

ALBERTA CROP INDUSTRY DEVELOPMENT FUND

Strategic Research Priorities for the Bioproducts Initiative

Focussed Discussion Workshop

SUMMARY REPORT

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INTRODUCTION AND CONTEXTING

The Alberta Crop Industry Development Fund (ACIDF) is an independent, not-for-profit company operating under the direction of the Alberta crop industry through a memorandum of understanding between thirteen diverse crop industry organizations. The fund is managed by five delegated crop industry representatives. ACIDF funds and supports selected crop related industry development activities including market development, research, and extension.

In June 2005, ACIDF signed a new funding agreement with Alberta Agriculture Food and Rural Development (AAFRD) which will provide \$23,000,000 over the next five years. This money must be committed to meaningful activities generating measurable outcomes before March 31, 2010 for complete disbursement by March 31, 2012.

The new funding agreement defines three crop initiative areas with defined scope for each one:

1. Feed grain quality and supply
2. Environment and nutrient management
3. Bioproducts

The bioproducts initiative has been allocated \$5,000,000 with the direction of supporting worthy world-class research and development (R&D) programs and projects to

- develop bioplastics and high value compounds from Alberta's agricultural feedstock and processing streams
- develop agricultural fibres for agriculture fibre/polymer composites and agriculture based pulp and papers

Performance measures for the bioproducts initiative are:

Measure	Targets				
	2005/06	2006/07	2007/08	2008/09	2009/10
Development of scale-up quantities of high quality bio-polymer materials for testing and product development	Establishment of scale up facility	Consistent production of materials	Expanded range of development Materials	Established supply of development materials by 2008	
Develop high value compounds from Alberta produced crops. (compounds or processes/yr)	3	3	3	3	3
Development of a highly qualified workforce to fuel the emerging industry. (Graduate studentships/yr)	3	3	3	3	3

Measure	Targets				
	2005/06	2006/07	2007/08	2008/09	2009/10
Attraction of industry investment into the program (Industry contribution or investment into the program)	Additional 20% of 2004/5 levels	20%	20%	20%	20%

ACIDF's Board has the responsibility of making the funding decisions. However, they operate on the basis that those charged with making the investment decisions need the best possible information. One part of that information is input from the industry and the research community.

To that end, 17 invited value-chain representatives from agriculture and food industry convened on June 15, 2005 to identify R&D priorities for the bioproducts initiative (see Appendix 1 for Participant List).

This workshop brought together a range of perspectives, insights, experience and knowledge with the goal of creating a comprehensive understanding of the needs, and subsequently, the R&D priorities that would respond to the feed grain quality and supply initiative, and moreover provide results for the three defined outcomes. The ACIDF Board, AAFRD, Alberta Agricultural Research Institute (AARI) and likely other funding consortium members will use the results to inform their decision process.

THE FOCUS DISCUSSION PROCESS

The bioproducts group was perhaps the most diverse and least experienced, due to the infancy of the industry, of the three groups. There were a select number of extremely knowledgeable people in both bioplastics and bio-fibres, and several less experienced or knowledgeable participants. Therefore the opening discussion and the poster debrief took on an air of education and information.

Basically, the area of bioproducts is considered to be an area of significant opportunity for several reasons including:

- The abundance of raw materials in Alberta (including wood fibres)
- The strong R&D capacity being developed in Alberta
- The emphasis being placed on (and support being provided to) this sector by the Government of Alberta Growth Strategy and the current bioplastics facility

The driving question for the workshop was, "What R&D needs to be done to achieve the stated outcomes and performance measures?"

Rather than brainstorming ideas for R&D project and programs, participants addressed eight questions in their discussion process. Responses resulted in a strategic approach to identifying R&D priorities.

