# Preface

Breeding for organic agriculture is gaining enormous attention in the scientific community due to burgeoning trade, production, and consumption of organic produce. It is well established that organically managed lands represent a different environment than conventionally managed lands mainly due to the presence of large weeds populations. Wheat is one of the most produced and consumed cereal grains worldwide. Weed infestation is a ubiquitous threat to the production of major cereal crops including wheat (*Triticum aestivum* L.), maize (*Zea mays* L.), and rice (*Oryza sativa* L.). This threat needs to be minimized in order to maximize global crop production and to meet the food demand of the ever-increasing human population. Currently, farmers control weed infestation mainly through the application of herbicides. According to Transparency Market Research, herbicide is the largest category in the crop protection sector that contributed about $19.9 billion in 2011. The use of herbicides is increasing on an annual basis. The continuous exposure of weed species/plants to strong herbicides has inevitably resulted in the development of herbicide-resistant weed populations in at least 80 crops in 63 countries (http://www.weedscience.com), which poses a major threat/challenge to global food production and security. This widespread evolution of herbicide-resistant weed species necessitates the development of alternate weed control strategies. Therefore, interest in breeding cereals, especially wheat, to enhance competitive ability is growing among the scientific community. Various traits of economic importance, conferring competitive ability against weeds, have been identified along with improved understanding of allelopathy. The combined effects of competition and allelopathy offer a great potential to achieve maximum weed suppression. Breeding efforts have resulted in the development of weed suppressive rice cultivars that are commercially available in China and the USA, whereas research work is being conducted in many parts of the world, including Canada, to develop a highly competitive wheat ideotype.

In planning this monograph, our main intent was to (i) describe and critically review key aspects of breeding wheat for organically managed systems to enhance competitive ability against weeds and (ii) to provide a unique and time-based resource for plant breeders, agronomists, teachers, students, and weed scientists around the globe to seek information on a discipline of crop competitiveness. Consequently, this brief is divided into five chapters which are arranged in logical progression. Chapter 1 highlights the importance, history, production, and

utilization of wheat from a global perspective. Chapter 2 begins with a brief overview of organic agriculture and extends a comprehensive discussion on crop–weed competitiveness. It also identifies traits of interests in different crops to breed for competitiveness and presents trait association to competitive ability in crop plants. Various strategies to control weed infestation and to enhance competitive ability through management, genetics, or genomic approaches have been presented in Chap. 3. It highlights various molecular studies undertaken to identify molecular markers linked with various traits conferring competitive ability in cereal crops. Chapter 4 provides strategies to breed wheat for disease resistance, quality, allelopathy, and earliness for organic systems. Chapter 5 summarizes the brief and outlines studies conducted during the last 5 years to examine competitive ability in various cereal crops throughout the world.

The brief is presented in a logical format making it available to a wide range of readers including plant breeders, agronomists, weed scientists, graduate, and undergraduate students involved in the field of agriculture and related disciplines, to help them in devising breeding strategies to deal with the problem of weed/weed infestation by enhancing/improving crop competitiveness.

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