

Alberta Agricultural Research Funders Manure Research Focus Workshop November 23, 2001



ALBERTA LIVESTOCK INDUSTRY DEVELOPMENT FUND

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Background:

In 2001, the Alberta Agricultural Research Institute (AARI) call for letters of intent for research projects generated an unprecedented number of responses from the research community. The sheer volume contributed to overlap and duplication and at the same time a disjointed and random approach to addressing the gaps in knowledge in the science in a number of research areas. One such area was in research relating to manure. Thirty-seven separate letters of intent pertaining to manure related projects were submitted.

With the goal of creating a coordinated and systemic approach to this science area, AARI in cooperation with the Alberta Livestock Industry Development Fund (ALIDF) and the Alberta Crop Industry Development Fund (ACIDF) convened the lead researchers of the 37 submissions for a focus development workshop.

The purpose of the workshop was to access the knowledge and expertise of the research community in the creation of a strategic focus in this area. The ultimate goal was to move the science, and correspondingly the application of the science, forward in a way that focused on knowledge gaps and benefited the industry.

The workshop planning team defined three desired outcomes:

- Identification of the gaps in knowledge in each of the three focus areas;
- Identification of the highest needs of industry relative to the knowledge gaps; and
- Identification of a defined number of projects responding to the knowledge gaps and corresponding industry needs that would be developed into research proposals in the three areas of manure research.

Framing the Discussion:

The funding agencies invited the participants to use their experience, expertise, and knowledge collaboratively to create synergies and focus that would result in research excellence in this area. Underlining that invitation was the fact that *none of the 37 letters of intent would be considered for funding*. Furthermore, there was no assurance that the resulting proposals would be funded. The proposals developed as a result of the workshop would be considered with the other projects that had submitted letters of intent and were invited to develop proposals.

All proposals would be assessed against the pro-grid criteria of:

- Contributions to Advancement of Agriculture and Agri-Food Knowledge
- Benefits to Alberta's Agriculture and Agri-Food Industry
- Background and Objectives
- Qualification of Research Team
- Research Design, Method and Analysis
- Ability to Complete Project
- Research Budget
- Funding Contribution

Points for Consideration or Insights:

Several insights, or points for consideration, were presented by participants in the plenary sessions throughout the workshop process that could inform the funding agencies as they proceed with this initiative, or apply this process to other research focus areas.

Process Insights:

The fact that none of the proposed projects would be funded resulted in a certain level of anxiety; however, a majority of participants stated that they were entering this process with a “cautious but optimistic” attitude and with some specific concerns:

- There was a level of skepticism about “another” new process which researchers felt had been tried before without follow through or notice by the research community.
- The diversity and multiplicity of interests in the room might preclude progress and limit the ability to find common ground.
- Two other funding groups have done this exercise regarding manure this year; there was a concern about duplication of efforts by funding agencies.
- Participants would have appreciated more detail in preparation and input into the discussion framework.

Defining Research Focus Areas:

There was a concern that the identified research focus areas were the most effective categorization to actually respond to industry needs.

- The producer faces four steps when it comes to manure management:
 - What are they going to feed and what effect will it have?
 - How will they store and process it?
 - How will they dispose of it?
 - How can they mitigate the environmental risk?
- Should the research focus areas respond to those stages?
- Some researchers felt that mitigating the environmental risk should be the driving question or the goal.
- Others felt that creating public confidence or comfort that the risks had been mitigated was paramount.
- And, others felt that both of those goals neglected the value-added component of manure research.

As a result of the diversity in views, it was decided that the workshop would proceed within the established framework.

Leadership and Direction through a Science Plan:

Workshop participants challenged that the categorization of manure research into three separate areas somewhat defeated the goal of a systemic and focussed approach to the science. In addition to addressing intersections or linkages that naturally existed between the focus areas, it

was felt that an overall science plan based on a five-year cycle was critical success of this initiative. The science plan should address the following considerations:

- Leadership requirements
- Identify what we know: The current state of the science and research currently underway
- Identify what we want to know: A life cycle analysis should identify system gaps, address the synergies and intersects in various research areas, and reduce overlap. Research should consider the intersections with the other focus areas and seek that expertise. Some examples were the integration of odour research in agronomy or treatment focussed projects; and the intersect of value-added or treatment in the agronomy focus area.
- Include breaking new ground as a key component
- Include all the players appropriately

Public Trust and Social Impacts:

Some participants felt that a fourth focus area should be dedicated to the issues surrounding public trust or confidence and addressing the social impacts relating to manure production, storage, and use as a land-based nutrient.

