



Plant Biostimulants and Growth Regulators in Sustainable Agriculture

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CRC Press
Taylor & Francis Group

APPLE ACADEMIC PRESS

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First edition published 2027

Apple Academic Press Inc.
1265 Goldenrod Circle, NE,
Palm Bay, FL 32905 USA

760 Laurentian Drive, Unit 19,
Burlington, ON L7N 0A4, Canada

CRC Press

2385 NW Executive Center Drive,
Suite 320, Boca Raton FL 33431

4 Park Square, Milton Park,
Abingdon, Oxon, OX14 4RN, UK

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For Product Safety Concerns and Information please contact our EU representative GPSR@taylorandfrancis.com Taylor & Francis Verlag GmbH, Kaufingerstraße 24, 80331 München, Germany

Library and Archives Canada Cataloguing in Publication

.....

CIP data on file with Canada Library and Archives

.....

Library of Congress Cataloging-in-Publication Data

.....

CIP data on file with US Library of Congress

.....

ISBN: 978-1-77964-144-1 (hbk)

ISBN: 978-1-77964-145-8 (ebk)

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Fungal-Based Biostimulants and Growth Regulators for Plant Growth and Disease Resistance

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Plant Biostimulants and Growth Regulators in Sustainable Agriculture.

Deepak Kumar, Sanjay K. Singh, Nutan Kaushik, and Mahaveer P. Sharma (Eds.)

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ABSTRACT

In recent years, there has been a growing interest in harnessing the potential of fungal-based biostimulants (BS) and growth regulators to enhance plant growth and bolster disease resistance. Rising demand for sustainable agriculture and a shift away from hazardous chemical fertilizers are driving the biostimulant market. Fungi play multifaceted roles in the soil microbiome, influencing nutrient cycling, soil structure, and plant health through symbiotic relationships with plants. BS produced by fungi can successfully stimulate nutrient uptake, improve stress tolerance, and enhance overall plant vigor by utilizing the symbiotic interactions between fungi and plants. Furthermore, fungal-based growth regulators offer promising avenues for sustainable agriculture by modulating plant physiology and defense mechanisms. Fungi produce an array of bioactive compounds, including secondary metabolites and volatile organic compounds (VOC), which can elicit systemic resistance against pathogens. These regulators induce the expression of defense-related genes, triggering plant immune responses and priming systemic acquired resistance. Additionally, fungal-based growth regulators can mitigate the impact of plant pathogens by antagonizing their growth or producing antimicrobial compounds.

7.1 INTRODUCTION

Fungal-based biostimulants (BS) and growth regulators are products derived from various types of fungi that are used to enhance plant growth, productivity, and overall health (Anand et al., 2022; du Jardin, 2015; Fadji et al., 2022). These products utilize the beneficial effects of fungi on plant growth and development, often through mechanisms such as improved nutrient uptake, hormone regulation, disease resistance, and stress tolerance (Begum et al., 2019; Zin and Badaluddin, 2020). BS derived from fungi contain a rich array of bioactive compounds, including hormones, enzymes, vitamins, and secondary metabolites, which exert multifaceted effects on plant physiology. These compounds can stimulate root development, enhance nutrient assimilation, improve water utilization efficiency, and activate defense mechanisms against pests and pathogens. By bolstering plant health from within, fungal-based BS enable crops to thrive even under challenging environmental conditions, such as drought, salinity, or nutrient deficiency (Anand et al., 2023; Melini et al., 2023). Moreover, fungal growth regulators offer a targeted approach to modulating plant growth and development, thereby optimizing resource allocation and