Plant Biotechnology Handbook

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Plant biotechnology is a precise process in which scientific techniques are used to develop molecular and cellular based technologies to improve plant productivity, quality and health; to improve the quality of plant products; or to prevent, reduce or eliminate constraints to plant productivity caused by diseases, pest organisms and environmental stresses. It can be defined as human intervention on plant material by means of technological instruments in order to produce permanent effects, and includes genetic engineering and gene manipulation to obtain transgenic plants. Plant genetic engineering is used to produce new inheritable combinations by introducing external DNA to plant material in an unnatural way. The results are genetically modified plants (GMPs) or transgenic plants. The key instrument used in plant biotechnology is the plant tissue culture (PTC) technique which refers to the in vitro culture of protoplasts, cells, tissues and organs. Plant biotechnology in use today relies on advanced technology, which allows plant breeders to make precise genetic changes to impart beneficial traits to plants. The application of biotechnology in agriculture has resulted in benefits to farmers, producers and consumers. Plant biotechnology has helped make both insect pest control and weed management safer and easier while safeguarding plants against disease. The worldwide demand for food, feed and modern textile fibers can only be met in the future with the help of plant biotechnology. It has the potential to open up whole new business areas that will totally redefine the current market scope and perception.
This book majorly deals with the organisms of biotechnology, herbicide resistant plants, transgenic plants with improved storage proteins, engineering for preservation of fruits, enhancing the photosynthetic efficiency, basic requirements for nitrogen fixation, animal and plant cell cultures , insecticides, cellular characteristics which influence the choice of cell , the growth of animal and plant cells immobilized within a confining matrix, virus free clones through plant tissue culture , microbial metabolism of carbon dioxide , organisms involved in the conversion of hydrogen, hydrogen utilization by aerobic hydrogen oxidizing bacteria, overproduction of microbial metabolites, regulation of metabolite synthesis etc.
The book contains measurement of plant cell growth, plant tissue culture, initiation of embryo genesis in suspension culture, micro propagation in plants, isolation of plant DNA and many more. This is very helpful book for entrepreneurs, consultants, students, institutions, researchers etc.

Maintenance media
Cell culture technologies
Cellular characteristics which influence the choice of cell culture technology
Mixing
Aeration
Doubling times
1. Sterlization of media
2. Sterlization of equipment
Cell stickness
Immobilized cell systems
The growth and exploitation of cell grown on the surface of a supporting solid substratum
1. Multiple process
2. Unit process
The growth of animal and plant cells immobilized within a confining matrix
1. Gel entrapment systems
2. Applications of entrapped cells
Dynamic cell systems
Air driven systems
Impeller and air driven systems
Impeller mixed systems
7. Somaclonal variation, cell selection an genotype improvement
Somaclonal variation
Historical perspective
The manifold incidence of somaclonal variation
Range of species
Characters displaying variation
Genetic nature of somaclonal variants
Pre-existing or culture induced variation
Genetic and explant sources effects
The origin of somaclonal variation
Chromosomal abnormalities
Molecular possibilities
Gene amplification and diminution
Tranposable elements
Cell selection
Disease resistance
Herbicide tolerance
Nutritional quality
Other cell selection systems
8. Virus-free clones through plant tissue culture
Distribution of viruses in plants
Techniques for eradication
Heat treatment
Chemotherapy
Meristem culture
Culture media
Factors affecting developments and rooting
Virus eradication
Major use of virus-free clones
Study effect of virus infection
Source for clonal propagation

Metabolic and structural injury
Thymine less death
Survival of slowly growing bacteria
Differentiation and survival
14. Effect of environment on microbial activity
Mechanisms of micro-organisms response to the environment
Primary response due to direct chemical or physicochemical effects
Enzyme inhibition and stimulation
Induction and repression of protein synthesis
Changes in cell morphology
Change in genotype
Dissolved oxygen
Cell Interactions with oxygen
Respiration
Oxygen incorporation
Oxygen as an inhibitor
Oxygen as an enzyme regulator
Measurement of dissolved oxygen
Generalized response to DOT
Diffusion limitation
Response of growing micro-organisms
Respiration rate
Change in cell constituents
Changes in metabolic products
Transient responses to changes in DOT
Control of DOT
Redox potential
Responses to carbon dioxide
Requirement for carbon dioxide
Inhibition by carbon dioxide
Water activity
Introduciton
Halotolerance and halophily
Effects of pH
Introduction
Cellular level responses
Intracellular pH
Effects of pH membrane function
Effects of pH on uptake of substrate
Effects of pH on products of metabolism
Effects of pH on cell morphology an structure
Effects of pH on the chemical environment
Effects of pH on flocculation and adhesion
Optimum pH values for growth
Causes of pH changes in cultures
Product formation
Nutrient uptake
Oxidation/reduction reaction
Chage in buffering capacity
Control of pH
By means of a buffer
By balancing metabolism
By feedback control

Feedback regulation
Limiting accumulation of end products
Feedback resistance mutations
Additional types of regulations
Permeability consideration
Recent approaches to strain construction
Amino-acid production by genetically engineered strains of
E-Coli and related organisms
Strain construction in other species
20. Microbial photosynthesis
Historical background
General characteristics of microbial photosynthesis
Structure and synthesis of photosynthetic pigments
Chlorophylls and bacteriochlorophylls
Carotenoids
The phycobissins
The initial reactions primary photochemistry and electron transport
Light harvesting
Charge separation and electron transport in an oxygenic
` photosynthesis
ATP synthesis
The eubacterial photosynthetic microbes
Introduction
The anoxygenic phototrophic bacteria
The major groups
Development of the photosynthetic appartus
Carbon metabolism
The Cyano bacteria: oxygenic photosynthesis in a diverse
prokaryotic group
Organization of the photosynthetic appartus
Interrelationship between photosynthetic and
chemosynthetic carbon metabolism in cyanobacteria
21. Extra cellular enzymes
Mechanism of Secretion
Signal hypothesis
Signal hyprosthesis in bacteria
Signal sequence structure
Function of signal peptide and translocation
Processing of the precursor
Gene fusion studies
Membrane associate intermediates
Alternative export mechanisms; post translocational secretion
Aspects of enzyme secretion in fungi
Regulation of Extracellular enzyme synthesis
Regulation of protein synthesis
Induction of exoenymes
End-product repression
Catabolite repression
Patterns of exoenzyme synthesis
RNA polymerase modification
Catabolite repression
Translocational control of exoenzyme synthesis in bacteria
Control of secretion

22. Overproduction of microbial metabolites
Effects of nutrient limitation
Effects of pH and uncouplers of oxidative phosphorylation
Effects of Temperature
23. Regulation of metabolite synthesis
A phospholactase system in Klebsiella
Catabolism of unnatural sugars
Regulatory mutations
Modular pathways
Evolution of an aliphatic amidase in pseudomonas
Evolution of a new ÃŸ-Galactosidase in E-Coli
Properties of the wild-type proteins
Evolution of lactose utilization
Evolution of new activities for ebg enzymes
Evolution of the ebg repressor
Decryptifying Existing Genes

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