Summary of ADF Projects 2011: Crops Research Funding

42 crops-related research projects: $7,406,563

Breakdown by Commodity

Oilseeds.....$3,130,119

Cereals.....$2,284,975

Pulses $884,409

Horticulture.....$719,020

Other $388,040

Breakdown by Organization

University of Saskatchewan.....$5,179,811

Agriculture and Agri-Food Canada $1,004,100

NRC- Plant Biotechnology Institute $719,746

Saskatchewan Food Industry Development Centre $299,000

Metabolix Oilseeds Inc $203,906

University of Saskatchewan/Crop Development Centre

Pea yield formation in warming temperatures – phenological mechanisms
Objectives:

- Identifying the key physiological and phenological mechanisms associated with yield formation in heat sensitive (Western Canadian) and normal pea cultivars.
- Determining which phenological mechanisms in heat tolerant pea cultivars can improve yield in new pea cultivars for the prairies.

Funding: $80,000
Contact: Rosalind Bueckert, Plant Sciences, (306) 966-8826

Improving hard white wheat to meet changing quality requirements
Objective:

- Developing higher yielding hard white bread wheat cultivars with higher protein content and stronger dough properties combined with levels of seed dormancy similar to the cultivar Snowbird.

Funding: $406,400
Contact: Pierre Hucl, Crop Development Centre, (306) 966-8667

Improving the colour of Canadian Durum wheat for premium pasta markets
Objectives:

- Developing and validating a rapid protocol to accurately predict pasta colour for early generation selection in Canadian durum wheat breeding programs;
- Understanding the genetic and biochemical basis of pasta colour improvement over time;
- Developing a DNA marker-assisted selection protocol that can effectively be used by Canadian durum breeders to select durum wheat breeding lines expressing high pasta colour; and
- Using the rapid protocol and DNA markers identified to develop high yielding, elite durum breeding lines with improved carotenoid content coupled with enhanced pasta colour.

Funding: $331,876
Contact: Curtis Pozniak, Crop Development Centre, (306) 966-2361

Yield loss study of stemphylium blight on lentil

Objectives:

- Developing a protocol for the mass production of spores (conidia) of Stemphylium botryosum for the purpose of controlled inoculations;
- Conducting replicated field experiments to determine yield loss through stemphylium blight, using the tunnel system evaluated in the pilot study and the spore inoculum developed as the first objective;
- Evaluating and optimizing the use of tunnels and spore inoculation for resistance screening of lentil germplasm to stemphylium blight.

Funding: $91,642

Contact: Sabine Banniza, Crop Development Centre, (306) 966-4959

Genomics of clubroot disease development in canola and development of in planta RNAi to impart novel resistance

Objectives:

- Identifying the colonisation and disease development transcriptome of *P. brassicae* from large scale EST datasets (40,000) using suppression substractive hybridization libraries at different disease developmental stages.
- Host (*Arabidopsis* and canola) and pest (*P. brassicae*) gene expression profiling during different disease developmental stages using next generation high throughput sequencing (Illumina). Findings used to develop molecular markers for commercial canola resistance breeding programs.
- Identifying *P. brassicae* effector proteins involved in colonisation of canola roots and the identification and characterization of avirulance genes. Cataloguing and characterizing prevalent races based on the presence of avirulence genes triggering a HR.
- Deploying an in-planta RNAi approach to impart resistance to clubroot in commercially grown, high-yielding Canadian canola varieties.

Funding: $205,500

Contact: Peta Bonham-Smith, Biology, 306-966-4400

Evaluating wheat cultivars for variation in ergot infection

Objective:

- Determining if there is a genetic component controlling wheat susceptibility to ergot by:
  1. Establishing field testing protocols for ergot and correlate with greenhouse test; and
  2. Assessing the relative susceptibility of spring and durum wheat to ergot in field tests.

Funding: $96,200

Contact: Pierre Hucl, Crop Development Centre, (306) 966-8667

Integrating cultural, chemical and mechanical weed management for controlling herbicide-resistant broadleaf weeds in lentil

Objective:

- Providing an alternate method to reduce the impact of herbicide resistance in weeds by:
  1. Determining optimum management of herbicide-resistant broadleaf weeds (ALS or Group 2 resistant kochia and wild mustard) in lentil through a combination of physical, chemical and cultural methods; and
  2. Developing an integrated weed management program that will reduce herbicide selection pressure in lentil.

