing Sheets