

Appendix A

List of Approved Projects
and
Related Executive Summaries

Derived from:

Calls for LOIs and Full Proposals – Fall 2010

OMAFRA-UG Partnership

Presented by 7 Research Thematic Pillars

May 20, 2011

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Eggs from alternative poultry housing systems: Meeting the needs of laying hens, producers and consumers

Agricultural and Rural Policy – Approved Projects

027053 – Lauzon, A.

Innovative Partnerships for Regional Economic Development: Ontario’s Colleges Of Applied Arts and Technology in Collaboration with Rural Small/Medium Enterprises

Executive Summary

In 2002 the *Ontario Colleges of Applied Arts and Technology Act* was updated, providing an official and clear mandate for colleges to engage in applied research and encouraged colleges to enter into partnerships with business and industry, creating new opportunities for establishing relationships with SMEs and opportunities for partnering in innovation. However, there is little empirical research that has been conducted on these new opportunities in Ontario (1 study conducted by the Conference Board of Canada, 2010), and no rural empirical research. This research offers a rural perspective, focusing on the rural context. It begins by examining the barriers to SME innovation in rural Ontario, followed by an in-depth study of successful regions. This is followed by an in-depth examination of four case studies of partnerships between SMEs and colleges that have been identified as successful by key informants. The results of this study will provide an overview of collaborative activity between colleges and rural SMEs, identify factors and characteristics associated with high levels of collaborative activity, and identify best practices for developing and implementing partnerships between Ontario colleges and rural SMEs.

027070 – Cranfield, J.

Identifying opportunities and strategies to enhance Ontario agribusiness’ capacity to capture value from emerging marketing channels for organic food.

Executive Summary

Agriculture and Agri-Food Canada estimates retail organic food sales in Canada at \$2 billion, with an estimated annual growth rate of 20%. This growth has been partially driven by product line extensions by national supermarket retailers, where imports account for a considerable share of organic sales, especially in value-added product categories. At the same time, the use of traditional organic food distribution channels continues alongside increasing demand for local/regional food. From this constellation, opportunities emerge for the organic production sector to benefit from Ontario based value chains that focus on providing an authentic food experience for consumers.

It is not clear whether such opportunities will lead to establishment of successful value chains for local/regional organic food, and under what circumstances such value chains can be situated within larger, mainstream distribution channels and/or benefit from smaller, local/regional distribution channels. The proposed research seeks to develop new knowledge that will inform

Ontario entrepreneurs regarding the potential size of the market for local/regional organic foods in Ontario, a typology of consumer segments that hold greatest growth potential in this market, and enhance entrepreneurs' capacity to create value chains that more fully exploits the growth potential in this market.

027074 – Joppe, M.

A Study of Innovative Best Practices to Foster Place-based Tourism Development in Ontario's Rural Communities.

Executive Summary

This research will identify and compile innovative best practices in rural tourism development that specifically align with the resource strengths of Ontario's communities. The process will begin with the identification of key strengths, encompassing the depth and range of our natural resources, agricultural produce, culture and heritage, built environment and human resources. Development initiatives will be collected from within Ontario, across Canada, and internationally. Rural culinary and food tourism are seen as one way to increase tourist expenditures in rural areas while at the same time increasing sustainable local food production. Value chains that increase local returns through enhanced "local" value or value added processing can also integrate well into a broad development strategy that includes tourism. Competitive differentiation can also come from the unique combination of attributes that together can create a destination and synergistic development, either through place-based or attraction-based tourism.

The end point is a report on the key factors that positively or negatively affect the success of rural tourism development initiatives. This will explore both the specific elements of the projects as well as the process through which the initiatives were planned and executed. These lessons will be particularly useful in ensuring the enduring success of the recently created Regional Tourism Organizations (RTOs) and other alliances whose aim it is to further collaborative approaches to strengthen rural development.

027099 – FitzGibbon, J.

An assessment of the potential economic benefits of Environmental Certification for Ontario's Farms

Executive Summary

The proposed research will be conducted in cooperation with Ontario farmer groups and will assess the value of environmental certification as an assurance of sustainable environmental quality management on the part of agriculture. It will assess the different approaches to certification and the societal willingness to pay a premium for environmentally certified commodities. It will also assess the willingness of farmers to participate in environmental certification and the magnitude of the benefits or premium they would expect. Specifically, the

study will include 1) Multi jurisdictional comparative review and analysis of certified environmental management systems in Canada, U.S, the European Union, & Australia & New Zealand.2) Development of a summary document for information on the experiences of other jurisdictions and the models that have developed.3) Survey of key informants regarding strengths, weaknesses, opportunities and threats costs and benefits that participation in a certified EMS program provide.

027140 Devlin, J.

Evaluating regional economic development initiatives: Understanding the challenges for rural regions in Ontario

Executive Summary

This study examines emerging best practices in the organization, governance and structure of regional development initiatives in rural Ontario and other jurisdictions in North America and Europe. Rural regions represent groups of communities that cross existing jurisdictional boundaries but that share economically significant resources. The study identifies factors contributing to the success of regional development initiatives and as well as barriers, issues, and challenges to participation of rural communities in regional economic development initiatives and how they can be overcome. Based on a review of existing programs and cases studies, with extensive field work in rural regions in Ontario, the research will inform policymakers and program officers about the roles that organizations can play in fostering the success of regional development initiatives in rural Ontario. It also identifies appropriate frameworks and mechanisms for evaluation of regional programming initiatives. The appropriate design and delivery of regional development initiatives will lead to prosperity and improved quality of life across Ontario's rural communities.

Bioeconomy-Industrial Uses – Approved Projects

27096 - Van Acker, R.

Development of the Castor oil plant as a new oil-seed crop for a new industrial bio-economy in Ontario

Executive Summary

We all know too well the price of gasoline and diesel oil for our cars, heating fuels. And as the world's economy improves it has nowhere to go but up. And this is without consideration of the increased demand by increasing population and reduction in supply of a finite resource. Many governments in North America have policies for various amounts of bio-renewable fuels. Estimates by Crosby and McKeown indicate that a 5% biodiesel target would use up approximately Ontario's entire soybean crop (Crosby and McKeown, notes prepared for Bot 2000, 2011). Another source of renewable oil that will not impact food prices and supplies is needed. Castor, *Ricinus communis* L., has been used by humans for centuries for numerous purposes including medicinal (castor oil), industrial lubricants and industrial feedstocks. Castor is an oilseed with an average of 50% high quality oil per kg seed, compared to about 24% for soybean. Castor oil has a world value of around USD\$490 million and has a large number of well established industrial uses (e.g. bio-diesel, soaps, lubricants, Nylon 11, hydraulic brake fluids, paints, polymers, perfumery products, surfactants, surface coatings and inks, telecom & engineering plastics, synthetic rubber chemicals, polishes, flypapers, and cosmetic derivatives). As petroleum supplies globally dwindle and prices increase, demand for plant-derived oils as a petroleum substitute will increase. Agronomic assessment of Castor is the missing piece in the supply chain to develop a Castor oil industry in Ontario. Cultivars, nutrition, pest management, crop rotations etc. need to be developed for Ontario growing conditions. Furthermore, there is evidence that some cultivars of castor suppress plant parasitic nematodes. Since we have few fumigants remaining and nematode pests in most horticultural crops, soybeans, it would be an asset to have a paying crop that could suppress nematodes when grown in rotation.

27121 - Crolla, A.

Dry Fermentation of Solid Manures with Yard and Kitchen Wastes for Enhanced Methane Production

Executive Summary

Over the past several years there has been an increased adoption of anaerobic digester systems for livestock farms in Ontario. The potential of digesting agricultural residues for energy production, while reducing greenhouse gas (GHG) emissions, mitigating pathogens and odours, and increasing ionized nutrients in the digestate, has made anaerobic digestion (AD) an attractive option for manure management. Ontario is beginning to grow its numbers of manure-based

biogas plants and it is estimated that by 2012 there will be at least 25 farm digesters operating in Ontario, all of which will be involved in co-digestion. The co-digestion of off-farm materials or energy crops with manure can enhance biogas production by as much as 2 to 4 times. There is now a growing interest in the use of dry fermentation for methane production from substrates with high solids content, including solid dairy cattle and horse manures and municipal residues such as yard and kitchen wastes.

Solid dairy and horse manures have a high fraction of biodegradable organic matter. However when these substrates, rich in organic nitrogen, are anaerobically digested at their original solids content of 20-25% TS there is typically a reduction in process performance due to ammonia accumulation. One way of dealing with this problem is co-digesting these solid manures with carbon-rich substrates to improve the digestion process by increasing the C:N ratio, thereby reducing ammonia inhibition and enhancing the final methane yield. This project proposes to enhance the digestion of solid manures (dairy and horse) by co-digesting with yard waste and source separated household kitchen waste using the process of dry fermentation. The use of heat pre-treatment of municipal residues and cellulosic enzymes in the dry fermentation process will also be evaluated for enhanced methane production. An economic assessment will be conducted, to provide a reference for farms and municipalities across Ontario considering the implementation of dry fermentation systems. The adoption of dry fermentation as a management practice for high solid residues will be based upon the successful demonstration of the economic viability. A technology transfer plan will also be an outcome from this project. The proposed project complements, but does not duplicate, a New Directions project investigating the dry fermentation of poultry manure with energy crops.

A large cohort of Ontario's farms manage manure with high-solids content. Therefore, successful results from this research would greatly enhance the opportunity for these farms to engage in the benefits derived from bioenergy production.

27129- Mohanty, A.

