Agriculture Industry

The following guidelines are intended to provide examples of "experimental development" projects which would qualify for Canadian SR&ED (Scientific Research & Experimental Development) tax credits.

Content Summary:

1 - Guidelines for Crop Production in Controlled Environments:

Scientific or Technological Objectives:

[NOTE: THIS EXAMPLE IS REPRODUCED FROM THE CRA CONTROLLED ENVIRONMENT CROP PRODUCTION SR&ED GUIDANCE PAPER. A COMPLETE COPY OF THIS PAPER IS AVAILABLE FROM THE CANADA REVENUE AGENCY WEBSITE AT WWW.CRA-ARC.GC.CA/TXCRDT/SRED-RSDE/PBLCTNS/GRNHS-NTR-ENG.HTML.]

Regardless of any business-oriented objectives, scientific and technological objectives need to indicate the nature of the underlying scientific or technological obstacles/uncertainties and attempts to resolve them. For example, the following would be appropriate objectives:

- develop a specific cluster pruning and canopy maintenance regimen for maximizing production of a new tomato cultivar (indicating that there is a direct relationship between these specific horticultural methods and the yield response of this cultivar that was not known before);

- develop a micro-propagation process for uniform and consistent commercial production of Mandevilla sp. (indicating that development and introduction of a specific micro-propagation process resulted in efficient and uniform production of this specie); and

- identify the causal agent of a new pepper disease and develop measures to control it (as the causal agent was new, this may have required development of a new control measure).

It is important that the objective has a scientific or technological basis that is clearly identified. For example, the following objectives are too general in nature and would not provide sufficient focus on the work relevant to the intended advancements identified above:

- develop an advanced growing method for a new tomato variety;
- improved production process for Mandevilla sp.; and
- dealing with a new pepper disease.

Technology or Knowledge Base Level:

Benchmarking methods & sources for citings:
Typically, a grower undertakes SR&ED work after recognizing that the existing or available scientific knowledge or technology is inadequate to resolve a scientific or technological obstacle/uncertainty or to achieve the intended purpose. The available scientific knowledge or technology referred to above may represent the claimant's knowledge level or technology base, but could also be available in various sources such as:

- published scientific research, extension bulletins, and provincial publications available in the public domain;
- technical manuals and pamphlets from suppliers of seeds, chemical products, substrates, green-house equipments, etc;
- advice from university extension specialists or government greenhouse specialists or consultants;
- in-house expertise of the claimant's company; or
- specialized production protocols available in the public domain.

Field of Science/Technology:

Agriculture (4.01.01)

Intended Results:

- Develop new processes
- Develop new materials, devices, or products
- Improve existing processes
- Improve existing materials, devices, or products

Scientific or Technological Advancement:

Uncertainty #1: SR&ED Project Must Have Technological Uncertainty

In order to be SR&ED, the claimed work, even if it is for a business purpose, must address certain underlying scientific or technological obstacles/uncertainties in pursuit of advancement in technology or scientific knowledge through a systematic process of investigation or search by experiment or analysis. Activities such as simple trial-and-error troubleshooting, or the optimization of known parameters do not meet the requirements of SR&ED (because there is no technological uncertainty present).

Not knowing the outcome of testing a new crop or technique or the effect of new pest controls is not specific enough to constitute a scientific or technological obstacle/uncertainty. Hence, the SR&ED project does not necessarily start when a crop is planted.

For example, trying raised-trough technology on flowers (the technology is mostly used for tomatoes) and following guidelines provided by an expert does not in itself define the start of an SR&ED project. However, while implementing new technology one may encounter certain unexpected technological obstacles/uncertainties that can not be resolved by the experts, which may constitute the start of an eligible SR&ED project.

Activity #1-1: Testing New Varieties - Not Eligible for SR&ED

Work performed in Fiscal Year 2010:

Methods of experimentation:

A grower tests a newly developed variety recommended by a proprietor or seed supplier by planting two rows. The grower follows the recommendations and monitors the crop for a variety of traits or characteristics (for example, disease resistance, yield, fruit quality) to determine if the new variety is commercially promising. Based on the outcome of this trial, the grower decides whether the variety will be grown commercially.

