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Khawar Jabran

# Manipulation of Allelopathic Crops for Weed Control

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# Preface

Evolution of herbicide resistance in weeds has severely impacted the sustainability of weed control systems all across the globe. Pesticide residue in both food and the environment is an important concern of humanity. Further, there has been a demand for organically grown food in various parts of the world. These three facts stress the need for achieving sustainable weed control with methods other than herbicides. Allelopathy is an attractive option to control weeds naturally under field conditions. This book straightforwardly defines the ways of exploiting the allelopathic potential of important field crops for controlling weeds, either in the same crops or other ones. This means that the crops normally grown are exploited for their allelopathic activity to suppress weeds naturally under field conditions. The book highlights the allelopathic potential of several important cereals (wheat, maize, rice, barley, sorghum, rye) and two oilseed crops [sunflower and canola (as well as some other members of *Brassicaceae* family)]. Further, the book explains how the allelopathic potential of these crops can be manipulated under field conditions to suppress weeds, for example, by growing allelopathic crop cultivars, using mulches from allelopathic crops, intercropping an allelopathic crop with a non-allelopathic crop, including allelopathic crops in crop rotation, and using these as cover crops.

Competition and allelopathy are always difficult to separate. The literature used in this book has been selected carefully in order to quote only the examples from allelopathy, and not the competition. The cases with possible involvement of competition (along with allelopathic effect) have been mentioned clearly.

The researchers in the field of allelopathy will be able to benefit from this book by using it as a ready reference. This book will be of great importance and interest to graduate and post-graduate students who can benefit from it as a first source of information regarding the concepts of allelopathy and allelopathic crops capable of suppressing weeds. Undoubtedly, the farmers aiming to achieve a non-chemical weed control in their fields can also benefit from this book.

Duzce, Turkey

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# Chapter 1

## Allelopathy: Introduction and Concepts

**Abstract** Plants communicate and influence the growth of other plants (or even microorganisms) through excretion of certain chemical compounds (allelochemicals). The process is called allelopathy. A number of allelochemicals have been reported from different plant species. Most important allelochemicals/allelochemical groups in major field crops (those focused in this book) may include phenolic compounds, benzoxazinoids, sorgoleone, glucosinolates, terpenes, alkaloids, and momilactones. The allelopathic potential of field crops may be utilized for controlling weeds without importing weed control agent into the field. This is possible through channelizing the allelopathic activity of field crops for controlling weeds in form of several techniques. Most importantly, these techniques may include growing the crop cultivars that possess an allelopathic potential. The other important ways may include intercropping of a crop possessing an allelopathic potential with a crop without allelopathic activity [e.g., intercropping of sorghum (*Sorghum bicolor* (L.) Moench) in cotton (*Gossypium hirsutum* L.)], including a crop possessing an allelopathic activity in a crop rotation, use of residues from an allelopathic crop as mulch, and use of an allelopathic crop as cover crop for controlling weeds. Most important in future research include determining the mode of action of allelochemicals and their formulation into a commercial weed control product.

**Keywords** Concepts of allelopathy • Allelochemicals • Weed control • Mode of action • Allelopathic crops

### 1.1 Introduction to This Book

The problems of herbicide resistance evolution in weeds, environmental pollution, and development of organic agriculture have highlighted the importance of non-conventional methods of weed management. The phenomenon of allelopathy, if utilized properly, may play an important role in managing weeds under field conditions. This book is aimed at providing basic details regarding the allelopathic potential of some important field crops [wheat (*Triticum aestivum* L.), rice (*Oryza sativa* L.), maize (*Zea mays* L.), rye (*Secale cereale* L.), barley (*Hordeum vulgare* L.), sorghum (*Sorghum bicolor* (L.) Moench), sunflower (*Helianthus annuus* L.) and some important crops from family *Brassicaceae*]. Further, the book describes how the