Funding: $75,000

Contact: Steven Shirtliffe, Plant Sciences, (306) 966-4959

Physical characterization of wheat low-temperature tolerance locus to yield perfect DNA markers to develop cold hardy cereals

Objectives:

- The completion of ongoing studies by:
  1. Delineating the 5A QTL region that is associated with LT tolerance in cold-hardy wheat lines to a sub-centiMorgan distance.
  2. Fully characterizing the functional properties of >23 CBFs encoded from the 5A QTL in cold-hardy Norstar and comparing the functional properties corresponding to CBFs produced in cold-sensitive winter wheat lines.
  3. Exploring the possibility for developing a new screening method for LT tolerance that is based on CBF functional properties.
  4. Analyzing the functional properties of CBFs produced in cold-hardy and cold-sensitive rye lines.
  5. Validating developed genetic markers for LT tolerance and winter survival by testing genotypes with variation for the traits.

Funding: $249,000

Contact: Ravindra Chibbar, Plant Sciences, (306) 966-4969.

Disinfestations of stored-grain insect pests using selective radio frequency (RF) heating
Objectives:

- Measuring the dielectric constant and the dielectric loss factor of the rusty grain beetle and CWRS wheat (cv. Lillian) at various moisture contents and temperatures at 27.12 MHz.
- Determining the mortality rate of the test insect at all life stages.
- Investigating the relationship of end-temperature of the mixture with RF exposure time, RF power level, and moisture content of the test grain.
- Checking the effect of RF treatment on a wide array of physio-chemical properties of the test grain along with germination and milling tests to assess its end-use quality.
- Assessing the cost per bushel of wheat to implement the technology.
- Disseminating the acquired knowledge and results to the Saskatchewan agricultural industry as well as international communities.

Funding: $119,000
Contact: Oon-Doo Baik, Agriculture and Bio-Resource Engineering, (306) 966-5320

Targeting insect reproduction for species-specific crop protection from insect pests
Objective:

- Reducing grasshopper reproductive potential by:
  1. Generating a full length clone of the oviposition-stimulating protein (OSP) from the migratory grasshopper *M. sanguinipes*.
  2. Generating OSP-RNAi hairpins in vitro, to feed to, and evaluate the reproductive capacity (fecundity) of *M. sanguinipes* females.
  3. Generating transgenic *Arabidopsis thaliana* expressing the OSP-RNAi construct driven from constitutive (i.e. CaMV 35S) and wound-inducible promoters.
  4. Rearing *M. sanguinipes* on transgenic (and control) *Arabidopsis* plants and evaluating reproductive capacity.

Funding: **$**72,000
Contact: Christopher Todd, Biology, (306) 966-4497

Novel expedited variation creation strategy for cereal crop improvement
Objective:

- Using a cereal spike culture system to generate mutations expeditiously for incorporation into wheat and barley breeding programs in order to:
  1. Use this system to create chemically (EMS) mutagenized populations for expedited variation mining in wheat and barley;
  2. Determine optimal EMS concentrations for future SCDV populations; and
  3. Assess the variants from our preliminary SCDV population using molecular tools for useful events that can be incorporated into breeding programs.

Funding: $118,000
Contact: Ravindra Chibbar, Plant Sciences, (306) 966-4969.

Genetic mapping of DNA markers of the different flax seed colour genes in RIL populations derived from crosses with CDC Bethune.

Objectives:

- Phenotyping recombinant inbred lines (RILs) of crosses involving lines with different seed colour genes and CDC Bethune.
- Genotyping the RIL mapping populations with selected DNA markers.
- Developing linkage group maps with selected DNA markers and identifying closely linked DNA markers with the different colour genes and other seed traits.
- Estimating genetic and environmental components of seed colour and other seed traits.

Funding: $130,200

Contact: Helen Booker, Crop Development Centre, (306) 966-5878

Developing deoxynivalenol (DON) screening capacity for CDC cereal breeding programs

Objective:

- Establishing a DON testing facility within the Crop Development Centre to service the spring wheat, durum and barley breeding programs.

Funding: $188,119

Contact: Curtis Pozniak, Crop Development Centre, (306) 966-2361

Assessment of a phenotyping facility for Saskatchewan

Objective:

- Examining the feasibility, usefulness and potential for a phenotyping facility (phenotron) in Saskatchewan. The drought response of specific barley and chickpea lines will be examined in a phenotron and compared to results from previous controlled experiments to assess the efficiency and cost-effectiveness of a phenotron, and to determine if such a facility in Saskatchewan would accelerate plant research.