This type of monitoring (although it may be done in a systematic manner) is undertaken for routine data gathering or for commercial purpose and not for the purposes of advancing technology or scientific knowledge. Therefore, such work does not qualify as SR&ED.

Activity #1-2: Cultural Management or Crop Husbandry Strategies - May Be Eligible for SR&ED

Work performed in Fiscal Year 2010:

Methods of experimentation:

NOT ELIGIBLE: Following the testing of the new variety, the grower may feel that there is a good chance for commercial success with a crop and proceeds with the growing of this new variety on a commercial scale. Depending on the zone size that can be controlled in the greenhouse, anywhere from 2 to 10 acres or more is planted. The grower proceeds to monitor the growth of the crop and, depending on its performance, adjusts a number of parameters to guide the crop to optimal production. However, greenhouse growers are generally aware of optimization techniques for parameters such as lighting, temperature, CO_2 and humidity. Also, the development and implementation of management protocols for controlling nutrient levels, de-leafing, thinning, and other operational practices are familiar to greenhouse growers. These approaches are part of standard practices applied by this industry sector. Therefore, this would not qualify as SR&ED.

ELIGIBLE: Work with respect to cultural management or crop husbandry strategies can fall in the realm of SR&ED only if the existing and available know-how is limited to such an extent that the claimant needs to conduct a planned systematic investigation, by experiment or analysis, to overcome technological obstacles/uncertainties. An example of SR&ED could be investigations performed to determine the influence of available potassium or calcium levels on the effect of CO_2 enrichment on tomato yields. In such cases, it is important to clearly establish how the SR&ED attempts to advance the existing know-how, knowledge and standard practices.

Results:

[NOTE: IF THERE WERE ANY TEST RESULTS FROM THIS ACTIVITY THAN THESE SHOULD BE STATED HERE]

Activity #1-3: Disease and Pest Control - May be Eligible for SR&ED

Work performed in Fiscal Year 2010:

Methods of experimentation:

No experimentation methods have been recorded for this Activity.

NOT ELIGIBLE: Often growers test or try new products such as bio-control agents that are newly introduced to the market. As the grower in this scenario often uses the product for the first time, or perhaps applies the strategy or product in a unique situation, the grower may have to make certain modifications or adjustments in order to optimize the process. Optimization of greenhouse operational parameters and practices using existing data, known principles and available knowledge (standard practice) to maximize the effectiveness of a strategy or product is not SR&ED.

ELIGIBLE: The work can be SR&ED only when the grower goes beyond standard and known practices by:

(i) approaching disease and pest control in a new, not previously known way; or

(ii) seeking new scientific knowledge through a systematic investigation using various treatments and a control in order to resolve a scientific or technological obstacle/uncertainty in pursuit of a scientific or technological advancement.

Results:

[NOTE: SIMILARLY, IF THERE WERE ANY TEST RESULTS FROM THIS ACTIVITY THAN THESE SHOULD BE STATED HERE]

Activity #1-4: Technology Transfer - May be Eligible

Work performed in Fiscal Year 2010:

Methods of experimentation:

NOT ELIGIBLE: Several techniques or technologies (for example, intercropping, growing crops year-round, and raised-trough and high-wire technologies) are relatively new technologies, but they have been used successfully in greenhouse or agricultural situations. Applying known technologies in a new or different situation generally does not constitute SR&ED.

ELIGIBLE: However, while testing, trying, or implementing new technology, one may encounter certain unexpected technological deficiencies or opportunities that translate to technological obstacles/uncertainties. If additional work is performed to address these, the claimant should determine whether that additional work is eligible SR&ED. Typically, the SR&ED project work would not begin until the technological obstacles/uncertainties have been clearly identified.

Activity #1-5: Work Must Be Systematic and Required to Resolve an Uncertainty

Work performed in Fiscal Year 2010:

Methods of experimentation:

NOT ELIGIBLE: A grower may learn that the total solids content and shelf life of tomato crops can be improved by using elevated levels of potassium, anywhere from two to five times the normal concentration. The grower decides to apply 300 ppm of potassium to the entire crop instead of the normal application of 100 ppm. This grower is not performing SR&ED. The general knowledge that using elevated levels of potassium improves the crop is publicly available. Implementing existing knowledge and techniques in one's commercial operations is not a technological advancement. The fact that the grower used the entire crop for this trial is indicative that the purpose of the trial was to produce a commercial crop. Further, the absence of a control group and other measures of a systematic approach indicate that this trial is not part of an SR&ED project.

