Handbook Of Bioenergy Crop Plants

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as the world s population is projected to reach 10 billion or more by 2100 devastating fossil fuel shortages loom in the future unless more renewable alternatives to energy are developed bioenergy in the form of cellulosic biomass starch sugar and oils from crop plants has emerged as one of the cheaper cleaner and environmentally sustainab

this completely revised second edition includes new information on biomass in relation to climate change new coverage of vital issues including the food versus fuel debate and essential new information on second generation fuels and advances in conversion techniques the book begins with a guide to biomass accumulation harvesting transportation and storage as well as conversion technologies for biofuels this is followed by an examination of the environmental impact and economic and social dimensions including prospects for renewable energy the book then goes on to cover all the main potential energy crops

ethanol as an alternative fuel is receiving a lot of attention because it addresses concerns related to dwindling oil supplies energy independence and climate change the majority of the ethanol in the us is produced from corn starch with the us department of energy s target that 30 of the fuel in the us is produced from renewable resources by 2030 the anticipated demand for corn starch will quickly exceed the current production of corn this plus the concern that less grain will become available for food and feed purposes necessitates the use of other feedstocks for the production of ethanol for the very same reasons there is increasing research activity and growing interest in many other biomass crops genetic improvement of bio energy crops focuses on the production of ethanol from lignocellulosic biomass which includes corn stover biomass from dedicated annual and perennial energy crops and trees as well as a number of important biomass crops the biomass is typically pretreated through thermochemical processing to make it more amenable to hydrolysis with cellulolytic enzymes the enzymatic hydrolysis yields monomeric sugars that can be fermented to ethanol by micro organisms while much emphasis has been placed on the optimization of thermo chemical pretreatment processes production of more efficient hydrolytic enzymes and the development of robust microbial strains relatively little effort has been dedicated to the improvement of the biomass itself

bioenergy and biofuels are generated from a wide variety of feedstock fuels have been converted from a wide range of sources from vegetable oils to grains and sugarcane second generation biofuels are being developed around dedicated non food energy crops such as switchgrass and miscanthus with an eye toward bioenergy sustainability bioenergy feedstocks breeding and genetics looks at advances in our understanding of the genetics and breeding practices across this diverse range of crops and provides readers with a valuable tool to improve cultivars and increase energy crop yields bioenergy feedstocks breeding and genetics opens with chapters focusing primarily on advances in the genetics

and molecular biology of dedicated energy crops these chapters provide in depth coverage of new high potential feedstocks the remaining chapters provide valuable overview of breeding efforts of current feedstocks with specific attention paid to the development of bioenergy traits coverage in these chapters includes crops such as sorghum energy canes corn and other grasses and forages the final chapters explore the role of transgenics in bioenergy feedstock production and the development of low input strategies for producing bioenergy crops a timely collection of work from a global team of bioenergy researchers and crop scientists bioenergy feedstocks breeding and genetics is an essential reference on cultivar improvement of biomass feedstock crops

this book delves into the popular food vs fuel arguments and examines the complicated interplay between biofuel and agricultural markets it provides information on forage crops as potential third generation sources of bioenergy and their cultivation practices the areas covered include methodologies to enhance production efficiency of bioenergy metabolism involved in cellulosic ethanol production influence of policy and technical implementation and the consequent impact on biofuels the discussion of current difficulties impeding the expansion of the cellulosic biofuel business as well as potential solutions are discussed as well this book also covers case studies describing the present biofuel policies and its consequences on both the energy as well as agricultural sectors as well as analysis of the current and growing biofuel market the gathered information in the book is an excellent source for phenotyping trait improvement and developing future crop stress management strategies and models students scientists policymakers and investors in the bioenergy business will find this book to be a useful resource also it serves as an excellent reference book for agriculturists plant scientists climatologists and research scholars

