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Enhanced production of feedstock biomass: Biostimulants as a low-cost, low-carbon approach

Canada has considerable capacity for production of advanced biofuels; feedstock is the major constraint to production. On the agricultural side, feedstocks can be purpose grown biomass crops and/or residues from food crops. Climate change will increase the frequency of conditions stressful to crop growth, and cause greater extremes of crop stress. Purpose grown crops will often be produced on more marginal lands, where stressful conditions are generally more frequent. A plant growing under field conditions is not an individual; it is a community. It has a set of regulated microbes associated with it; the microbes also exert effects over the plants. The microbial community is the phytomicrobiome and, it plus the plants are referred to as the holobiont. Microbial inoculants can improve the growth and productivity of crop plants and reduce overall costs associated with traditional inputs of fertilizers, pesticides, etc. Microbial inoculants can improve the growth and productivity of crops by helping the plants access water and nutrients, fight off diseases, and activate growth responses with signalling compounds. Microbe-to-plant signal compounds (lipo-chitooligosaccharides and thuricin 17) have been shown to increase plant growth when applied at very low concentrations, particularly when plants are growing under stressful conditions. The interaction with stress was demonstrated during the recent 5-year funding period associated with BioFuelNet Canada. They are the hormones of the holobiont. Exploiting the phytomicrobiome constitutes a new opportunity for development of low-input, sustainable practices to improve crop biomass productivity and yield, delivering more biomass from crops and crop residue, leading to greater food production from food crops, a feedstock for fuel production. Meaningful progress has already been made: the lipo-chitooligosaccharide technology is already being applied to millions of hectares of agricultural land each year. However, it is clear that enormous untapped potential remains.

Biography

Donald L Smith (James McGill Professor) has conducted research in the production and physiology of crop plants, with an emphasis on plant-microbe interactions, most recently, within the context of biofuel feedstock production. Specific areas of research have been: nitrogen metabolism, nitrogen fixation, low temperature stress and nodulation, methods for injection of metabolites into plants, cereal production, plant growth regulators, intercropping, inter-plant competition, plant-microbe signaling, plants and climate change, biofuel crops, crop stress responses and biochar as a soil amendment. He has trained 66 graduate students, 38 PhD and 28 MSc, published >310 papers, generated 11 patents, started a spin-off company (Bios Agriculture Inc.), and commercialized technologies that are now applied to >100 million ha of crop land per year. He has been principal investigator on research grants totaling >$55 million. He currently leads the BioFuelNet Canada.

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