ELIGIBLE: A grower normally uses potassium levels ranging from 50-100 ppm (depending on the stage of the tomato crop), and the grower would like to test the hypothesis that applying higher amounts during the fruit-bearing stage will increase the total solids of tomato fruit and thus enhance the shelf life of the tomato. The work may include testing potassium levels at 200, 250, 300, 350, 400, and 500 ppm as separate concurrent treatments (vs. 100 ppm as the control) and analyzing the total solids content, and determining its correlation with shelf life of the tomato fruits under different storage conditions. As this work directly corresponds to the technological objective of testing the hypothesis, it can be claimed as SR&ED work. The plot and sample sizes used must also be reasonable in respect of the SR&ED objective.

1 - Guidelines: Crop Production in Controlled Environments

Benchmarks: Internet searches: 15 sites / articles
Patent searches: 1 patent
Similar prior in-house technologies: 14 products

Objectives:

Uncertainty: 1 - SR&ED Project Must Have Technological Uncertainty

Key Variables:

Activity	Testing Methods	Results - % of Objective	Variables Concluded	Hours	Materials $	Subcontractor $	Fiscal Year
1 - Testing New Varieties - Not Eligible for SR&ED	Comparison of two strains	New variety met requirements (100%)	Climate tolerance	100.00	150.00	50.00	2010
2 - Cultural Management or Crop Husbandry Strategies - May Be Eligible for SR&ED	Analysis of effect of Calcium: 5 samples	1 sample met goal (20%)	CO2 level Calcium level	210.00	508.00	100.00	2010
3 - Disease and Pest Control - May be Eligible for SR&ED	Experimentation of treatment: 4 altervatives	Crop-loss reduced 50%	safety crop production rate	300.00	1,500.00	150.00	2010
4 - Technology Transfer - May be Eligible	Analysis: 2 systems	New system 75% of goal	Accuracy	192.00	3,000.00	1,500.00	2010
5 - Work Must Be Systematic and Required to Resolve an Uncertainty	Analysis of effect of Potassium	At 500ppm began to kill plant	Effect of Potassium	100.00	500.00	125.00	2010

2 - Guidelines: Formula Ingredient Manufacturing Specs (FIMS):

Scientific or Technological Objectives:

[NOTE: THIS EXAMPLE IS REPRODUCED FROM THE FOOD AND CONSUMER PACKAGED GOODS SECTOR SR GUIDANCE DOCUMENT AS PREPARED BY FOOD AND CONSUMER PRODUCTS MANUFACTURERS OF CANADA (FCPMC) AND CANADA REVENUE AGENCY (CRA)]

Desirable manufacturing and processing attributes are often accomplished by developing specifications for formulations and manufacturing parameters. (F.I.M.S. is the terminology used to describe this activity). In cases where such work involves a SR&ED project, those activities that directly contribute to the resolution of the technological uncertainties, qualify as SR&ED support activities.
[AN IDEAL TECHNICAL DESCRIPTION WOULD QUANTIFY THE OBJECTIVE PERFORMANCE PARAMETERS.]

Technology or Knowledge Base Level:

Benchmarking methods & sources for citings:
The technology involved in the development of product formulations and manufacturing process specifications usually requires SR&ED to meet consumer needs throughout worldwide geographical locations and temperature zones including:
1) Product stability,
2) consistency in quality,
3) flavor,
4) texture,
5) form,
6) extended shelf life &
7) safety
as some of the key attributes which this industry designs into its products.
[AN IDEAL TECHNICAL DESCRIPTION WOULD QUANTIFY THE PRESENT PERFORMANCE PARAMETERS MENTIONED ABOVE.]

Field of Science/Technology:

Agriculture (4.01.01)

Intended Results:

- Develop new processes
- Improve existing processes
- Improve existing materials, devices, or products

Scientific or Technological Advancement:

Uncertainty #1: Agricultural material variability

Materials used by the food and consumer packaged goods industry in its wide range of products are primarily derived from agricultural or chemical sources which tend to exhibit chemical and physical variability. In the case of those materials derived from agricultural sources, this variability is largely caused by factors such as:
1) time of harvest,
2) change in species variety,
3) growing location and conditions,
4) seasonal climatic variation,
5) water availability,
6) stress factors, etc.