Funding: $202,800

Contact: Dorothy Murrell, Crop Development Centre, (306) 966-8195

New vegetable crops and cultivars suited to Saskatchewan growing conditions and market demand

Objectives:

- Evaluating newly released cultivars of vegetable crops of commercial significance in Saskatchewan, comparing their field performance against presently recommended cultivars in replicated trials.
- Evaluating any new (or new to Saskatchewan) vegetable crops with the objective of determining the new crop's suitability to local production conditions and market requirements.

Funding: $208,100

Contact: Doug Waterer, Plant Sciences, (306) 966-5860

Field performance and agronomic requirements of new potato cultivars for local and export markets

Objectives:

- Evaluating newly developed potato lines for their suitability and desirability for licensing and production in Saskatchewan.
- Developing agronomic packages specifically adapted to the new potato cultivars of interest to the growers in Saskatchewan.

Funding: $200,000

Contact: Doug Waterer, Plant Sciences, (306) 966-5860

Soil nitrogen forms and turnover as affected by duration of no-till and N fertilization rate

Objectives:

- Determining the effect of soil management (duration of no-till, N fertilization rate) on soil N forms, amounts, and dynamics (release rates of available N).
- Evaluating the impact of the management practices (duration of no-till, N application rate) on soil organic and inorganic N amounts, release rates of available N, microbial respiration and nitrous oxide production in the surface horizon of the soil.
- Determining the time frame required to improve degraded soils when no-till, continuous cropping and different rates of N are used.

Funding: $19,500

Contact: Jeff Schoenau, Soil Sciences, (306) 966-6844

Biochars as amendments to improve fertilizer and water use efficiency and sequester carbon in soil

Objective:

- Evaluating the effectiveness of biochar soil amendments produced from locally sourced biomass as a means to:
  1. improve fertilizer and water use efficiency; and
  2. sequester carbon and lower greenhouse gas emission in Saskatchewan soils.

Funding: $194,800

Contact: Jeff Schoenau, Soil Sciences, (306) 966-6844

FHB screening of CDC barley breeding selections 2011 - 2016

Objective:

- Identifying CDC barley breeding lines with improved FHB resistance and low DON accumulation by:
  1. planting, maintaining and harvesting 2,400 CDC lines; and
  2. selecting and advancing promising breeding lines for crossing or potential variety release.

Funding: $400,000

Contact: Aaron Beattie, Crop Development Centre, (306) 966-2102

Breeding of grapes and apples with emphasis on juice products and rootstocks

Objectives:

- Breeding, selecting and testing table grapes, juice grapes, wine grapes and grape rootstocks that convey cold hardiness to the scions.
- Breeding, selecting and testing fresh eating, cider and fireblight-resistant apples, cider and apple rootstocks with fireblight resistance and compatibility.
- Developing production practices to further enhance winter hardiness.
- Developing methodology for rapid production of superior rootstocks and grafted trees, such as 'stenting' and tissue culture.
- Assessing sugars and acids useful for wine and cider makers.

Funding: $193,220

Contact: Bob Bors, Plant Sciences, (306) 966-8583

Endophytic Fungi: novel bioinoculants to enhance crop yield and stress resistance in Saskatchewan fields

Objective:

- Developing biofertilizer/bioprotectant products and field application methods for managing heat/drought and disease stresses affecting efficiency and profitability of wheat and barley production by:
  1. evaluating seed pre-treatment and soil inoculation methods for biofertilizer and bioprotectant inoculants;
  2. evaluating Saskatchewan native microbial inoculants for their ability to enhance stress resistance in wheat and barley, and for their ability to enhance yield in field trials; and
  3. elucidating differences in mechanisms by which fungal endophytes confer higher biomass production and stress tolerance to plants.

Funding: $169,500

Contact: Vladimir Vujanovic, Applied Microbiology and Food Sciences, (306) 966-5048

Feasibility study of an "off-grid" sprinkler irrigation system
Objectives:

- Determining the technical and economic feasibility of small-scale (< 3 ha.) solar-powered centre-pivot irrigation systems.
- Developing the technical constraints associated with designing and operating a solar-powered centre-pivot irrigation system (number of sunshine hours required, reliability of water delivery system, size of solar equipment required, optimum operating pressures, special irrigation management considerations, etc.).
- Identifying climatic regions within Saskatchewan that are suitable for solar irrigation (matching the available solar energy with seasonal plant water requirements).

