

PRAIRIE RECOMMENDING COMMITTEE
FOR
WHEAT, RYE AND TRITICALE

OPERATING PROCEDURES

- FINAL DRAFT -

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1. INTRODCUTION

1.1 *Wheat Cultivar Registration and Market Classification in Canada*

The Canada Seeds Act and associated seeds regulations require that cultivars (varieties) of most agricultural crops be registered prior to seed sale in Canada and prior seed import into Canada (Seeds Act, 3. (1) (b)). The Canadian Food Inspection Agency (CFIA) under authority of the Canada Seeds Act registers cultivars of spring wheat, winter wheat and durum wheat. CFIA authorizes recommending committees to establish science-based criteria to determine suitability to be registered. The current variety registration system consists of three regulatory tiers of varying registration requirements (Schedule III, Parts I, II, and III).

Part I crops require testing prior to registration with official oversight and merit assessment to ensure that cultivars meet minimum standards. Registration requires a recommendation from a crop specific Registration Recommending Committee (RRC); e.g. cereals, pulses, flax, mustard. “Merit”, with respect to variety registration means that the variety is equal to or better than appropriate reference varieties with regard to any single characteristic or combination of characteristics that render the variety beneficial for a particular use in a specific area of Canada” (Seed Regulations 63). Merit is determined by the crop specific recommending Committees; not by any other party. Merit is only assessed for crops in Schedule III, Part I.

For western wheat varieties, the choice was made to have merit linked to the western grain classification system. Thus, registration testing of candidate cultivars is specific for the grain class to which they will be eligible if registered, as set out in the Canada Grains Regulations administered by the Canadian Grain Commission (CGC). The western wheat industry has decided that efficiencies are gained by determining the value for cultivation and the value for use (i.e. market classification) simultaneously. The PRCWRT has therefore established protocols for the concurrent determination of the value for cultivation and market classification so as to:

- increase predictability of market classification
- add value to experimental candidate cultivars
- increase the rate of new cultivar adoption

Candidate cultivars require merit assessment in registration trials that assess their suitability for a market classification; e.g. the Durum Wheat Cooperative Registration trial determines suitability for the Canada Western Amber Durum (CWAD) class and the Hard White Wheat Cooperative Registration trial determines suitability for the Canada Western Hard White Spring wheat (CWHWS) class.

Part II crops require testing prior to registration, with official oversight; i.e. a recommending Committee recommendation is required to verify that the testing was done. A demonstration of merit is not required.

Part III crops have basic registration requirements. Application is made directly to the CFIA-VRO.

1.2 Procedural Framework

This document outlines the merit testing and evaluation system operated by the Prairie Recommending Committee for Wheat, Rye and Triticale (PRCWRT). The PRCWRT is responsible for testing and evaluation of wheat, rye and triticale candidate cultivars for registration in the various agro-ecozones of western Canada, excluding the lower British Columbia mainland. The purpose of these activities is to generate relevant, unbiased, and representative data for candidate cultivars of wheat, rye and triticale, and upon request by the sponsors (or designate) provide informed recommendations regarding their merit for registration by the CFIA-VRO.

Common wheat or durum lines that are not candidates for existing wheat classes may be eligible for interim or contract registration. Interim registration for market development purposes requires experimental grades under the aegis of the CGC. CFIA mandates that contract registration requires strict identity preservation and a detailed quality control manual. Testing of candidate cultivars for contract registration is detailed in Section 6.

Non-standard types of wheat (e.g. spelt, rivet, dinkel, einkorn, club wheat), spring rye and winter triticale may be tested using the rules in Section 3.8 – Introducing New Crop Kinds. The introduction of new types of wheat into western Canada has many implications for existing wheat classes. The approval of a registration trial protocol does not imply that the infrastructure to accommodate it will exist.

Candidates that have the potential to cause biological and/or environmental harm as defined by CFIA may be rejected for registration. The PRCWRT has no legal authority to refuse a recommendation for registration to the CFIA-VRO for candidates that have merit.

2. THE PRCWRT

2.1 Operating Procedures

The PRCWRT operating procedures are approved by the CFIA-VRO. The operating procedures will undergo a regular full review; however, changes may be proposed at any time. All changes to the operating procedures or their appendices require a Committee motion supported by a simple majority vote and approval by the CFIA-VRO. Amendments will be published in the annual PRCWRT minutes and updated operating procedures reflecting the changes will be posted to the PRCWRT website, following CFIA-VRO approval. Changes in operating procedure become effective on April 1.

Under exceptional circumstances, in order to be flexible and exercise good judgment, it may be necessary for the Committee to temporarily set aside the approved operating procedures. This should not be a regular occurrence and requires a motion to suspend regular procedures supported by a minimum two-thirds majority vote. The rationale for setting aside the regular procedures and the record of the empowering vote will form part of the recorded decision. In addition, the CFIA-VRO must be notified in writing of any candidate cultivar supported where regular guidelines have not been adhered to and the reasons for the special consideration.

Disagreements on procedural interpretation will be raised at the Committee meeting and settled by majority vote. New wording to clarify the offending procedure and its interpretation will be drafted.

2.2 Terms of Reference

PRCWRT mandates:

1. To establish test procedures and co-ordinate trials to evaluate the merit of potential cultivars of wheat, rye, and triticale.
2. To assess the merit of lines in registration trials and make recommendations to the CFIA-VRO regarding the suitability of candidate cultivars for registration in the various agro-ecozones of western Canada, excluding the lower British Columbia mainland.

Additional objectives:

1. To act as a forum for exchange of information relevant to the development of improved cultivars of wheat, rye and triticale for western Canada.
2. As a crop specific stakeholder group, to provide expert input to federal and provincial agencies regarding proposed or existing legislation and regulations governing wheat, rye, and triticale breeding and cultivar production.

2.3 Structure and Membership

2.3.1 Structure

The PRCWRT (the Committee) consists of three Evaluation Teams responsible for the merit assessment of agronomic performance, disease/pest resistance and end-use quality.

- Agronomic Evaluation Team (AET)
- Disease Evaluation Team (DET)
- Quality Evaluation Team (QET)

Each Evaluation Team must have a Chair and Secretary. These six individuals form the PRCWRT Executive from which the PRCWRT (Committee) Chair and Secretary will be selected. The Committee and Evaluation Team Chairs and Secretaries must be approved by a majority vote.

Terms for individual members of the Executive Committee will normally be three years. These terms are renewable and commence on April 1. For the sake of continuity, it is encouraged that secretaries take the position of Chair following completion of a three-year term.

In circumstances where a Chair is unavailable to act in the official capacity of the position, the Secretary will assume the role of Chair. In this case or where the Secretary is unavailable, the Chair (elected or acting) will appoint a temporary Secretary from among the membership of the Evaluation Team or Committee, whichever is appropriate.

2.3.2 Membership

The PRCWRT has two types of membership: full (voting) and associate (non-voting). New PRCWRT members are nominated by a current full member and are approved by a simple majority vote of the Committee. Membership lists will be updated annually and provided to the CFIA-VRO for each Evaluation Team, indicating the elected Chairs and secretaries, and for the associate members.

All PRCWRT members will be provided access to the proprietary area of the PRCWRT website, which has the registration trial data associated with the three Evaluation Teams. All members must have internet access and an email address, as this is the primary method of communication by the Committee.

Individuals who do not qualify for full or associate membership but are interested or otherwise involved with the process may register for the meetings as guests. Guests have a voice in discussions and may provide input at the Evaluation Team and Committee levels, but do not have a vote.

2.3.2.1 Full Members (voting privileges)

Eligibility for full voting membership consists of crop value chain stakeholders who are actively engaged in the production, development, processing, marketing, and/or evaluation of potential wheat, rye and triticale cultivars and possess the expertise to do so.

Voting members of the three Evaluation Teams must represent a sector of the cereal stakeholder value chain. New members are considered based on their ability to contribute to the recommendation process rather than the organization they represent. To become a voting member, an individual must attend a complete PRCWRT meeting as a guest and be nominated by a full member to an Evaluation Team, based on the expertise that the nominee possesses. On becoming a full member, voting privileges are granted. It is expected that members will vote impartially, declare conflicts of interest, and attend the annual meeting regularly.

There is no membership cap on the number of voting members per Evaluation Team. All full members are allowed to vote at the Evaluation Team level; however, a maximum of 25 members per Evaluation Team will be allowed a vote on operational matters at the Committee level. If the number of Evaluation Team members attending the PRCWRT meetings is greater than 25, each Evaluation Team Chair will call for members to temporarily give up their voting privilege. In the event that there are insufficient volunteers willing to forego their voting privilege, the 25 voters will be determined randomly. A record of the members who have relinquished their vote will be kept so that they will be allowed a vote at the next annual meeting.

Full members who fail to attend the PRCWRT Annual Meeting for two consecutive years will be moved to Associate Member status unless an acceptable excuse is provided to the Committee Chair.

2.3.2.2 Associate Members (non-voting)

Associate members are individuals with a direct interest in Committee activities but do not meet the criteria for full membership or do wish to have the associated responsibilities. Associate members do not have voting privileges but are allowed a voice during Committee and Evaluation Team meetings and have full access to the proprietary area of the PRCWRT website.

2.4 Meetings

The PRCWRT normally meets annually in late February at a location determined at the previous annual meeting. The meeting location, room allocation, audio-visual equipment, food and refreshments are organized by the Prairie Grain Development Committee (PGDC) but the PRCWRT is responsible for organizing all other meeting aspects. Extra-ordinary meetings may be called on 30 days notice or less upon the consensus of the membership.

Meetings are open to all interested parties but registration is mandatory. Graduate students will be allowed to attend the meetings without paying the registration fee. The Committee or Evaluation Teams may, by a majority vote, create members only portions of the meetings as necessary.

Meetings will operate under Robert's Rules of Order.

3. REGISTRATION TRIALS

3.1 Purpose and Definitions

The PRCWRT, as a variety registration recommending committee approved by the Minister, sanctions registration trials and establishes the testing protocols for the merit evaluation of wheat, rye, and triticale candidate cultivars. The purpose of registration trials is to provide representative data to the Committee for the determination of merit of the candidate cultivar and a final recommendation to the CFIA-VRO regarding variety registration.

Registration trials are replicated, multi-location agronomic performance tests supplemented with tests for disease/pest response, end-use quality, and/or other important traits as deemed appropriate by the Committee.

3.2 Registration Trial and Protocol Endorsement

Registration trials may be conducted by the public or private sector, individually or through collaborative arrangements. Prior to the commencement of registration testing, the protocols used in the conduct of the registration trial must be approved by each Evaluation Team as it relates to their expertise. The data collected must be relevant to the mission and agro-ecological zone of the registration trial. For existing registration trials with well-established and approved protocols, Committee approval is implicit if no concerns are raised by the membership, and there are no proposed changes to the traits collected, experimental protocols, or check cultivars used.

Where there is disagreement over the testing protocol, interpretation, or validity of data, the majority decision of the appropriate Evaluation Team will be final. It is recognized that consultation and discussion between Evaluation Teams may be necessary to arrive at a consensus and final decision.

The mission of each approved registration trial, the primary contact person, check cultivars, agronomic traits to be measured, disease resistance guidelines, end-use quality testing requirements, and the methods of evaluation will be reviewed annually and described in the following appendices:

- Appendix A: Registration Trial Missions
- Appendix B: Check Cultivars
- Appendix C: Measurement of Agronomic Traits
- Appendix D: Guidelines for Disease Resistance in Wheat and Triticale
- Appendix E: Disease Screening Protocols
- Appendix F: Wheat and Durum: Measurement of Quality Traits

Historically, members of the PRCWRT have collaborated for the efficient use of limited resources. This collaboration in operating the various registration trials resulted in the commonly used terms of “cooperative tests”, “co-ops”, and “C-Level” trials. Collaborators involved in the conduct of a registration trial will set its operating principles. For a set of principles developed by “cooperative test” collaborators, please see Appendix K.

3.3 New Registration Trials

A request and proposal for a new registration trial must be submitted to the PRCWRT no later than February 1 in the year of first planting. It is advised that all Evaluation Team Chairs be notified of the intent to request a private registration trial prior to the February 1 deadline to provide guidance to the requesting party and expedite the approval process.