The Exploration Questions

1. What is already happening in the area of bioproducts R&D that can be built upon?
2. Who are the major players in bioproducts R&D?
3. Where are there leveraging opportunities for new bioproducts R&D?
4. What is the most pressing issue to be addressed in bioproducts? Why is it pressing?
5. What needs to happen to create momentum in bioproducts R&D and achieving the outcomes?
6. What are the barriers to be addressed to achieve the outcomes and measures in the bioproducts initiative?
7. The most significant opportunity in the bioproducts initiative is:
8. What outcomes can realistically be achieved in the next five years?

DISCUSSION SYNOPSIS

Key Messages

Throughout the discussion, a number of consistent themes emerged and became key messages for ACIDF:

Flexibility

It is critical that scale-up facilities are developed with sufficient flexibility to accommodate new products and methods and development of products created through by-product generation.

Market-driven

It is important to identify markets for products simultaneously with developing the product. Moreover, targeting niche markets may be the most effective way to create markets. Niche markets can take the form of high value/low volume or low value/high volume production. It was suggested several times that the high value/low volume market held the greatest potential.

Consistency

Consistent supply of raw materials, consistent quality of supply and consistent ability to provide a specified quantity of products were all seen as critical factors in developing the bioplastics or bio-fibre industry in Alberta.

Communicating the Benefits

Bioproducts is a new and growing industry in Alberta which is not well understood by producers or taxpayers. The industry needs to provide clear messages of the potential and benefits of investing in bioproducts or producing for this industry.

Discussion of Exploratory Questions

Response to the exploratory questions was the tool used to trigger ideas about R&D required to provide the required outcomes in the bio-product initiative. In summary:

1. What is already happening that bioproducts R&D can build upon and who are the major players?

There are existing expertise and core knowledge groups in plastics and fibres (ARC, U of A, AT Plastics, EU partners, Netherlands, R&D industry in Europe, U of T, Manitoba Composite Centre, U of S, Crop Fibres Canada, and Biolin Research) that can serve as a spring board for bioproducts R&D.

This illustrates that even in this young industry there is a great deal of activity and participants stressed there is a need to apply filters and focus on areas of opportunity recognizing that any undertaking will require technology feasibility, an industrial partner, a sound business case and a receptor industry. It was stressed there are many existing networks—Alberta needs build upon them by connecting together and adding industry to the groups (Chamber of Commerce, etc).

While there is potential for growing new crops to produce fibre/oils for plastic production there are also existing crops that need to be maximized using existing technology and the potential of adopting crops for the Alberta environment (i.e. hemp).

2. What are the leveraging opportunities and what are they?

In addition to the leveraging opportunities identified with the major players, participants suggested the following strategies for leveraging or growing the bioproducts industry:

- Working with special interest lobby groups that would create awareness and market demand for bioproducts
- Leverage with the public—create demand for the “bio-label”
- Partner with a large processor with deep pockets to incur the capital investment and with a distribution networks to make it feasible
- Find a “Kyoto” hook—sustainability
- Making someone else’s product better by adding functionality

3. Pressing issues

There were a significant number of pressing issues facing the development of the bioproducts industry and bioproducts R&D which basically fell into four categories; supply and consistency of product, scaleability of production, market development and profitability.

4. Creating momentum to achieve the required outcomes

The most significant theme under creating momentum was focus and coordination to build capacity in a few selected areas. This was consistent through the entire supply chain.

- Need receptor industry—market and industry partners—supply chain and distributors
- Need to identify secure, quality supply
- Need to build science capacity—scientists, labs and lab technicians and a critical mass of expertise in selected areas
- Need investment/focus/pilot facilities/critical mass. Since being in the business of converting agricultural commodities to products results in demands across many product areas, critical mass and multi-disciplinary approaches are required
- Need for integration of programs/initiatives/expertise within Alberta, regionally and nationally
- Need targeted research focused around carefully selected opportunities because there is a danger of being spread too thin. Create learning around a few opportunities and then leverage the learning to further opportunities
- Need coordinated funding
- Need risk money (venture capital) government position to support proof of concept
- Need to identify “low hanging fruits”—easy to achieve products that would create momentum

5. Barriers

Barriers identified reiterated the points made in previous section regarding creating momentum—consistent supply, consistent quality (and testing capacity) and the need for market driven product development. In addition the issue of relevant ASTM standards and the cost of processing equipment and disconnect along the supply chain were listed as barriers to the development of the bioproducts industry.