the last few years have seen the concept of bioenergy and biofuels come of age rising oil prices have lead to more food crops being grown for energy as well as food this has created controversy by adding to the upward pressure on crop commodity prices that was already being created by the increasing demand for food from an expanding population more attention has therefore focussed on meeting the rising demand for bioenergy and biofuels in more sustainable ways a wider range of crops is being explored including non food crops as well as the use of crop residues rather than grain or seed energy crops is a comprehensive reference source which looks at this topic from the plant and agricultural science perspective it covers energy crops that are already in use and those that are being developed or researched species that have been cultivated by humankind for millennia and some that have never been considered as crops before fall within its coverage the introductory chapter defines energy crops before reviewing the development and current state of the technology it also gives an historical perspective and introduces the ethical issues each of the subsequent chapters is dedicated to a single crop and describes the current usage of that crop for energy its potential for future development

the economics of its use for energy production and the research that is being undertaken to tailor it for use as an energy crop where appropriate the implications for food and feed security are balanced against the benefits in terms of fuel security the impending oil supply peak the need to reduce co2 emissions and the implications for climate change mitigation each chapter is written by a specialist author or authors of international standing the chapters by representatives of the plant breeding and biofuel industries give an industrial perspective on why energy crops have come of age they also describe how the sector is expected to develop with a wish list of crop improvements that industry would like to see realized these include higher levels of fermentable starch cellulose fibres and oil quality through to the production of pure hydrocarbons the book is suitable for undergraduates postgraduates academics and those working in industry

bioenergy crops can provide a reliable and adequate supply of biomass feedstocks to support the bioenergy industry however commercial scale production of bioenergy crops has not been established to meet the increasing energy demand for the bioenergy industry thus there is a need to explore the full potential of bioenergy crop production to support energy generation this dissertation examined the feasibility of bioenergy crop production in the southern united states with a case study from kentucky for the feasibility of bioenergy crop production i 1 analyzed trade offs among the major components of bioenergy crop production 2 assessed landowners willingness to promote bioenergy crops and 3 evaluated potential bioenergy policies and prioritized them based on their effectiveness to support the promotion of sustainable bioenergy production i used multiple approaches including a multi objective optimization model a questionnaire survey and an analytic hierarchy process ahp model to examine the feasibility of bioenergy production the trade off analysis highlighted potential opportunities and risks in bioenergy production even though there were suitable lands for growing bioenergy crops the production was not economically beneficial further higher bioenergy production generated concerns for negative impact on the environment thus results from the trade off analysis showed a need to find the best balance among the trade offs for better production decisions the landowner survey indicated that they were relatively more willing to grow bioenergy crops themselves than rent their land to others current land management practices and socio economic and environmental factors affected their land use decisions about bioenergy crop production finally my policy analysis highlighted that policies that incorporate environmental conservation are key to establishing bioenergy crops in addition consideration should also be given to efficient technological support while designing specific policy to promote bioenergy production overall results from the whole study can be useful to design effective policies develop outreach activities and support technological investments that would promote bioenergy crop production in ways that are economically efficient as well as compatible with social and environmental factors

providing comprehensive coverage on biofuel crop production and the technological environmental and resource issues associated with a sustainable biofuel industry this book is ideal for researchers and industry personnel beginning with an introduction to biofuels and the challenges they face the book then includes detailed coverage on crops of current importance or with high future prospects including sections on algae sugar crops and grass oil and forestry species the chapters focus on the genetics breeding cultivation harvesting and handling of each crop

the growing of crops for bioenergy has been subject to much recent criticism as taking away land which could be used for food production or biodiversity conservation this book challenges some commonly held ideas about biofuels bioenergy and energy cropping particularly that energy crops pose an inherent threat to ecosystems which must be mitigated the book recognises that certain energy crops e g oil palm for biodiesel have generated sustainability concerns but also asks the question is there a better way of using energy crops to strategically enhance ecosystem functions it draws on numerous case studies including where energy crops have had negative outcomes as well as well as cases where energy crops have produced benefits for ecosystem health such as soil and water protection from the cropping of willow and poplar in europe and the use of mallee eucalypts to fight salinity in western australia while exploring this central argument the volume also provides a systematic overview of the socio economic sustainability issues surrounding bioenergy