Prior to the commencement of registration testing, the protocol used in the conduct of the registration trial must be approved by each Evaluation Team as it relates to their expertise. This review and approval step is to ensure that data on the appropriate traits are collected, and appropriate experimental protocols and check cultivars are used to facilitate assessment of the candidates by the Evaluation Teams and the Committee. Without registration trial and protocol endorsement, the collected data will not be considered by the PRCWRT.

Entities participating in a registration trial are reminded that changes in protocol may be mandated by the Evaluation Teams and thus, the protocol approved in the first year of testing may not be the same as that in years two and three. The registration trial coordinator is responsible for maintaining current knowledge of accepted procedures and implementing any required changes in protocol.

3.4 Merit Assessment

This section details merit assessment for candidate cultivars of wheat, rye and triticale under the auspices of the PRCWRT. For specifics on data requirements, traits measured, and trial reporting for candidates of CWGP wheat, fall rye, and spring triticale, please refer to sections 3.4.4 and 3.4.5.

3.4.1 Yield and other Agronomic Characteristics

3.4.1.1 Data Requirements and Traits Measured

The conduct of registration trials at multiple sites over several years provides the opportunity for merit assessment of yield and agronomic performance under a wide range of growing conditions. Registration testing of individual lines will normally encompass three consecutive years at an approved set of sites across a broad range of climate and soil types in the area of expected commercial production. One site per year may be altered from the approved list without prior consultation. A standard of eight sites of

acceptable grain yield data per year, for a total of at least 24 site-years, collected over three years or more are required prior to consideration of a candidate for registration recommendation. With the exception of grain yield, data for the prescribed agronomic traits are required from at least three sites per year.

The agronomic traits to be measured for the registration trials sanctioned by the PRCWRT for the various wheat classes, fall rye and spring triticale are summarized in Appendix C.

The first year of registration testing for a candidate cultivar may occur outside of the formal merit assessment system provided that it emulates subsequent years of registration testing as outlined in this section (3.4 – Merit Assessment).

3.4.1.2 Check Cultivars

Check cultivars for each registration trial are chosen by the Committee to represent specific grain classes, types and adaptation. Check cultivars will include widely grown, established cultivars, special purpose cultivars (e.g. solid stem cultivars resistant to wheat stem sawfly), or recent cultivars of improved merit. An improved cultivar with an offsetting weakness in a particular trait (e.g. a high yielding cultivar with unusual susceptibility to bunt) may be included as a check without diminishing the selection standard for the trait in which it is deficient. Such check cultivars will be specifically excluded as a check for the trait(s) in which they are deficient at the time of their elevation to check status and all such exceptions are to be noted in the list of checks.

Changes in check cultivars must be approved by the Committee and will be recorded in the annual Committee minutes.

In the case that a newly recommended candidate cultivar is approved as a check, the data collected during its registration testing are considered to be check data.

Candidate cultivars will be assessed relative to the range of the appropriate checks of the class for which they are being considered. Note that because checks will change over time, they may not be the same as those when the line was entered into the registration trial.

Seed stocks for check cultivars used in the registration trials must be of reasonable purity. As a guideline, the standards for purity and germination should be similar to that required for Certified seed, as defined by the *Seeds Regulations, Part I*.

3.4.1.3 Quality Assurance

A. Experimental Design

Individual registration trials will be no larger than 36 entries, with a minimum of three complete replicates planted. Use of recognized experimental designs that permit localized error control through the use of sub-blocks is encouraged.

B. Site Inspections

The registration trial coordinator must ensure that at least one-third of the sites are inspected each year. Inspections are to be conducted by a recognized plant breeder who is independent of the test site. For example, the research trial coordinator may inspection test sites conducted by collaborators. Further, inspection of a registration trial by a plant breeder employed at the same location is permissible if there is no association with the trial.

Access to registration trials will be granted to the test coordinator, collaborators, and other parties with a bona fide interest in the test. Site collaborators should be contacted in advance to provide entrance to the site, treatment lists, randomizations, and other pertinent information.

Inspectors should discuss any concerns about the trial site with the individual responsible and, if possible, agree on corrective action. A brief, critical evaluation of the site should be written, identifying the areas that required attention and the solutions discussed. These reports are to be forwarded to the registration trial coordinator for follow-up and additional inspection if necessary. If the issues are not resolved to the satisfaction of the coordinator, notification of the PRCWRT Chair is required.

A form to assist in the inspection of registration trial sites is in Appendix J.

C. Statistical Acceptability of Data

Grain yield data will be considered acceptable if the coefficient of variation (CV) is less than 12%. Yield data may be acceptable if the CV is in the range of 12% to 15% and the appropriate F-test for genotypes is significant ($p < 0.05$), or in the range of 15% to 20% if the appropriate F-test for genotypes is highly significant ($p < 0.01$).

D. Loss of Data

The loss of data from natural causes (e.g.: drought, flooding, hail, complete winterkill) is often unavoidable; however, the loss of data due to pre-existing conditions (e.g. soil variability, salinity, weed problems) should be minimized. Where there is a shortfall from 24 broadly distributed site-years of acceptable grain yield data over three years, justification and Committee approval is required for acceptance of the data package in the *Request for Support of Registration* document.

3.4.2 Disease Resistance Characteristics

The Disease Evaluation Team evaluates the merit of candidate cultivars based on the resistance to the following diseases:

- stem rust (*Puccinia graminis*)
- leaf rust (*Puccinia triticina*)
- stripe rust (*Puccinia striiformis*)
- common bunt (*Tilletia caries* and *T. foetida*)
- Fusarium head blight (*Fusarium graminearum*)

These diseases must be assessed in a manner acceptable to the Disease Evaluation Team, using a mixture of races carrying all commonly occurring virulences. It is recommended that seedling reactions to common races of stem and leaf rust also be determined.

The assessment of additional disease resistance traits is for information purposes. Demonstrated resistance to other diseases may assist in presenting a positive case for recommendation of the candidate.

Disease resistance guidelines are published in Appendix D. The protocols to be used for disease screening are detailed in Appendix E.

3.4.3 End-use Quality Testing

Requirements for end-use quality evaluation vary depending on the wheat class for which the candidate is intended (Appendix F).

For quality assessment, grain from individual sites will be combined into composites for each check and candidate cultivar. The CGC will provide a site blending formula to be followed for all checks and candidate cultivars in the trial. These composites will be based on CGC determination of protein concentration and grade of the check cultivars from the individual trial sites. Inclusion of grain from some trial sites may be limited or eliminated based on protein concentration and degrading factors. More details on this process are provided in Appendix F.

3.4.4 Canada Western General Purpose Wheat

3.4.4.1 Data Requirements

A minimum of 15 site-years of agronomic data collected in western Canada over a period of two or more years, with at least two locations per province per year in at least two provinces, is required. Data must be collected from the area of adaptation and intended production. Use of pre-registration trial data may be used to meet the minimum requirement for 15 station-years of agronomic data, provided that it is of acceptable quality as defined in section 3.4.2.3 - Quality Assurance.

Three years of disease resistance data are required and may consist of one year of pre-registration trial data and two years of registration trial data. If it is deemed that there is insufficient disease resistance data to provide a recommendation, a third year of registration testing may be requested by the Disease Evaluation Team. The collection of additional disease resistance data will not necessitate additional agronomic testing.

3.4.4.2 Traits Measured

Please refer to Appendices C and D for the list of traits that must be measured, relative to appropriate check cultivars.

3.4.4.3 Trial Reporting

Registration trial reporting for the Canada Western General Purpose wheat class is the same as that outlined in section 3.6

3.4.5 Fall Rye and Spring Triticale

3.4.5.1 Data Requirements

A minimum of 15 site-years of agronomic data collected in western Canada over a period of three or more years is required. Data must be collected from the area of adaptation and intended production. Disease resistance data is required for at least two of the years of testing.

3.4.5.2 Traits Measured

Please refer to Appendices C and D for the list of traits that must be measured, relative to appropriate check cultivars. If the candidate is intended as an animal feed or forage crop, inclusion of data indicating its suitability for the proposed purpose is appropriate and encouraged.

3.4.5.3 Trial Reporting

Registration trial reporting for fall rye and spring triticale is the same as that outlined in section 3.6.

3.4.6 Foreign Data

A total of four site-years of the required minimum of 24 site-years of grain yield data may come from Montana, North Dakota and/or Minnesota (states that share a border with the Canadian Prairie Provinces). This does not apply to Canada Western General Purpose and non-standard types of wheat, all rye, and all triticale, as these classes/crop kinds have reduced data requirements (see Section 3.4.4.1). Data collection from these foreign sites must emulate the registration trial protocols conducted in Canada and meet the merit assessment criteria as outlined in Section 3.4.2.

Disease resistance data from outside of Canada is acceptable provided that the candidate sponsor can demonstrate that the race mixture was similar to that in western Canada and that PRCWRT sanctioned protocols were used. Discussion by the Disease Evaluation Team and a subsequent vote accepting the data is required.

The composite sample used for end-use quality testing may contain grain from one foreign site each year. Conduct of the end-use quality testing (e.g.: milling, baking, etc.) may occur anywhere, provided that the appropriate protocols are followed, as defined by the Quality Evaluation Team.

3.5 Service Fees

Registration trials run by private entities may have access to disease and quality testing used within the public sector under a fee-for-service arrangement, if resources permit. The establishment of these arrangements is not a function of the PRCWRT.

3.6 Trial Reporting

Annual reports of the registration trials will be made available to the PRCWRT membership at least seven days prior to the February annual meeting. A draft report may be circulated in advance so that there is ample time to produce the *Request for Support of Registration* documents. In practice, the end-use quality evaluation reports will be made available as soon as possible before the meetings.

The registration trial annual report must include information on test collaborators, site conditions, planting date, plot size, fertilizer and pesticide use, and area harvested. Data for each agronomic trait must be summarized on a site and overall mean basis, with coefficients of variation (CV) and least significant differences (LSD) or standard errors reported for each data type, if possible. All disease resistance data must also be reported. The creation of a summary page reporting the means for each agronomic and disease resistance trait is encouraged.

If errors in the registration trial annual report are found by the membership, a clearly identified revised report will be made available and posted to the PRCWRT website within two weeks of the error being detected.

3.7 Canadian Wheat Workers Code of Ethics

While not a requirement for conduct of a registration trial, several collaborating institutions that operate and participate in registration trials have chosen to adhere to the principles outlined in the Canadian Wheat Workers' Code of Ethics (Appendix I). A copy of the code should be included in each registration trial report to which it applies. Registration trials conducted by individuals or collaborating entities in which the use of candidate cultivars is prevented or restricted must clearly communicate these requirements in the registration trial report.

3.8 Introducing New Crop Kinds

3.8.1 Preface

Spring rye, winter triticale, and non-standard types of wheat that are ineligible for existing wheat classes (e.g. spelt, rivet, dinkel, einkorn, club wheat) may be merit tested using the rules in this section.

Non-standard types of wheat require special planning prior to their entry into registration trials, particularly as it relates to appropriate quality testing. Quality testing to assess potential in existing or new markets must be performed in consultation with a grain marketing entity and the CGC prior to entry into an existing or new registration trial. It is the responsibility of the candidate proposer and marketing entity to determine how the new wheat type should be produced for early quality and market testing purposes.

Following early market testing of a new wheat type, if the developer wishes to proceed toward registration, a new registration trial may be required (see Section 3.3). Entry of a new wheat type into a registration trial must be accompanied by comments from the marketing entity regarding the market potential of the new wheat type, and CGC comments on initial plans for handling and segregation of the wheat type, if registered.

Registration testing of spring rye, winter triticale, and non-standard types of wheat will proceed as outlined in Section 3.4 (Merit Assessment), with the data requirements and traits measured as outlined below. It is strongly recommended that the Evaluation Teams are consulted to ensure that the testing regime and traits measured are appropriate.

3.8.2 Data Requirements

A minimum of 12 site-years of agronomic data collected over a period of three or more years is required and must be of acceptable quality as defined in section 3.4.2.3 - Quality Assurance. All data must be collected from the area of Canadian adaptation and intended production.

Disease resistance data is required for at least two of the years of testing.

3.8.3 Traits Measured

The following agronomic traits must be measured relative to appropriate check cultivar(s): grain yield, maturity, height, lodging, kernel weight, test weight and relevant disease resistance characteristics. For fall-seeded crops, winter survival must be reported. If the candidate is intended as an animal feed or forage crop, inclusion of data indicating its suitability for the proposed purpose is appropriate and encouraged.