6. The most significant opportunities

Participants identified a number of substitution opportunities in which bioproducts (bioplastics and biofibres) could replace current markets because they appear to be more environmentally friendly and could utilize material in the current waste stream and address bio-mass utilization (ie. packaging and construction materials, specialty papers, railroad ties, fibre for “pulp sweeteners, functional specialty chemicals, and truly bio-degradable plastics).

A key point made was the need to look at the whole product—bioplastic/biochemical/ bio-material/bio-composite because the business of being in business requires the entire commodity utilization. Bioproducts dictate the opportunities for commodity utilization.

Research and Development Priorities

Participants developed and ranked the following seven R&D priorities as being the most important steps in achieving the outcomes identified in the bioproducts initiative.

Interestingly, priorities focused on creating the infrastructure to build R&D capacity. An overarching principle for the practice of, or approach to, bioproducts R&D was collaboration and the development and utilization of multi-disciplinary teams.

The top four priorities received significant investment by all participants while the last three did not.

Priority One: Expanded support for bio-plastic pilot plant

R&D Ideas

- A project that evaluates the product opportunities of bioplastics and the specific characteristics needed to meet market standards—clearly identify and choose an opportunity which would result in commercial partners investing and moving forward
- Full pilot facilities with “Agri-food Discovery Place” resulting in ready access and facilitation for scale up
- Establish bioplastics pilot plant and continuation of funding to commercialization resulting in more products for prototype and eventual commercial product
- Build pilot plant to process bioplastics/bioproducts which will result in consistent, scaleable supply for testing commercially

Measure, Indicator or Action

- Consistent material, scaleability, physical testing capacity, testing by target industry
- Focus on integrated bioplastics/bio-composites projects
- Build teams that have science/business/markets around proposals initiatives

Investment \$20 X 6 \$10 X 1 \$5 X 1 Total: \$135

Priority Two: Agronomy and genetic tailoring of biomass

R&D Ideas

- Identify:
 - Important properties and how they vary in straw
 - What influences these properties
 - How to cost effectively manage straw
 - How to grade straw
 - Blend straw, fibre and by-products

Measure Indicator or Action:

- Consistency and volume of supply
- Understanding and managing the raw material
- More consistent and lower cost raw materials
- Cost effective ways to produce lower cost, more consistent and/or higher const agricultural fibres to make ag-fibres business more commercially viable

Investment \$20 X 3 \$10 X 7 \$5 X 1 Total: \$135

Priority Three: Lipid centre

- Establish large, multi-disciplinary research team on utilizing lipids for the creation of bioproducts under the same focus: lipid utilization centre

Measure, Indicator or Action

- Commercial Plant

Investment \$20 X 3 \$10 X 3 \$5 X 6 Total: \$120

Priority Four: Support for pilot plant for bio-fibres

- Support a pilot plant and lab for testing various agriculture fibres that can be grown in Western Canada

Measure, indicator or action

- More knowledge on properties of fibres

Investment \$20 X 2 \$10 X 3 \$5 X 2 Total: \$80

Priority Five: Testing facility for fibre and bioproducts

- Characterization of raw materials

Investment \$20 X 1 \$10 X 0 \$5 X 5 Total: \$25

Priority Six: Development of structural composites

- Development of high traction roads that don't degrade from resin/fibre
- Development of an extrudable railway—one piece tie/track and forming system using fibre/resin composite

Investment \$20 X 0 \$10 X 1 \$5 X 1 Total: \$15

Priority Seven: Innovation centre

- Workshops/seminars/learning
- Create tools for funders to help determine portfolios and projects to fund resulting in new tools for decision making
- Integration of market and research resulting in high value products that reach market

Measure, indicator or action

- Market research, competitive intelligence product and corporate development to get products to market

Investment \$20 X0 \$10 X0 \$5 X 2 Total: \$10

CONCLUSION

ACIDF committed to summarizing the discussion results into a report, testing it for validity and completeness, and then using the results to round out the business plan and the granting process. They will share it with their partners in the funding consortium, in industry, and with the workshop participants.

