Bioenergy Feedstocks: Breeding and Genetics


Energy has been an important driver of economic development throughout the world. Shortages of energy, whether real or orchestrated by special interests, have always negatively impacted consumers in many ways—for example, the ‘gasoline shortage of 1974’ in the USA. Energy generation by use of non-renewable fossil fuels (coal, petroleum, etc.) has had negative effects on the environment. Direct or indirect use of fossil fuels for energy has now been linked to release of greenhouse gases (GHGs) (carbon dioxide, methane, and nitrous oxide), which leads to global warming and climate change. Climate change impacts food production and water resources in addition to impacting energy use, transmission of diseases, and other aspects of human health and well-being. The search for renewable sources of energy has attracted attention in many developed countries—for example, use of maize grain for ethanol production. The world witnessed a sharp rise in food prices in 2008–2009 on account of two climate change-related actions—one, the use of bioenergy produced from maize grain as a substitute for fossil-fuel energy, and second, reduced food grain production as a consequence of erratic weather/climate change. It is therefore imperative to look for and promote non-food sources of energy, such as switchgrass and Miscanthus, as sustainable alternatives to hydrocarbons expected to reduce GHG emissions, enhance economy, and ensure food security. Co-firing of feedstocks and coal (i.e., biopower) is indicated as helpful in reducing GHG emissions. Mention is made of food vs. fuel controversy, referring to the use of sugarcane, and vegetable oil feedstocks to produce ethanol. The use of non-food, lignocellulosic (e.g., municipal waste and wood chips) as well as crops, such as switchgrass and Miscanthus, is covered in the book. The editors correctly argue that plant breeding was critical for crop improvement and cite the fact that systematic breeding had increased average maize grain yields by 745% since 1930. They suggest that for biofuel purposes, vigorous, dedicated breeding efforts would be needed to improve switchgrass and Miscanthus because these species had only recently been taken from their natural habitat. Bioenergy Feedstocks: Breeding and Genetics is written to promote breeding of such new biomass crops. A chapter-wise discussion of the book follows.

In the introductory chapter (Ch. 1), the editors provide a brief historical development of the concept, indicating that by 1912, Rudolf Diesel had demonstrated that diesel obtained from plant biomass could be used in automobiles, and that crude oil had only recently been taken from their natural habitat. Brazil is said to have been using plant-based sugarcane-based, ethanol in automobiles since the 1920s and to have produced >16 billion liters in 2007. According to the authors, genetic improvement of switchgrass and Miscanthus is important.