The collection of disease reactions for stem rust, leaf rust, stripe rust (2015), Fusarium head blight and common bunt according to Disease Evaluation Team protocols are required for three years.

Quality traits for spring rye and winter triticale should emulate those collected for fall rye and spring triticale, respectively. The end-use quality characteristics required for a non-standard type of wheat will be determined by the entities responsible for early quality and market testing (see Section 3.8.1.).

4. REQUESTS FOR SUPPORT OF REGISTRATION

4.1 Requirements for Full or Interim Registration

For crop kinds listed in Part I, Schedule III of the *Seeds Regulations*, a candidate cultivar must have a recommendation from a recognized registration recommending Committee (the PRCWRT in western Canada) in order to be registered by the CFIA-VRO. Recommendations to “support” or “object to” a candidate cultivar are made on the basis of merit determination which is assessed by the PRCWRT based on data collected and sanctioned by the Committee via the registration trials. Consideration of the candidate cultivar will be based on the sponsor providing a *Request for Support of Registration* document to the Committee members no later than the Monday, at least one week prior to the start of annual meeting.

A *Request for Support of Registration* will normally be for full registration. Except in very unusual circumstances, the Committee will only consider candidates that have demonstrated merit following three years of registration testing. If a candidate has been tested in registration trials for three years, but data are absent for a trait or set of traits through no fault of the sponsor, consideration of the candidate may proceed using the data that are available.

Interim registration following two or three years of registration testing may be requested if for market development purposes. Interim registration following one year of registration testing may be requested if there is a demonstrated urgent need and general benefit to the industry. It is advised that the CGC be consulted prior to seeking interim registration, since market classification and the establishment of experimental grades are necessary. Suspension of normal Committee procedure is required for all cases

in which consideration for interim registration is sought. Note that all proposed motions to suspend normal operating procedures require a two-thirds majority vote to pass.

The maximum period for interim registration is five years. The Committee may make an initial recommendation for interim registration for up to 3 years, with the requirement of recommendation renewal to achieve the total of five years.

The CFIA-VRO must receive an *Application for Registration* by August 31, approximately 30 months after the recommendation vote. The PRCWRT will not conduct a revote on candidate cultivars that have missed this deadline.

Recommendation for registration does not include information on distinguishability of the candidate cultivar from other currently registered cultivars. Please note that the CFIA-VRO will require this type of information in the application for variety registration. For more information on the application process and a current “objective description” for wheat, rye or triticale, please contact CFIA directly.

4.2 The Request Document

The *Request for Support of Registration* must be concise and error free. Legible copies of the request document must be available to the voting membership of the Committee no later than the Monday, one week prior to the start of the annual PRCWRT meeting. By majority vote, the Committee may refuse to consider a request on the grounds of late circulation, illegibility, or inaccuracy.

A *Request for Support of Registration* must be made for a candidate cultivar no later than two consecutive annual meetings following the completion and publication of the complete merit assessment requirements as defined by the Committee.

4.2.1 Description of the Candidate

The first page will contain the following information: the proposer and owner of the candidate, the crop kind and grain class for which the line is a candidate, the registration category being sought (full or interim), a brief description of the phenotype, testing history, all designations under which the candidate has been tested, all strengths and weaknesses of the candidate, the expected area of adaptation, expected end-use, and the rationale for registration. Disclosure of the parentage, derivation, and selection history is encouraged but not required if it reveals confidential business information.

4.2.2 Data Summaries

Second and subsequent pages will concisely summarize the agronomic performance and disease/pest resistance. A summary of available end-use quality should also be included; however, the Quality Evaluation Team will usually consider available quality information *in extenso*. Summaries should be based on all registration trials in which the candidate was tested, using the data as analyzed and reported in the registration trial reports.

The manner in which data are presented will be obvious, in accordance with accepted scientific practice and will not conceal any weakness of the candidate. It is suggested that data be organized by trait to

simplify comparisons between years. The Committee may assume that a candidate is deficient in an important trait if it is excluded from the summary.

Data in the registration trial report may be reanalysed, and other supporting (supplementary) data may be introduced in support of specific or unusual claims of performance; however, this will not replace the registration trial summary and must be presented in separate tables.

A candidate proposed for registration must only be compared to the designated check cultivars in the registration trial(s) in which it was evaluated. The check cultivars are those that are so designated at the time the *Request for Support* is made. When interpreting results for a specific trait, a candidate will not be compared to a check cultivar known to perform poorly for that trait. Data collected for a check prior to its registration is considered to be check data. Performance of other candidates unregistered at the time the proposal is made is not relevant, nor is the performance of previously registered cultivars not designated as checks.

4.2.3 Definition of Merit

Under the authority of the Canada Seeds Act, candidate cultivars of wheat, rye and triticale must show merit to be eligible for registration. Candidates that show merit are equal to or better than the appropriate check cultivars with regard to any single characteristic or combination of characteristics that renders the candidate beneficial for a particular use in a specific area of Canada. The phrase "*equal to*" is defined as arithmetic equality to the mean of the checks. Relative to the check mean, the phrases "*better than*" and "*poorer than*" are defined as simple arithmetic differences as appropriate for the trait being considered.

The phrases "*superior to*" and "*inferior to*" will not be used unless statistical significance relative to the check mean is shown by a two-tailed test at the 5% probability level using the pooled error mean square as error.

In practice, few candidate cultivars reach the minimum standard in all of the important characteristics under consideration. Most will show a collection of strengths and weaknesses relative to the checks. In some cases deficiencies in one characteristic may be compensated for by strength in another (e.g. lower yield for earlier maturity). It is the overall merit of a candidate cultivar that is assessed when making a recommendation for or against registration.

4.2.4 Supplementary Data

Data collected external to the registration trials may be included in the *Request for Support of Registration* document to improve the case for registration or substantiate claims of specific or unusual performance. Registration trial data and supplementary data must be presented in separate tables and labelled appropriately. A motion to accept the supplementary data as part of the *Request for Support of Registration* must be passed by a two-thirds majority at both the Evaluation Team and Committee deliberations to be accepted as part of the registration data.

Except for those provisions outlined in Section 3.4.6 (Foreign Data), data collected outside the prairie region of Canada will be considered a supplement to the registration trial data, not a substitute for it.

4.3 Role and Conduct of the Evaluation Teams and Committee

4.3.1 Evaluation Team Deliberations

All full members may vote on operational matters pertaining to the Evaluation Team, including the Chair and Secretary. Voting is normally conducted by a show of hands. The quorum for Evaluation Team meetings is 50% of the voting members.

For the consideration of candidate cultivars proposed for registration, each Evaluation Team will consider merit according to their expertise (Agronomy, Disease Resistance, Quality) prior to the PRCWRT Committee meeting. Merit will be based on the ratings for each merit criterion upon which the candidate is assessed. These ratings are entered into a merit score calculation spreadsheet that provides an objective assessment of the Evaluation Team findings. Values for each merit criterion and threshold values for each level of endorsement will be determined by the responsible Evaluation Team. Changes to merit criteria and threshold values must be made during the annual PRCWRT meetings, a year prior to the changes taking effect. The Evaluation Team Chair must communicate these changes to the membership during the PRCWRT Committee meeting.

At the Evaluation Team level, the merit score calculation will determine endorsement of the candidate cultivar in the following categories:

- Support: the collective attributes of the candidate for the traits being considered are “better than” those of the check cultivars or exceed the “Do-not-object” level.
- Do-not-object: the collective attributes of the candidate for the traits being considered are “equal to” those of the check cultivars or are equal to the “Do-not-object” level.
- Object: the collective attributes of the candidate for the traits being considered are “poorer than” those of the check cultivars or fail to meet the “Do-not-object” level.

Where the candidate for registration has received an endorsement from all of the Evaluation Teams (either Support or Do-not-object decisions), consideration at the PRCWRT Committee is not required. Candidates in which one or more Evaluation Teams have objected to its registration will be presented for consideration at the PRCWRT Committee meeting. Candidate sponsors are reminded that an “Object” based on the merit score calculation is only an alert that closer examination is required at the Committee level, where the overall attributes of the candidate (the balance of agronomic, disease resistance and end-use quality traits) are thoughtfully considered.

Non-binding guidance from the DET and QET is provided to the sponsors of candidate cultivars in the first- and second-years of registration testing based on the established merit criteria. The merit score tools may be used for this determination but it is not required.

4.3.2 Committee Deliberations

As outlined in Section 2.2 – Terms of Reference, the PRCWRT has two mandates.

1. To establish test procedures and co-ordinate trials to evaluate the merit of potential cultivars of wheat, rye, and triticale.

2. To assess the merit of lines in registration trials and make recommendations to the CFIA-VRO regarding the suitability of candidate cultivars for registration in the various agro-ecozones of western Canada, excluding the lower British Columbia mainland.

Mandate 1: All matters pertaining to operating procedure are to be ratified at the Committee meeting. For issues that require Committee approval, a maximum of 25 members per Evaluation Team are allowed a vote to provide a balanced approach. If the number of Evaluation Team members attending the PRCWRT meetings is greater than 25, each Evaluation Team Chair will call for members to temporarily give up their voting privilege. In the event that there are insufficient volunteers willing to forego their voting privilege, the 25 voters will be determined randomly. The Committee Chair and proposer of the candidate are also entitled to vote if they are among the 25 members provided this privilege. A record of the members who have relinquished their vote will be kept so that they will be allowed a vote at the next annual meeting. It is expected that all members will vote impartially. Quorum for Committee deliberations is 50% of members registered for the meetings and 50% of each of the attending Evaluation Team members at the beginning of the Committee meeting.

Mandate 2: At the Committee level, only candidate cultivars in which one or more of the Evaluation Teams have objected to registration will be considered. Voting on the candidates will be done by a Cultivar Voting Panel (CVP) consisting of full PRCWRT members who represent various sectors of the wheat, rye and triticale value chain.

The Cultivar Voting Panel will consist of the following representatives:

	Value Chain Role	Sector
AET:	1. Producer representative – Alberta	Producer
	2. Producer representative – Saskatchewan	Producer
	3. Producer representative – Manitoba	Producer
	4. Agronomist	Public
	5. Private breeder	Private
	6. University breeder	Public
	7. AAFC breeder	Public
DET:	8. Stem rust expert	Public or Private
	9. Leaf rust expert	Public or Private
	10. Stripe rust expert	Public or Private
	11. Fusarium head blight expert	Public or Private
	12. Other diseases (Bunt, Smut, Leaf diseases, etc.)	Public or Private
	13. Chemical control (fungicide) representative	Private
	14. Producer organizations representative	Producer
QET:	15. Hexaploid wheat quality specialist	Public
	16. Durum wheat quality specialist	Public
	17. Milling industry representative	Private
	18. Baking Industry representative	Private
	19. Western Grain Elevator Assoc. representative	Private
	20. Canadian Grain Commission representative	Public
	21. Canada branding / technical & market support (CIGI)	Independent

Other: 22. Canadian Seed Growers Association representative	Producer
23. Canadian Seed Trade Association representative	Private

Each Evaluation Team will elect appropriate individuals for the value chain roles. The CSGA and CSTA members will be elected at the Committee level. The term for CVP members is three years but may be renewed.

All CVP members are expected to be present at the candidate cultivar deliberations for their respective Evaluation Teams and must also be present for the Committee discussions. In the situation where a member is unable to attend the meeting, notice should be provided to the Committee Chair prior to the meetings so that a suitable alternate member can be elected.

At this level of consideration, the CVP will consider the overall attributes of the candidate (the balance of agronomic, disease resistance and end-use quality traits) based on interpretation of the data provided by the registration trials and any acceptable supplementary data, as presented in the *Request for Support for Registration* document. Each Evaluation Team Chair or Secretary will report a summary of the findings for each merit criterion and the recommendation. The breeder or designate of the line under consideration will then be given the opportunity to make a short presentation on the case for recommendation. All full and associate members, including the Chair and Secretary may actively participate in these deliberations.

Paper ballots will be used by the CVP for voting on the candidate cultivars they consider. Following discussion of the candidate cultivar proposed for registration, the PRCWRT Chair will ask the CVP members to mark their ballots in the following categories:

- Support: the attributes of the candidate for the traits being considered are equal to or better than those of the check cultivars.
- Object: the attributes of the candidate for the traits being considered are poorer than those of the check cultivars.
- Abstain: abstentions are only expected in the absence of information on which to base a decision or in the case of a declared conflict of interest.