Development of Biocomposites for Plant Pots from Proteineous Co-products and Natural Fibres for Greenhouses in Ontario

Executive Summary

Greenhouse in Ontario is the 3rd largest agricultural sector based on farm gate receipts which uses more than 1 billion pots for various plants; most of them are not biobased composites. Also, greenhouses use structural and ground films made from plastics which are not biodegradable. Corn gluten meal (CGM) is rich in protein and is well-known herbicides. The CGM will be plasticized with low grade glycerol to obtain bioplastics. The developed bioplastic will be reinforced with natural fibers to develop biobased composites for manufacturing pots for greenhouse uses in Ontario. Industry adaptive melt processing techniques like reactive extrusion and injection moulding will be adopted to engineer these biocomposites. This approach has two

main outcomes: one is the effective utilization of waste from greenhouse farming and two is the utilization of low value agro-residues for product development.

27146-Mohanty, A.

Carbon Dioxide based Bioplastics and Their Engineered Biomaterials for Industrial Uses

Executive Summary

Carbon dioxide (CO₂) is the biggest contributor to global warming and many initiatives have been taken to address this issue and to reduce the carbon emission. In agro-based industry like corn ethanol production, CO₂ is produced in the same amounts as that of the ethanol and no effort is taken in its direct utilization in obtaining useful products. Direct utilization of CO₂ to produce useful polymers is an attractive proposition for these industries in further improving the sustainability of the biofuel industries. Hence, the current research proposal is aimed to develop technology that is capable of utilizing CO₂ based polymers in developing biomaterials for industrial uses in Ontario. This will enhance the efforts of advancing the CO₂ based polymer technology in the province of Ontario and address the issue of carbon emission.

27150-Dutta, A.

Study and development of a self-sustained torrefaction process for upgradation of fuel properties of agricultural residues.

Executive Summary

Torrefaction is a thermochemical conversion process that improves combustible characteristics in biomass, producing a more stable, denser, hydrophobic material with higher energy values. The conversion process occurs in the absence of oxygen and is impacted by a number of system parameters, which include material handling, residence time, reaction temperature and heating rate. Control of these parameters impacts the properties of the torrefied material while such a system needs to be sufficiently flexible to deal with the range and mixture of potential agricultural feedstocks. However present research neither examined the feasibility of implementing torrefaction for farms and large commercial applications, nor discussed any challenges of integrating torrefaction into the existing combustion systems, nor the economics of what the addition of this process would add to the feasibility of going towards this route. Furthermore, information on biomass hydrodynamics, heat and mass transfer, and energy demand at different stages of torrefaction on a sizable unit are not available in the literature. Also, densification of biomass before or after torrefaction needs to be assessed. The proposed research will hence investigate the torrefaction and densification process for agricultural residues and evaluate the implementation of torrefaction and densification of these materials to achieve

on-farm as well as large-scale commercial production of torrefied biomass (either in the form of pellet or briquette), and supply bio-energy for industrial applications and power generation.

The proposed research has the potential to help utility industries (such as Ontario Power Generation(OPG)) meet renewable energy and air quality targets and encourage rural communities, in particular the agricultural industry (farms) in Ontario to grow biomass crops for energy and many other industrial purposes. This technology will increase Ontario's technology base in the renewable energy industry.

27171- Misra, M.

Renewable Resources Based High Conducting Cellulose-Carbon Nanocomposites for Energy Storage Devices

Executive Summary

The exponential growth of the portable electronics market creates a huge demand for lithium based rechargeable energy technology. Furthermore, it is well accepted that developing clean transportations is one of the major challenges posed by the climate change issues. Rechargeable lithium batteries can be the ideal solution to power zero-emission electrical vehicles. Developments in the field of flexible electronics are currently highly depending on thin film lithium batteries. Incorporation of conducting materials based on renewable resources into energy-storage systems will advance the application of greener materials in real world applications. However, uses of functional materials that are developed from agricultural resources in energy storage technology are still at an infant stage and needs to be explored further. Hence the proposed research work aims at developing the highly conducting nano-cellulose composite materials based on renewable agricultural resources for application as anode electrode in environmentally friendly batteries.

27172-Tetlow, I.

Development of Branching Enzymes as Agents for Modifying Glucan Branching in Industrial Processing

Executive Summary

The ability to manipulate glucan branching in starch-based bio-products offers many industrial end-users, particularly the paints and coatings sectors (a multi-million dollar industry), with superior performance products and consequently a significant competitive advantage in the market. Although existing starch-based crops with desirable structural traits are available (e.g. waxy maize), immediate product improvement is currently only possible through post-harvest modification of starch using environmentally hazardous chemical agents. This proposal aims to address the needs of a wide range of industrial end-users by developing the use of branching

enzymes (not yet commercially available) as agents for manipulating the branching frequency of starch-based bio-polymers.

Emergency Management – Approved Projects

27054-Warriner, K.

A Surveillance Study to Determine the Prevalence of *Clostridium difficile* in Manure Derived from Animal Production and Dissemination of the Pathogen via Watercourses

Executive Summary

Clostridium difficile accounts for over 25,000 deaths in North America each year and is increasing. Although *C. difficile* infections have previously been linked to hospital acquired infections there is an increasing trend of Community Acquired infections (i.e. no association with clinical settings or antibiotic use). The following proposal will be directed towards quantifying the potential risks of rivers and lakes in disseminating *C. difficile* from animal production facilities to the wider environment. Part of the project will develop a sensor to facilitate rapid screening of toxin-producing *C. difficile* in sediment samples. Manure samples from different animal sources will be screened for *C. difficile* and isolates characterized (toxin production, antibiotic resistance and ribotypes). Further isolates will be recovered from river and water samples taken across Ontario. The isolates will be compared to *C. difficile* recovered from patients diagnosed with Community Acquired infections. The results from the study will establish if water courses act as a dissemination route for *C. difficile* in the environment. In the context of the agri-food Emergency Management Research Theme, such knowledge will enable future policy strategies in reducing the incidence of Community Acquired infections.

27058- Berke, O.

Understanding the effect of diagnostic misclassification bias on spatial surveillance methods with emphasize on farm location health data such as swine influenza.

Executive Summary

Spatial statistical methods are widely used in disease surveillance systems, but their performance is not well understood when it comes to diagnostic misclassification. How do false positive and false negative reports impact on critical information for disease control management systems?

With emerging diseases the quality of respective diagnostic tests (sensitivity and specificity) is generally unknown. As an example for an emerging disease the emergence of swine influenza on Ontario pork farms is considered in this project. Respective data are available through the Animal Health Laboratory at the University of Guelph, where most if not all food animal diagnostics from Ontario farms are conducted.

This project will generally advance our understanding of disease surveillance methods and therefore improve emergency preparedness. This project will specifically address the question how misclassified farm health status information will impact statistics that (i) measure the range

of infections spread, (ii) identify the location of disease hot spots, and (iii) identify potential risk factors of disease? This will be done by use of Monte Carlo simulation studies.

The results of this study will guide public health administrators in making informed decisions with respect to food animal disease control.

27063 – Friendship, R.

Peri-weaning failure-to-thrive syndrome (PFTS) in pigs in Ontario

Executive Summary

The research problem is the emergence of possibly a new disease, tentatively referred to as “peri-weaning failure-to-thrive syndrome”(PFTS). In case-herds suffering from this syndrome about 5 to 10% of healthy-looking weaned pigs stop eating and rapidly lose body condition. Diagnosis has been based more on exclusion of all known possible causes because the agent of this disease is, as yet, unknown. A major problem in establishing that this is a new disease is that there are many causes of poor-doing weanling pigs and there is considerable interaction between management-environmental factors and post-weaning diseases. Pathological examination has not revealed distinctive lesions that help to characterize cases of PFTS, although it appears gastritis has been a relatively consistent finding but may be not specific to PFTS. A retrospective study is planned to further examine tissues submitted from cases where stomach samples are available. In addition, we will conduct interviews to explore whether gastritis lesions are strongly associated with clinical cases of PFTS. This survey will help identify herds with on-going problems of PFTS and these will be investigated prospectively and will be part of a large North American study. Stomach samples will be collected for the Guelph study and other samples and information will be passed along to Dr John Harding at Saskatoon.

27077- Pearl, D.

Improving the syndromic surveillance of cattle diseases through provincial abattoir data with the joint application of multi-level modeling and space-time scan statistics.

Executive Summary

A comprehensive animal disease surveillance system has the potential to identify known and emerging pathogens that threaten the security of Ontario’s Agri-Food sector. Syndromic surveillance is recognized increasingly as a means to provide early warning of changes in the health of populations. These systems rely on the identification of changes in signs and/or symptoms to identify outbreaks of disease. In animal agriculture, a variety of data sources offer opportunities for syndromic surveillance, including abattoir data. The identification of space-time clusters in condemnation rates of carcasses and specific organs among Ontario’s provincial abattoirs can offer insight into the location and timing of outbreaks of disease. However, a

variety of factors including season, abattoir capacity, and the economics of the industry can have an impact on statistical methods designed to identify these clusters. In the proposed research, we will explore the ability of multi-level modeling as a means to eliminate known biases or “noise” from abattoir data prior to the application of spatial scan statistics to identify space-time clusters of condemnations. This research will provide the Ontario Agri-Food sector a more rational and effective means to conduct syndromic surveillance, and take a leadership role in exploring quantitative methods for disease surveillance.

27083- Eberl, H.

Predictive modeling of the disease dynamics of honeybee – varroa mite – virus complexes.

Executive Summary

As food crop pollinators, honeybees play an outstanding role in agriculture. However, recent years have seen dramatic losses of honeybee colonies in Canada, the USA and in Europe. The exact reasons for this are not clear, but parasitic Varroa mites and the viruses that they carry have been implicated as stressors that contribute to these losses. For several decades, mathematical models have been developed as a major tool to understand the course of infectious diseases in human populations and to aid in the development of vaccination and control strategies. In this project, we will adapt this methodology and draw on the wealth of experience and expertise available in this field to study the effect of Varroa mites and their viruses on honeybee colonies. A better understanding of the course of viral infections in honeybee colonies, and their effect on the fate of the hive, will help in the development of control and treatment strategies to protect honeybee colonies. It will also aid policy makers to develop emergency management policies. This will be for the benefit of beekeepers and honey producers, but also for food crop growers, the Ontario Agri-Food industry, and Ontario consumers in general.