The most significant underlying key variables are:
time of harvest, change in species variety, growing location and conditions (unresolved), seasonal climatic variation, water availability

Activity #1-1: Potentially eligible activities

Work performed in Fiscal Year 2009:

Methods of experimentation:

Due to the inherent variability of a wide variety of the materials used in producing food and consumer packaged goods, unanticipated and unacceptable results can occur, creating technological challenges that cannot be resolved using standard practice or knowledge available to the claimant. This may result in the performance of a SR&ED project to resolve the scientific and technological uncertainties encountered.

Results:

[NOTE: IF THERE WERE ANY TEST RESULTS FROM THIS ACTIVITY THAN THESE SHOULD BE STATED HERE]

Conclusion:

[AN IDEAL TECHNICAL DESCRIPTION SHOULD PROVIDE TECHNICAL CONCLUSIONS AS TO WHY THESE "RESULTS" AND RELATED "INTEGRATION ISSUES" WERE NOT "READILY PREDICTABLE" TO YOU FROM A TECHNICAL STANDPOINT?]

Key variables resolved: change in species variety, seasonal climatic variation, time of harvest, water availability

Uncertainty #2: Additive integration

In the case of other materials used for food and consumer packaged goods including preservatives, flavors, binders, fragrances etc., manufacturing or other source specific factors may introduce differing degrees of material variability.

The most significant underlying key variables are:
preservatives, flavors, binders, fragrances, manufacturing (unresolved)

Activity #2-1: Scale up and Commercialization

Work performed in Fiscal Year 2009:

Methods of experimentation:

In addition to the actual "small scale" formulations, as a project moves through various phases of development, frequent trials on a larger scale will be required. These experimental trials are often part of a SR&ED project using equipment of any appropriate scale.
[AN IDEAL TECHNICAL DESCRIPTIONS SHOULD DESCRIBE AND QUANTIFY THE TESTING PARAMETERS.]

Results:

[NOTE: SIMILARLY, IF THERE WERE ANY TEST RESULTS FROM THIS ACTIVITY THAN THESE SHOULD BE STATED HERE]

Conclusion:

[SIMIRLARLY FOR EACH ACTIVITY, AN IDEAL TECHNICAL DESCRIPTION SHOULD PROVIDE TECHNICAL CONCLUSIONS AS TO WHY THESE "SCALE-UP" AND RELATED "COMMERCIALIZATION ISSUES" DESCRIBED IN THE ACTIVITY ABOVE WERE NOT "READILY PREDICTABLE" TO YOU FROM A TECHNICAL STANDPOINT?]

Key variables resolved: binders, flavors, fragrances, preservatives

2 - Guidelines: Formula Ingredient Manufacturing Specs (FIMS)

Benchmarks: Internet searches: 13 sites / articles
Patent searches: 1 patent
Similar prior in-house technologies: 10 products

Objectives: (none)

Uncertainty: 1 - Agricultural material variability

Key Variables: change in species variety, growing location and conditions, seasonal climatic variation, time of harvest, water availability

Activity	Testing Methods	Results - % of Objective	Variables Concluded	Hours	Materials $	Subcontractor $	Fiscal Year
1 - Potentially eligible activities	Analysis of effect:5 factors	Determined new variety meets	time of harvest change in species variety seasonal climatic variation water availability	120.00	1,000.00	110.00	2009

Uncertainty: 2 - Additive integration

Key Variables: binders, flavors, fragrances, manufacturing, preservatives

Activity	Testing Methods	Results - % of Objective	Variables Concluded	Hours	Materials $	Subcontractor $	Fiscal Year
1 - Scale up and Commercialization	Experimentation with 5 variables	Product optimized for Scale	preservatives flavors binders fragrances	200.00	6,000.00	2,000.00	2009

3 - Guidelines: University assisted projects - simplified claims:

Scientific or Technological Objectives:

They are used by agricultural organizations, in part, to finance research and development work that benefits the individual contributors, as well as the agricultural industry as a whole. [PAYMENTS OF THIS SORT MAY ALLOW YOU TO MAKE SIMPLIFIED APPLICATIONS FOR SR&ED TAX CREDITS!]