Funding: $51,500
Contact: Warren Helgason, Chemical and Biological Engineering, (306) 966-5315

Dehumidification requirement determination and dehumidifier evaluation for humidity control in greenhouses
Objectives:

- Evaluating the performance of commercial-grade high-efficiency dehumidifiers in a greenhouse and conducting economic analysis on cost and benefit.
- Modeling the moisture balance in the airspace of the greenhouse and the water balance of the greenhouse in order to determine the dehumidification requirement of a greenhouse.

Funding: $117,700
Contact: Huiqing Guo, Agricultural and Bioresource Engineering, (306) 966-5350

Determining the representative sampling size for soil testing in direct seeding fields
Objectives:

- Identifying the representative length of the strip for soil testing purposes.
- Determining the optimal location (relative to row) for taking point samples for soil testing.
- Comparing different methods of soil sampling for accuracy and precision without knowledge of locations of fertilizer band.

Funding: $122,240
Contact: Bing Si, Soil Science, (306) 966-6877

An evaluation of soil water use efficiency for different seeding row spacings
Objective:

- Examining how stubble height affects the spring wheat and canola yield and water use efficiency with different row spacings.

Funding: $134,880
Contact: Bing Si, Soil Science, (306) 966-6877

Quantifying nitrogen loss from 15N-enriched crop residues: Developing a case for the lowering of N2O emission factors

Objective:

- Quantifying and comparing N2O emissions associated with the decomposition of pulse, oilseed and cereal crop residues, developing emission factors for these residues and comparing these to the emission factor for urea fertilizer. The specific objectives are to:
  1. quantify total- and 15N-N2O emissions resulting from the decomposition of 15N-labelled pulse, oilseed and cereal crop residues in Saskatchewan soils;
  2. quantify total- and 15N-N2O emissions associated with the use of 15N-labelled urea fertilizer in Saskatchewan soils; and
  3. calculate emission factors for the plant residues and fertilizer.

Funding: $67,467

Contact: Richard Farrell, Soil Science, (306) 966-2772

Development of formulated canola protein-based ingredients for the food industry

Objective:

- Developing encapsulated canola protein-based ingredients that could then be tailored to specific food application (ex. gelling, emulsions).

Funding: $162,000

Contact: Michael Nickerson, Food and Bioproduct Sciences, (306) 966-5030

Preparation of aqueous-ethanol-washed protein concentrates from air-classified pea protein

Objective:

- Determining the composition and functionality of the aqueous-alcohol-washed protein concentrates and the extracted by-products of air-classified pea protein.

Funding: $68,500

Contact: Robert Tyler, Food and Bioproduct Sciences, (306) 966-6940

Production of biolubricant from canola oil using solid catalysts

Objective:

- Preparing and characterizing a series of mesoporous catalysts for maximum conversion of products at different stages of canola-oil-based lubricant base stocks synthesis.

Funding: $194,000

Contact: Ajay K. Dalai, Chemical Engineering, (306) 966-4771

Industrial products from vegetable oils

Objective:

- Increasing the efficiency of biodiesel production using novel catalysts, and converting mustard, rapeseed and canola oils into biolubricants and oil additives.

Funding: $378,000

Contact: Martin Reaney, Food and Bioproduct Sciences, (306) 966-5027

Investigation and demonstration of close-coupled gasification combustion of raw glycerin and canola hull fibre fuel pellets/briquets

Objective:

- Demonstrating the performance and energy potential of canola fibre, canola meal fibre and crude glycerin obtained during canola-seed processing and biodiesel production, respectively, through gasification/combustion route.

Funding: $132,667

Contact: Ajay K. Dalai, Chemical Engineering, (306) 966-4771

Agriculture and Agri-Food Canada

Development of high-yielding self-compatible varieties in condiment yellow mustard (*Sinapis alba*)
Objective:

- Developing superior, high-yielding, high-quality self-compatible mustard cultivars by:
    1. Identifying plants with self-compatible (SC) alleles and developing genetically stable SC breeding lines.
    2. Studying the inheritance of the SC trait and developing diagnostic molecular markers for the gene(s) controlling the self-compatibility trait.
    3. Developing superior SC open-pollinated varieties with high seed-yield ability and improved quality profiles.