It is expected that all members of the CVP will vote impartially.

Votes will be counted by three PRCWRT associate members and audited after the meeting. The auditor will not be a member of the PRCWRT but must be agreed upon by the membership. Any variance between the initial vote counts and the auditor's review of the ballots will be communicated to the membership upon receipt of the vote auditor's report. The voting ballots will be kept for two years.

A simple majority will constitute a positive recommendation. In the event of a tie, a re-vote will be conducted in which the Chair will cast a vote.

It is the responsibility of the Committee Secretary to inform the Registrar, CFIA-VRO in writing of the decision of the Committee, with copies to the sponsor, and Committee Chair. Copies of the *Request for Support of Registration* document that was considered and the merit score calculation spreadsheets from each Evaluation Team (when implemented) will also be provided to the sponsor and to the CFIA-VRO.

4.4 *Extra-ordinary Circumstances*

4.4.1. **Committee Votes Outside of the Annual Meeting**

At the discretion of the Committee Chair, votes may be conducted using regular mail, facsimile or electronic mail. The quorum for this type of vote is a response from 50% of the voting members from each Evaluation Team.

4.4.2 **Missing or Erroneous Data**

If the *Request for Support of Registration* document or registration trial reports have missing or erroneous data, or omitted data formed the basis of a decision, the sponsor or Chair of an Evaluation Team may call for a re-vote. This request must be in writing to the PRCWRT Chair, with an explanation of the concern. The PRCWRT executive will then determine if there was an omission or error and if this information could have changed the decision. If so, the Committee will be informed and a re-vote will be conducted following the distribution of a revised data package. Since detection of these occurrences is likely to occur after the annual meeting was adjourned, the Committee Chair will determine how the vote will be conducted as per Section 4.4.1 – Committee Votes Outside of the Annual Meeting.

4.4.3 **Appeal of Committee Recommendation**

A PRCWRT recommendation to object to the registration of a candidate cultivar may be appealed by the sponsor on the following grounds:

- The Committee did not follow prescribed procedures.
- The recommendation was the result of erroneous data.

The criteria used in making the recommendation shall not be subject to appeal, as these criteria have been discussed and ratified by the Committee and form the basis of merit evaluation in the registration trial.

A sponsor who has grounds for an appeal must submit a written application to the PRCWRT Chair no later than March 31 of the decision year. The application must indicate the complete basis for the appeal and include a copy of the data package prepared for the candidate in question. The Committee Chair will convene an appeal board and notify the appellant and the CFIA-VRO of the decision by April 30.

The appeal board will consist of 5 to 7 full members. The number, composition and members of the appeal board will be determined by the PRCWRT Chair, who will inform the appellant of the composition of the appeal board, prior to hearing the appeal. The appellant may propose up to two alternative appeal board members, with acceptance of the alternates upon the discretion of the Chair. It is recommended that the appeal board be an odd number to avoid a tie vote.

Each Evaluation Team must be represented by at least one member. If the appeal is centered upon the actions of a particular Evaluation Team, more than one member of that Evaluation Team should be represented. The PRCWRT Chair will preside over the proceedings of the appeal, but will not vote. The

appellant or a designate has the right to attend the appeal proceedings to present the case for the appeal, but does not have a vote. Following the hearing of arguments and any clarifications required by the appeal board, a secret ballot will be conducted and scrutinized by the PRCWRT Chair.

The Appeal may take one of several forms as decided by the appellant.

- A written case which is voted upon by the appeal board using regular mail, facsimile or electronic mail.
- A conference call where the appellant presents the case based on documentation previously distributed to the appeal board.
- A face-to-face meeting where the appellant submits arguments based on documentation previously distributed to the appeal board.

All appeal board travel and meeting expenses will be paid by the appellant. No additional appeals will be available at the recommending committee level.

5. APPLICATION FOR REGISTRATION

Applications for registration of the recommended candidate should be submitted using the *Variety Registration Application Form* available on the CFIA website (www.inspection.gc.ca). The application, along with other required supporting documentation, reference samples and the prescribed fee, must be sent to:

Variety Registration Office
Canadian Food Inspection Agency
59 Camelot Drive
Ottawa, ON K1A 0Y9

Telephone: 613-773-7148
Facsimile: 613-773-7261

For further information, please refer to the CFIA website:

<http://www.inspection.gc.ca/plants/variety-registration/eng/1299175847046/1299175906353>

6. CONTRACT REGISTRATION

6.1 Terms of Reference

Contract Registration is available for candidate cultivars where biochemical or biophysical characteristics distinguish them from the majority of registered cultivars of the same kind or species. Further, to qualify for Contract Registration, the owner/sponsor of the candidate cultivar must make evident the possibility of industry harm if granted an unrestricted registration.

The basis for industry harm is a scientific process in which agronomic performance, disease reaction, and/or end-use quality are assessed; socio-economic factors including market access of transgenic candidates are not to be considered. If it is shown that the candidate cultivar has characteristics that will cause harm toward cultivars registered for traditional commodity markets, or if it or its progeny may be detrimental to human or animal health, and/or safety of the environment, Contract Registration may apply.

As a general rule, Contract Registration is not to be used as a substitute for traditional forms of registration (full or interim) in situations where the PRCWRT has objected to the registration of the candidate cultivar based on a deficiency in merit. However, the PRCWRT may suggest that the candidate be considered for Contract Registration where there is rationale to do so. In this case, an extraordinary meeting of the Contract Registration Committee (CRC) may be required to consider the case and determine if the required conditions for Contract Registration have been met.

Contract Registration is a form of Restricted Registration and it can be either full or interim. Full Contract Registration is permanent and is granted for cultivars for which merit has been established. An Interim Contract Registration may be requested for initial periods of up to three years. Renewal of Contract Registration for a further term of up to an additional two years (a maximum of five years total) will require:

1. A review by the CRC and a determination of whether conditions of the initial Contract Registration have changed significantly.
2. A recommendation from the CRC to the PRCWRT.
3. Review and approval by the CFIA-VRO.

The PRCWRT does not have the authority to recommend cancellation of variety registration; however, it is expected that the PRCWRT will advise the CFIA-VRO of any potential harm that a cultivar (contract registered or otherwise) may cause.

6.2 Structure and Membership

The CRC will consist of five individuals appointed by the PRCWRT, with at least one from each of the following disciplines or areas of specialization:

- wheat or durum breeder
- cereal disease expert
- end-use quality expert

The terms of appointment will normally be for three years. A Chair of the CRC will be chosen from among these five individuals. In cases where confidentiality of data or conflict of interest is identified, the owner/sponsor of the proposed candidate may request the PRCWRT Chair to appoint alternative members. The CRC has the right to consult with other experts provided that the owner/sponsor (or designate) agrees with the choice of external consultants. The CRC will act to protect the confidentiality of data where required. There may be cases where the applicant will require confidentiality agreements to protect all parties involved in the deliberations.

Consideration or review of a contract registration application may occur at any time. Meetings of the CRC will normally be held during the annual PRCWRT meeting in February if there is a reason to do so. Other meetings may be called upon 30 days' notice or less upon the consensus of the CRC membership.

6.3 Eligibility Requirements for Candidates Considered for Testing

Where a candidate has not previously been tested in registration trials, the CRC must receive a written document from the owner/sponsor addressing the rationale for contract registration. The following points should be addressed in the document:

1. The candidate cultivar possesses unique biochemical or biophysical characteristics specific to a defined end-market and could cause industry harm if produced outside of a closed system.
2. An end user/purchaser exists for the contract registered crop.
3. A closed system for the production of the candidate is achievable.
4. The closed system provides assurance that "off-grade" production will not enter the normal marketing system for the commodity crop.

Upon a CRC endorsement that testing of the cultivar under contract registration procedures is required and appropriate, the CFIA-VRO will be informed of the decision and of any additional data requirements prescribed by the CRC.

Owners/sponsors of candidates being tested under contract registration procedures are urged to contact the CFIA-VRO for details on the required Quality Assurance Manual, which must accompany the variety registration application. The proponents should share their Quality Assurance Manual and receive support from the CGC prior to bringing the variety forward to the CRC. Support from the CGC for the proposed closed-loop production system and quality assurance processes will be required for wheat or durum lines to be considered for recommendation of contract registration to the CFIA-VRO.

Current details of CFIA's quality control system (QCS) are outlined in the CFIA-VRO's guidance document: *Procedures for the Registration of Crop Varieties in Canada* (www.inspection.gc.ca). In addition to these requirements the owners/sponsors must also provide the following:

1. A risk assessment that takes into consideration the impact of the candidate cultivar on the viability of other classes and registered cultivars of wheat and durum, including any health, safety, environment, and marketplace impacts. It is recommended the owners/sponsors consult with the CFIA-VRO and the CGC at an early stage to discuss risk assessment issues.
2. The risk assessment must include production, handling, quality control, and financial costs such as monitoring, including sample acquisition, laboratory analysis and reporting. The owners/sponsors must identify the entity responsible for covering the costs of monitoring, and liability if problems associated with leakage of the contract registered cultivar from the closed-loop system occurs. Tolerance levels for such leakage should be identified and agreed to by the relevant industry stakeholders such as the Western Grain Standards Committee.

The assessment of production, handling, quality control, and other risks should provide the CRC with information to assess if the proposed cultivar is of high, medium or low risk to non-contract registered classes. This assessment should include (but need not be limited to) the following factors:

Factor	Comments	Risk: High, Medium or Low
Grain yield vs. alternative varieties?	Yield might be high relative to alternative varieties, making this factor “high” risk.	
Premium, discount or equivalent price (relative to alternative varieties) confirmed from identified market?	If the candidate is expected to provide a premium, there is less potential for it to be misrepresented as a conventional variety of lesser value.	
Identified market prepared to take off-grade product?	This is an absolute necessity as there is likely to be a level of production that will not meet the quality requirements.	
Quality differences against the typical class in which the variety could be co-mingled	Need to establish the risk level if co-mingling occurs.	
CGC grade designation issues	Are there special requirements for the CGC to allow this variety to be certified for shipments?	
Development of a test to allow detection that will be required in a monitoring program	How difficult will it be to detect this new product in a mixed sample?	
Geographic region of production	Will this allow selection of the candidate from a limited region or a few specific primary delivery points?	
Disease impact	Is there a disease susceptibility of major concern?	
Health and safety aspects	Are there specific characteristics of this candidate that will pose risks due to health and safety concerns?	

6.4 Contract Registration Recommendations

If the CRC is to be convened during at the PRCWRT annual meeting, the owner/sponsor of the candidate will provide the PRCWRT Chair written notification of their intent to approach the CRC at least 30 days in advance of the meeting. Appropriate documentation and/or data summaries must be included with the notice. The owner/sponsor of the candidate will be informed of the date and time of the CRC meeting and will be allowed to address the members. Following the meeting, the CRC will have up to 30 days to rule on the suitability of the candidate for testing under Contract Registration procedures, prescribe additional data requirements over the minimum specifications, or make a recommendation on the request for Contract Registration. The CRC may seek external advice, recognizing that confidentiality may be of extreme importance. A simple majority vote will constitute the decision of the CRC. Votes will be cast in two categories: Support and Object.

The owner/sponsor or designate of the cultivar may contest a CRC decision in two general areas:

1. If the candidate is deemed ineligible for testing under contract registration procedures.
2. If the CRC objects to the contract registration of the cultivar.

A three-person appeal board will be selected: one by the appellant, one by the CRC Chair, and one neutral party agreed upon by the appellant and the PRCWRT Chair. The appeal board will choose its own Chair and determine its own procedure. The appellant will pay any expenses related to the appeal. The decision of the appeal board will be binding.

6.5 Conduct of Trials and Minimum Data Requirements

The following are minimum data requirements for the Contract Registration of a candidate cultivar. The CRC may set additional requirements within 30 days following the meeting to determine the suitability of the candidate for Contract Registration procedures.

Upon acceptance of a candidate for testing under Contract Registration procedures, the owner/sponsor agrees that the evaluation protocols and requirements for a Quality Control System by the CRC are appropriate and that these protocols and requirements, however defined, will not justify an appeal.