27084- McDonald, M.R.

Emerging plant pathogens: Identification, biology, pathogenicity and integrated management of emerging pathogens infecting asparagus, cucumber and basil.

Executive Summary

Diseases of vegetable crops caused by *Phytophthora* spp., *Pseudoperonospora cubensis*, and *Peronospora belbahrii* are serious and growing concerns of Ontario growers of asparagus, cucumber and basil. New, aggressive and rapidly evolving strains of *P. cubensis* (cucurbits downy mildew), *Phytophthora* spp. (asparagus spear and crown rot) and *P. belbahrii* (basil downy mildew), are occurring in Ontario. On asparagus, a new pathogen, *Phytophthora asparagi* has been found and identified in asparagus fields in Michigan, and a similar organism has been isolated from asparagus fields in Norfolk County, Ontario. On cucumber, extremely virulent strains of downy mildew resistant to cucumber cultivars and fungicides previously

effective are causing significant losses to the industry. On basil, new and virulent *P. belbahrii* is infecting the crop both in the greenhouse and field, causing high crop losses. Pathogens will be monitored, isolated and identified using morphological and molecular methods and pathogen virulence and reaction to fungicides will be tested in the laboratory, greenhouse and in the field. Studies will be carried out to evaluate the best disease management strategies for these pathogens, including conventional and biocontrols, reduced risk pesticides, and resistant varieties. Spore traps and field scouting will be used. Team members include OMAFRA specialists, scientists and researchers from the University of Guelph and Michigan State University.

27092- Spinato, M.

Development of a benefit/cost financial management template for veterinary laboratory emergency preparedness.

Executive Summary

The goal of this project is to develop a financial management template that can be used by veterinary diagnostic laboratories, their funding organizations, and regulatory agencies to determine the realistic benefits/costs of preparing and conducting an effective response to an emergency situation such a foreign animal disease incursion. Lack of adequate organizational preparation will negatively impact the laboratory's ability to respond to an emergency event, as well as adversely affecting long-term financial viability and passive surveillance capacity. The Laboratory Emergency Management Checklist developed by the principal investigator (EMRP 200023) details the specific processes involved in laboratory emergency preparedness. This project seeks to build upon this Checklist by conducting a benefit/cost analysis of each process, and developing a simple electronic financial tool that will assist users in calculating real costs of advance planning and surge testing demands, in addition to estimating the risks of lost business. This tool will support sound management decisions, and ensure best outcomes for both the emergency event and laboratory business continuity.

27110- Guerin, M.

The epidemiology of inclusion body hepatitis in broiler breeders in Ontario

Executive Summary

Outbreaks of inclusion body hepatitis (IBH) in broiler flocks caused by Fowl adenoviruses (FAdVs) is a major issue for the poultry industry, causing substantial economic losses in both the hatching egg and broiler sectors. The rate of IBH infection in Ontario broiler flocks has been increasing since early 2007. As part of an industry initiative to address the IBH problem, a breeder baseline surveillance study was conducted to determine the magnitude and type of exposure of broiler breeder flocks prior to production to problematic serotypes of FAdV. This

project will allow for the epidemiological analysis of these data in order to understand the spread of the disease in Ontario.

In addition, the project will evaluate a potential disease prevention strategy by immunizing target broiler breeder flocks with a new autogenous vaccine prior to production. A successful vaccination strategy will result in the transmission of adequate maternal immunity to the broiler progenies and reduce the susceptibility of broilers to virulent FAdV strains, thereby improving health and productivity. If breeder flocks at risk for IBH in their broiler progeny can be identified, targeted vaccination would gain a net economic benefit to the industry and would be cost-effective. This project is the epidemiological analysis of all data already collected and compiled by the poultry industry through the IBH working group.

27118- McEwen, S.

Emerging and potentially zoonotic viruses in pigs and pork: identifying public health risks

Executive Summary

The recent H1N1 pandemic demonstrated the potential threat posed by zoonotic viruses to Canadian public health and the livestock industry, as well as the importance of having scientific data to support transparent decision-making. This project will investigate the public health risks posed by three emerging and potentially zoonotic viruses (hepatitis E virus, recombinant Norovirus, and reassorted Rotavirus) that are ‘on the radar’ with researchers, public health officials, and agricultural analysts in Canada. Evidence will be gathered from multiple sources: systematic review-meta-analysis; national survey of retail pork products, a proposed national survey of on-farm swine, and expert elicitation. All evidence gathered will be summarized in the form of a risk profile, to inform public health and agricultural policy-making. The proposed research will provide the best evidence available regarding zoonotic potential of these viruses. Using multiple evidence sources provides maximum understanding of attribution of disease: for example, although HEV is reported in swine in many geographic locations, detection and genotyping of swine and human isolates has demonstrated that in some regions, swine are not a source of human HEV infection. Estimating on-farm viral prevalence may be advantageous if trading partners require pork certified free of these viruses in future. As a potential zoonotic threat, this issue is partly related to food safety but is also a potential occupational health and safety issue for swine workers and abattoir personnel, potentially with subsequent person-to-person spread.

27137- Kelton, D.

Assessing the emergency preparedness of livestock producers (beef, dairy, swine, sheep) and Large Animal Veterinarians in Ontario

Executive Summary

The recent concerns about civil emergencies (ice storms in Eastern Ontario) and infectious disease outbreaks (SARS) in the human health care profession have led to the development of various emergency preparedness procedures and protocols. These have been implemented to mitigate the risk and hazards associated with these emergencies on an individual level, as well as through the three levels of government. The consequences of emergencies, whether large or small in scale, are not mutually exclusive to either human or animal populations. Therefore, understanding the level of emergency preparedness of livestock producers and their supporting veterinary community is of importance to the successful development and design of best management practices for emergency preparedness in rural Ontario. The aim of this research is to assess the current level of emergency preparedness, and the prevailing attitude towards emergency planning, by livestock producers in Ontario. Furthermore, an understanding of the level of preparedness and planning among the large animal veterinarians who service these producers will be explored. Finally, the role the local municipalities in emergency planning for livestock will be examined. The results of this study will contribute to our understanding of the current state of emergency preparedness of livestock producers and the large animal veterinarians who service them, the human response during livestock emergencies and improved communication between governmental agencies and individual producers. Knowledge of an emergency plan, or lack thereof, and the prevailing attitude of the producer to emergency preparedness will offer direction to development of future protocols for emergency response. This research will also address how humans respond in the face of emergency, as the degree of preparedness for infectious or civil emergencies will dictate the successful response and resolution of the crisis. The information disseminated as a result of this work may prompt individual producers and veterinarians to implement their own emergency plan. On a larger scale, the knowledge of the level of preparedness of a community will provide a platform for more effective communication between government agencies and producers with respect to the role each partner needs to take during emergency situations.

27139- Kelton, D.

Johne's disease prevention and control on organic dairy farms in Ontario

Executive Summary

Johne's disease (JD) is a chronic, production limiting bacterial disease of ruminants. The causal agent, *Mycobacterium avium* subspecies *paratuberculosis* (MAP) has been associated with Crohn's disease in humans. Although a causal link has yet to be established, this association looms as a potentially important zoonotic risk that could have a major negative impact on milk consumption and the entire cattle industry. While most infected cattle do not develop clinical disease, they do experience reduced production and can transmit the infection to their calves and herd mates. There is no treatment or cure for JD and available diagnostic tests fail to identify all infected and infectious animals. The only reasonable approach to managing this disease is

through the implementation of risk assessment (RA)-based JD control programs, which aim to change husbandry management practices to break the transmission cycle from susceptible to naïve individuals on and between farms. Worldwide the organic dairy industry has been steadily growing. Given that there are significant differences in management practices on organic versus conventional dairies, very little is known about the impact that these differences may have on the prevalence of many common endemic diseases, including JD. Unfortunately, organic farmers may not be able to implement commonly recommended management changes that have been proven to be effective in controlling JD, because they are not compliant with the principles of organic farming. The proposed study will establish a baseline for JD prevalence in organic dairy herds and help to develop alternative prevention strategies for JD control that are consistent with organic farming practices. Furthermore, information about the economic impact of JD on organic farms and of preventive management solutions will be quantified, in order to provide a framework for implementing a sustainable control program for farmers engaged in organic dairy production in Ontario.

27145- Mutharia, L.

Development and applications of an amoeba-based pathogen-capture trap for detection of persisting and emerging microbial pathogens in farm and aquaculture environments

Executive Summary

Baseline inventories of pathogens present in environments are essential to identify and manage microbial disease threats. However, environmental reservoirs for pathogens are often unknown, limiting information about persistence, true distribution, and prevalence. We propose to use amoeboid protozoa to selectively concentrate and aid detection of pathogens in dairy farm and aquaculture environments. Amoebae are bacteriovores, efficiently grazing on bacteria and biofilms. Amoeba-resistant bacteria (ARB) resist killing, remain alive, and multiply inside amoebae. Traits allowing survival in amoeba appear useful to survival in vertebrate hosts; many ARB are significant pathogens. Free-living amoeba cultured from water, soil and biofilms will be examined by microscopy and rapid molecular techniques (PCR) to detect and identify ARB. Both known pathogens and possible unknown, emerging pathogens are of interest. Cultured laboratory amoeba and ARB-free natural isolates from test environments will be used to determine how long specific pathogens persist in amoeba and cysts: to compare survival of virulent and low-virulence pathogens, and, to determine how pathogens may change within amoeba. The amoeba culture system has the advantage of similarity to potential natural reservoirs (*e.g.* biofilms). We propose to design an amoeba-trap device to be applied to detect pathogens persisting in particular dairy farm and aquaculture environments.