this volume of the bioenergy plants compendium contains a collection of chapters that focus on the history economics and practical sciences related to sugarcane as one of the key biofuel crops in the world that is under large scale cultivation sugarcane is attracting interests for its adoption and emulation worldwide with a high ratio of energ

climate change has become the most important global environmental problem we face today agriculture forestry and the land use sector not only contribute to national economies but also provide a source of greenhouse gas ghg emissions as well as a carbon store contributing approximately 20 but removing about 16 energy crops and associated increases in soil carbon sequestration from different ground covers through various land management strategies are examples of approaches that could be adopted to reduce ghg emissions a number of these options have an associated economic cost to the land manager and it is important to understand what is economically and socially viable by understanding the link between energy crop adoption and a range of socio economic factors agent based modelling abms has been identified as providing a promising approach to integrate social economic and biophysical processes in the past these areas of research have been mainly studied separately but now there is an urgent need to address these areas in a combined way economic rationalisation is fundamental to farmers decision making although not wholly representative and non

economic factors were identified the estimated ghg mitigation potential of bioenergy crops at current adoption levels is modest when taking scotland s national ghg emissions into account however more significant when considering the agricultural sector in isolation this contribution can only increase with improved management practices and policy designed to encourage adoption and improve energy security this work will contribute to a greater understanding of bioenergy land use strategies this project used north east scotland as the case study with raw data collated by questionnaire however conclusions drawn add to the broader understanding of the link between socio economic activity bioenergy adoption and ghg emissions

in recent years there has been increasing recognition of the need for sound regulatory frameworks for bioenergy faced with high petroleum and natural gas prices and increasingly aware of climate change and environmental concerns many countries are implementing national policies and legislation to encourage bioenergy production and use these developments stem from the desire to achieve energy security and self sufficiency the need to reduce reliance on foreign fossil fuel reserves and the hope of providing increased trade opportunities for some agricultural commodities land use and the competing needs of energy and food security are key issues in the bioenergy debate international and national regulatory frameworks will have to establish clear guidelines for the sustainable development of the bioenergy industry this paper aims to stimulate discussion on the elements of appropriate national legal frameworks for bioenergy particularly in developing countries it provides legislators and policy makers with a tool to assist in identifying areas of law which may affect bioenergy regulation and in designing key elements of national bioenergy laws

this book evaluates maize as a bioenergy fuel source from two perspectives it explores whether the input energy needed to generate fuel significantly exceeded by the energy harvested in examining this issue the chapters provide assessments of the social economic and political impact on fuel pricing food costs and the environmental challenge with corn biomass the engine of change it then examines whether corn be genetically improved so that its biomass is significantly increased its cellulose lignin complex made more amenable to harvesting and to processing and grown in regions not normally associated with its cultivation of food

bioenergy is expected to play an increasingly significant role in the global energy budget in addition to the use of liquid energy forms such as ethanol and biodiesel electricity generation using processed energy crops as a partial or full coal alternative is expected to increase requiring large scale conversions of land for the cultivation of bioenergy feedstocks such as cane grasses or short rotation coppice with land use change identified as a major contributor to changes in the emission of biogenic volatile organic compounds bvocs many of which are known contributors to the pollutants ozone o3

and fine particulate matter pm2 5 careful review of crop emission profiles and local atmospheric chemistry will be necessary to mitigate any unintended air quality consequences in this work the atmospheric consequences of bioenergy crop replacement are examined using both the high resolution regional chemical transport model wrf chem weather research and forecasting with chemistry and the global climate model cesm community earth system model regional sensitivities to several representative crop types are analyzed and the impacts of each crop on air quality and climate are compared overall the high emitting crops eucalyptus and giant reed were found to produce climate and human health costs totaling up to 40 of the value of co2 emissions prevented while the related costs of the lowest emitting crop switchgrass were negligible

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