- a) A minimum of two years of testing is required.
- b) Testing must be conducted in the region where production is intended. The geographic region(s) may vary in area from all of western Canada to a smaller region within a province.
- c) Testing will provide comparisons with the appropriate checks for the crop kind, as currently used in regular registration testing, or as determined by the CRC.
- d) Agronomic data must be collected but will be used for descriptive purposes only. No minimum levels of performance are required for agronomic traits. A minimum of eight site-years of agronomic data are required, with a minimum of three site-years in each of two calendar years.
- e) Data quality assurance procedures must be followed as outlined in Section 3.4.2.3.
- f) Disease resistance evaluation must take place in each of the two years of testing and must follow the procedures outlined in Appendices D and E. Candidates must meet the merit requirements for disease resistance in place for traditional cultivars, unless the owner of the candidate can demonstrate that susceptibility to a particular disease will not endanger production of traditional cultivars.
- g) Agronomic performance and disease reaction data will not be considered confidential. Grain quality and the trait deemed to cause potential harm must be evaluated in each year of testing, relative to the appropriate check cultivars for the crop kind. Quality evaluation is required to confirm that the candidate has the quality claimed by the proposer and that such quality requires production within a closed-loop, contract system. Where data for a candidate for Contract Registration has been produced in regular registration trials, these data will be supplemental and not necessarily a substitute for the required two years of testing. However these data may be submitted to the CRC and CGC to determine if it is sufficient to proceed. In consultation with the Chair and Secretary of the appropriate Evaluation Teams, the CRC has may allow supplemental data to be considered in lieu of the normal minimum testing requirements.
- h) All costs for data collection for Contract Registration shall be borne by the proposers of the candidate cultivar.
- i) Recommendations in support of contract registration will be made by the CRC and forwarded to the CFIA-VRO. The VRO will review the contract registration application and process it accordingly.

APPENDIX A: Registration Trial Missions

Central Bread Wheat Co-op: Adaptation of candidate cultivars of CWRS wheat to the rust areas of Manitoba and central and southern areas of eastern Saskatchewan.

Co-ordinator: F. Kirigwi - Syngenta Canada, Inc. (Morden, MB)

Western Bread Wheat Co-op: Adaptation of candidate cultivars of CWRS wheat for the non-rust areas of southern and central Alberta and Saskatchewan including the sawfly area.

Co-ordinator: R. Cuthbert, AAFC - Semiarid Prairie Agricultural Research Centre (Swift Current, SK)

High Yielding Red Wheat Co-op: Adaptation of candidate cultivars of CPS and CWGP wheat in the black and brown soil zones and the central and southern parkland area.

Co-ordinator: H.S. Randhawa, AAFC – Lethbridge Research Centre (Lethbridge, AB)

Parkland Wheat Co-op: Adaptation of candidate cultivars of CWRS, CPS and CWES wheat in the northern and central parkland area.

Co-ordinators: D.M. Spaner, U. Alberta (Edmonton, AB); D.G. Humphreys, AAFC – Cereal Research Centre (Winnipeg, MB)

Hard White Wheat Co-op: Adaptation of candidate cultivars of CWWS wheat for all growing areas of the Prairies.

Co-ordinator: R. Cuthbert, AAFC - Semiarid Prairie Agricultural Research Centre (Swift Current, SK)

Western Soft White Spring Wheat Co-op: Adaptation of candidate cultivars of soft white spring wheat to the irrigated areas of Alberta and Saskatchewan

Co-ordinator: H.S. Randhawa, AAFC – Lethbridge Research Centre (Lethbridge, AB)

Durum Wheat Co-op: Adaptation of candidate cultivars of durum wheat to southern and central areas of western Canada.

Co-ordinator: R. Cuthbert, AAFC – Semiarid Prairie Agricultural Research Centre (Swift Current, SK)

General Purpose Spring Wheat Co-op: Adaptation of candidate cultivars of spring wheat for the CWGP class in western Canada.

Co-ordinator: C.J. Pozniak, Crop Development Centre – University of Saskatchewan (Saskatoon, SK)

Western Winter Wheat Co-op: Adaptation of candidate cultivars of winter wheat for the CWRW and CWGP classes in western Canada.

Co-ordinator: R.J. Graf, AAFC - Lethbridge Research Centre (Lethbridge, AB)

Western Fall Rye Co-op: Adaptation of candidate cultivars of fall rye in western Canada.

Co-ordinator: J. Larsen, AAFC – Lethbridge Research Centre (Lethbridge, AB)

Western Spring Triticale Co-op: Adaptation of candidate cultivars of spring triticale to western Canada.

Co-ordinator: H.S. Randhawa, AAFC – Lethbridge Research Centre (Lethbridge, AB)

Western Feed Grain Development Coop Wheat Registration Trial: Adaptation of spring CWGP candidate cultivars from the WGFDC Coop to western Canada.

Co-ordinator: D. Maxwell, AgQuest (Minto, MB)

Ag Quest Wheat Registration Trial: Adaptation of CWRS and CPSR candidate cultivars to western Canada.

Co-ordinator: D. Maxwell, AgQuest (Minto, MB)

ICMS Wheat Registration Trial: Adaptation of CWRS and CPSR candidate cultivars to western Canada.

Co-ordinator: B. Wright, ICMS (Portage la Prairie, MB)

Seed-Link Winter Wheat Registration Trial: Adaptation of candidate cultivars of winter wheat for the CWRW and CWGP classes in western Canada.

Co-ordinator: P. Bonis, Seed-Link (Lindsay, ON)

Spring Spelt Wheat Registration Trial: Adaptation of candidate cultivars of spring spelt wheat to western Canada.

Co-ordinator: P. Hucl, Crop Development Centre – University of Saskatchewan (Saskatoon, SK)

New Market Class Registration Trial: Adaptation of candidate cultivars of spring wheat for the NMC class in western Canada.

Co-ordinator: C.J. Pozniak, Crop Development Centre – University of Saskatchewan (Saskatoon, SK)

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APPENDIX B: Check Cultivars – 2013**Central Bread Wheat Co-op** (3 replicates)

Checks: Carberry
 Glenn
 Unity (Sm1 pure component)
 BW965

Western Bread Wheat Co-op (3 replicates)

Checks: Carberry
 Glenn
 Unity (Sm1 pure component)
 BW965

Exceptions: Lillian – check for yield of solid-stemmed candidates

High Yielding Red Wheat Co-op (3 replicates)

Checks: 5700PR
 HY537
 Glenn
 AAC Foray

Parkland Wheat Co-op (3 replicates)

Checks: Glenn
 PT472
 PT772
 AC Splendor

Hard White Wheat Co-op (3 replicates)

Checks: AAC Iceberg
 Whitehawk
 Snowstar

Western Soft White Spring Wheat Co-op (4 replicates)

Checks: AC Reed
 AC Andrew
 Sadash
 Exceptions: AC Andrew – agronomic check only

Durum Wheat Co-op (4 replicates)

Checks: AC Avonlea
 Brigade
 AC Navigator
 Strongfield

General Purpose Spring Wheat Co-op (3 replicates)

Checks: AC Andrew
 Sadash
 Pasteur

Western Winter Wheat Co-op (3 replicates)

Checks: CWRW: CDC Buteo

Flourish
Moats
AAC Elevate

CWGP: CDC Falcon
Broadview
Sunrise

Western Fall Rye Co-op (3 replicates)

Checks: Prima
AC Rifle
Hazlet

Western Spring Triticale Co-op (4 replicates)

Checks: Pronghorn
AC Ultima
Brevis
AC Andrew

Exceptions: AC Andrew and – check for yield of high yielding wheat

Western Feed Grain Development Coop Wheat Registration Trial:

Checks: AC Andrew
Sadash
Pasteur

Ag Quest Wheat Registration Trial:

Checks for CWAD, CWRS, CWGP, CWHWS, CWRW, CWRW(GP), CPS, Fall Rye, and Winter Triticale are the same as those specified for the Co-ops Registration Trials.

ICMS Wheat Registration Trial:

Checks for CWAD, CWRS, CWGP, CWHWS, CWRW, CWRW (GP), CPS, Fall Rye, and Winter Triticale are the same as those specified for the Co-ops Registration Trials.

Seed-Link Winter Wheat Registration Trial:

Checks: CWRW: CDC Osprey
AC Bellatrix
Radiant
CDC Buteo
Flourish
Moats
CWGP: CDC Falcon
Broadview
Sunrise

Spring Spelt Wheat Registration Trial:

Checks: AC Barrie
CDC Nexon
CDC Zorba
CDC Origin
CDC Silex

Exceptions: AC Barrie – check for yield of free-threshing CWRS wheat

APPENDIX C: Measurement of Agronomic Traits

Agronomic Traits Measured in each Co-operative Registration Trial

	Central Bread Wheat	Western Bread Wheat	High Yielding Red Wheat	Parkland Wheat	Hard White Wheat	Soft White Spring Wheat	Durum Wheat	General Purpose Wheat	Western Winter Wheat	Fall Rye	Spring Triticale
Number of Replicates	3	3	3	3	3	3	4	3	3	3	3
Grain Yield	+	+	+	+	+	+	+	+	+	+	+
Heading	-	-	-	+	-	-	-	-	+	-	-
Maturity	+	+	+	+	+	+	+	+	+	+	+
Height	+	+	+	+	+	+	+	+	+	+	+
Lodging	+	+	+	+	+	+	+	+	+	+	+
Shattering	-	-	-	-	-	+	-	-	-	-	-
Cleanout	-	-	-	-	-	-	-	-	-	-	-
Test Weight	+	+	+	+	+	+	+	+	+	+	+
Kernel Weight	+	+	+	+	+	+	+	+	+	+	+
Smudge	-	-	-	-	-	-	+	-	-	-	-
Black Point	-	-	-	-	-	+	-	-	-	-	-
Starchy Kernels	-	-	-	-	-	-	+	-	-	-	-
Sample Grade (site basis)	-	-	+	+	-	-	+	-	-	-	-
Wheat Stem Sawfly Cutting*	-	+	-	-	-	-	-	-	-	-	-
Winter Survival	-	-	-	-	-	-	-	-	+	+	-
Hagberg Falling Number	-	-	-	-	-	-	-	-	-	+	+

Cultural Conditions: Cultural conditions are representative of farming practices within the surrounding area and should produce seed of quality similar to the commercial commodity. Use of unregistered herbicides, or insecticides and seed applied fungicides should be avoided wherever possible. The use of foliar-applied fungicides or growth regulators is undesirable.

Experimental Design: Lattice or randomized block design, three or four reps, 36 entries or less.

Grain Yield: Plot yields should be converted to a yield per unit area (kg/ha). Equilibrate samples to similar moisture content within test sites. Record all reps.

Days to Heading: 50% heads emerged, recorded 3 times weekly. Calculated from planting date or from January 1, whichever is shorter. Record at least 2 reps.

Days to Maturity: 16 - 18% moisture content - kernels resist denting by fingernail. Recorded 3 times weekly. Calculated from planting date or January 1, whichever is less. Record at least 2 reps.

Plant Height: Straw length measured in cm from ground to top of heads excluding awns after extension growth has ceased. In the event of lodging, plants should be straightened before measurement. Record at least 2 reps.

Lodging: Record on a 1 - 9 scale, where 1 is bolt upright and 9 is completely prone, wherever significant lodging occurs. Record all reps.

Shattering: Record on a 1 - 9 scale, where 1 is undamaged and 9 is completely shattered, wherever significant shattering occurs. Record all reps.

Cleanout: Weight of cleaned sample expressed as a percentage of uncleaned sample. Record on all replicate composite.

Test Weight: Kilograms of cleaned sample (zero chaff) per hectolitre measured under standard conditions, e.g.: Dickey John Grain Analysis Computer, or to CGC standards. Record on composite of all replicates.

Kernel Weight: Milligrams per kernel based on a cleaned sample of at least 200 undamaged kernels from a composite of all replicates.

Smudge and Kernel Black point: Smudged or black pointed kernels expressed as a percentage by count or by weight of at least 10 g of the cleaned four rep composite wherever non-trace amounts of smudge or blackpoint are noted.

Percent Starchy Kernels: As determined by the Industry Services division of the Canadian Grain Commission from the cleaned composite of all replicates.

Sample Grade: As determined by Industry Services division of the Canadian Grain Commission from a composite of all replicates.

Wheat Stem Sawfly Cutting: Estimated percentage of stem girdled and subsequently toppled over from wheat stem sawfly infestation and cutting (% cut per 100 stems observed).

Winter Survival: Estimated to nearest 5% after spring regrowth wherever there is winterkill. Record all replicates.