Environmental Sustainability – Approved Projects

027057 Zytner, R.

Reducing the amount of process water needed to wash and peel vegetables by optimizing and implementing wash-water recycling

Executive Summary

Carrot producers use significant amounts of water in washing, peeling and preparing their produce for market. Completion of the research will reduce the water footprint of the carrot washer Industrial Partner through the effective treatment, recycling and disposal of wash-water, while at the same time maintaining high food quality. Reducing the quantity of water needed during food production also lowers the volume of wash-water that needs to be disposed of, whether through land application or other appropriate means. Analysis of the waste wash-water will expand the database of the significant parameters including nutrients, solids and pathogens to identify best management practices for the disposal of the wash-water. This ultimately reduces watershed impacts and minimizes nutrient loadings in groundwater and surface watercourses. The associated training of HQP will allow them to address similar issues in the entire sector as there are many cases of food processing wash-water including fruit, dairy and poultry operations. Ultimately, the goal is for farmers and processors to understand and accept the non-agriculture source materials (NASM) process as a valid and manageable method for the application of wash-water and related residues to the land in compliance with provincial legislation. This gives producers a more sustainable approach to their operations.

027075 Van Heyst, B.

Evaluation of Control Strategies to Minimize the Emissions of Particulate Matter, Ammonia and other Gaseous Pollutants from Poultry Operations

Executive Summary

Livestock operations are known to generate various airborne pollutants, such as particulate matter (PM) and ammonia, which are considered to be hazardous to human and animal health as well as the environment. This proposal builds on the capacity developed under earlier projects that measured baseline emissions of size fractionated PM, ammonia, methane and secondary aerosols and their precursor gases from commercial poultry operations. The primary goal of the current proposal is to evaluate three different control strategies and/or technologies that might aid in the abatement of atmospheric releases of PM and ammonia from commercial poultry operations. The experimental design will employ two nearly identical barns with one barn randomly selected as the control and the other barn employing the control strategy. Continuous measurements of size fractionated PM and ammonia will be conducted using a portable trailer housing the analyzers. As only one set of analyzers is available, the measurements will be

cycled between barns on a regular basis. Discrete measurements of inorganic aerosols and their precursor gases will be conducted periodically using an annular denuder system with subsequent extraction and analysis by ion chromatography. Ventilation rates will be measured and correlated to static pressure and power consumption. In addition, economic factors associated with the control strategies (e.g. capital, maintenance and operational costs) will be collected along with production indicators to determine the overall performance of the systems on commercial operations.

027106 Kinsley, C.

Development of a Hybrid Constructed Wetland Technology to Treat Dairy Farm Wastewaters

Executive Summary

The objective of this project is to develop new constructed wetland technology coupled with the use of a passive phosphorus (P) filter to treat milking centre wash waters and/or barnyard runoff. The project will use data from both pilot and full scale trials to develop wetland kinetic design models and system design recommendations to treat milking centre wastewaters from both conventional and organic dairy farms. A passive subsurface flow (SSF) wetland filter technology will enable farms to divert wash waters from liquid manure storages or treat wash waters which are in many cases being discharged untreated directly into the environment. This technology will provide an effective solution to dairy producers, who are required to properly treat and dispose of their wash waters with the amended General Nutrient Management Regulation (O. Reg. 267/03) which came into effect January 1, 2011. A passive constructed wetland technology can address this issue and coupled with a passive P filter can remove the high levels of phosphate in the wash waters from the phosphoric acid commonly used to clean the pipelines. An SSF wetland is comprised of a submerged horizontal flow gravel bed planted in macrophytes. SSF wetlands enable year-round operation, effective odour control and can be approved through the OBC, avoiding the requirement for a MOE CofA. The treatment of milking centre wash waters and/or barnyard runoff, particularly for solid manure dairy operations, will reduce pollutant loading to the environment including organic matter and pathogens but particularly P. Pilot scale experiments at the Ontario Rural Wastewater Centre's (ORWC) Alfred testing facility and full scale trials at both the Campus d'Alfred dairy barn and at a operational dairy farm in Manotick, ON will allow for comprehensive technology evaluation and validation as well as the first steps in technology uptake.

027117 Rudra, R.

Management Tool for Design and Evaluation of Seasonal performance of Vegetative Filter Strips and Setbacks along the Stream

Executive Summary

Numbers of management options, Vegetative Filter Strips (VFS) and setbacks, are being explored to reduce movement of sediment and nutrients from agricultural landscape to the stream. In addition, the change in climatic conditions is providing another challenge for the use of these options. Up to now, the selection and design of VFS and setbacks options do not adequately address the effect of area (fields) in the watershed contributing, also called Variable Source Area (VSA), flows, and pollutant loads to VFS/setbacks. VSA exhibits huge spatial and seasonal variability due to soil, landuse, topography, and precipitation characteristics. An environmentally sustainable and economically feasible management approach requires identification of source fields and their relative contribution to the pollutant loads, prior to selection of proper location and size of VFS/setbacks. This research will provide an innovative tool to design VFS/setbacks under changing climatic conditions. The field experimental data collected on the effectiveness of VFS/setbacks will be used to develop algorithm for the proposed management tool. The developed tool will be used to design and evaluate the performance of VFS/setbacks in a rolling upland, a midland, and a lowland watershed under present and future climatic conditions. This research will also provide a tool to estimate change in growing season due to change in frost-free days.

027119 Sibley, P.

Characterizing Risks of Triclosan from Biosolids: Uptake and Distribution in Plants and Effects on Plant-Arbuscular Mycorrhizal Fungi Relationships

Executive Summary

Applying biosolids to agriculture lands for fertilization is widely considered to be a beneficial practice by the agricultural community but it is often opposed by the public. Several factors contribute to public concern but a key issue is chemical contaminants associated with biosolids. A key class of chemicals is pharmaceutical and personal care products (PPCPs). Among PPCPs, triclosan (TCS), a ubiquitous and relatively persistent constituent of biosolids, and purported endocrine disruptor, is a potentially significant contaminant of concern. However, its availability to, and uptake by, plants, and its potential effects on plant health and plant-soil fungal relationships is poorly understood. Using a combination of laboratory and field studies, we will investigate exposure to TCS in crops (soybean) and vegetables (carrot, alfalfa, lettuce) by measuring the residues associated with the edible portions of the plants thereby providing a basis for assessing potential human exposure via ingestion. We will also investigate the potential effects on plant and arbuscular mycorrhizal fungal (AMF) health and the symbiotic relationship between plants and AMF. We will use this information to estimate the risk of TCS in crops,

plant-AMF relationships, and exposure potential in humans. This work will provide the Ontario Agri-food sector with information needed to address public concerns about TCS and a methodological basis for assessing other PPCPs of potential concern in biosolids.

027124 – Berg, A.

RADAR-derived digital elevation models for improved drainage mapping

Executive Summary

Source water protection is a concern in areas where rainfall runoff can allow for the transport of sediment and contaminants. Digital Elevation Models (DEMs) are a critical component for hydrological modelling related to source water protection as they are required for the derivation of terrain features, the delineation of stream networks and sub-catchments, and the identification of variable source areas for runoff. This proposed research will produce a DEM data set for a 625 km² area north of Waterloo and Guelph using synthetic aperture RADAR (SAR) imagery. We will employ novel post-processing techniques to the DEM to create a topographic data layer suitable for variable-source area, and sub-catchment mapping for runoff routing, groundwater recharge and source water protection applications. The resulting hydrologically corrected DEM and the post processing tools will be made publically available.

027161 Raizada, M.

Novel Tests for Nitrogen and Testing of Inoculants With Potential to Reduce Chemical Inputs for Ontario Crop Production

Executive Summary

The widespread use of chemically synthesized fungicides and fertilizers used in crop production is expensive and can cause negative impacts on human health and natural ecosystems. The Raizada Lab has discovered beneficial microbes inhabiting the seeds of ancient and modern corn. We propose to pyramid these microbes to create a bio-based inoculant formulation that effectively reduces synthetic fertilizer and/or synthetic fungicide inputs for corn and turfgrass. Second, this project aims to engineer three diagnostic technologies to help Ontario crop producers with nutrient management. Farmers often apply excess fertilizers because they do not have an accurate, yet cheap, early-season soil test. We propose to engineer a \$1 laboratory test for bioavailable soil nitrogen, and to determine its accuracy and predictability in making nitrogen application recommendations, compared to the current conventional \$10 test. We will also assist soybean producers, who unlike corn producers, rely on their plants to associate with bacteria (Rhizobia) that convert atmospheric nitrogen gas into “fixed” nitrogen fertilizer. As new/improved Rhizobia have the potential to improve yields, we propose to reduce the cost of testing which bacteria fix nitrogen from \$5-\$10/sample to 10-cents per sample. Since specific microbes only associate with specific plant varieties, we aim to develop a new test that reduces the diagnostic cost of validating a successful plant-microbe interaction, from \$10/plant to

\$1/plant. All of these technologies will reduce production costs and lead to a new generation of “green” ag-technologies.

027167 Newman, J.

Evaluating the environmental pillar of sustainability for bioenergy crop production

Executive Summary

Several perennial grass species are under consideration for large-scale bioenergy production in Ontario and elsewhere, including *Miscanthus x giganteus*, *Miscanthus sinensis*, *Panicum virgatum*, and *Phalaris arundinacea*. Introduction of these species may have deleterious effects on native biodiversity, if viable pollen, seeds, or vegetative fragments are allowed to escape from production fields. Therefore, it is important to investigate the potential invasiveness and community impacts of these species prior to introducing them on large scales for bioenergy production. First, we will compile a database of known invasive populations in Ontario. These populations will be visited and compared with uninvaded surrounding vegetation to quantify local impacts to native seedbank biodiversity. Second, we will perform a weed risk assessment (WRA) for the perennial bioenergy grasses being considered for Ontario. In addition, we will conduct a controlled experiment in an old-field remnant in which we will test the effects of bioenergy species identity and planting density on native plant abundance and diversity. Finally, we will monitor the field margins of the bioenergy plots to quantify the rate of vegetative spread for *M. sinensis*, *M. x giganteus* and *M. sacchariflorus*. These activities will advance our understanding of the potential invasiveness, impacts, and sustainability of bioenergy grasses, and will help guide selective breeding programs and bioenergy policy for Ontario.