Technology or Knowledge Base Level:

Benchmarking methods & sources for citings:
In the agriculture industry, investments eligible for SR&ED credits are often referred to as CHECK-OFFS, ASSESSMENTS, or LEVIES.

Field of Science/Technology:

Agriculture (4.01.01)

Intended Results:

- Develop new processes
- Develop new materials, devices, or products
- Improve existing processes
- Improve existing materials, devices, or products

Work locations:

Lab

Scientific or Technological Advancement:

Uncertainty #1: Determination of eligible work

Various universities and agricultural associations act as agents for farm producers in all matters relating to the SR&ED Program.

The universities and associations, have to satisfy an agent principal relationship. Differing levels of credits can be earned independent of whether the farm producer is participating in the decision making process.

Activity #1-1: Call to confirm eligibility

Work performed in Fiscal Year 2009:

Methods of experimentation:

- Process trials: 1 runs / samples

  Simplified filing procedures include the use of a form T661 Schedule A rather than including a full "project description."

  An additional 20% fully refundable (OBRI - Ontario Business Research Institute) tax credit may be earned by Ontario claimants.

  For more information, contact MEUK Corporation at 905-631-5600.

  You can also contact your local tax services office or visit the CRA's Web site at www.cra-arc.gc.ca/taxcredit/sred/menu-e.html

Results:

[NOTE: IF THERE WERE ANY TEST RESULTS FROM THIS ACTIVITY THAN THESE SHOULD BE STATED HERE]

3 - Guidelines: University assisted projects - simplified claims

Benchmarks: Consulted three experts

Objectives: Determine eligibilty of project

Uncertainty: 1 - Determination of eligible work

Key Variables:

Activity	Testing Methods	Results - % of Objective	Variables Concluded	Hours	Materials $	Subcontractor $	Fiscal Year
1 - Call to confirm eligibility	Process trials: 1 runs / samples	100%	Project Eligibility	20.00	250.00	0.00	2009

901 - Plant breeding example

Benchmarks:
Internet searches: 18 sites / articles
Patent searches: 2 patents
Similar prior in-house technologies: 23 products /

Objectives:
Yield improvement: 100 %
Lodging resistance improvement: 10 %
maintain disease resistance: 100 %
reduce cost: 4.5 $ per kilo
maintain time of maturity: 45 days

Uncertainty: 1 - Trait isolation combination

Key Variables: genotypes (xx), genotypes (yy), genotypes (zz)

Activity	Testing Methods	Results - % of Objective	Variables Concluded	Hours	Materials $	Subcontractor $	Fiscal Year
1 - Experimental crosses	Process trials: 9770 runs / samples	Yield improvement: 95 % (50 %) maintain time of maturity: 45 days (100 %) Lodging resistance improvement: 8 % (80 %) reduce cost: 4.9 $ per kilo (20 %)	genotypes (xx) genotypes (yy) genotypes (zz)	0.00	0.00	0.00	2009

Uncertainty: 2 - Maintain disease resistance

Key Variables: disease resistance, yield

Activity	Testing Methods	Results - % of Objective	Variables Concluded	Hours	Materials $	Subcontractor $	Fiscal Year
1 - Disease testing	Process trials: 40 runs / samples	maintain disease resistance: 98 % (100 %) Lodging resistance improvement: 8 % (80 %)	disease resistance	0.00	0.00	0.00	2009

901 - Plant breeding example:

Scientific or Technological Objectives:

Measurement	Current Performance	Objective
Yield improvement (%)	90	100
Lodging resistance improvement (%)	0	10
maintain disease resistance (%)	100	100
reduce cost ($ per kilo)	5	4.5
maintain time of maturity (days)	45	45

[NOTE: THIS EXAMPLE IS REPRODUCED FROM THE CRA PLANT BREEDING SEED INDUSTRY SR&ED GUIDANCE PAPER. A COMPLETE COPY OF THIS PAPER IS AVAILABLE FROM THE CANADA REVENUE AGENCY WEBSITE AT WWW.CRA-ARC.GC.CA/TAXCREDIT/SRED/MENU-E.HTML]

The objectives of this plant breeding project are to develop soybean cultivars, for the 2600 to 3000 heat unit areas of Eastern Canada, that offer the following improvements over existing cultivars:
- 10% improved yield over currently available cultivars
- 10% improved lodging resistance over currently available cultivars
- no sacrifice of resistance to leaf disease(s) or Phytophthora root rot.