Hagberg Falling Number: As determined using the prescribed method for the Hagberg Falling Number apparatus.

APPENDIX D: Guidelines for Disease Resistance in Wheat and Triticale for the Prairie Region of Canada

(Revised April 17 2015)

The rationale of having a Disease Evaluation Team (DET) evaluate candidate lines for cultivar registration is that there is value in having genetic resistance in wheat cultivars versus relying on the use of fungicide sprays. Extremely susceptible varieties will still sustain loss even with the application(s) of fungicide sprays, and there is the additional risk of developing new pathogenic strains that are tolerant or resistant to fungicide use. Increase reliance on and use of fungicides also is not environmentally sound. The operating guidelines for the DET of the PRCWRT are presented in Table 1 for the various classes of Canadian wheat. The "Do-Not-Object-To" level of resistance described in the table is the level that would prevent significant economic loss. This is the minimum level of resistance expected in registered cultivars. This level is agreed upon by breeders and pathologists for each disease and may change depending on virulence changes in the pathogen and availability of resistance. The "Do-Not-Object-To" level of resistance may not be sufficient to provide adequate disease control for some pathogens. The disease ratings for registered cultivars can be found in provincial seed guides, based on meetings of the Western Committee of Plant Diseases. The most common level of resistance presently found in registered cultivars is the level considered achievable within breeding programs.

For each Priority 1 disease in each class of wheat or triticale, ratings by the DET are primarily based on the assessment of three years of disease data. The DET will "Object to" the registration of candidate cultivars that do not meet the "Do-Not-Object-To" level of resistance. The DET will "not object to" the registration of candidate cultivars that meet the "Do-Not-Object-To" level of resistance. The DET will "Support" the registration of candidate cultivars that exceed the "Do-Not-Object-To" level of resistance for one or more diseases and meet "Do-Not-Object-To" level of resistance for the other Priority 1 diseases. The DET will also take into consideration additional pest resistance such as wheat curl mite and orange blossom wheat midge during evaluation team deliberations.

Disease priorities are defined as follows:

Priority 1 = Those diseases for which Coop testing is being done and the "Do-Not-Object-To" level of resistance is necessary for support for registration.

Priority 2 = Those diseases for which breeding and pathology research is being done in western Canada and a minimal level of resistance is desirable to reduce economic loss to producers.

Priority 3 = Other diseases of wheat to which little or no breeding or pathology research is being done in western Canada but which are of localized or temporal significance.

A five point rating system of R, MR, I, MS and S is used to describe Priority 1 disease ratings where R= Resistant, S= Susceptible, M= Moderate, and I= Intermediate.

The "Do-Not-Object-To" requirements for the Priority 1 diseases are listed in Table 1 for the CWRS, CPS, CWGP, CWAD, CWHW, CWSWS, CWRW, Triticale, and Spelt classes. Selected check line(s) which represent the "Do-Not-Object-To" level of resistance have been identified for each disease and are listed in Appendix E.

Disease Data

For disease data to be considered by the DET, it must be generated using procedures identified in Appendix E. The required criteria include three years of data, the use of inoculum with appropriate races/strains for each pathogen, irrigation as needed to generate sufficient disease pressure, and the inclusion of check lines with susceptible and "Do-Not-Object-To" levels of resistance for each pathogen. Check lines and the description of the evaluation method for each pathogen are listed in Appendix E. If disease data is deemed unacceptable, the DET will report to the WRT subcommittee that no decision could be made because of insufficient data. Table 1 below lists the check cultivars/lines for the current priority1 diseases and the acceptable levels of disease severity for these checks.

Table 1. Disease Checks and Acceptable Disease Severity Levels for Priority 1 Diseases

Rating	Stem Rust Check	Stem Rust Sev. (%)	Leaf Rust Check	Leaf Rust Sev. (%)	Stripe Rust Check	Stripe Rust Sev. (%)	FHB Check	FHB Index (%)	Bunt Check	Bunt Sev. (%)
R	Glenn	1-10			Lillian	0-5	FHB37	1-25	McKenzie**	1.8-4.6
MR			McKenzie	10-20	AC Andrew	10-20	5602HR	12-35		4.0-18.6
I	Columbus	20-40	Glenlea	10-40	CDC Imagine	35-45	AC Cora	12-42	Neepawa***	13.7-25.6
MS			AC Barrie	50-80	Laura	50-60				18.8-46.4
S	Hoffman	80-100	Thatcher	80-100	AC Barrie	80-100	CDC Teal*	64-100	Laura****	34.5-58.4

Sev. = severity

* AC Morse is also included as a durum susceptible FHB check.

** AC Foremost is also a resistant bunt check.

***AC Barrie is also an intermediate bunt check.

**** Fielder is also a susceptible bunt check.

Establishing Disease Guidelines for New Classes and New Priority 1 Diseases

Priority 1 diseases are those diseases which can be controlled by genetic resistance and which are considered to cause harm significant enough to warrant regulation through the registration process. Wheat candidate lines require a "Do-Not-Object-To" level of resistance to Priority 1 diseases for support for registration. In general, Coop disease testing is provided for major grain classes. In the case of new or minor classes of grain occupying or predicted to occupy a small acreage, external data collected in the prescribed manner may be requested. If a new class of wheat is proposed, Disease Guidelines will be established by the DET in consultation with the PRCWRT. Actual or forecasted area of production will be considered for the development of disease guidelines. It is important to note that pathogens do evolve and can adapt to new environmental conditions. Shifts in the genetic base in the host crop can also lead to new disease risks. Both can result in new or existing pathogens that can cause catastrophic yield losses and reduction in quality in wheat. Therefore, addition of new diseases to the Priority 1 list is possible. Additions to or changes in the Priority 1 list is the responsibility of the DET in consultation with the PRCWRT.

Disease Reports

DET members appointed by the chairperson prepare the disease reports. A separate report is prepared for each wheat class. Prior to the PRCWRT meeting, a draft report is prepared that summarizes disease data for all entries. Recommendations for the advancement of lines are given on first and second year entries. A single summary

disease rating of the three years data for each disease is provided on a five point rating scale of R, MR, I, MS and S where R= Resistant, S= Susceptible, M= Moderate, and I= Intermediate. Report writers will provide voting recommendations on lines proposed for registration. Disease assessments and recommendations are discussed at the DET meeting and reports are updated prior to submission for inclusion in the minutes.

**Table 2. The “Do-not-object” guidelines for Priority 1 diseases wheat and triticale in Western Canada.
Priority 2: Loose smut, leaf spots**

Disease	CWRS	CPS	GP	CWHW	CWAD	SWS	CWRW	Triticale	Spelt
Leaf Rust	I	I	I	I	I	MS (I 2017)	I	I	I
Stem Rust	I	I	I	I	I	MS (I 2017)	I	I	na
Common Bunt	I	I	I	I	I	MS (I 2017)	I	I	I
FHB	I	I	I	I	MS	MS	MS	MS	MS
Stripe Rust	I (2017)	I(2017)	I (2017)	I (2017)	I (2017)	I (2017)	I (2017)	I (2017)	I (2017)

Na = not applicable

APPENDIX E: Disease Screening Protocols

Protocol for evaluating reaction to loose smut in wheat (Dr. J. Menzies)

Ten to 12 seeds of each wheat line are sown in hill plots. At heading, three spikes of each hill are selected for inoculation. The chosen spikes are at mid-anthesis (the anthers at either end of the spike are dehisced, while those in the middle are yellow). About 1 cm is cut off the tips of each inoculated spike with scissors to mark the inoculated heads. The partial-vacuum method described by Nielsen (1983) and Menzies et al (2009) is used for inoculation. With this method, the spikes are placed in an inoculation cylinder and immersed under vacuum in a suspension of water and teliospores of *U. tritici* at a concentration of about 4 g teliospores per L of water. The vacuum is maintained for two to three seconds and then released, allowing the teliospore suspension to drain into a reservoir. Without removing the spikes from the inoculation cylinder, this procedure is immediately repeated once.

The Poehlmann method of inoculation can be used as an alternative to the partial-vacuum method. It requires filling a syringe with inoculum (same inoculum as above), and holding the syringe and needle at an approximate angle of 5 to 10° to the rachis. The needle is gently pushed through the upper part of the soft palea. A slight resistance will be felt when the needle tip reaches the tougher lemma of the floret. Inoculum is ejected to fill the floret, which causes a change in the hue of the lemma. It is easiest to start at a floret at the bottom of the spike and continue inoculation of the florets in ascending order on one side of the spike, and then progress to the other columns of florets on the spike.

The loose smut races T2, T9, T10, and T39 (Nielsen 1987) are employed in the inoculum suspension; each at 1 g teliospores L⁻¹ of water. These four races represent the common races of *U. tritici* in western Canada (Thomas and Menzies, *unpublished data*). A fresh mixture of inoculum is prepared each day.

At maturity, each spike is harvested and threshed individually. The seed are sown in a soil bed in the greenhouse during the following winter. At heading, the numbers of healthy and smutted plants are recorded and the percentage of smutted plants determined. The wheat cultivar 'McKenzie' should be used as a susceptible check. The percentage of smutted plants is used to determine the reaction, where <15%=R; 16-35%=MR; 36-55%=I; 56-75%=MS; >75%=S. The most susceptible reaction over the 3 coop test scores is used as the final loose smut reaction for registration.

Menzies, J.G., Turkington, T.K., and Knox, R.E. 2009. Testing for resistance to smut diseases of barley, oats and wheat in western Canada. *Can. J. Plant Pathol.* 31: 265-279.

Nielsen, J. 1983. Spring wheats immune or highly resistant to *Ustilago tritici*. *Plant Dis.* 67:860-63.

Nielsen, J. 1987. Races of *Ustilago tritici* and techniques for their study. *Can.J. Plt Pathol.* 9:91-105

Protocol for evaluating reaction to common bunt in wheat: Dr. D. Gaudet (updated Mar. 19 2015)

Spring wheat bunt reaction nurseries are sown on fallow land at the earliest possible date. Winter wheat is sown as late as possible to ensure good winter survival. Seeds are sown to a depth of 6 cm in cool soil, with row lengths from 4.5-6 m. Inter-row spacing is set at 25 cm. Guard rows at the start of the plot are infested with common bunt to pre-contaminate the seed drill. Check lines are included every tenth row. At maturity, each plot is visually evaluated for percent bunt infection for each row. The test is seeded at two locations (= 2 reps), one under dryland conditions and one with access to irrigation.

Seed is inoculated to excess with a 1:1 composite of the bunt species *Tilletia tritici* and *T. laevis* in a 1:1:1:1:2:2 mixture of the races T-1, T-6, T-13, T-19, L-1, L-16. This composite represents the virulence spectrum of most locally collected bunt isolates. The population dynamics of the races may vary from year to year and location to location depending on environmental conditions. Spores are collected by grinding bunt infested heads with a Wiley mill grinder fitted with a 2 mm screen. Seeds are infested with the mixed spore mixture within an envelope (0.02 g bunt/10 g seed). The bunt is not pre-weighed but only scooped into the envelope at an estimated amount. Envelopes are bound together with elastic bands and inserted in seeding trays, which are placed on an agitator and allowed to agitate until seed is thoroughly infested. Envelope size and elastic band placement are chosen to ensure seed can freely agitate within the envelope while on the shaker.

Plots are visually rated for bunt as the wheat is turning color. Care must be taken to rate the shorter tillers, which are more prone to being bunted. The intermediate resistant check cultivar Neepawa is inserted every twenty rows, while the minor check lines (Barrie, Fielder, Foremost, Laura, and McKenzie) are inserted every hundred rows. Bunt reactions (R, MR, I, MS, S) are defined by the reaction of the intermediate check Neepawa. Lines falling within a single standard deviation on either side of the mean percent infection of Neepawa are defined as intermediate. Lines falling within 2 standard deviations from the Neepawa mean are moderately resistant and moderately susceptible. Lines greater than 2 standard deviations to the left of Neepawa are resistant, whereas lines 2 standard deviations to the right are susceptible.

*NB. If the number of lines in the test is small, the test should set up using a standard field design using 4 replications of both lines and checks

Bunt Checks

Neepawa is intermediate it is the major check line every 20 rows

Minor check lines occur once per 100, alternating every ten rows with Neepawa.

Foremost and McKenzie are resistant minor checks

Laura and Fielder are susceptible minor checks

AC Barrie is an intermediate minor check.