027176 Van Eerd, L.

Cover crops for sustainability: Evaluating the role of cover crops in low crop residue production systems.

Executive Summary

Maintaining healthy, productive soil is critical to enhancing the longterm profitability of agriculture. The anticipated demand for crop residue (corn stocks/cobs or wheat straw) may have a negative effect on soil and crop productivity. For instance, previous research has shown that removing winter wheat straw lowered tomato yields the following year but no yield reductions were observed when cover crops were in the rotation (Van Eerd et al. 2009). Thus, cover crops may play a significant role maintaining soil and crop productivity, especially in production systems where crop residues are low or removed. The goal of the proposed research is evaluate the role of cover crops in maintaining soil and crop productivity within two low crop residue production systems 1) vegetable crop production systems and 2) corn crop residue removal for the anticipated bioeconomy. The proposed project builds on two already existing

rotational trials, initiated in 2007 and 2008 with four and six cover crop types and a no cover crop control treatment. The effect of cover crops in low crop residue production systems will be evaluated in terms of crop yield and quality, soil health and quality, insect and disease pressure and economics. The systems-based approach of proposed research is expected to benefit 1) producers by identifying strategies that maintain soil and crop productivity, 2) consumers by increasing soil and crop production resiliency thereby maintaining food security, 3) government by evaluating assumptions of cover crop BMPs and developing BMPs on crop residue removal and 4) the environment by minimizing practices that cause soil degradation and ultimately may lead to erosion, nutrient losses and water contamination.

027181 – Chang, S.

Development of Membrane Anaerobic Baffled Reactor (ABR AnMBR) for Food Processing Wastewater Treatment

Executive Summary

Anaerobic digestion is an attractive technology for food processing wastewater treatment due to its double benefits of wastewater treatment and biogas production. The recent development of high rate anaerobic reactors is to couple the membrane filtration with the anaerobic digestion to form an anaerobic membrane bioreactor (AnMBR). The introduction of the membrane filtration allows decoupling the solid retention time from the hydraulic retention time without relying on the sludge properties. As a result, its operation will be less sensitive to the process conditions than the prevailing up-flow anaerobic sludge blanket reactors (UASB). In this project, we aim to optimize the design and operation of the AnMBR for food processing wastewater applications. The innovated strategies include coupling membrane filtration with an anaerobic baffled reactor (ABR) and using advanced submerged membrane filtration technology. Different from the conventional complete mix reactors, the ABR can form two phase (acid forming and methane-forming) operation longitudinally without associated control problem and cost increase. Meanwhile, utilization of the solid separation capacity of the ABR can result in a significantly reduction of the solid loading to the membrane tank. The ABR AnMBR is a novel concept applicable to the treatment of a wide range of food processing wastewaters. It is expected that this project will contribute significantly to the environmental sustainability theme through providing advanced technology for wastewater treatment, water reuse, and energy recovery.

Food for Health – Approved Projects

27082 – Yada, R.

Selecting Ontario potatoes for improved processing quality, food safety and health: The role of asparagine, reducing sugars, acrylamide and phenolic compounds

Executive Summary

Although consumers continue to buy certain food products based on quality characteristics (e.g., light colour for potato chips), factors such as safety and health issues are now also being considered vital and are challenges to the food industry. Issues such as acrylamide content and foods containing potentially health promoting bioactives are presently topical for the agri-food industry ranging from grower, processor and retailer to the consumer. French fries and chips are a major source of acrylamide found in foods due to the interaction of free asparagine and reducing sugars, the two precursors of acrylamide. Potatoes contain high levels of phenolic compounds which have antioxidant potential, a property known to have health benefits. In addition, phenolics have been shown to reduce acrylamide formation. Due to the carcinogenic and neurological issues associated with acrylamide, world-wide efforts have been taken to reduce the dietary intake of acrylamide. Potatoes used for chip manufacturing represent about 52% of the total potato production in Ontario, therefore, improving the quality, safety and health profile of Ontario chips by selecting varieties low in reducing sugar and asparagine while screening for cultivars with higher antioxidant potential will increase the profile and marketability of Ontario potatoes used for chipping. Thus, the proposed research will benefit the Ontario potato industry from growers and processors to consumers.

027081 – McDonald, M.R.

Purple vegetables for better health: a study of the antioxidant and other beneficial effects of anthocyanin pigments in potatoes and carrots

Executive Summary

Anthocyanin-rich purple vegetables are new and have not been extensively studied to document their added health benefits. Purple vegetables, such as Ontario potatoes and carrots, are relatively inexpensive and available virtually all year round. We recently found that purple vegetable cultivars were stronger in antioxidants than white potatoes or orange carrots. This proposal will therefore focus on new, purple cultivars of potatoes and carrots and investigate the anthocyanin pigments and their contribution to human health. We propose to identify and quantify the anthocyanins and other polyphenols in these crops, determine the antioxidant, anti-inflammatory and diabetes-related enzyme inhibitory activities in both in vitro and in vivo studies. We will also study the stability of these phytochemicals and how they can be incorporated into value-added products such as functional foods and beverages. Drs Rong Cao and Kelly Meckling will address the Food for Health priorities. As a result, the nutritional quality of local, healthy foods

can be documented and enhanced. Functional foods will be developed in collaboration with Campbell's Canada. The potato lines will be supplied by Dr. Sullivan. The carrots will be commercially available cultivars grown in Dr. McDonald's program in the Holland Marsh. Changes in anthocyanin levels from year to year in relation to weather variables and over time in cold storage (potatoes and carrots) will be evaluated. The effect of different levels of nitrogen and phosphorous on pigments in carrots will be studied. Another trial will look at the effects of different disease management practices (fungicides and biocontrols compared to untreated) on pigment levels. The adaptation of these vegetables to Ontario, and the horticultural quality and health benefits, will be determined. New elite cultivars will be identified that will be of higher value as a functional food.

27175 - Paliyath, G.

Nutraceutical and cosmeceutical components from sea buckthorn fruits, their health benefits, and stabilization in processed products

Executive Summary

Sea buckthorn is well-adapted to the climate of Ontario. In Ontario, developing sea buckthorn orchards is particularly attractive as it offers a diversification opportunity for growers currently exiting the tobacco industry, as well as providing a new avenue for the production of functional foods, and nutraceutical and cosmeceutical supplements. Sea buckthorn fruits are enriched in carotenoids, phytosterols, omega-3-fatty acids, vitamin C. Juice preparations from sea buckthorn are commercially produced in specialized farms and are targeted towards the functional food market. However, there are several issues that limit the expansion of the industry. These include the lack of stability in juice preparations, oxidation of fatty acids providing rancid flavours, un-standardized extraction protocols, lack of utilization of the ingredients in the nutraceutical and cosmetic markets etc. In recent research conducted at the University of Western Ontario (Priti Krishna and coworkers, unpublished), several genomic and metabolomic characteristics of sea buckthorn fruits from Ontario and Saskatchewan, were analyzed. In the proposed project we will develop strategies for the utilization of sea buckthorn fruits into a variety of products such as whole juice, blended juice with other fruits, whole infused fruits, cold-pressed seed oil, carotenoids for skin health and UV-protection, and phytosterols for obesity reduction. A number of industries in Ontario (Evergreen Farms, Inovita, Campbell's Soup Company, From the Meadows, Pelee Island Wineries) have shown interest in sea buckthorn products. Through these advances, a new segment of agricultural economy encompassing the entire value chain can be built up, thus improving the Ontario Agri-Food Industry sector.

27114 - Emes, M.

The impact of Resistant Starches in healthy baked products on mitigation of risk for Type 2 Diabetes and Colorectal Cancer

Executive Summary

The goal of the proposed research is to understand the efficacy of, and mechanisms by which, Resistant Starch enhances baked products to offer health benefits to the consumer. Overconsumption of calories coupled with a sedentary lifestyle is leading to an epidemic of obesity, diabetes and cardiovascular disease. Colorectal cancer is the second most significant non-gender related cancer and is prominent in western societies because of the highly refined, processed foods consumed. Using maize starches arising from our previous research, this project will develop prototype foods (bagels) containing RS and document their impact on metabolic responses. The relationship between RS consumption and i) the glucose-insulin metabolic response in the small intestine and ii) the production of colon-healthy compounds (short-chain fatty acids, SCFA) in the large bowel, will be determined in human subjects. When incorporated into processed foods, Resistant Starch (RS) offers the opportunity to create multi-faceted advantages for the Ontario public in terms of health and wellness, disease prevention and mitigation, and lead to new premium market opportunities for Ontario farmers, grain producers and food companies. Maple Leaf Foods/Canada Bread are contributing directly to the project and have already indicated a desire to license Intellectual Property with a view to transferring technology into commercial products within the lifetime of the project.

27062- Holloway, G.

Malleability of the mitochondrial proteome and respiratory function in response to polyunsaturated fatty acids.

Executive Summary

The prevalence of type 2 diabetes in the Canadian population continues to rise, suggesting that our understanding of this complex metabolic condition remains incomplete. A reduced expression in skeletal muscle mitochondrial proteins, and the subsequent impairment in mitochondria function, has been linked to type 2 diabetes. It has been hypothesized that inducing the expression of mitochondrial proteins likely has a positive health benefit for a number of clinical populations due the subsequent increase in fat breakdown and/or a decrease in reactive oxygen species (ROS) production. Polyunsaturated fatty acids (PUFA) are bioactive nutrients that regulate gene expression and are associated with numerous metabolic benefits, such as reduced inflammation. We propose to elucidate if n-3 and n-6 PUFA have a differential capacity to modulate insulin sensitivity by activating transcriptional profiles that result in increased oxidative phosphorylation (ie. increased oxygen consumption) and/or decreased mitochondrial production of potentially harmful ROS. The fundamental knowledge stemming from this research will have an immediate impact on the scientific

community, and may lead to the creation of a new market for PUFA-supplemented foods. More specifically, this research will affect the production of existing products (i.e. via increased production and sales) and may stimulate a market for new products specifically focused to treating and managing individuals with reduced insulin sensitivity.

