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The Potential of C_4 Perennial Grasses for Developing a Global BIOHEAT Industry

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Abstract
Unprecedented opportunities for biofuel development are occurring as a result of rising fossil fuel prices, the need to reduce greenhouse gases, and growing energy security concerns. An estimated 250 million hectares (ha) of farmland could be utilized globally to develop a bioenergy industry if efficient and economical perennial biomass crops and bioenergy conversion systems are employed. In temperate zones, C_4 or warm-season grass research and development efforts have found switchgrass (*Panicum virgatum*) and *Miscanthus* capable of producing biomass yields of 10 to 20 oven dried tonnes (ODT)/ha/yr, while in tropical areas *Erianthus* and napier grass (*Pennisetum purpureum*) are producing 25 to 35 ODT/ha/yr. The potential to annually produce 100 barrels of oil energy equivalent/ha with a 25:1 energy output to input ratio appears achievable with high-yielding, N-fixing warm-season grasses grown on marginal lands in the tropics. Commercialization of densified herbaceous plant species has been slow because of the relatively high alkali and chlorine contents of the feedstocks, which leads to clinker formation and the fouling of boilers. This challenge can be overcome by improving biomass quality through advances in plant breeding and cultural management to reduce the chlorine, alkali, and silica content and through the use of new combustion technologies.

Warm-season grasses can be readily densified provided suitable grinding and densification equipment and pressure are utilized. The major advantages of producing densified warm-season grasses for BIOHEAT include: it is the most efficient strategy to use marginal farmlands in most temperate and tropical climates to collect solar radiation; it has an excellent energy balance; the feedstocks can be used conveniently in a variety of energy applications; and it is relatively environmentally friendly. Densified warm-season grass biofuels are poised to become a major global fuel source because they can meet some heating requirements at less cost than all other alternatives available today.

Reference: Samson, R., Mani, S., Boddey, R., Sokhansanj, S., Quesada, D., Urquiaga, S., Reis, V., and Ho Lem, C. 2005. The Potential of C4 Perennial Grasses for Developing a Global BIOHEAT Industry. Critical Reviews in Plant Sciences. 24:461-495.