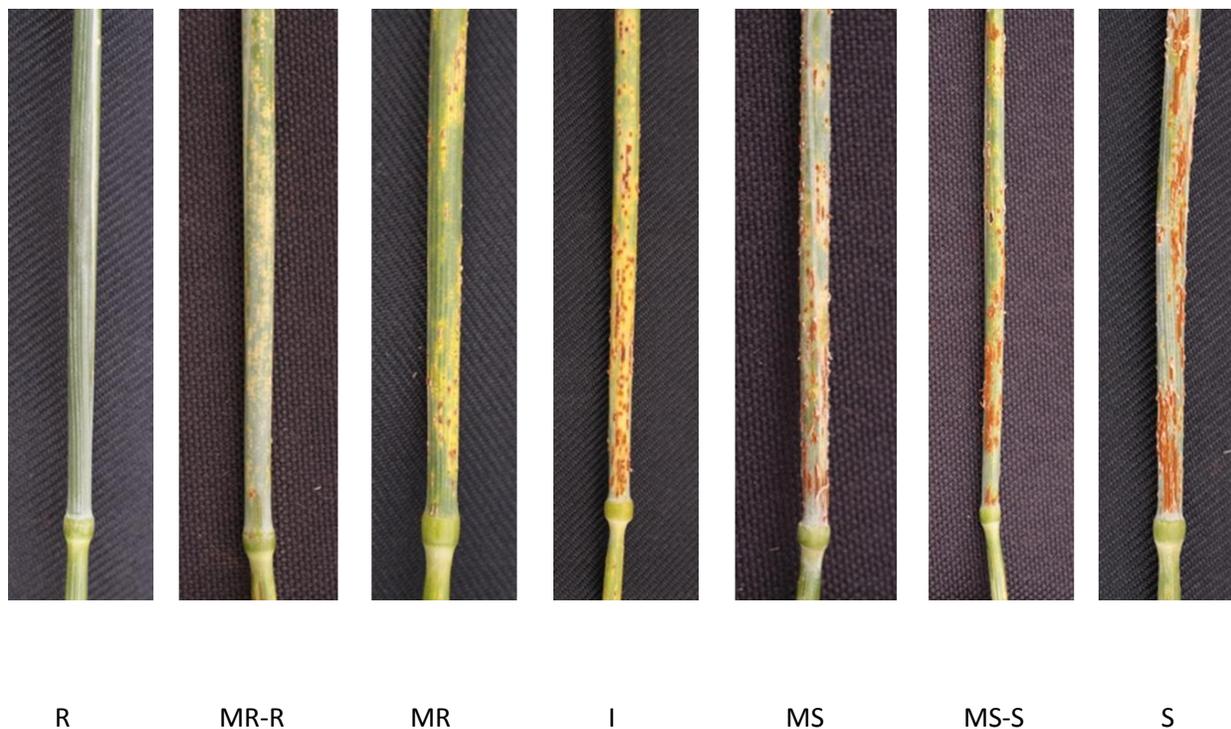
For winter wheat IDO 337 (R), Belatrix (MR), Tempest (MS), Osprey (S) Every ten rows a check is inserted. The checks repeat every 40 rows.

Protocol for evaluating reaction to wheat stem rust: Dr. T. Fetch (Updated Mar. 2015)

Lines are screened at the adult plant stage in field stem rust nurseries (bulk inoculum) as well as in seedling tests (using individual races) in the greenhouse. Data from both sources are considered in determining a rating. Spreader rows are planted first (single row planter, Planet Jr. works well) about 2 weeks ahead of coop entries (usually about late May) to get rust infection started early and get maximum infection of nursery entries. The stem rust spreader row seed is a mixture of susceptible wheat and barley lines (AAFC uses 25% Wolfe barley; 15% each of Red Bobs, Klein Anniversario, W3488, W2691, and La Prevision wheat but could use Hoffman or other known fully susceptible wheat). The distance between spreader rows is selected based on the width of the tractor/planter used to plant the test entries (typically about 9 feet), and the length of the spreader row is selected based on the type of planter used (eg. If using a WinterSteiger Plotseeder with magazine system, each tray needs 125 ft of spreader row). It is advised to spray the field with glyphosate after planting but prior to emergence of the spreader rows for good early weed control. About 2 weeks after planting of spreader rows, entries in the field stem rust nursery are seeded between spreader rows using a plot planter (65 seeds per row, about 1.5 m long, with 1 m alleys between drops and 12 inch row spacing). The check cultivars 'Columbus' (Intermediate resistant check) and 'Hoffman' (Susceptible check) wheat are inserted once in each coop test and resistant lines such as 'Superb', 'Katepwa', or other known resistant check (severity usually <10%) are inserted randomly in the nursery. Spreader rows are inoculated using a Microfit Herbi (EvenSpray Inc., Winnipeg) sprayer (1g spores per L Soltrol oil (Phillips petroleum, USA), apply evenly over spreader row plants at a slow walking pace) with a mixture of stem rust races (TPMK, TMRT, RKQS, RHTS, MCCF, RTHJ, and QTHS in equal amounts) starting at about early boot stage. These races represent a wide range of virulence to ensure adequate levels of resistance are maintained in wheat cultivars, i.e. more than one *Sr* gene. Stem rust inoculum is typically increased in winter in greenhouse or growth cabinets for use in the nursery. Starter inoculum and procedures are available upon request from the AAFC stem rust pathologist. Spreader rows are inoculated in late afternoon or early evening on days where dew or rain is expected at night. Irrigation using Rainbird sprayers mounted on fence posts can be done as needed in late evening to provide dew for spore germination. Repeat rust inoculations every 7-10 days until stem rust pustules are abundant on spreader rows.

Lines are rated for disease when symptom expression is optimal, as indicated by the reactions on the check cultivars 'Columbus' (range of 20-40% severity with an intermediate "Do Not Object" reaction) and 'Hoffman' (range of 70-100% severity and susceptible reaction). Usually this is at early dough stage, but before stems become senescent. Two ratings are given for each line; (1) severity of the disease expressed as percentage of stem coverage using the Peterson scale, and (2) reaction or pustule type (R, MR, I, MS, or S) as shown in Figure 1. Infection levels will vary each year depending on environmental conditions, but the inoculum mixture is the same.

Figure 1. Field stem rust infection responses



For seedling tests, coop entries are seeded in hills using fibre flats, pots, or in conetainers (Steuwe and Sons, Inc) and inoculated at the first leaf fully expanded stage (8-10 d). Races TPMK, TMRT, RKQS, RHTS, MCCF, RTHJ, and QTHS are individually inoculated on each entry. Inoculation protocols are available online (Fetch et al. Can. J. Plant Pathol. 33:54-60; <http://www.tandfonline.com/doi/pdf/10.1080/07060661.2011.536650>). Lines are rated for infection type on a 0-4 scale (0, ;, 1, 2, 3, or 4). Reaction types from 0 to 2 are considered resistant, and types 3 and 4 are usually considered susceptible (3⁻ reactions may show some level of resistance).

Brent McCallum - Protocol for evaluating reaction to wheat leaf rust (Updated Mar. 19 2015)

Co-op entries are screened in a field leaf rust nursery (adult stage) as well as in seedling tests indoors. Data from the field is considered in determining a rating, but seedling data can add information.

The field leaf rust nursery is seeded in short rows (approximately 60 cm) with spreader rows of a susceptible variety (Thatcher and Morocco work very well) at regular intervals. Spreader rows are inoculated with a mixture urediniospores (in mineral oil) of leaf rust races that were collected during the leaf rust disease survey from the previous year. To determine the composition of this inoculum, check the wheat leaf rust publication from the previous year in the Canadian Journal of Plant Pathology. The field nursery is rated for disease when symptom expression is optimal. The cultivar 'Thatcher' is used as

the susceptible check, while 'Glenlea' can be used as the "Do-Not-Object" check. Two ratings are given for each line; (1) severity of the disease expressed as percentage of leaf coverage, using the modified Cobb Scale (2) reaction or pustule type (R, MR, M, MS, or S). The severity is used to determine a rating, by comparison to a severity scale that is appropriate for the nursery based on the check lines.

Recommended checks, their rating, and the range of severity that should be obtained in a well infected nursery are as follows; McKenzie - MR – 10-20%, Glenlea – I - 10-40%, AC Barrie – MS – 50-80%, Thatcher – S – 80-100%. Rows are rated late enough that rust severity is maximized, but before senescence of the wheat lines.

Seedling tests: Lines are seeded in flats and inoculated at the two leaf stage. Races MBDS, TBJJ, MBRJ, MGBJ, and TDBG are used for the seedling test. Lines are rated for pustule type ;, 1, 2, 3, 4. Reaction types ;, 1, and 2 are considered resistant and types 3 and 4 are usually considered susceptible (some type 3 reactions may show some level of resistance). Inoculation and rating methods are detailed in the annual wheat leaf rust survey publication.

Jeannie Gilbert - Protocol for evaluating reaction to leaf spots

Leaf spot reaction of coop materials is assessed 18-21 days after anthesis on plots that have only been exposed to natural field inoculum. Three replicates at the "C" level and two at the "B" level are planted. Percent severity of flag (F) leaves and the F-1 leaves are recorded between milk and soft dough stage of ripeness. Data are presented as (0.6 Flag) + (0.4 Flag-1). The prevalent leaf spot pathogens infecting the coop entries are subsequently determined from leaf tissue samples collected from the check varieties. Samples are collected at the time of scoring, surface sterilized, then incubated under cool white light for 5 days at 20° C to promote pathogen sporulation and facilitate identification of the organism(s) causing disease. The cultivar 'AC Domain' is used as the susceptible check, while AC Crystal or Vista are "Do-not-Object" checks.

Protocol for evaluating reaction to leaf spots in Saskatchewan – Myriam Fernandez (Updated Feb. 2015)

The leaf spot reaction of co-op and pre-coop entries is assessed under natural inoculum conditions at about the mid- to late-milk stage on replicated single or 4-row plots in at least two locations in Saskatchewan. Leaf spotting for each plot is assessed using a 0-11 severity scale (McFadden's), which takes into account percent area infected on the flag, penultimate and lower leaves. Immediately after rating, a random composite sample of infected flag leaves is collected from each test. For fungal identification and quantification, pieces of lesioned leaf tissue are then surface-disinfested, plated on water agar and incubated under cool-white fluorescent and near-UV lights. Mean percentage isolation of the leaf spotting pathogens present is calculated based on the percentage of leaf area from which each fungus is isolated from each test.

Jeannie Gilbert - Protocol for evaluating reaction to Fusarium head blight using macroconidia inoculum (Updated by Maria Antonia Henriquez – April 2015)

Identify rows at 50% anthesis (spray paint of different colours used to denote each date). Inoculate plants with 50 ml spore suspension (50,000 macroconidia ml⁻¹) per meter of row when 50% heads are in anthesis. Inoculate the same rows 2-3 days later to infect later tillers. Misting or irrigation is applied in the afternoon or evening of each inoculation. The cultivars 'AC Vista', 'CDC Teal' and 'AC Morse' are used as susceptible checks, 'AC Cora' and '5602 HR' are used as intermediate check, FHB 37 as a resistant check. Disease development is dependent on environmental conditions. High temperatures on the day of inoculation may cause little disease to develop. Check varieties are planted at regular intervals throughout the nursery and interpretation of disease ratings (VRI) have to take conditions and check reactions into account. A low score may mean escape rather than resistance. It is therefore very difficult to make an arbitrary statement about levels of disease being rated as MS or MR etc., although we are attempting to. The FHB reaction (R, MR, I, MS, S) is determined relative to the check lines' reactions and will change from year to year.

Visual Rating Index (VRI):

In the field, rate infected rows using two digits at 18-21 d after inoculation. The first digit/number (0-10 scale) represents the incidence (percent of heads with infection), while the second digit/number (0-10 scale) represents the severity (average amount of infection on infected heads). The VRI is the product of Incidence × Severity. After harvest (using low wind speed on the combine to retain lightweight *Fusarium*-damaged kernels (FDK)), 20g of well-mixed cleaned seed (again retaining FDK) of at least 2 replicates of 'C' tests are ground to flour. From each replicate, 1.000 g of flour (weighed to three decimal places) is used for DON analysis using ELISA tests.

