Chapter 16
Developing Energy Crops for Thermal Applications: Optimizing Fuel Quality, Energy Security and GHG Mitigation

Roger Samson, Claudia Ho Lem, Stephanie Bailey Stamler and Jeroen Dooper

Abstract Unprecedented opportunities for biofuel development are occurring as a result of increasing energy security concerns and the need to reduce greenhouse gas (GHG) emissions. This chapter analyzes the potential of growing energy crops for thermal energy applications, making a case-study comparison of bioheat, biogas and liquid biofuel production from energy crops in Ontario. Switchgrass pellets for bioheat and corn silage biogas were the most efficient strategies found for displacing imported fossil fuels, producing 142 and 123 GJ/ha respectively of net energy gain. Corn ethanol, soybean biodiesel and switchgrass cellulosic ethanol produced net energy gains of 16, 11 and 53 GJ/ha, respectively. Bioheat also proved the most efficient means to reduce GHG emissions. Switchgrass pellets were found to offset 86–91% of emissions compared with using coal, heating oil, natural gas or liquid natural gas (LNG). Each hectare of land used for production of switchgrass pellets could offset 7.6–13.1 tonnes of CO_2 annually. In contrast, soybean biodiesel, corn ethanol and switchgrass cellulosic ethanol could offset 0.9, 1.5 and 5.2 tonnes of CO_2/ha, respectively.

✉ R. Samson
Resource Efficient Agricultural Production (REAP) – Canada, Box 125 Centennial Centre CCB13, Ste. Anne de Bellevue, Quebec, Canada H9X 3V9,
e-mail: rsamson@reap-canada.com

C. Ho Lem
Resource Efficient Agricultural Production (REAP) – Canada, Box 125 Centennial Centre CCB13, Ste. Anne de Bellevue, Quebec, Canada H9X 3V9

S. Bailey Stamler
Resource Efficient Agricultural Production (REAP) – Canada, Box 125 Centennial Centre CCB13, Ste. Anne de Bellevue, Quebec, Canada H9X 3V9

J. Dooper
Resource Efficient Agricultural Production (REAP) – Canada, Box 125 Centennial Centre CCB13, Ste. Anne de Bellevue, Quebec, Canada H9X 3V9

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