Technology or Knowledge Base Level:

Benchmarking methods & sources for citings:

- Internet searches: 18 sites / articles -- Insufficient info
- Patent searches: 2 patents -- examined cultivar techniques from 2 US patents - not applicable due to climate differences
- Similar prior in-house technologies: 23 products / processes -- Prior cultivars

a) Initial Standard Practice(s):
Soybeans are typically accompanied by maturity delays or increased susceptibility to lodging and disease(s).

b) Departure(s) from Standard Practice(s):
The scientific/technological advancement expected in this plant-breeding project is the development of a new cultivar that embodies the genetic traits for higher yield and resistance to lodging in a genotypic combination that surpasses the performance features of existing cultivars without compromising disease resistance.

[AUTHOR'S NOTE: IDEALLY, THE TAXPAYER WOULD ATTEMPT TO IDENTIFY THE SPECIFIC METHODS OR VARIABLES WHICH CREATE THE PERCEIVED LIMITATIONS WITH RESPECT TO OBTAINING THE STATED OBJECTIVE(S).]

Field of Science/Technology:

Plant breeding & plant protection (4.01.08)

Intended Results:

- Develop new materials, devices, or products

Work locations:

Research Facility, Commercial Facility, on-site trial locations

Scientific or Technological Advancement:

Uncertainty #1: Trait isolation combination

The scientific/technological uncertainty relates to the feasibility of combining the desirable genetic traits from different germplasm sources into a superior performing cultivar out of thousands of possible segregating genotypic outcomes resulting from hundreds of crosses.

Need to evaluate the genome-wide gene expression profiles of various cell lines:
(xx) genotypes,
(yy) or
(zz) genotypes.

Determination of genes determines yield vs. early maturity.

The most significant underlying key variables are:
genotypes (xx), genotypes (yy), genotypes (zz)

Activity #1-1: Experimental crosses

Work performed in Fiscal Year 2009:

Methods of experimentation:

- Process trials: 9770 runs / samples - Total number of crosses/lines, as outlined below.

  During the current taxation year, the following work was undertaken and progress attained included:

  120 new parental crosses were made in the nursery

  4500 F3 lines meeting our selection criteria from the 2004 crosses were advanced to F6 by single seed descent using winter nurseries

  5000 F6 Lines originating from the 2003 crosses were tested in preliminary yield trials at 2 locations and 200 selected that met the criteria for further advancement

  150 advanced lines from the 2002 crosses were tested in advanced trials in 4 locations and 6 elite performers selected for wide area testing

  [AUTHOR'S NOTE: IDEALLY, WE WOULD ALSO EXPLAIN "WHY" ANY OF THE ABOVE DECISIONS WERE MADE.]

Results:

- Yield improvement: 95 % (50% of objective)
- Lodging resistance improvement: 8 % (80% of objective)
- reduce cost: 4.9 $ per kilo (20% of objective)
- maintain time of maturity: 45 days (100% of objective)

Conclusion:

The enhanced yield trait was more successfully transferred from (xx) genotypes than from (yy) or (zz) genotypes

There was a negative correlation between yield and early maturity (i.e. < 2900 heat units)

Five lines yielded at least 5% above commercial check varieties, with improved lodging and acceptable disease resistance.

[AUTHOR'S NOTE: IDEALLY, WE WOULD COMPARE RESULTS TO INITIAL EXPECTATIONS AND PROVIDE EXPLANATIONS OR "CONCLUSIONS," FOR RESULTS THAT WERE UNEXPECTED AT THE OUTSET OF THE WORK. THESE "CONCLUSIONS" ARE MORE RELEVANT TO DETERMINING SR&ED ELIGIBILITY THAN MERELY LISTING THE "RESULTS" (I.E. WHETHER THE END PRODUCT ITSELF WAS SUCCESSFUL).]

Supporting information must be generated over the course of the work to demonstrate a systematic experimental investigation in SR&ED. The type of records required would be those that would normally be generated in the course of undertaking plant breeding.