This is the first step in this process. While the results probably reflect the important priorities right now, ACIDF has learned this is a generative process and it is committed to a continuous review, learning and adaptation process to ensure the work the organization funds responds to an evolving industry.

The interesting reflection of the results is the low priority placed on melding the biopolymer and fibre areas, even though they often come together in commercial products. This implies the two areas of interest are still immature in development and dealing with more basic process-related issues.

ACIDF also realizes some key R&D projects or programs may require coordination and facilitation through solicited proposal calls and are open to that possibility.

Participants

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Poster Questions

What is happening that we can build upon?

- Some existing expertise and core knowledge groups in plastics and fibres (ARC, U of A, AT Plastics, EU partners, Netherlands, etc)
- Looking for new sources of fibre/oils for plastic production
- Existing crops that need to be maximized using existing technology
- Adoptions of crops for Alberta environment
 - Hemp as an example—transfer of Hemp experience to other crops
 - Need a receptor industry
- Wood bases composites reaching the market
- Biopolymers—U of A, ARC
- R&D industry development in Europe—other research institutions in Canada, U of T, Manitoba Composite Centre, U of S, Crop Fibres Canada, Biolin Research)
- Assist ASTM to more quickly develop testing methods for agriculture fibres and resins
- There are many existing networks—build upon them by connecting together and adding industry to the groups (Chamber of Commerce, etc)
- Lots happening, need to apply filters to focus, require technology feasibility, require industrial partner and sound business case

Where are there leveraging opportunities and what are they?

- Working with other research initiatives and centres (Biolin Research, Crop Fibres Canada, Composites Innovation Centre in Winnipeg)
- Other funders within Alberta, Canada and internationally
- Special interest lobby groups that would create awareness and market demand
- Existing and potential new companies
- Leverage with the public—create demand for the “bio-label”
- Partner with a large processor with deep pockets to incur the capital investment and with a distribution networks to make it feasible
- Find a “Kyoto” hook –sustainability
- Making someone else’s product better
- Adding functionality –integrate project manager concept

The most pressing need in bioproducts R&D

- Scalability—ability to mass produce as opposed to labs
- Consistency—same product attributes time and again
- Technology development/maximizing potential
- Focus-realizing that taking anything to market requires more focused approach
- Price competitiveness—value for dollar
- Functionality in marketplace—competitive advantage
- Fibre/bio-composite measurements (quality attribute measurements)
- Ability to measure quickly and cheaply
- Profitability at all stages development from producer to researcher to consumer (all stakeholders must have benefits)

- Coordination of research and development
- Understanding of product lifestyles
- Clear definitions/standards in North America of biodegradable versus compostible
- Landfill versus incineration
- Understanding of raw material variability
- Decortification technologies –cost effectiveness
- Economic sustainability

What needs to happen to create momentum in this area and how would it do that?

