Willow Research Program at the University of Saskatchewan

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The Saskatchewan government has committed to deriving one-third of its electricity from renewable energy sources by 2030 and short-rotation woody crops (SRWC) will play a key role in meeting these targets. Consequently, in 2005 the provincial government proposed an ambitious 1.6 million-hectare (i.e., 10 per cent of the province's arable land) afforestation initiative, with the intention of addressing not only the expected increased demand for woody biomass as differential markets develop, but also to mitigate the increasingly unfavourable agricultural sector within the province. The establishment of SRWC, such as willow, therefore, represents a legitimate option for diversifying farmers trying to maintain an economically viable operation in the face of historically decreasing commodity prices, along with increasing input and transportation costs, especially in the northern regions where annual crops are grown on marginal agricultural soils. Before there is widespread incorporation of willow into Saskatchewan agroforestry practices, however, a clear economic advantage for producers to grow willow must become apparent. In order to achieve this goal, a number of important agronomic, economic, and environmental questions need to be addressed, from both operational and empirical perspectives, which will be the focus of the willow research program at the University of Saskatchewan over the next several years. Specifically, these research objectives will aim to answer the following: i) What willow clones demonstrate the best survival and growth characteristics for use in Saskatchewan, ii) What key cultural practices (and their associated costs) are required for realizing optimal high density willow plantation establishment and productivity, iii) What is the effect of environmental gradient on willow biomass yield, iv) What diseases and pests within willow age sequences affect above- and below-ground biomass production, v) Does intercropping willow with caragana (i.e., N-fixer) improve soil nutrient availability within these plantations, vi) What are the rates of greenhouse gas emissions from soil in willow and willow/caragana plantations following various cultivation practices, vii) How does a three-year rotation of high density willow affect biogeochemical cycling and the rhizosphere microbial community, viii) How much carbon is sequestered above- and below-ground in these SRWC plantations and using the ECOSYS model what are the constraints for carbon accumulation, and finally ix) What molecular techniques could be effectively used to explicitly distinguish among the currently available willow clones for developing a molecular fingerprint library. This work will help to fill the current knowledge gap regarding cultivating short-rotation willow plantations in the prairie provinces and, therefore, should benefit farmers looking to diversify their production system, the renewable energy industry looking for reliable biomass feedstock, and government policy makers developing strategies to meet Canada's Kyoto commitments.