Dr. Johanna Liesbeth Kubelka Döbereiner
Doctor of Science honoris causa

Most important awards, prizes and academies

EMBRAPA Frederico Menezes Veiga prize (1976); Research Agriculture of Today prize (1977); OAS Bernardo Houssay prize (1979); Member of the Brazilian Academy of Sciences (1977); Member of the Pontifical Academy of Sciences (1978); Founding member of the Third World Academy of Sciences (1981); First Secretary of the Brazilian Academy of Science (1992), and Vice President (1995).

Summary of scientific research

The main line of my research envisaged from the beginning alternatives for the increasingly expensive and hazardous nitro-gen fertilizers. The use of the unlimited reserve of molecular dinitrogen via photo-synthesis which uses sun energy seems the obvious solution. Along this line research which permits more efficient use of biological dinitrogen fixation in the legume-*Rhizobium* symbiosis focalized in tropical agriculture, where an infinitely larger choice of still unexplored systems exists. Breeding of grain and forage legumes and selection of *Rhizo-bium* strains adapted to poor acid soils and high temperatures was one approach. Surveys of nitrogen-fixing legume trees which have not been known as such before, representing additional alter-natives. Studies on the physiology of grain legumes in relation to photosynthesis and to the efficiency of the translo-cation of the fixed nitrogen to the grain yield also are very

interesting new prospects. The major challenge of our research was and still is the expansion of dinitrogen fixation to the major cereal crops. Seven new dinitrogen fixing bacteria were described and their as-sociation with maize, sorghum, wheat, etc., demonstrated. N balance studies performed over the last few years have shown that several Brazilian varieties of sugarcane are capable of obtaining over 60% of their nitrogen (>150 kg N ha-1 year-1) from biological nitrogen fixation (BNF). This may be due to the fact that this crop in Brazil has been systematically bred for high yields with low N fertilizer inputs. Rice can obtain at least some N from BNF and acetylene reduction (AR) assays also indicate differences in N2-fixing ability between different rice varieties. Although many species of diazotrophs have been isolated from the rhizosphere of both sugarcane and wetland rice, the recent discovery of endophytic N2-fixing bacteria within roots, shoots and leaves of both crops suggests, at least in the case of sugarcane, that these bacteria may be the most important contributors to the observed BNF contributions. In sugarcane both *Acetobacter diazotrophicus* and *Herbaspirillum* spp. have been found within roots and aerial tissues, *Herbaspirillum* spp. are found in many graminaceous crops, including rice (in roots and aerial tissues), and are able to survive and pass from crop to crop in the seeds. The sugarcane/endophytic diazotroph associa-tion is the most efficient N2-fixing system to be discovered asso-ciated with any member of the gramineae. As yet the individual roles of the different diazotrophs in this system have not been elucidated and far more work on the physiology and anatomy of these systems is required. However, the understanding gained in these studies should serve as a foundation for the improvement/ development of similar N2-fixing systems in wetland rice and other cereal crops.

Main publications

Dobereiner J., *Evaluation of nitrogen fixation in legumes by the regression of total plant nitrogen with nodule weight*. «Nature», *210*, 850-852 (1996); Bulow J.F.W. Von and Dobereiner J., *Potential for nitrogen fixation in maize genotypes in Brazil*. «Proc. Natl. Acad. Sci., USA», *72*, 2389-2393 (1975); Scotti M.R.M.M.L., Sá N.M.H., Vargas M.A.T. and Dobereiner J., *Strepto-mycin resistance of* Rhyzobium *isolates from Brazilian cerrados*. «An. Acad. Bras. Ciên.», *54*, 733-738 (1982); Dobereiner J., *Ten years* Azospirillum. In: Azospirillum II (Klingmüller, ed.). Experientia Supplementum, *48*, 9-23 (1983); Magalhaes F.M.M., Baldani J.I., Souto S.M., Kuykendall J.R. and Dobereiner J., *A new acid-tolerant* Azospirillum *species*. «An. Acad. Bras. Ciên.», *55*, 417-430 (1983); Baldani V.L.D., Alvarez M.A. De B., Baldani J.I. and Dobereiner J., *Esta-blishment of inoculated* Azospirillum *spp. in the rhizosphere and in roots of field grown cereals*. «Plant and Soil», *90*, 35-46 (1986); Baldani J.I., Baldani V.L.D., Seldin L. and Dobereiner J., *Characterization of* Herbaspirillum seropedicae *gen. nov., sp. nov., a root-associated nitro-gen-fixing bacterium*. «Intern. J. Syst. Bacteriol.», *36*, 86-93 (1986); Lima E., Boodey R.M. and Dobereiner J., *Quantification of biological nitrogen fixation associated with sugar cane using a 15N aided nitrogen balance*. «Soil Biol. Biochem», *19*, 165-170 (1987); Boddey R.M., Urquiaga S., Reis V. and Dobereiner J., *Biological nitrogen fixation associated with sugar cane*. «Plant and Soil», *137*, 111-117 (1991); Pimentel J.P., Olivares F., Pitard R.M., Urquiaga S., Akiba F. and Dobereiner

J., *Dinitrogen fixation and infection of grass leaves by* Pseudomo-nas rubrisubalbicans *and* Herbaspirillum seropedicae. «Plant and Soil», *137*, 61-65 (1991); Baldani V.L.D., Baldani J.I., Olivares F.L. and Dobereiner J., *Identification and ecology of* Herbaspirillum seropedicae *and the closely related* Pseudomonas rubrisubalbicans. «Symbiosis», *13*, 65-73 (1992); Baldani V.L.D., James E., Baldani J.I. and Dobereiner J., *Localization of the N2-fixing bacteria* Herbaspirillum seropedicae *within root cells of rice*. «An. Acad. Bras. Cienc.» 64-431 (1992b); Boddey R.M. and Dobereiner J., *Nitrogen fixation associated with grasses and cereals: recent results and perspectives for future research*. «Plant and Soil», *108*, 53-65 (1988); Cavalcante V.A. and Dobereiner J., *A new acid-tolerant nitrogen-fixing bacterium associated with sugarcane*. «Plant and Soil», *108*, 23-31 (1988); James E.K., Reis V.M., Olivares F.L., Baldani J.I. and Dobereiner J., *Infection of sugar cane by the nitrogen-fixing bacterium* Acetobacter diazotrophicus. «J. Exp. Bot.» (in press); Reis V.M., Olivares F.L. and Dobereiner J., *Improved methodology for isolation of* Acetobacter diazotrophicus *and confirmation of its endophytic habitat*. «World J. Microbiol. Biotechnol.» (in press).

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