

**Research Methods in  
Plant Sciences :**

# **Allelopathy**

**Volume 4**

## **Plant Analysis**



*Chief Editor*

**S.S. Narwal**

*Editors*

**O.P. Sangwan**

**O.P. Dhankhar**



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## *Volume - 4* Plant Analysis

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**SCIENTIFIC PUBLISHERS (INDIA)**

P.O. BOX 91

JODHPUR

Published by :  
Pawan Kumar  
Scientific Publishers (India)  
5-A, New Pali Road, P.O. Box 91  
JODHPUR - 342 001 (India)  
E-mail: info@scientificpub.com  
www.scientificpub.com

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ISBN: 81-7233-383-8 (Set)  
81-7233-469-9 (Vol. 4)  
81-7233-386-2 (Vol. 3)  
81-7233-385-4 (Vol. 2)  
81-7233-384-6 (Vol. 1)

eISBN: 978-93-8791-337-0

Laser typeset : Rajesh Ojha  
Printed in India

## PREFACE

Allelopathy is a new field of science, as the term 'Allelopathy' was coined by Prof. Hans Molisch, a German Plant Physiologist in 1937. Till now lot of allelopathy resech has been done in various fields of Agricultural and Plant Sciences. However, there is no compilation of various Research Methods used. Every scientist is conducting research in his own way. It is causing lot of problems to researchers working in underdeveloped/Third World Countries in small towns without Library facilities. Therefore, to make available the standard methods for conducting allelopathy research independently, this multi-volume book has been planned. Since allelopathy is multi-disciplinary area of research, hence, volumes have been planned for each discipline.

In all the conferences held since 1990's in India or in Foreign countries, a need has always been felt for a Manual of Allelopathy Research Methods. During II International Allelopathy Conference, New Delhi (September 6-8, 1994), it was decided that a Book **"Methodology of Allelopathy"** may be compiled. Prof. S.S. Narwal, India and Prof. G.R. Waller, Oklahoma State University, Stillwater, USA agreed to prepare this Book. But the Project was later shelved. Sine then Prof. Narwal has been strongly feeling to prepare such a Book. After 10-years, Prof. S.S. Narwal has planned this multi-volume Book **Research Methods in Plant Sciences : Allelopathy**. Three volumes (Volume 1. Soil Analysis, Volume 2. Plant Protection and Volume 3. Plant Pathogens) of this Book have been released during the **IV. International Allelopathy Conference, August 23-25, 2004 at Haryana Agricultural University, Hisar-125004, India**. Two volumes (Volume 4. Plant Analysis and volume 5. Plant Physiology) will be released in November, 2006. Three volumes (Volume 6, Cell Diagnostics, Volume 7. Chemistry Methods and Volume 8. Weed Studies) are under preparation.

The Book series **"Research Methods in Plant Science : Allelopathy"** aims to provide basic information about the various methods to Researchers so that he can conduct research independently. The methods have been described in a simple way just like **"DO IT YOURSELF"** Book. Now it is hoped that researchers can

do research independently by following steps given in this Book series.

This book consists of 12 Chapters, describing the methods to analyse various nutrients in plants. The Book is divided into two Sections : General and Determination of Plant nutrients. **The Section I. General**, provides very elementary and basic information about the various equipments and apparatus used to determine plant nutrients and preparation of Reagents etc. Further, methods of collecting plant samples and their digestion have been described. In **Section II. Determination of Plant Nutrients**, 8 Chapters describes methods of determining various plant nutrients (Carbon, Nitrogen, Phosphorus, Potassium, Sodium, Calcium, Magnesium, Sulphur, Micronutrients and Toxic metals).

This book provides complete information for Plant Analysis in simple and lucid language. The Figures/Illustrations have been given at appropriate places in text. It will prove very useful to undergraduate and post graduate students and teaching Faculty for Class Room and Laboratory experiments as well as for research. We also express thanks to Sh. Pawan Kumar and Sh. Rajesh Ojha, Scientific Publishers, Jodhpur, India to print this Book.

We invite valuable suggestions from students and researchers, to make further editions of this Book more useful and meaningful.