27061 – Purslow, P.

Using proteins and protein fragments from meat to enhance human iron uptake from Dietary supplements

Executive Summary

Iron deficiency is a major health problem for millions of people, especially women of child-bearing age, in Canada and elsewhere in the world. Conventional iron supplements are only inefficiently absorbed. It is known that some meat proteins enhance the absorption of iron from the human diet.

The project aims to identify those meat components present after digestion that are responsible for enhancement iron uptake from the general human diet, find out the cellular uptake mechanisms in the gut and design microencapsulated mixtures of iron supplements and meat proteins that would maximize iron uptake by human gut epithelial cells.

This project will lead to the development of meat-based functional protein additives (nutraceuticals) for enhanced iron uptake, so benefiting the health of Canadians.

The research aims to develop much more efficient iron supplements, which will provide new opportunities to the Ontario Agri-Food sector for product development of functional foods and nutraceuticals with added value.

27066 – Dyck, D.

CLA content in cow's milk and the potential impact of its consumption on glucose tolerance and insulin resistance.

Executive Summary

Dairy products have traditionally been associated with the promotion of health, and used as a vehicle for increasing the delivery of beneficial products including omega fatty acids and probiotics. Current strategies utilized to increase milk production from cows may inadvertently lead to a condition known as subacute rumen acidosis (SARA), which is estimated to affect up to 30% of cows. SARA can alter milk fat composition, including the relative proportion of bioactive conjugated linoleic acid (CLA) isomers. Dairy products are the principle dietary source of CLA. CLA supplementation has been demonstrated to have numerous potential beneficial effects on cancer, atherosclerosis and insulin sensitivity. However, these effects appear to be dependent on the type of CLA isomer; furthermore, the effects of CLA supplementation on insulin sensitivity and glucose tolerance appears to be more controversial. Research involving

both human subjects and animals has demonstrated potential health benefits of the c9,t11 isomer (anti-atherogenic, anti-carcinogenic), but possible detrimental effects of the t10,c12 isomer with respect to insulin sensitivity and glucose tolerance. In recent pilot work, we have demonstrated that SARA-inducing diets can increase the detrimental t10,c12 isomer by ~10-fold in butter made from the milk of affected cows. Furthermore, feeding this butter to rodents for only 4 weeks resulted in a significant increase in blood glucose concentration, suggesting a possible worsening of glucose homeostasis. There are no published studies that we are aware of that have examined the impact of altering CLA isomer content in a natural product on a health outcome, such as glucose tolerance and insulin sensitivity. Clearly, such information should prove to be extremely valuable to both the dairy industry and the consumer.

27136 - Cant, J.

Does consumption of selenized milk protein improve or exacerbate insulin resistance?

Executive Summary

Selenium (Se) is a dietary mineral that is essential for antioxidative defense of cells. Supranutritional consumption of Se results in a decrease in the incidence and progression of several cancer types. It also has beneficial effects on HIV progression, Alzheimer's disease, and recovery of tissues from injury. When cows are fed supplemental organic Se in order to combat mastitis and retained placenta, the Se is incorporated into milk protein that can be used to manufacture high-Se dairy products for human consumption. We have obtained external funding to study the effects of selenized milk proteins in the diet on tumour progression in a rodent model of human breast cancer. The current application is to extend this work to a new health issue arising from Se supplementation studies. Recent epidemiological evidence has come to light that dietary Se may produce symptoms of type II diabetes or insulin resistance. These findings are surprising because Se has been shown to act as an insulin mimetic and decrease symptoms of insulin resistance. We propose a controlled experiment to definitively establish whether selenized milk protein causes insulin resistance or not, and to investigate the mechanism by which Se modifies insulin signalling. Our findings will be to the benefit of Ontario consumers, health professionals, the dairy industry, the feed additives industry, and rural communities at large.

27048 – Mine, Y.

Soy peptide-based Interventions to Prevent Chronic Inflammation and Oxidative Stress-related Diseases.

Executive Summary

Chronic disease is the leading cause of death and disability in Canada. There is a growing body of evidence suggesting that chronic inflammation and oxidative stress are possible causes of

obesity and diabetic-related diseases. This research will provide a better understanding of the role of oxidative stress and inflammation in obesity and obesity-related disease. Through proteomic and nutrigenomic approaches, we will evaluate the efficacy of soy-derived bioactive peptides in obesity/diabetes and gut oxidative stress and inflammation, and determine the mechanism of action of these candidate peptides, which will facilitate the identification of novel anti-obesity and diabetic bioactive compounds in the future. Furthermore, this research will allow for the development of peptide-based nutraceutical interventions for the management of obesity and the prevention of obesity-related disorders such as diabetes, resulting in an overall benefit to Ontarians and a reduction in health care expenditures, and the production of value-added products, benefitting Ontario agri-food industry. The developing a new concept of “preventive model” based on scientific outcome provides effective nutritional strategies for the dietary prevention and management of chronic diseases with emphasis on the consumption of Ontario grown soy proteins. As a direct result of these links with industry, the project is greatly focused on the development of commercial products such as nutraceutical capsules, functional beverages, and functional foods. Furthermore, this project has significant potential for direct knowledge transfer, such as increased training and skills development in large-scale protein production and purification to ensure spinning off the technology to Ontario food and health industry.

Product Development and Enhancement through Value Chains – Approved Projects

027073- Somers, D.

New hybridizations for Ontario apple cultivar development.

Executive Summary

The Ontario apple market is demanding high quality fruit that tastes good and handles well through the storage, packing and marketing system to the consumer. Recently new cultivars like Gala, Honeycrisp and Ambrosia have been well received by consumers, and growers have received better prices, which will enable them to invest in new intensive and efficient orchards. The interest in “new” cultivars has prompted many countries to bring new patented cultivars to the marketplace, but our growers cannot access them legally. Research into new hybridizations is an important first step towards helping the Ontario industry develop the next new cultivar for Ontario and reduce the amount of imported high quality apple produce. Sensory evaluations on potential parents to determine consumer preferences will help target hybridizations with better chances to capture the qualities the consumer wants. Research on apple genetics will help identify parents with desirable traits and prepare the program for future molecular breeding capabilities. Results of our hybridizations will be evaluated for sensory characteristics as well as orchard performance to work towards the development of new cultivars well adapted to the Ontario production systems and the Ontario markets. The project will also include training an MSc student in genetics and molecular mapping to build capacity in molecular breeding of apples.

027112- Mohanty, A.

Improved Utilization of Biochar for the Production of New Industrials Bioproducts

Executive Summary

Biochar production is a well known carbon negative or carbon subtractive approach with greener energy solution, which receives more attention due to their environmental impact and other potential uses including soil amendment, metallurgical as well as energy generation. Apart from these regular uses, investigating high value application is one of the challenging issues, which is necessary for the sustainability of this emerging technology. Hence, the proposed research is aimed to establish an innovative technology that is capable of integrating engineered biochar and plastics including engineering plastics [nylon and poly (trimethylene terephthalate)] for the development of newer industrial biocomposite materials, including automotive parts and consumer products.

027125-Lim. L-T

Utilization of spent coffee grounds in compostable food packaging applications

Executive Summary

Coffee is one of the most favorite beverages in Canada due to personal, social and cultural habits. It is estimated that more than 150 thousand metric tons of spent coffee ground is generated in Canada per year, creating a considerable amount of solid waste. Currently, spent coffee grounds are disposed off in the landfill, being composted, or used as fuel in boiler, all of these can be considered as waste economy opportunity. The purpose of this project is to utilize the high quality waste product, specifically to develop biodegradable composite based on poly(lactic acid) – an emerging biobased thermoplastic polymer that has gained increasing acceptance by the food industry in Ontario. We hypothesize that the coffee waste product can be processed and incorporated into poly(lactic acid) to produce composite materials with enhanced material properties. The envisaged “green” materials may be suitable for replacing some of the existing petroleum-based plastic packages in food and consumer products. By diverting the spent coffee grounds away from the landfill and developing novel applications for the waste product, the value of coffee bean can be upgraded, which is beneficial for coffee processors and end-users in Ontario. Furthermore, the disposal issues of spent coffee can be partially addressed.

027184-Widowski, T.

Eggs from alternative poultry housing systems: Meeting the needs of laying hens, producers and consumers

Executive Summary

Consumer concerns about the welfare of laying hens and legislative changes that prohibit the use of conventional cages are impacting the ways that eggs are produced and marketed around the world. A variety of alternative housing systems for laying hens have been developed but most increase the cost of producing eggs and each has its own set of welfare risks. Additionally, consumer acceptance and willingness to pay for eggs from different types of alternative production systems is still poorly understood in Canada. We have assembled a team with expertise in animal welfare science, poultry science, poultry epidemiology and economics of food production to investigate the welfare of hens in alternative housing systems and the perceptions and attitudes of consumers about hen welfare. Over the course of this 3-year project, we will conduct a series of laboratory experiments and field trials that address the behaviour and health of hens in alternative housing systems. We will examine how rearing environment affects the welfare of hens in enriched systems with different group sizes with a goal of optimizing the welfare of hens in those systems. We will conduct consumer research to understand the socio-demographic factors associated with acceptance of eggs from hens housed in different systems and determine consumers’ valuation of eggs produced in those systems. This project will

generate knowledge to inform Ontario egg producers about alternative production systems that meet consumer expectations and enhance the welfare of hens.

Production Systems – Approved Projects

27064 – Loewen, S.

