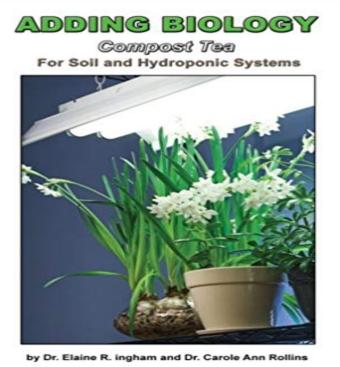
Adding Biology for Soil and Hydroponic Systems



Simple explanations about how to add biology to any plant growing system makes this book easy-to-read for the general Guidelines public. for conventional. sustainable and organic applications -whether you are growing indoors in controlled environments and soilless media or outdoors in open fields of soil, this book helps you design your growing systems and incorporate biology into your programs. Basic biology and chemistry nutrient-cycling and plant growing environments are given, so the mystery is taken out of plant growing. TABLE OF **CONTENTS CHAPTER** INTRODUCTION Types of Nutrients for Growing Plants Plants Take Up Nutrients in the Form of Ions Chelation of Nutrients Benefi cial and Non-Beneficial Microorganisms The Soil and Hydro Food CHAPTER 2. SYNTHETIC OR Web INORGANIC SYSTEMS Chemical **CHAPTER** Dependency 3. BIOLOGICAL/ORGANIC SYSTEMS How the Biology Works Organic Systems Require Nutrient Cycling Nutrient Cycling Depends on Biology Reduction of Salt and Toxic Levels Essential Benefi ts of Biological Organic Systems CHAPTER 4. PLANT GROWING SYSTEMS OUT OF BALANCE Chemical Answers 50 Years Ago Biological Alternatives CHAPTER 5. ROOTS INTERFACE BIOLOGY AND **PLANTS** Balance of Benefi cial Microorganisms Essential CHAPTER 6. TYPES OF MICROORGANISMS Benefi cial Aerobic Microorganisms Anaerobic Microorganisms CHAPTER 7. TYPES OF BENEFICIAL AEROBIC ORGANISMS Bacteria Fungi Mycorrhizal Fungi Pathogenic Fungi Saprophytic Protozoa Flagellates Amoebae Ciliates Nematodes Microarthropods **CHAPTER ENVIRONMENTS FOR** MAINTAINING MICROORGANSIMS Dissolved Oxygen Issues pH Issues CHAPTER 9. Electrical Conductivity

MICROBES AND PLANTS FORM A **SYMBIOTIC** RELATIONSHIP **Plants** Feed Microbes and Microbes Feed Plants and **Bacterial-Dominated** Fungal Environments **Bacterial-Dominated** Growing Environments Fungal-Dominated Growing Environments Diversity Community Microorganism Essential Bacteria and Fungi Retain Nutrients Protozoa and Nematodes Release Food for CHAPTER 10. INTEGRATING BIOLOOGY INTO PLANT GROWING SYSTEMS Pumps Checking Levels of Oxygen, pH and Electrical Conductivity Checking the Biology Examples of Plant Growing Systems Reservoir Systems --Deep Water Culture, Ebb and Flow and Nutrient Film Drip Irrigation Aeroponics Sustainable Recycling Nutrient Film Technique for Hydroponics **CHAPTER SOURCES** OF 11. **BENEFICIAL** MICROORGANSIMS **Dormant** Microbial **Products** Single **Species** Inoculums Trichoderma Pseudomanads Bacillus Dry Microbial Products Worm Casting/Compost Vermicompost or Thermophilic Compost Actively Aerated Compost Teas Leachates, Extracts, Plant and Manure Teas are not Compost Tea Quality of Compost Teas CHAPTER 12. **APPLYING** MICROORGANISMS Compost Tea Application Parameters Outside Field Applications of Compost Teas Seasonal Compost Tea Applications Seasonal Approach for Annual Single-Season Plants General Approach to Applying Tea in Perennial Systems CHAPTER 13. TESTING **FOR BIOLOGICALS** Chemical Analysis Biological **Analysis Types** of Microbiological **Tests** Test Results Indicating Problems Plant Tissue Testing RESEARCH **CHAPTER** 14. ON MICROORGANISMS **AND** INTERACTIONS Endnotes Resource List About the Authors PREFACE This notebook is an attempt to provide basic information about adding biology to soil and soilless media whether in outdoor fi elds or indoor controlled environment hydroponics systems. Once we

equipped with the knowledge, we can then make intelligent decisions when faced with so many choices of brands and products in the marketplace. Whether we are using synthetic fertilizers/nutrients or sustainable practices, or have converted to organic systems, there is a way to add biology to enhance production, yield and quality. This notebook will provide you with some of the parameters, tools and knowledge so you can integrate biology into your specific growing system.

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