November 6, 2006

S. S. Narwal  
O. P. Sangwan  
O. P. Dhankhar



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**Research Methods in Plant Sciences : Allelopathy.**

**Volume 4. Plant Analysis**

*Eds. S.S. Narwal, O.P. Sangwan and O.P. Dhankhar*

Scientific Publishers (India), Jodhpur (2007) (pp. vii-x)

# **ALLELOPATHY AND PLANT ANALYSIS**

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## **1. INTRODUCTION**

Allelopathy refers to any process involving secondary metabolites produced by plants, microorganism, viruses, fungi that influence the growth and development of Agricultural and Biological systems. It has been established that allelopathy offers great potential (a) to increase agricultural production (food grains, vegetables, fruits, forestry), (b) to decrease harmful effects of modern agricultural practices [multiple cropping, leaching losses from N fertilizers, indiscriminate use of pesticides (weedicides, fungicides, insecticides, nematicides), tolerant/resistant biotypes in pest] on soil health/productivity and on environment and (c) to maintain soil productivity and a pollution free environment for our future generations. It is likely that in the near future allelopathy will be used in crop production, crop protection, agroforestry and agrohorticultural practices in developed and developing countries. Allelopathy may become one of the strategic sciences to reduce the environmental pollution and to increase agricultural production in Sustainable Agriculture of the 21<sup>st</sup> Century. The Allelopathy provides basis to Sustainable Agriculture, hence, currently the Allelopathy research is being done in most Countries Worldwide and is now receiving more attention from agricultural and bioscientists.

Allelopathy is a new field of science, as the term 'Allelopathy' was coined by Prof. Hans Molisch, a German Plant Physiologist in

1937. Therefore, till now there is no Book on **Methodology of Allelopathy Research**. It is causing lot of problems to researchers working in underdeveloped/Third World Countries, in small towns without Library facilities. Therefore, to make available the standard methods for conducting allelopathy research independently, this multi-volume book has been planned. Since allelopathy is multi-disciplinary area of research, hence, volumes have been planned for each discipline.

## 2. ALLELOPATHY AND PLANT NUTRIENTS

The adequate supply of plant nutrients is necessary for the normal growth and development of plants. The excess or deficiency of plant nutrients adversely influence the various growth processes and production of allelochemicals. In general, most of the soils are deficient in major plant nutrients and under such conditions Interference (Competition + Allelopathy) starts between the various plant spp. growing together. It becomes very intense as the plant enters grand growth phase. Then plants start interfering with the neighbouring plants, leading to their decreased growth. In natural grasslands, the deficiency of nitrogen leads to succession, where, new plant spp with less nitrogen requirements start growing, replacing the spp with large requirements of nitrogen. Under these conditions, plants start releasing allelochemicals in soil, which are toxic to neighbouring plants spp leading to their reduced growth and death, so that all nitrogen is available to its own plants (Rice, 1984).

Plant nutrients are closely associated with allelopathy, both in the synthesis of allelochemicals and influence of allelochemicals on various physiological processes in plants. These physiological processes effects the seed germination, seedling growth, development and senescence of plant organs and plant maturity. Besides, plant nutrients also influence the synthesis of allelochemicals in plants and their release into the environment. Various factors (a) radiation, (b) mineral deficiencies, (c) water stress, (d) temperature, (e) allelopathic agents, (f) age of plant organs, (g) genetics and (h) pathogens and predators affect the amount of allelochemicals produced in plants (Rice, 1984). All these factors influence various physiological processes, which affects the synthesis of allelochemicals. These allelochemicals after the release into the environment influences the plant growth and development through the changes of following physiological processes (Rice, 1984): (a) cell division and cell elongation, (b) phytohormone induced growth, (c) membrane permeability, (d) mineral uptake, (e) availability of soil phosphorus and potassium, (f) stomatal opening (g) photosynthesis, (h) respiration, (i) protein synthesis and changes in lipid and organic acid

metabolism, (j) inhibition of porphyrin synthesis, (k) inhibition or stimulation of specific enzymes, (l) corking and clogging of xylem elements, stem conductance of water and internal water relations and (o) miscellaneous mechanisms.

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*Section I.*

**GENERAL**