The rationale for this focus area is the fact that manure is a by-product of a larger industry and public concern could/does have a profound effect on the entire industry. In that context, this is a key issue that not may fit as a research focus area but might fit in the overall science plan.

The Research Focus Areas:

Three research focus areas were identified in response to the themes identified in the letters of intent:

1. Agronomics and Manure Management
2. Odour
3. Energy and/or Treatment

Workshop participants self-selected into working groups based on where they felt their expertise or knowledge could best be utilized. Each workgroup was tasked with:

- Establishing clarity regarding the focus area;
- Identifying the gaps in knowledge related to the focus area—what do we need to know?;
- Identifying the highest industry needs relative to the knowledge gaps;
- Identifying how to use the expertise in the research community to address these areas by defining up to three collaborative research initiatives.

The Nine Research Projects:

The following sections of the workshop summary provide a more detailed description of the proposed research projects which are listed below.

1. *Agronomics and Manure Management:*

- Feed Management
- Land Application
- Nutrient Losses/Pathogens and Pollutants

2. *Odour:*

- Measure Odour accurately in a repeatable way
- Evaluate Odour impacts to define acceptable community odour standards
- Assess existing and develop new odour control technologies

3. *Energy and Treatment:*

- Lifecycle Analysis
- Comparative Analysis of Manure and Treatment Technologies
- Greenhouse Gas Inventory and Mitigation Project
- Nutrient Recovery

Research Focus Area One: Agronomics and Manure Management

Agronomics in manure management was defined or framed as addressing:

- Efficiency in utilizing nutrients
- Access to markets
- Environmental stewardship
- Competitiveness

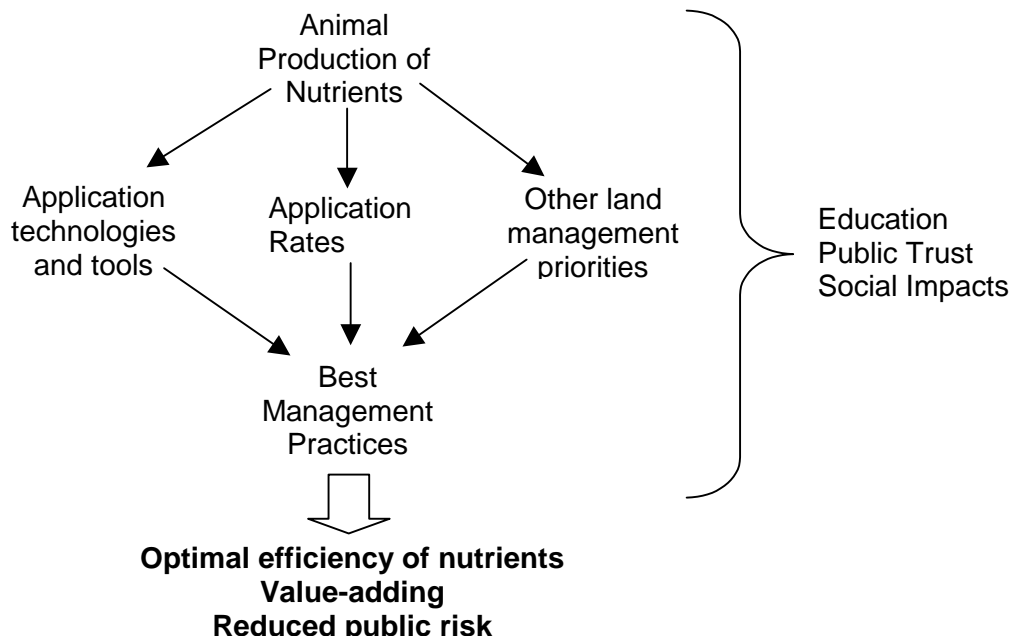
Agronomics intersected with the other research focus areas in the value-added components such as greenhouse gases or in addressing odour.