As a guideline, some examples of the kinds of supporting information that should be available for on-site review by the Canada Revenue Agency (CRA) may include the following:
1) background literature related to a project objectives and plan
2) record of genetic crosses
3) nursery data books
4) records of field trials
5) notes on experimental procedures
6) project note books and/or quantitative measurement data
7) results of statistical analyses
8) any other relevant material/information (e.g. photos) that substantiates the SR&ED work

Key variables resolved: genotypes (xx), genotypes (yy), genotypes (zz)

Uncertainty #2: Maintain disease resistance

Additionally, scientific uncertainty relates to the feasibility of achieving this result without sacrificing disease resistance, which is often compromised with yield improvements.

The most significant underlying key variables are:
disease resistance, yield (unresolved)

Activity #2-1: Disease testing

Work performed in Fiscal Year 2009:

Methods of experimentation:

- Process trials: 40 runs / samples - 5 lines tested at 8 locations.

  5 finished lines originating from the 2003 crosses were tested in pre-commercial trials at 8 locations, and tested in official public registration trials. Official tests will be used to corroborate our disease, quality and performance results and select candidates for registration and commercialization.

Results:

- Lodging resistance improvement: 8 % (80% of objective)
- maintain disease resistance: 98 % (100% of objective)

Conclusion:

Resistance to soil borne diseases (e.g. Sclerotinia, Alternaria) was influenced more by plant stature (i.e. lodging trait) than the presence of the disease resistance gene itself due to the closer proximity of foliage to the soil in lodged specimens.

[AUTHOR'S NOTE: IDEALLY, WE WOULD COMPARE RESULTS TO INITIAL EXPECTATIONS AND PROVIDE EXPLANATIONS OR "CONCLUSIONS," FOR RESULTS THAT WERE UNEXPECTED AT THE OUTSET OF THE WORK. THESE "CONCLUSIONS" ARE MORE RELEVANT TO DETERMINING SR&ED ELIGIBILITY THAN MERELY LISTING THE "RESULTS" (I.E. WHETHER THE END PRODUCT ITSELF WAS SUCCESSFUL).]

Key variables resolved: disease resistance

Benchmarks: Internet searches: 18 sites / articles
Patent searches: 2 patents
Similar prior in-house technologies: 23 products /

Objectives: Yield improvement: 100 %
Lodging resistance improvement: 10 %
maintain disease resistance: 100 %
reduce cost: 4.5 $ per kilo
maintain time of maturity: 45 days

Uncertainty: 1 - Trait isolation combination — **Key Variables:** genotypes (xx), genotypes (yy), genotypes (zz)

Activity	Testing Methods	Results - % of Objective	Variables Concluded	Hours	Materials $	Subcontractor $	Fiscal Year
1 - Experimental crosses	Process trials: 9770 runs / samples	Yield improvement: 95 % (50 %) maintain time of maturity: 45 days (100 %) Lodging resistance improvement: 8 % (80 %) reduce cost: 4.9 $ per kilo (20 %)	genotypes (xx) genotypes (yy) genotypes (zz)	0.00	0.00	0.00	2009

Uncertainty: 2 - Maintain disease resistance — **Key Variables:** disease resistance, yield

Activity	Testing Methods	Results - % of Objective	Variables Concluded	Hours	Materials $	Subcontractor $	Fiscal Year
1 - Disease testing	Process trials: 40 runs / samples	maintain disease resistance: 98 % (100 %) Lodging resistance improvement: 8 % (80 %)	disease resistance	0.00	0.00	0.00	2009

1001 - Improving Shelf Life of Tomatoes through Increased Potassium Levels:

Scientific or Technological Objectives:

Measurement	Current Performance	Objective
Increase micro-nutrient content (%)	91	95
maximum cost increase ($ per unit)	0.45	0.51
maintain Time of maturity (days)	15	15
Improve shelf life (days)	12	15
Increase mineral content (%)	90	95

[NOTE: THIS EXAMPLE IS REPRODUCED FROM THE CRA CONTROLLED ENVIRONMENT CROP PRODUCTION SR&ED GUIDANCE PAPER. A COMPLETE COPY OF THIS PAPER IS AVAILABLE FROM THE CANADA REVENUE AGENCY WEBSITE AT WWW.CRA-ARC.GC.CA/TXCRDT/SRED-RSDE/PBLCTNS/GRNHS-NTR-ENG.HTML.]

