

Preface

The focus on lignocellulosic biomass-based fuels, also known as second-generation biofuels, has been increasing substantially in recent years. This is evident from the number of journals dedicated to this topic, the number of research papers published, and the number of conferences organized globally. The criticality of efficient and reliable biomass feedstock production and provision (BFPP) for sustainable lignocellulosic biofuel production is also now well acknowledged. It has further been realized that a significant shift from conventional agricultural practices may be needed to achieve the proposed biomass production targets, such as the well-known billion ton target for the United States.

Our own research on this topic started in 2008 as part of a research program funded through the Energy Biosciences Institute co-located at the University of Illinois at Urbana-Champaign and the University of California, Berkeley. The field was nascent at that stage, and the fundamental understanding of various aspects of BFPP was developing through many concurrent research initiatives. Most of the relevant information pertained to agricultural residue such as corn stover. Information specific to dedicated energy crops such as perennial grasses was sporadic in the literature. Subsequently, we have seen an explosion of research output in the last few years in the form of journal papers, conference presentations, technical reports, feasibility studies, and white papers. New knowledge was being generated and novel challenges were being identified. However, the consolidation of this new knowledge in the form of a comprehensive book is still lacking. We have interacted frequently with researchers working in this and related fields as well as with students initiating research on this topic. These interactions have emphasized the need for a comprehensive book on this topic that covers all the aspects of BFPP. Moreover, the topic of bioenergy, and consequently BFPP, has been the basis of many new interdisciplinary educational degree/certificate programs. We realize that a book on the topic of BFPP will be of significant value to the students and instructors participating in these programs.

Therefore, when Springer Science approached us in January 2012 to write a book in the area of bioenergy, we were very excited to suggest biomass feedstock production and provision as a potential topic of the book. The field had matured enough to justify the publication of a compendium of recent progress and future challenges. We are very glad that Springer Science wholeheartedly supported the idea and recognized the value of a book in this field.

Finalizing the scope of the book was an important step. The topic of BFPP comprises basic sciences, engineering, economics, policy and regulation, and social sciences. Engineering plays a key role in translating the scientific understanding into practical solutions. Given the importance of engineering and our strong background in this area, we decided to focus the book primarily on the engineering aspects of BFPP. As part of our own research, we have identified various subsystems or tasks of BFPP, namely, preharvest crop monitoring, harvesting, storage, and transportation. Our research also integrates these tasks in a holistic manner through a systems informatics and analysis task. The book follows a similar philosophy and reviews the recent developments on each of these topics. Engineering properties of biomass play an important role in all tasks described above. We, therefore, included a chapter on describing these properties and their measurement methods. We further realized that the BFPP system is impacted by aspects of agronomy, including crop establishment and management, and have included a chapter that focuses on this topic. We also recognized that the topic of BFPP would be of relevance not only to engineers but also to other stakeholders, such as farmers, plant managers, investors, policy makers, and businesses. Decisions for these stakeholders must account for the long-term sustainability viewed through the policy framework. We, therefore, have included a chapter elaborating on these issues, which makes this book really unique. There was a thought of including a chapter on processing of biomass into fuels and other products. However, we believe that there are many excellent books already published on this topic to which interested readers can refer.

Individual chapters provide an overview of the challenges, review current status, identify knowledge gaps, and provide future research directions. The chapters primarily discuss the production and provision of dedicated energy crops such as switchgrass and *Miscanthus*. However, literature on agricultural residue, green energy crops, and short rotation woody biomass is also discussed wherever appropriate. The target audience for the book includes engineers (agricultural, chemical, mechanical, civil), agronomists, researchers, undergraduate and graduate students, policy makers, bioenergy industries/businesses, farmers, and farm consultants. We also hope that the book will be used as learning material for classroom or laboratory instructions on this topic. A few pilot-scale biomass processing facilities have recently been set up, and focus will soon shift on setting up commercial scale facilities. The material presented in this book will provide valuable guidelines for setting up such facilities. We believe that the book will serve as an authoritative treatise on BFPP with particular emphasis on the engineering aspects. While we assume that the readers will have a preliminary understanding of the bioenergy systems and agricultural operations, all the chapters would be easy to comprehend for most readers. The readers can jump to a specific chapter of interest without going through the preceding chapters.

There are several people to acknowledge for the successful completion of the book. First and foremost, we would like to thank all the authors for their contributions. They readily accepted our request for contribution and have been very cooperative during the submission, review, and revision stages. The number of researchers working in this area is small, albeit increasing, and all the authors contributing to this book are leading researchers in their respective fields. We are, therefore, really glad that we have been able to bring them together for the purpose of this book.

We would also like to thank Springer Science for their interest in publishing in this area. The publishing house and its staff have provided us with excellent support throughout the preparation of the book. Ms. Hannah Smith, Associate Editor, Plant Sciences, helped us during the initial stages of conceptualizing the book, providing feedback on the scope, and finalizing the contributors. We thank the reviewers for providing us with valuable inputs and suggestions. Ms. Diane Lamsback, Developmental Editor, has subsequently provided very good support during the preparation and editing of the individual chapters and the compilation of the book. Needless to say, the book would not have come out without their support.

Finally, we would like to acknowledge the Energy Biosciences Institute for providing the unique opportunity to many contributing authors to work together on this important topic.

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