The gaps in knowledge:

In the first round of this discussion participants identified seven areas where increased knowledge was required:

- *Efficiency of nutrients:* How do we “tighten” nutrient cycles for the purpose of ensuring crop uptake and minimizing loss to water /air? What are the rates of nutrient release from different sources of manure in the long term? How do we minimize the “leakiness” of nutrients from agronomic lands?
- *Land application rates:* What nutrients are released (from manure) and how much do I need to apply? What are the appropriate rates for manure and compost application on agricultural land for optimum yield and environmental protection? How to provide economic data on methods of application?
- *Alternative technologies:* What impacts of alternative technologies have on production costs and returns? Production level? Industry level?
- *Best management practices and tools:* How effective are BMP’s for land application of manure in protecting water quality? What are the pathogen and contaminate risks? What are the opportunities for Pathogens Management? What are the best tools for manure application? Where are the environmentally “sensitive” areas of the landscape and how should management practices reflect these areas? What are BMP’s to control nutrient losses?
- *Greenhouse gas reduction:* Reduction of greenhouse gases in manure management opportunities. Further processing (value-added) of manure to reduce /eliminate environmental imputes. Measurement/verification of GHG reduction from improved efficiency of livestock feeding, manure management and use of manure
- *Site-specific impacts:* What impacts of alternative technologies have on production costs and returns? Production level? Industry level?
- *Social/economic impacts:* How to raise public trust in the regulations? What education is needed?

Rather than isolated issues these knowledge gaps were seen as an interrelated system that led to the optimum efficiency of nutrients, value-added opportunities and increased public trust.



The Research Projects

In response to this concept the three research priorities that respond to the highest industry need are:

1. Feed management: Industry has a need for increased understanding of the impact of how and what animals are fed on manure production. Some of the key areas that need to be included in this research are:

- Species variations
- Feed strategies
- Bedding

The focus of this research would be to reduce the Phosphorous and Nitrogen output in manure

Project leaders: Erasmus Okine, Willem Sauer, Ron Ball, Karen Beauchemin

2. Land application: What are the nutrient loading standards (science-based) that are sustainable on our soils and water resources? What is the economic data on methods of application? Some key areas that could be included in this research area are:

- Nutrient release/decomposition process
- Long-term impacts
- Grazing/pasture management (natural and mechanical spreading)
- Site specific issues
- Crop rotation
- Direct seeded /forage

- Phosphorus
- Environmental impacts

Project leaders: Rod Bennett, Mohamed Amrani, Shabtai Bittman

3. *Nutrient losses/ pollutants and pathogens:* How do we “tighten” nutrient cycles for the purpose of ensuring crop uptake and minimizing loss to water /air? What are the rates of nutrient release from different sources of manure in the long term? How do we minimize the “leakiness” of nutrients from agronomic lands? Some key areas that could be included in this research area are:

- Mitigation
- Storage and handling
- Refining guidelines in code the Code of Practice to address application rates and technology

Project Leaders: Dan Heaney, David Nielson, Les Fuller

Overarching Components:

Each of the three research projects must address the following components:

- Environmental sustainability
- Mitigation of social impacts
- Best management practices
- Cost/economics: There is a need to understand the economic implications of applying the research. It will not be supported if it does not support a viable industry.
- Tech transfer
- Intersection with other research focus areas (i.e.: odour)
- New approaches and technologies (engineering included): There is a need to break our paradigms about the treatment and use of manure. Some examples include looking beyond land-based application process and looking beyond composting to other technologies or technological applications.
- Grounded in credible science

Research Focus Area Two: Odour

The focus area on Odour means or includes:

- Sustainability of the sector
- Community perception/acceptability – not a hard environmental impact
- Consumer or market impacts
- Nuisance that affects siting and expansion opportunities
- Acceptability – nuisance vs. health; air quality linkages
- Lots of areas that we are lacking understanding

The gaps in knowledge related to the Odour focus area:

- We need to understand the characteristics of odour - FIDO – frequency, intensity, duration and offensiveness
 - Both from a qualitative and quantitative sense
- We need to understand the Health-Odour Linkage
 - Odour constituents, particulate matter, pathogens, air quality
 - We need health surveys that are linked to exposure studies
 - Assess the chronic, low level exposures to odour
- We need siting tools and standards that are science-based
 - We need an accompanying information database
- We need to develop and assess odour control technologies
- There is no standardized way of measuring odour
- We need to assess the production-economic impacts of odour
- We need a credible source and communication pathways to producers and the public (communities)
- We need to transfer the technical information by way of extension, education, demonstration, etc.