Funding: $400,000
Contact: Bifang Cheng, (306) 956-7691

***Final phase research to improve "hairy canola" trait in* Brassica napus**
Objectives:

- Improving additional new tester lines of *Brassica napus* with different expression levels and combinations of *Brassica napus* primary trichome regulatory genes.
- Testing hairy tester lines and hairy combination lines for *Phyllotreta* flea beetle feeding preferences and growth parameters in a field setting.
- Testing hairy tester and hairy combination lines for drought tolerance.
- Releasing hairy canola lines with flea beetle resistance to the plant breeding community.

Funding: $186,600
Contact: Margaret Gruber, (306) 956-7263

Protein allergenicity of mustard: assessment and risk reduction from seeds to products
Objectives:

- Developing a robust immunochemical method to assess the levels of allergenic proteins in Canadian-grown brown, oriental and yellow mustard.
- Evaluating the impact of industrial processing practices on the level of allergenicity.

Funding: $215,500
Contact: Janitha Wanasundara, (306) 956-7684

Maximizing the value of canola proteins obtained from a novel fractionation process
Objective:

- Generating economic value for canola seed proteins through understanding the biological and chemical value of major storage proteins to develop food and non-food uses.

Funding: $202,000
Contact: Janitha Wanasundara, (306) 956-7684

National Research Council of Canada

Production of* B. carinata *with improved oil and seed weight and high levels of nervonic and erucic acids for the biodiesel and health sectors

Objective:

- Producing *B. carinata* prototype lines with increased oil content and seed size, coupled with ultra-high levels of nervonic and other very long chain fatty acids such as erucic acid and reduced polyunsaturated fatty acids to make it a viable, dedicated new platform crop.

Funding: $210,692

Contact: David Taylor, Plant Biotechnology Institute, (306) 975-5268

Investigating the influence of Phospholipid signaling in canola performance under suboptimal climate conditions

Objective:

- Generating canola lines that have a higher tolerance to temperature extremes (heat and cold) and drought by:
  1. developing Diachylglycerol kinase (DAGK) transgenic sense and antisense lines;
  2. examining the effect of over-expression of Phospholipase D and DAGK on temperature and drought tolerance in DH12075; and
  3. profiling gene expression for temperature-tolerance and drought tolerance.

Funding: $206,150

Contact: Fawzy Georges, Plant Biotechnology Institute, (306) 975-4815

Targeting key lipid metabolism genes to improve Brassica seed oil traits

Objectives:

- Screening canola TILLing population (DH12705) for mutations in the LPCAT genes.
- Identifying canola LPCAT mutant lines with altered seed oil traits.
- Pyramiding mutation alleles to generate canola lines with higher oil yield.
- Developing a molecular platform to further enhance erucic content in high erucic rapeseed lines (hero).

Funding: $302,904

Contact: Jitao Zou, Plant Biotechnology Institute, (306) 975-5583

Metabolix Oilseeds Inc.

Advanced technologies for engineering of camelina (ATEC)
Objective:

- Generating polyhrdroxylbutyrate in the oilseed crop *Camelina sativa* by:
  1. developing a transformation method for Camelina and transforming camelina with PHB-synthesizing genes;
  2. regenerating transformed plants from callus tissue; and
  3. evaluating plants for PBH seed oil content.

Funding: $203,906
Contact: Benjamin Locke, (617) 583-1741

Saskatchewan Food Industry Development Centre

Develop a peanut-free replacement for whole peanut utilizing extrusion technology
Objective:

- Developing a peanut-like prototype using non-allergenic, Saskatchewan-grown ingredients utilizing extrusion technology.

Funding: $85,500
Contact: Shannon Hood-Niefer, (306) 964-1819

Utilization of extrusion technology to produce food products from Saskatchewan-grown crops
Objective:

- Developing and optimizing extrusion parameters to produce breakfast foods and snacks from Saskatchewan-grown cereals and pulses.

Funding: $94,000
Contact: Shannon Hood-Niefer, (306) 964-1819

Investigation into pulse proteins into meat and cheese alternatives utilizing low-, medium- and high-moisture extrusion technology
Objective:

- Testing the effect of low-, medium- and high-moisture extrusion cooking on structure and functionality of formed textured pulse protein ingredients for model meat and cheese foods.

Funding: $119,500
Contact: Shannon Hood-Niefer, (306) 964-1819