- Need to build science capacity –scientists, labs and lab technicians
- Need coordinated funding
- Need targeted research
- Need to focus around carefully selected opportunities because there is a danger of being spread too thin
 - create learning around a few opportunities and then leverage the learning to further opportunities
- Need receptor industry—market and industry partners—supply chain and distributors
- Need to identify secure, quality supply
- Need to identify “low hanging fruits”—easy to achieve products that would create momentum
- Create a vision of possibilities, knowledge base, human capital and educate people (general population) about the future potential in this area
- Need to work with appropriate lobby groups
- Need risk money (venture capital) government position to support proof of concept
- Support incubator concept
- Government policy for use of product –procurement policy
- Critical mass of expertise in selected areas

Barriers that need to be addressed”

- Properties, processing characteristics (fibres and polymer) and quick, quick cheap methods to test for these
- Consistent quality of bio-based products—current and relevant standards development/blending systems
 - ASTM standards for petroleum products that don’t suit bio-based materials
- Raw material supply and logistics to produce bioproducts
- Processing equipment to produce starting materials or feedstocks at the right scale. Equipment is currently too expensive for its productivity
- Lack of vision re opportunities
- What is in it for me? Many of the stakeholders are not motivated or don’t recognize the opportunity
- Ability to move cost up the value chain—need consumer demand
- Certification for bioproducts
- Inconsistent or disconnect between research and marketability—need market driven R&D programs
- Investment/focus/pilot facilities/critical mass
 - Since being in the business of converting agricultural commodities to products results in demands across many product areas, critical mass and multi-disciplinary approaches are required

- Need for integration of programs/initiatives/expertise within Alberta, regionally and nationally
- Integration of value chain (producer—processor—consumer)
- Lack of funding agency—support for innovative, risk orientated R&D—venture capital
- Support integrate bioproducts with forestry/petro-industry
- Legislation—procurement policy for bioproducts

The most significant opportunity in the bioproducts initiative is (because)

- Packaging and construction material (substitution opportunity) because it sounds green and is more environmentally marketable. It is perceived as being easier to dispose/recyclable/ (waste stream friendly)
- Bio-papers (substitution opportunity) because it saves trees, sounds green—cardboard, newsprint, Kleenex
- Fibres because of access to quality and quantify of feed stock
- Rail road ties
- Bio-plastic/bio-chemical/bio-material/bio-composite because the business of being in business means that you must look at the entire commodity utilization. Bioproducts dictate the opportunities for commodity utilization
- Fibre for specialty papers
- Fibre for “pulp sweeteners”
- Functional specialty chemicals—environmentally friendly solvents, pharmaceuticals, anti-oxidants, lubricants
- True bio-degradability of plastic (medical plastics)
- Biomass utilization
 - Crop based feedstocks (seed to oil, stalks to fibre) both food and non/food like plastics and chemicals
- Bio-fibre export markets (focus on client requirements) opportunity to be define niche—least cost or high quality by defining functionality price ratio

What R&D needs to be done? (Worksheet data before grouping)

What programs would contribute to achieving the identified outcomes	How
Focus: oilseeds and tallow –Lipid utilization centre	
Build critical multi-disciplinary team, all focused on same outcome	Build the centre by hiring world class team
Build pilot facility to scale up bio-plastic/chemicals/cosmetics	Secure dollars and build it
Study supply chain	Have closer study performed—improve current studies Tracing the value chain
Secure large partner	Done
Scale up infrastructure that is readily accessible—pilot facilities	

What programs would contribute to achieving the identified outcomes	How
Establish a pilot plant facility for bioplastics	Fund and construct a bioplastics pilot plant from funding agencies and industrial partner
Pilot plant and testing laboratory for agriculture fibres	Supported by Western Canada Industries/partners
Expand funding to Alberta bio-plastic network and Alberta Ag Fibre Network	Provide additional funds to focused projects
Characterize of raw materials (i.e. oils and fibres)	Research and development and instrumentation
Quality and consistency of raw materials before and after processing	
Application development	
Integration of market and research	
Funding through venture capital	
Basic research	
Bio-polymers	
Licensing technology	
Genetic tailoring of bio mass	
Help create tools for funders to help determine portfolios and projects to fund	Contract/technical support learning opportunities to build tool box
Build teams that have science/business/markets around proposals initiatives	Establish criteria
Understanding and managing the raw material	More consistent and lower cost raw materials