[AUTHOR'S NOTE: IDEALLY THE TAXPAYER WOULD ATTEMPT TO QUANTIFY THE OBJECTIVES THEY ARE TRYING TO ACHIEVE. A QUANTIFIABLE OBJECTIVE HAS BEEN ADDED ABOVE, TO ILLUSTRATE.]

Our objective is to determine whether applying higher levels of potassium during the fruit-bearing stage of the tomato crop will increase the total solids of tomato fruit and thus enhance the shelf life of the tomato.

Technology or Knowledge Base Level:

Benchmarking methods & sources for citings:

- Internet searches: 13 sites / articles -- Insufficient data
- Patent searches: 3 patents -- Not applicable due to different climate
- Similar prior in-house technologies: 1 products / processes -- current practice is to use potassium levels ranging from 50-100 ppm
- Literature Review: 5 articles

Our current practice is to use potassium levels ranging from 50-100 ppm (depending on the stage of the tomato crop). We currently use 100 ppm during the fruit-bearing stage.

From a literature review we have learned that the total solids content and shelf life of tomato crops can be improved by using elevated levels of potassium, anywhere from two to five times the normal concentration.

Field of Science/Technology:

Agriculture (4.01.01)

Intended Results:

- Develop new processes
- Improve existing processes
- Improve existing materials, devices, or products

Work locations:

Commercial Facility

Scientific or Technological Advancement:

Uncertainty #1: Effect of potassium levels during fruit-bearing stage on shelf life

Although literature indicates that using elevated levels of potassium improves tomato crops, we do not know whether we can achieve these improvements through increasing potassium levels only during the fruit-bearing stage.

As well, we want to determine a correlation between potassium level and total solids of tomato fruit, and the resulting correlation with shelf life under different storage conditions.

The most significant underlying key variables are:
potassium levels, storage conditions, total solids content

Activity #1-1: Correlating solids contents and shelf life with potassium levels

Work performed in Fiscal Year 2010:

Methods of experimentation:

- Process trials: 7 runs / samples - We tested potassium levels at 200, 250, 300, 350, 400, and 500 ppm as separate concurrent treatments (vs. 100 ppm as the control).

  We analyzed the total solids content, and determined its correlation with shelf life of the tomato fruits under different storage conditions.

  [IDEALLY WE WOULD SPECIFY THE 'DIFFERENT STORAGE CONDITIONS' TESTED.]

Results:

- Increase micro-nutrient content: 94 % (75% of objective)
- maximum cost increase: 0.5 $ per unit (83% of objective)
- maintain Time of maturity: 15 days (100% of objective)
- Improve shelf life: 14 days (66% of objective)
- Increase mineral content: 93 % (60% of objective)

Conclusion:

[AN IDEAL TECHNICAL DESCRIPTION SHOULD PROVIDE TECHNICAL CONCLUSIONS AS TO WHY THESE "RESULTS" AND RELATED "INTEGRATION ISSUES" WERE NOT "READILY PREDICTABLE" TO YOU FROM A TECHNICAL STANDPOINT]

Key variables resolved: potassium levels, storage conditions, total solids content

1001 - Improving Shelf Life of Tomatoes through Increased Potassium Levels

Benchmarks:	Internet searches: 13 sites / articles Patent searches: 3 patents Similar prior in-house technologies: 1 products / Literature Review: 5 articles	**Objectives:**	Increase micro-nutrient content: 95 % maximum cost increase: 0.51 $ per unit maintain Time of maturity: 15 days Improve shelf life: 15 days Increase mineral content: 95 %
Uncertainty:	1 - Effect of potassium levels during fruit-bearing stage on shelf life	**Key Variables:**	potassium levels, storage conditions, total solids content

Activity	Testing Methods	Results - % of Objective	Variables Concluded	Hours	Materials $	Subcontractor $	Fiscal Year
1 - Correlating solids contents and shelf life with potassium levels	Process trials: 7 runs / samples	Increase micro-nutrient content: 94 % (75 %) maximum cost increase: 0.5 $ per unit (83 %) maintain Time of maturity: 15 days (100 %) Improve shelf life: 14 days (66 %) Increase mineral content: 93 % (60 %)	potassium levels storage conditions total solids content	0.00	0.00	0.00	2010