The industry needs relative to the knowledge gaps:

- Industry needs us to find acceptable odour levels (exposure, etc.)
- Industry needs us to evaluate the odour impacts
 - Include health, air quality, particulate matter, pathogens, case sensitive situations
- Industry needs us to develop and assess new and existing odour control technologies
 - Performance measures or criteria for testing needs to be developed
 - Cost-benefit analysis and economics with each technology
- Industry needs an objective, standardized way of measuring odour levels
 - Qualitatively and quantitatively
- Industry needs to partner with us (the research community) in technology transfer and dissemination of credible information to industry, communities and the general public

The top five needs of industry relative to the knowledge gaps:

1. Acceptable odour levels (FIDO)
 - Standards for community acceptance
2. Evaluate the odour impacts
 - In the form of a siting tool (source–dispersion-impacts) and determine particulate matter, health, air quality and pathogen overlaps
3. Objectively measure odour
 - Reliable, repeatable, standard Alberta procedure
4. Develop and assess different odour control technologies
5. Researchers partner with industry in tech transfer and public communications
 - Information database
 - Demonstration
 - Communication – credible information

The Research Projects:

1. ***Measure Odour accurately in a repeatable way.***

- Develop standardized, objective procedures for measuring odour – in both the lab (olfactometer) and the field (dispersion models and real time measurements)
- Look to other sector's approaches to methodology and process
- Examine the relationship between measuring intensity, concentration and offensiveness
- Explore pathogens, particulate matter and health related issues – partner with other agencies
- Outcome – Quantitative tool
- Tech transfer plan and communication plan for the public is included

Project Leaders: John Feddes, U of A; Richard Coleman, ARC; Robert Borg, AAFRD

Project Team: Expanded Odour Control Working Group

2. ***Evaluate Odour impacts to define acceptable community odour standards.***

- Includes development of a siting tool/odour database
- Includes evaluating particulate matter, health, air quality and pathogens
- Evaluate annoyance versus health - valid/invalid complaints
- Develop a science-based MDS system
- Focus will be on nuisance, with a concentration on source health impacts (receiver impact will be inferred based on dispersion technology)
- Examine other sectors'/countries approaches to dealing with odours

Project Leaders: John Feddes, U of A; Richard Coleman, ARC; Robert Borg, AAFRD

Project Team: Expanded Odour Control Working Group

3. ***Assess existing and develop new odour control technologies.***

- Includes odour reduction efficiencies under different conditions
- Includes cost-benefit analysis
- Includes performance measures/criteria for evaluation
- Developed assessed with awareness of the production cycle
- Develop a protocol for assessing new technologies

Project Leaders: Huiqing Guo, Odour Control Specialist, AAFRD

Summary

Three Priority Projects: (note-projects are presented in a sequential fashion)

Projects	Identified Gaps	Specific Benefits	Required Synergies/Areas of Expertise
1. <i>Measure Odour accurately in a repeatable way</i>	No standard way to measure and sample for odour in field or lab	<ul style="list-style-type: none"> Reliable measurement leads to reliable management Find the best ways to measure odour Public confidence in odour control management 	<ul style="list-style-type: none"> Linkage with other sectors/countries Tap into global research network Tech transfer and extension Scientist and engineers
2. <i>Evaluate Odour impacts to define acceptable community odour standards</i>	<ul style="list-style-type: none"> Need a better understanding of odour FIDO factors and health linkage Need to work with communities to develop acceptable levels 	<ul style="list-style-type: none"> Delineate valid from invalid complaints Foster expansion and sustainable development of the industry Understanding of overall health complaints 	<ul style="list-style-type: none"> Dept of Env and Health and Wellness, AAFC, NRC, NRCan Toxicologists, microbiologists, physiologists etc Health officials Tech transfer and extension, RDSOs Industry groups
3. <i>Assess existing and develop new odour control technologies</i>	<ul style="list-style-type: none"> Need to provide producers with a toolbox of cost-effective odour control tools Need to scan other sector's/jurisdictions for applicable tools 	<ul style="list-style-type: none"> Finding solutions to odour control that are both practical and cost effective Increased density of CFOs: alternatives to buying more land to control odour through MDS 	<ul style="list-style-type: none"> Work with other sectors/countries for relevant, applicable information Rely on global network- Industry groups Private sector solution providers Tech transfer/ demonstrations

***Note: Funding estimates range in the \$100 to \$500K per year for all three projects taken together. Firmer estimates available in full proposals.**