Remediation strategies to suppress vine decline disease complex in processing tomatoes.

Executive Summary

Vine decline disease complex in processing tomatoes is associated with several soil-borne fungi. Early results from studies of this disease complex indicate that it may be possible to breed tomato cultivars for resistance to this complex. While breeding for resistance may be possible, the fact that there are no commercial cultivars to date, in spite of the knowledge of suitable genes for resistance to some of the associated pathogens for many years, indicates that this may not be a simple problem to solve in this way. As an alternative until breeding yields usable cultivars, and as an additional control strategy, this proposal outlines experiments using soil amendments and putative disease suppressive bacteria to learn if rhizosphere microbe profiles can be modified to enhance the presence of beneficial species that will help to suppress vine decline. The approach we are taking seeks to develop an alternative to soil fumigation and will be readily applicable to both conventional and organic production systems.

27068 - Dale, A.

Adapting cultivars and production systems of dayneutral strawberries to the changing and diverse climate of Ontario.

Executive Summary

The strawberry industry, a successful sector of Ontario's horticultural industry, is moving from a 4-6 week season to a 6-month season and at the same time needs to adapt to hotter and more variable weather patterns brought about by climate change. To do this we are developing F1 hybrid seed-propagated dayneutral cultivars with University of Florida, and developing the seed and plant technologies required to provide plants to the fruit growers. These include development of Female:hermaphrodite pollination systems and methods to maintain and propagate inbred lines. Small-fruited, easy capping, dayneutral cultivars are offshoot of this research. They have the potential to provide a niche market for a value-added product which could be sold retail at premium price.

Collaboration with the University of Florida allows us to develop widely adapted F1 hybrid cultivars which will be adaptable to varying climates. Also, we are investigating the causes of reduced fruit size at high temperatures with the help of a graduate student. This will allow us to incorporate adaptability to high temperatures into our cultivars. Production systems need to be developed to accommodate this new type of strawberry. Here we are researching high tunnels, row covers, crown size and timing systems in different climates in the Province.

**27073- Somers, D (This project is under Product Development as well)
New hybridizations for Ontario apple cultivar development.**

27080- Navabi, A.

Combining Anthracnose Resistance with Resistance to other Major Diseases in Ontario Common Bean (*Phaseolus vulgaris* L.) Germplasm

Executive Summary

Anthracnose (caused by *Colletotrichum lindemuthianum*) and common bacterial blight (CBB; caused by *Xanthomonas axonopodis* pv. *Phaseoli*), both seed-borne diseases of common bean (*Phaseolus vulgaris* L.), are the main reasons why most seed production for the Ontario bean crop occurs in disease free environments (mainly Idaho), adding significant seed production cost. Despite the significant progress that has been made in the last two decades in incorporating CBB resistance in bean germplasm and new varieties in Ontario, resistance to anthracnose, especially to the dominant race (race 73) is still scarce. The challenge that the breeding program is now facing, in terms of disease resistance, is to develop breeding materials and varieties with resistance to multiple diseases i.e., anthracnose, CBB, and bean common mosaic virus with reasonable tolerance against white mould and root rot. A better understanding of the anthracnose host-pathogen interaction in Ontario can significantly help the breeding program in making progress in achieving its disease resistance objectives. This project will focus on this interaction on one hand through the study of the pathogen in terms of its annual spread and virulence pattern, and on the other hand through the study of the genetics of resistance in the host, and further will use this knowledge in developing germplasm with improved resistance against multiple diseases. The outcome, while providing the knowledge that is crucial for the breeding program in achieving its disease resistance goals, is expected to have significant impact in the bean industry through the commercial release of anthracnose resistant varieties.

27081- McDonald, M.R. (This project is under Food for Health as well)

Purple vegetables for better health: a study of the antioxidant and other beneficial effects of anthocyanin pigments in potatoes and carrots

27082- Yada, R. (This project is under Food for Health as well)

Selecting Ontario potatoes for improved processing quality, food safety and health: The role of asparagine, reducing sugars, acrylamide and phenolic compounds

27084- McDonald, M. R. (This is project is under Emergency Management as well)

Emerging plant pathogens: Identification, biology, pathogenicity and integrated management of emerging pathogens infecting asparagus, cucumber and basil.

27090- Sullivan, A.

Native ornamental species for novel applications for greenhouse and landscape culture

Executive Summary

The floriculture industry is faced with increasing competition from off-shore imports of the same species and cultivars that are being grown in Ontario. Rising imports have caused a downturn in the floriculture business, especially greenhouses. In this research we plan to develop new varieties, unique germplasm and in vitro propagation schemes to assist the floriculture industry. Some species for preliminary evaluation are *Amsonia tabernaemontana*, *Baptisia australis*, *Geranium macculatum* and *Silene regia*. The majority of the focus will be on *Liatris* sp, *Echinacea* and *Cypripedium canadidum*. *Echinacea* also has medicinal properties. During the breeding program, we will be selecting plants adapted to low input (i.e., water, light and nutrients) environments. By using native species, Ontario growers will have unique plant material and have the potential to sell to the rest of the world. Concurrent with the breeding program, we will produce unique variants using mutagenic agents. New varieties and unique variants can be rapidly multiplied using tissue culture methods that produce thousands of plants in a small area and very rapidly. With these technologies our growers will be able to bring new varieties to the market in months rather than years required for traditional propagation.

27094- Deen, B.

Effect of high corn residue levels on soybean production

Executive Summary

Use of no-till/reduced till systems for soybean production has declined dramatically in recent years due to real or perceived yield reductions. Producers are foregoing the environmental benefits, such as reduced soil erosion, associated with these systems. Yield reductions observed in recent years may be due to increasing amounts of corn residue resulting from a higher corn yields, delayed corn harvest, and other factors. Increasing corn residues could alter soil temperature and/or impede planter performance. OMAFRA has initiated multi-location field trials to evaluate a range of residue management strategies as well as improved planter equipment. The objective of these trials is to develop corn residue management strategies to increase success of reduced/no-till systems thereby maintaining environmental and economic benefits associated with these systems. The specific objective is to measure the effect of the corn residue management strategies and planter strategies on soil properties, corn residue decomposition, soybean nodulation, and soybean morphology parameters. An understanding of the actual impact of corn residue on soybean production would result. The stakeholder group for results from this research include: 1) Ontario's 28,000 farmers involved in corn, soybean and wheat production; 2) others in society that realize the soil erosion, greenhouse gas benefits of no-

till/reduced till systems; and 3) various governments that have invested heavily in developing and promoting reduced/no-till systems over the past three decades.

27115- Jordan, K.

Cultivar resistance/tolerance and management of plant-parasitic nematodes on strawberries in southern Ontario

Executive Summary

The lesion nematode (*Pratylenchus penetrans*) has been problematic on strawberries for a very long time and anecdotal sampling data suggests that sandy soils combined with continued growth of host crops has led to marked increases in nematode population levels. There have been studies conducted assessing cultivar sensitivity to this nematode, but no significant research has been conducted on plant-parasitic nematodes on strawberries in Ontario in over a decade. In addition, with Telone (*1,3-dichloropropene*) nematicide being slated to be taken off the market in Ontario at the end of 2011, more information needs to be collected on cultivar susceptibility and potential alternative management practices that affect plant parasitic nematode populations. The objectives of this study are to test a variety of commonly grown strawberry cultivars both in grower's fields as well as in experimental micro-plots at a University research station and to examine the effectiveness of alternative management methods for the reduction of plant-parasitic nematode populations. Data will also be collected on the soil characteristics and management practices of various fields to determine how these parameters affect nematode populations in strawberry fields. The results of this study will aid strawberry growers in their efforts to reduce the effects of plant-parasitic nematodes on yield of their crops by determining specific soil properties and possibly management practices related to nematode populations and symptom development, aid in cultivar selection by screening commonly used and previously untested cultivars for their tolerance to nematode feeding and symptom development and finally shed some light on the efficacy of potential alternatives for reducing plant-parasitic nematode populations with the least negative impact to the environment.

27161- Raizada, M. N. (This project is under Environmental Sustainability as well)
Novel Tests for Nitrogen and Testing of Inoculants With Potential to Reduce Chemical Input for Ontario Crop Production

027063 Friendship, R. (This project is under Emergency Management as well)
Peri-weaning failure-to-thrive syndrome (PFTS) in pigs in Ontario

027089 Friendship, R.
Is tilmicosin useful in reducing viremia and the clinical impact of Porcine Reproductive and Respiratory Syndrome (PRRS)?

Executive Summary

Porcine reproductive and respiratory syndrome (PRRS) is the most important swine disease in Canada today. Veterinarians are commonly prescribing mass medication of an antibiotic, tilmicosin (Pulmotil), when dealing with an outbreak of PRRS. There is a widespread belief that tilmicosin has anti-viral properties as well as being useful in the control of secondary bacterial infections. There is some *in-vitro* work to support this idea but little *in-vivo* information. We propose to inject pigs with live PRRS virus (a commercial vaccine strain) and monitor viremia in pigs receiving one of two approved levels of tilmicosin compared to pigs injected with PRRS but not receiving tilmicosin. Macrophages will be recovered from a subset of live animals and euthanized pigs to examine the effect of tilmicosin on macrophage function. If it appears tilmicosin reduces viremia in PRRS infected pigs, this information can be used in handling PRRS outbreaks to reduce losses and to reduce the spread to other farms. If tilmicosin is shown to provide no benefits as an antiviral drug then this information might be used to reduce the use of an antibiotic in an off-label manner. Producers could benefit from a reduction in costs associated with handling a PRRS outbreak, and overall, the discontinuation of this practice could improve consumer confidence and reduce the dangers of antimicrobial resistance.

