

## Biological control as a key component in sustainable agriculture

J M Barea<sup>1</sup>, C. Calvet<sup>2</sup>, V. Estaún<sup>2</sup> & A. Camprubi<sup>2</sup>

<sup>1</sup>*Departamento de Microbiología del Suelo y Sistemas Simbióticos, Estación Experimental del Zaidín, CSIC, Prof. Albareda 1, 18008 Granada, Spain and* <sup>2</sup>*Departamento de Patología Vegetal, Centre de Cabrils, IRTA, Carretera de Cabrils s/n, 08348 Cabrils, Barcelona, Spain*

Agricultural practices have evolved into highly technified and sophisticated plant production systems until recently the management of plant diseases in these systems was done by breeding for plant resistance and the heavy, and sometimes in discriminated application of pesticides.

Breeding for plant resistance is the most promising method or dealing with pest and diseases, however it is virtually impossible to breed for multiple resistant varieties to a wide range of races and pathogens. In many instances resistant varieties to a particular pathogen are highly susceptible to others, therefore the use of pesticides has not been superseded with a genetic approach to disease control, in fact it might be sometimes enhanced.

On the other hand there is a global outcry for the reduction of pesticide use often damaging to human health and environment, in order to address this problem the new approaches to farming systems, included in the Common Agricultural Policy (CAP) of the European Union, propose the adequate management of natural, renewable, resources and the reduction of chemical inputs. It is in this context that the replacement of pesticides by the controlled use of microorganisms to protect plants against pathogens (bacteria, fungi, nematodes) can be considered as a key component in the development of a sustainable agriculture (Barea and Jeffries, 1995), economically profitable with a minimized environmental pollution (Bethlenfalway and Linderman, 1992).

Soil microorganisms play an important role in the maintenance of the stability of the agrosystem (Gianinazzi and Schuëpp, 1995) contributing to soil fertility, structure and biodiversity and have an undeniable effect on plant health and development. The appropriate management of soil/plant/microbial interactions is a promising biotechnological approach to achieve a long term stable and productive agrosystem, this is to say a sustainable system.

Among the multitude of microorganisms that make up an agrosystem the arbuscular mycorrhizal (AM) fungi stand out from the other components of the soil microbiota because of their ability to form a link between plant and soil. These fungi have been shown to improve plant health through the enhancement of plant resistance/tolerance against abiotic and biotic stresses.

The COST action 8.21 (Arbuscular Mycorrhizas in Sustainable Soil Plant Systems) has been aware of the importance of AM in biological control and consequently has devoted one of its working groups to study the role of AM in stress alleviation and plant protection. The outcome of the first meeting of this group is presented in this issue.

This special issue of *Plant and Soil* is the outcome of a meeting held in Sitges, Barcelona, Spain (27 – 29 April, 1995), organized in the framework of the COST Action 8.21 to discuss the state of the art, the current research aspects and the future perspectives of arbuscular mycorrhizas and biological control. This information should allow a better understanding of the mycorrhizal symbiosis the adequate biotechnology for the practical application of AM as bioprotection agents.

There are still many questions that need to be answered but the information gathered in this issue represents a major step forward the understanding of the role of AM in an integrated biological control strategy, regarding both the mechanisms involved and the possibilities of developing this adequate biotechnology for the practical application of AM as bioprotection agents within the scope of sustainable crop production systems.

**References**

- Barea J M and Jeffries P 1985 Arbuscular mycorrhizas in sustainable soil plant systems. *In* *Mycorrhizae Structure and Function, Molecular Biology and Biotechnology*. Eds. B Hock and A Varma. pp 521–559. Springer-Verlag, Berlin Heidelberg.
- Bethlenfalvai G J and Linderman R G 1992 *Mycorrhiza Sustainable Agriculture*. ASA Special Publication Madison, WI 124 p.
- Gianinazzi S and Schüepp H 1994 *Impact of Arbuscular Mycorrhizas on Sustainable Agriculture and Natural Ecosystems*. Birkhäuser Verlag, Basel, 226 p.