Research Focus Area Three: Energy and Treatment or Value-Added

The opportunities for significant research in this focus area:

- Moving manure from waste to an industrial product
- Addressing GHG issues related to manure
- Manure as a profit center, not a cost center
- Transportation/location cost issues
- Research needs to address:
 - GHG, odour and agronomic criteria as well
 - Other environmental issues
 - The true cost of manure – total “lifecycle” cost

The gaps in knowledge related to our focus area:

- **We need to know what to measure to be able to do a full lifecycle analysis.** This was a priority gap to be addressed – by knowing what to measure to address other aspects of research outside of one’s own interests, will be able to address some of the overlap issues.
 - Lifecycle analysis – integrated, holistic approach
 - Common elements from all three focus areas need to be identified and addressed
 - What are the changes in the production cycle that change the manure product in the end – what happens with each change in the production cycle
- Benefits/impacts on the soil over the long term
- Operating in a regulatory vacuum
- Need to put a dollar value on manure, manure products and benefits
- Technology transfer is a gap – lots of different technologies available, but little information about them
- Resource recovery
- Sources of carbon to work with manure in composting – links with other industries

The highest needs of industry relative to the knowledge gaps

- A full lifecycle analysis is the top priority for the industry to address the gaps.
- Need to identify ALL potential uses for manure, the technology required for those uses and markets for manure in those forms.
 - How might/does this priority intersect with the other focus areas?
- A Lifecycle analysis addresses all three focus areas
 - At the same time
 - How they interact/overlap
- How changes to affect of focus area impact the others?
- Need to remember that we are addressing a problem, not just creating a value added product.

The Research Projects:

1. *Lifecycle Analysis*

- The proposal will enable researchers to address all the gaps the group identified and any gaps the other groups identified.
- This will identify areas where more work is needed and help to prioritize which gaps should be addressed first – address the lack of priorities in manure management research in AB.
- The result of this work will enable the producer to make better management decisions.
- This project should be done in a phased approach.

Project Leaders: AAFRD in conjunction with the Pembina Institute, Mark Anileski

2. *Comparative Analysis of Manure Treatment Technologies*

- This proposal will address the technology transfer gaps identified earlier.
- Areas of expertise are required: Technology providers, producers, microbiologists, chemical engineers, soils scientists.

Project leaders: Jerry Leonard, Xiaomei Li

Project Team: Lethbridge Research Station, Olds College, U of A, ARC

3. *Greenhouse Gas Inventory and Mitigation Project*

- This project would help Alberta/Canada to meet our Kyoto protocol commitments, improve environmental sustainability, improve public perception of the industry and add value to our product.
- Expertise required: Nutritionists, economists, engineers, industry representatives, manure management specialists, producers – cattle and hogs, soils and range management specialists.

Project leaders: John Hastie, Erasmus Okine

Project team: ARC, U of A, Idaho (check with John for contact), Lethbridge Research Station

4. *Nutrient Recovery*

- This project would provide information on resource recovery from manure, and the cost/efficiency of these processes.
- We would have information on the nutrient types available and much more information on the viability of these technologies.
- Address nutrient pollution issues to make agricultural operations more sustainable. It could be tied to future regulations.
- Areas of expertise: Engineers, livestock operators and specialists, soil scientists.

Project Leaders: Dr. Chi Chen- Lethbridge Research Station, Larry Zeng, Dave Segó

Conclusion:

This stakeholders' workshop for developing a research focus that would serve to advance the science and the application of the science in a strategic, synergistic and coordinated way was a risky undertaking for both the funders and the researchers.

In concept, it is a worthy and necessary goal. In follow through and practice it will represent a fundamental shift in strategic focus.

In some of the focus areas, there was an evidence of excitement and willingness to embrace this approach to focused research. In others there continued to be a level of cynicism about the benefits that might be achieved through this process that would not have been achieved through the originally submitted projects.

There are still several risks to be managed:

- The chance that researchers will not follow through on the development of projects,
- The concern that this is a one-time, bright idea and not a step in the evolution of a synergistic, strategic process, or
- The risk that the results may not meet expectations.

Creating a paradigm shift requires sustained engagement, proof of benefits and demonstrated commitment to the concept. The agricultural research funders were challenged to demonstrate leadership in creating a science plan and providing a coordinating role that models collaboration, strategic focus and synergistic efforts.