027110- Guerin, M. (This project is under Emergency Management as well)

The epidemiology of inclusion body hepatitis in broiler breeders in Ontario

027111 Haley, D.

The behaviour and welfare of cattle unloaded for feed, water and rest during long-duration Transportation

Executive Summary

Roughly half of all the beef cattle finished in Ontario come from out of province, and a majority of those arrive here from Western Canada, after a very significant journey by road transport. By federal law, cattle expected to be in transit for more than 52 hours must be fed, watered, and rested for at least 5 hours, at some point during their journey. In many other countries a rest period is required after a much shorter period of transport (e.g., after 8 hours in the UK). As the regulatory agency overseeing the interprovincial transportation of livestock, the Canadian Food Inspection Agency (CFIA) is mindful of the discrepancy, and considering revising the legislation. The present proposal will provide scientific evidence about our current transport and rest practices, which will be invaluable in helping us assess whether changes are necessary. We will assess the impact of longduration journeys on the welfare of cattle by looking at the animals themselves, and documenting their behaviour after being unloaded for a period of rest (N=40 loads). This study will also carefully examine the process of unloading and reloading the cattle by recording the behaviour of the stockpersons involved and the response of the animals, as well as the time required (N=50 loads). Lastly, we will administer a survey (N=70) that will allow us to characteristics the loads of cattle that are stopping for rest to determine whether there are

important trends that are deserving of more careful consideration in the realm of the cross-country long-distance transport of cattle in Canada.

027127 Merkies, K.

A two-stage method for reducing weaning stress in horses

Executive Summary

Traditional equine industry management practices artificially impose abrupt weaning by physically separating mares and foals. Weaning management and stress have been linked to increased risk of disease and subsequent stereotypic behaviour in horses. An effort to reduce stress during the period of weaning and physical separation of dam and foal could reduce the incidence of future health and behavioural problems in horses. Prior studies in cattle and a preliminary trial in horses have utilized a two-stage weaning approach with positive success in reducing stress and increasing average daily gain. Nursing is physically prevented during stage 1 using a physical barrier to deny access to the mare's udder. All other forms of social interaction are permitted. In stage 2, mare and foal are physically separated. A recent survey revealed that many in the equine industry view gradual weaning methods as impractical to implement. Investigation of alternative weaning practices that may decrease immediate stress and improve animal welfare will provide empirical evidence to encourage breeders to utilize gradual weaning methods.

027139 Kelton, D. (This project is under Emergency Management as well)

Johne's disease prevention and control on organic dairy farms in Ontario

027147 LaMarre, J.

Identification of small regulatory RNAs in gametes and embryos.

Executive Summary

Essentially every animal production system ultimately depends on reproduction. The efficient, regular and timely replacement of stock destined for meat production, or the initiation of lactation, constitute indispensable first steps in every production cycle. Despite its importance, reproduction is often surprisingly inefficient, with both pregnancy rates and litter sizes significantly lower than potential maximum levels. One particularly important time in the reproductive cycle of any species involves the period around fertilization and subsequent early embryo development. During this period, oocyte, sperm, and maternal factors interact in a series of complex events that dictate the developmental fate of the embryo. Central to these events is a shift in the expression of important genes, from those expressed in the egg to those required for early embryo development. We postulate that this change in gene expression is partly regulated by different small, non-coding, regulatory RNA molecules that affect the rate at which key genes are turned off. Variations in the levels of these RNAs, present in the oocyte or sperm, or

synthesized by the embryo, are likely to have major effects on important reproductive parameters. We propose to characterize these small RNAs in bovine and porcine oocytes, sperm and early embryos and then establish whether they are associated with fertility. The identification and manipulation of these RNAs may provide novel opportunities for producers and companies in the Ontario Agri-Food sector to improve reproductive outcomes and increase production efficiency.

027149 LeBlanc, S.

Monitoring and managing metabolic health to prevent reproductive disease in postpartum dairy cattle

Executive Summary

Reproductive disease (retained placenta, metritis, and endometritis) is the second major reason (with mastitis) for treatment of milking cows with antibiotics. Approximately 10% of cows have retained placenta, 10-15% have metritis, and 30% have at least one form of endometritis. While these overlap, about 25% of cows have at least one form of reproductive disease, with the cost of each case being \$100 to \$500. Essentially all cows go through reduced immune responsiveness and negative energy balance in early lactation, and most have bacterial contamination of the uterus in the weeks after calving, but little is understood about which animals have worse immune function and increased disease risk, and why. Therefore, there is a lack of practical methods to support immune function in transition cows and prevent reproductive disease. In Experiment 1, an observational study will determine associations among energy metabolism, immune function, and reproductive health. Experiment 2, which will test whether a practical, but as yet not widely adopted housing strategy of providing free feeding and lying access by having no more than a ratio of 80% cows to feeding spaces and stalls, can effectively support immune function and reduce disease. If validated, the glucose tolerance test will be usable in the field to detect cows at risk of metabolic and reproductive disease. Success will lead to both reduced disease incidence and reduced use of antimicrobials in lactating cows.

027152 Lumsden, J.

Improving the management of bacterial coldwater disease in rainbow trout aquaculture via autogenous vaccination and family susceptibility.

Executive Summary

Bacterial coldwater disease (BCWD) caused by *Flavobacterium psychrophilum* is the most important production-limiting disease for Ontario rainbow trout farmers. Disease occurs following stress, i.e. movement and is always a risk at water temperatures below 12-13°C. There is no commercial vaccine for BCWD and fish veterinarians have a limited repertoire of antimicrobials to manage disease outbreaks. An autogenous vaccine, developed in partnership with this project, will be evaluated on an experimental basis. Additionally, progeny from families

of rainbow trout that are selected for growth and other production parameters will be assessed for susceptibility to *F. psychrophilum*. This may allow preferential selection of families that both grow faster, etc. but are also less likely to suffer from BCWD. This work will directly advance the Ontario agri-food sector by providing tools to reduce antimicrobial use in food animals, while minimizing the clinical and economic impact of a major production-limiting disease. The proposed research will also complement efforts to improve production characteristics of Ontario rainbow trout.

027159 DeVries, T.

Effect of early life feeding and management strategies on weaning success and development of feeding behaviour patterns in dairy calves

Executive Summary

There is much empirical evidence to suggest that the feeding behaviour patterns of lactating dairy cows play a significant role in cow productivity, health, efficiency, and welfare. These patterns are strongly influenced by external factors such as food availability and social conditions. In addition, there is growing evidence that eating habits in animals are greatly affected by learning early in life. Thus, it is likely that such factors may also be influential for young ruminants, in particular in the learning of feeding behaviour patterns. As such, these factors may also have significant effects on the success of transition of dairy calves from liquid to solid feed in the weaning process, a time when they are particularly susceptible to infectious and metabolic disease. The overall goal of the proposed research is to develop an understanding of how early life dietary and management strategies affect the learning of subsequent feeding behaviour in dairy heifers. The long-term objective of this research will be to identify feeding, housing and other management practices for dairy calves that not only result in improved health, welfare and growth efficiency over the weaning period from milk to solid feed, but also promote the development and persistence of desirable feeding patterns. A series of experiments will be conducted to evaluate feeding and housing strategies (including milk-feeding levels, solid feed type and form, and competition for feed access), aimed at promoting a smooth transition through weaning, and development of desirable feeding patterns ensuring immediate and long-term animal health, efficiency and welfare. The results of this research will not only allow Ontario dairy producers to be more profitable, but also promote the health and welfare of replacement dairy heifers, which will further improve efficiency and consumer confidence in this agricultural sector.

027160 – Haley, D.

Effect of peri-parturient housing and calving management practices on the behaviour, health and welfare of dairy cows and calves

Executive Summary

The peri-parturient period has a tremendous impact on the health and welfare of dairy cows and their calves. Studies examining the threats and hazards around this time have often overlooked the actual process of giving birth itself. Careful consideration of the influence of calving management practices offers us the opportunity to try and further reduce the stressors on cows and calves, at this critically important time. We propose to survey dairy producers in Ontario to benchmark some of their key calving management practices. This will yield us insight into practices that may be worthy of closer evaluation. Next, we will document the normal periparturient behaviour of dairy cows giving birth to test predictors of imminent calving, as well as calving difficulties. The third part of this study will involve determining the effects of pulling calves. Pulling may be done, even in trouble-free situations, to assist the cow's efforts but the effects of this have not been documented. The final study in this series will test the effects of how much space cows have during calving. The national Code of Practice recommends cows be given "adequate" space, but there is no scientific data from which to draw guidance about how much space might be sufficient.

027162 Leslie, K.

Understanding early-life growth, and the diagnosis and long-term impacts of respiratory disease, on health, performance, and survival of dairy calves

Executive Summary

There is a growing body of evidence that the occurrence of bovine respiratory disease (BRD), during the pre-weaning or post-weaning periods, has profound long-term effects on growth, performance, longevity and welfare of dairy cattle. Furthermore, evidence is also mounting that there may be genetic influences on the susceptibility of dairy calves to BRD, as well as for their survival through weaning and into first lactation. However, it is important and necessary to substantiate these findings on a large population of animals, and in various geographic regions. In addition, the findings currently reported are on calves that have shown overt clinical findings of BRD (i.e. animals requiring and receiving systemic antibiotic treatment for respiratory disease). In several other species, it is known that subclinical respiratory disease also has profound impacts on important outcomes. Yet, quantification of subclinical BRD and information on its impact is lacking for dairy replacement heifers. The overall goal of the proposed research is to develop an understanding of how subclinical and clinical BRD in dairy calves exert their impacts on growth, performance and survival into future life. Also, the project will determine whether subclinical BRD can be characterized early in the pathophysiological process of this condition, as well as if susceptibility to BRD can be predicted by genomic

characterization. Finally, these results will help to determine if BRD in dairy replacement heifers can be prevented from having a devastating impact on the growth, performance, longevity and welfare of dairy replacement animals.

027184 Widowski, T. (This project is under Product Development as well)

Eggs from alternative poultry housing systems: Meeting the needs of laying hens, producers and consumers