Beneficial Management Practices for Greenhouse Gas Mitigation from Agroecosystems, with Emphasis on Cow-Calf Non-confinement Production Systems in Western Canada

New funding announced by the Agricultural Greenhouse Gas Program (AGGP) by Agriculture and Agri-Food Canada, December 9, 2011: $3 million to support the full project budget of $4.3 million for the 2011 to 2015 period.

Project Goals:

Enhance our scientific understanding of net greenhouse gas (GHG) emissions in agricultural production systems, with focus on beef cow-calf operations in non-confinement production systems. This science-based information will be used to identify Beneficial Management Practices for policy development and program delivery to improve the economic and environmental sustainability of the Canadian cattle industry.

A key part is *whole-system* analyses of crop and livestock operations to inform policy. About 30 highly-qualified personnel will be trained including students and new scientists.

This project aims at:

1) Furthering scientific information and knowledge to support existing concepts of BMPs and to propose new BMPs that will have a substantial impact on the reduction of GHG emissions.

2) Implementing this knowledge by taking the research results from both separate and linked investigations and place the net GHG effect of BMPs into the context of a life-cycle analysis.

3) Transferring the technology through active collaborations with provincial and federal extension personnel and through direct producer interactions during field days, extension events and producer meetings.

4) Following up on BMPs that have been adopted by producers to mitigate GHG emissions, even beyond the tenure of the AGGP.

Why is this research important? Agriculture contributes about 10% of the global greenhouse gas emissions that cause climate warming. These gases also result in losses of energy from animals and loss of nitrogen from soil; so their reduction has both environmental and economic benefits.

The Team:

Investigators from the Faculty of Agricultural and Food Sciences at the University of Manitoba tied to the National Centre for Livestock and the Environment (NCLE); the University of Waterloo; and the University of Saskatchewan

Collaborators from Manitoba Agriculture, Food and Rural Initiatives; Agriculture and Agri-Food Canada; Alberta Agriculture and Rural Development, Texas A&M University, University of California-Davis; Environment Canada, University of Guelph, University of Alberta

Supporters include Manitoba Forage Council; Canadian Cattlemen's Association; Manitoba Beef Producers; NSERC; the Canadian Fertilizer Institute; the Canadian Foundation for Innovation; plus individual agricultural producer co-operators.

Global Linkages: The AGGP is part of Canada's commitment to the Global Research Alliance on Agricultural Greenhouse Gases, aimed to find ways to grow more food without increasing greenhouse gas emissions. See: www.globalresearchalliance.org

Nature of the Project

Over the past several years, both federal and provincial governments have been working to develop policy in the areas that influence land use practices, particularly lands traditionally used by cattle producers for grazing, hay and silage production. Recent policy efforts have focused on such issues as environmental sustainability including climate change (GHG mitigation), nutrient management, and water quality. At the same time, substantial increases in feed grain and other input prices (led by an expansion in the biofuel sector), coupled with low cattle prices, have forced many cattle producers to convert perennial forage land to grain land as a strategy for economic viability. It is expected that future policy supporting biomass (forage, straw and chaff, woody fibre) conversion to fuel will add further pressure to grasslands that have been taken out of cattle production, leading to increased forage prices. Beef cattle producers in Western Canada manage a significant portion of the agriculture land base and cattle herd. Volatility in commodity pricing and currencies, continuing trade issues and a changing climate require proactive decisions if this sector is to be sustainable. Gaps in knowledge regarding the productivity and environmental sustainability (nutrient utilization and accumulation, GHG emissions, pathogen movement) of low-cost, overwintering systems (backgrounding and cow-calf) have been identified as factors limiting good management decisions and policy.

A whole-system approach is needed to develop models which will allow assessment of current and alternative management practices in Western Canada. In large part, the challenge is related to choices made by producers with respect to land management, where a given change can have downstream consequences that are not easy to predict. For example, a decision to convert grassland to annual crops to support an expanding bioenergy market can change feeding strategies for the cattle herd, with increased emphasis on byproduct use (stubble grazing, straw feeding in absence of perennial forage, DDGS and oilseed meals). A reduction in the beef cattle herd may decrease enteric methane emissions but increase the portion of annual to perennial crops, causing greater nitrous oxide (N_2O) emissions from fertilizer use. Beneficial Management Practices (BMPs) need to be formulated with the full life-cycle included so that net GHG emissions can be assessed. We also need to relate these BMPs and their potential success back to our national GHG inventory, while considering agroecosystems that transcends provincial borders, as well as the economic implications for a practice.

For the agriculture sector, much of the focus on GHG emissions has concentrated on methane (CH_4) from cattle (enteric or manure) and N_2O from soils. However, carbon dioxide (CO_2) exchange between agroecosystems and the atmosphere is also important and can potentially dominate the GHG balance from soils during a transient change, such as conversion from perennial to annual crops. Hence, our approach is to evaluate the three main GHGs (CH_4, N_2O, and CO_2, integrated as CO_2 equivalents) with emphasis on the portion of the agroecosystems where each of these gases dominates. In particular for GHG accounting in the beef-cattle sector of Western Canada, we will investigate the cow-calf herd component that emits about 80% of the GHGs from beef production in Western Canada (Agric. Sys. 103:371-379). Meaningful reductions in GHG emissions can be achieved by focusing on these major source terms.

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