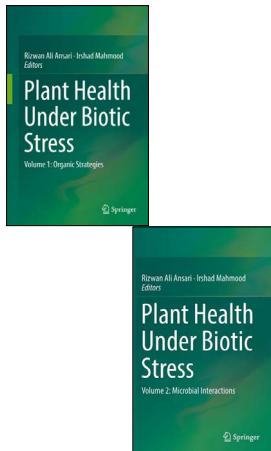




Green actions for better plant health

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Volume 1: Organic strategies and
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Plant health is a planetary issue with major implications for global welfare. Beyond the anthropocentric vision we tend to profess, plants are essential for our lives: we need them to breathe and to eat. Healthy plants are essential for providing these extremely basic human needs. Thus, we need to keep our plants safe from diseases that can impact on humanity's food security and safety.

In the two volumes of *Plant Health Under Biotic Stress*, edited by Dr Rizwan Ali Ansari and Dr Irshad Mahmood, important aspects relative to plant health are presented. Overall, these two books make a compendium of articles focused mostly on promoting plant health ranging from soil amelioration and care to the application of older natural actions and biotechnological approaches. They invite us to consider that a good substrate and knowledge of plant physiology will provide better fundamental health in important plants and cultivars. Along with the information in these chapters, we are given several recommendations to provide sustainable plant health. Moreover, these books provide interesting information through specific examples and synopses that can orientate state-of-the-art knowledge to minimise biotic stress. Three main actions are suggested: the use of genetic techniques and biotechnological systems; the application of beneficial microorganisms; and following agronomic practices that might lower the impact of harmful chemicals.

Organic strategies

The first volume presents distinct approaches, homing in on the different organic and natural applications of distinct organic material and focusing on particular cases of cultivars. Organic strategies are conceived for ameliorating soil to enhance the production of a cultivar that would reduce the use of agrochemicals, as well as for other ecofriendly practices with the same objective. Organic amendments are considered to be animal manure, municipal biosolids and septage, green manure, food residues and wastes, and compost. The application of these organics impacts differently on the physical, chemical and biological properties of the soil, promotes a healthy environment for plants and fosters plant health through plant biomass promotion and plant disease management. Nevertheless, these materials can be costly to prepare before they can be used in agriculture; microorganisms that might bear non-desirable effects for food safety must be removed, and the material must be in a suitable form to avoid negative consequences on the physical and chemical properties of the soil. This volume also presents other agrofriendly management ideas on practices that mimic the action of agrochemicals. For instance, the grafting process has a similar effect on the plant's defensive response to applying agrochemicals in inducing oxidative enzymes. The application of botanicals and antagonistic fungus is a green option to avoid the harmful biocides to combat biotic stress, especially in the tropics where the high temperatures and humidity may favour the proliferation of fungi that may be pathogenic. In general, there is growing interest in integrated pest management that allows for equilibrium in the ecosystem, but landholders also need to earn their living and obtain a profit for their work. The example of the action against rice blast caused by *Magnaporthe oryzae* explains how one might go about this by integrating several approaches like the integration of biocontrol agents (ex. *Trichoderma viride* or *Pseudomonas fluorescens*), botanicals (for example the application of an extract of *Atalantia monophylla*), nutrition, water and the controlled use of chemicals. Kumar and Ashraf (Chapter 5) also support the use of biotechnological approaches and the search for resistant cultivars. Taking all these 'green' considerations into account, it is easy to outline the urgency for increasing research for food safety and security. Each plant–pathogen interaction has a different treatment, even between the same species, while the selection of resistant varieties is also an option for implementing plant health. Moreover, another chapter emphasises the relevance of this 'green' health in improving quality traits for the final product that reaches the consumer. These include organoleptic and nutritional characteristics, and hygienic/sanitary and commercial aspects. At this point, the authors do not neglect the combination of different stresses and their consequences on plant health. Plants try to live in equilibrium with their environment and must respond to, or to be immune to, potential pathogenic pests. Forecasting may introduce a disequilibrium in the ecosystem and plants must respond to an excessive inoculum or population produced by the changes in humidity and temperature, or weakness of the plant due to a hostile environment (salinity, drought) may be a good trait for phytopathogenic agents to colonise plants.

Microbial interactions

Plants are not alone in their environments. They are surrounded by different microorganisms living in the rhizosphere and the rhizoplane sites that are in continuous dialogue. The second volume presents different approaches for biocontrol tools based on the use of endophytic bacteria, biofilmed biofertiliser, and beneficial fungi like the genus *Trichoderma*. Along with the chapters, the reader will find a review of the different mechanisms used by all these biological tools in ameliorating the impact of biotic stress. Despite being a beneficial known interaction there is still a long way to go. The efforts for sustainably handling biotic problems are described in these chapters. Concepts such as phytoremediation, mycoremediation and rhizoengineering are explained. The primary focus is on the application of promoting growth-promoting rhizobacteria (PGPR) and their role as a biostimulant, in phytoremediation, and in biocontrol, with a long list of already known and registered bacteria for agricultural use. The study of mechanisms by which the endophytes can promote health in plants is of great interest because it allows for the introduction of policies for improving food production and environmental health. When scrutinising the table of mechanisms proposed by Tewari et al. (Chapter 10), the complexity of these biocontrol actions is made clear. These findings point to a need to prioritise future studies and to contemplate more complex situations than two-way interactions, like plant–pathogens or plant–endophytes. The scenario is becoming increasingly challenging as the players in this drama are not acting alone, but within a net of interactions together with abiotic factors that will determine the final result in overcoming the biotic threat.