The VRI or FHB Index and DON data (ppm) are provided in the DET reports. Additionally, the Incidence/Severity/DON value (ISD) = (0.3 Incidence) + (0.3 Severity) + (0.4 DON) is calculated to give a measure of damage due to the fungus and to DON accumulation.

In the greenhouse, screening may be done by spray inoculation or by single floret inoculation (SFI). The spray method closely follows the field inoculation procedure, except that the head is subjected to inoculum (approximately 2 ml/head at 50,000 macroconidia ml⁻¹) and humidity just once. SFI provides a measure of spread of the fungus in the head. 10ul of a spore suspension of 50,000 macroconidia ml⁻¹ is placed inside the floret at anthesis. Plants are provided with 100% RH for 24 h. Rating is done 18-21 d later as percent infected spikelets.

Maria Antonia Henriquez - Protocol for evaluating reaction to *Fusarium* head blight using corn kernel inoculum

Having a nursery with plots that are 0.9 -1.0 m long, determine the amount of corn kernel inoculum based on a rate of 8 g/row. Prepare the inoculum in steam table pans (4") (Ref # APSP03, A plus Restaurant Equipment and supplies) using four *F. graminearum* isolates (two 15-ADON, two 3-ADON) selected from previous-years infected wheat. Each isolate is inoculated in individual pans in order to avoid growing competition. Starter isolates and detailed procedures are available upon request from the AAFC FHB pathologist. Entries in the FHB nursery are seeded with a 1.0m row length of and 0.6m pathway. The inoculum is dispersed between rows three times at weekly intervals starting when earliest

lines get into flag leaf stage. The cultivars 'CDC Teal' and 'AC Morse' are used as susceptible checks, 'AC Cora' and '5602 HR' are used as intermediate check, FHB 37 as a resistant check. The visual rating of fusarium head blight is evaluated at 21 days after anthesis. The FHB Index and the ISD data is assessed as described in the protocol for evaluating reaction to Fusarium head blight using macroconidia inoculum.



Protocol for evaluating reaction to wheat stripe rust (Denis Gaudet Mar. 2015)

Co-op entries are screened in a field stripe rust nursery at the adult stages. Field tests, which rely on natural inoculum for infection, should be conducted in regions such as southern Alberta, eastern Washington State, or south eastern British Columbia, that are normally exposed of high stripe rust severity. The field stripe rust nursery is seeded at two different sites, both in the same area, preferably with access to irrigation. Seeding late for both winter (late September, early October) and spring wheat (late May or early June) encourages late maturity of both wheat types which make them vulnerable to late airborne stripe rust infections. Plots are seeded in standard 3 to 5-metre rows with spreader rows of a susceptible variety at regular intervals. Spreader rows are inoculated in early to mid-June with a mixture of stripe rust races that were collected from naturally infected plots from the previous year. Spores are mixed in Soltrol oil to obtain a distinct orange colour (eg. to 2.5×10^5 cells/ml) and are sprayed on the crop in the evening in order to obtain optimum infection levels. The field nursery is rated for disease when symptom expression is optimal. A single rating is given for each line where the severity of the disease expressed as percentage of leaf coverage. The cultivar CDC Imagine is intermediate in

resistance, which corresponds to the “Do Not Object” level. Lines falling within a single standard deviation on either side of the CDC Imagine mean are defined as intermediate.

Checks: Lillian (Resistant), CDC Imagine (Intermediate) and Barrie (susceptible).

Appendix F. Wheat and Durum: Measurement of Quality Traits

The Canadian Grain Commission (CGC) is the federal agency with the authority to classify new wheat and durum varieties at registration. To be considered for support by the Quality Evaluation Team of the PRCWRT and to ensure a candidate line meets the class-specific quality requirements, registration trial material must be prepared, tested and reported as specified in the following four parts:

Part 1: Submission of registration trial material

Part 2: Quality factors to be tested for each registration trial category

Part 3: Laboratory testing methodology

Part 4: Reporting of data

Part 1. Submission of registration trial material

Instructions and spreadsheet templates “*Guidelines for Trial Coordinators and Private Labs*” can be found at: http://www.pgdc.ca/test_committees_wrt.html (*NOTE this link is not yet updated and active***)**

This section provides the breeding institution and/or trial coordinator with instructions on how to put together a composite from the various trial locations. The trial check samples are used to determine the desired composite percentage to be selected from each location. The CGC will review the check varieties from the trial for protein, grade and degrading factors and then calculate the desired location blend for quality submission purposes. The blend calculation will then be used by the breeder for preparing composites for each check and each candidate line and submitting these to the testing laboratory.

Part 2: Quality Criteria and tests for each registration trial category

CRITERIA	TESTS/PARAMETERS	Hard Red Spring	Hard White Spring	High Yield (Prairie Spring)	Hard Red Winter	Soft White Spring	Durum	Interim Wheat
WHEAT CHARACTERISTICS	Grade	✓	✓	✓	✓	✓	✓	✓
	Hard vitreous kernels, %						✓	
	Cadmium, ppb						✓	
	Protein, % (13.5 moisture basis)	✓	✓	✓	✓	✓	✓	✓
	Falling number, seconds	✓	✓	✓	✓	✓	✓	✓
MILLING PERFORMANCE	Milling yield, clean wheat basis, %	✓	✓	✓	✓	✓	✓	✓
	Milling yield, 0.50% ash basis, %	✓	✓	✓	✓			✓
	Semolina yield, %						✓	
FLOUR / SEMOLINA ANALYSIS	Protein, % (14.0% moisture basis)	✓	✓	✓	✓	✓	✓	✓
	Protein loss (wheat to flour), %	✓	✓	✓	✓	✓		✓
	Ash, %	✓	✓	✓	✓	✓	✓	✓
	Amylograph peak viscosity, BU	✓	✓	✓	✓	✓		✓
	Starch damage (Megazyme), %	✓	✓	✓	✓	✓		✓
	Solvent retention capacity, %					✓		
	Semolina colour						✓	
	Gluten index, %						✓	
	Yellow pigment, ppm						✓	
DOUGH PROPERTIES	Farinograph <ul style="list-style-type: none"> Water absorption, % Dough development time, min Stability, min 	✓	✓	✓	✓	✓		✓
	Alveograph <ul style="list-style-type: none"> P (height x 1.1), mm L (length), mm P/L W, x 10⁻⁴ joules 					✓	✓ *	
	Extensograph (90 or 135 minute rest) <ul style="list-style-type: none"> Area, cm² Rmax, BU Length, cm 	✓	✓	✓	✓			✓
END-PRODUCT QUALITY	Bread quality (Canadian Short Process or Remix-to-peak) <ul style="list-style-type: none"> Baking absorption (%) Mixing time (min) Mixing energy (Whr /kg) Loaf volume (cm³/100g flour) 	✓	✓	✓	✓			✓
	Spaghetti quality <ul style="list-style-type: none"> Colour (L*, a*, b*) 						✓	
	Noodle quality (Yellow alkaline/white salted) <ul style="list-style-type: none"> Sheet colour (L*, a*, b*) 	✓	✓	✓	✓			✓
	Cookie quality (Sugar snap) <ul style="list-style-type: none"> Spread (mm) Ratio (width/ thickness) 					✓		

* Only on those durum lines where Gluten Index is greater than 75

Part 3. Laboratory testing methodology

The CGC-Grain Research Laboratory official methods used in determining classification of varieties can be accessed at:

<http://www.grainscanada.gc.ca/wheat-ble/method-methode/wmtm-mmab-eng.htm>

Other testing laboratories may use different equipment or use different methods to achieve their analysis. It is incumbent on the breeding organization and wheat quality testing institution to ensure their data submission will meet registration trial requirements.

The Quality Evaluation Team chair and/or secretary should be consulted for any clarification of testing protocols or registration trial requirements.

Wheat quality tests are conducted according to standardized procedures and methods. Each time a test is performed on a composite sample, the method for that test must be closely followed in order to assure reliable and accurate quality data that can be compared from year to year through the registration trial process.

Unless otherwise specified:

- Analytical results for wheat are reported at 13.5% moisture content.
- Analytical results for flour and semolina are reported at 14.0% moisture content.
- AACC International methods cited are from the American Association of Cereal Chemists (AACC) International: Approved Methods of Analysis of the AACC International, 11th Edition, (<http://methods.aaccnet.org/toc.aspx>).
- ICC methods cited are those of the International Association for Cereal Science and Technology (ICC): ICC Standards: Standard Methods of the International Association for Cereal Science and Technology, 7th supplement, 1998.

Part 4: Reporting of data

Required Documents:

1 - **Introduction:** Prepared by the breeder/trial coordinator this provides a one page summary narrative on trial makeup including number of entries, trial locations and any seeding, growing or harvest issues that influenced the composite preparation. The summary can also declare the laboratory that prepared the samples as well as the testing laboratory and any relevant information on test results.

2 - Completed template from **Part 1 – Preparation of Registration Trial Material** providing results by trial location of check sample grading, protein and composite blending calculations as provided by the CGC as well as check and line composite grade and degrading factors as provided by the CGC

3 - Quality data sheet:

All data from testing of check varieties and candidate lines for each trial must be reported in a standardized spreadsheet (Microsoft Excel) for evaluation by the PRCWRT Quality Evaluation Team. Use of the standardized spreadsheet will provide a consistent format for reviewing quality data relative to check varieties. Data for some parameters will be rated based on established ranges in order to assist review and give a visual (colour) profile of test results.

Each of the templates for reporting the following Quality Data is available at:

http://www.pgdc.ca/committees_wrt.html *(NOTE this link is not yet updated and active)*

Hard Red Spring wheat

Hard White Spring wheat

High Yield (Prairie Spring) wheat

Hard Red Winter wheat

Soft White Spring wheat

Durum wheat

Interim wheat

Note there is no quality testing required for candidate lines for the Canada Western General Purpose class.

Optional Document:

The breeder/ trial coordinator may provide the pedigree of entries if desired.

Submit data to the QET Committee (see contact below) as early as possible for review and posting before the PGDC meeting in late February.

For more detail on reporting data, contact the Quality Evaluation Team Secretary, Ms. Connie Briggs at connie.briggs@usask.ca

APPENDIX G: Data Release Policy

Operating Procedures used by the PRCWRT will be available.

The PRCWRT minutes are available at the PGDC website page:

http://pgdc.ca/committee_wrt/committees_wrt_p.html and posted by April 1 following the annual meeting. Included in this report will be the voting results (Evaluation Team and Committee votes) for each candidate cultivar considered. The report will consist of the meeting minutes of each Evaluation Team and the Committee.

Developers, owners and marketing institutions may use the data for their lines without request for permission. Comparisons may only be made with check cultivars in the trials in which the candidate was evaluated.

Data for candidates supported for registration may be used in “provincial government variety guides” without request for permission.

Disclaimer to be published with the PRCWRT minutes:

The data contained in these documents are the copyright property of the Prairie Recommending Committee for Wheat, Rye and Triticale (PRCWRT). The information contained herein may not be reproduced, published or disseminated in any form other than in its entirety, without the express written consent of the PRCWRT.

The data contained in this document are collected from several sources. The PRCWRT does not guarantee the veracity of subsets of these data.

The members/experts of the PRCWRT evaluate the merit of genotypes/cultivars using a pool of performance parameters collected over several years and multiple locations. Any subset of these data cannot be considered a reliable indication of overall merit.

Requests for permission to use portions of this document must be forwarded, in writing, to the PRCWRT Chair. Guidelines to the Chair in granting permission to use portions of PRCWRT data are as follows:

- a) Permission to use data subsets will be refused in situations where, in the considered opinion of the Chair, the data will be presented in a misleading manner.
- b) The data for the checks is considered public domain and a request for use will be approved unless it conflicts with point (a).
- c) The use of data specific to entries may be approved with the express written consent of the relevant breeder/sponsor.
- d) The Chair, in granting permission to use the data, will consider and respect information that is proprietary.
- e) If Registration Trial data is used outside of the PRCWRT, proper acknowledgement of who provided the data should be made.

APPENDIX H: Conflict of Interest Guidelines

The PRCWRT has as one of its mandates, the responsibility “to advise on the performance of lines in registration trials and make recommendations regarding the registration of candidates to the Variety Registration Office, Canadian Food Inspection Agency.” While members are expected to vote impartially, abstaining from a vote is appropriate when sound ethical judgment indicates a ‘Conflict of Interest’.

A Conflict of Interest arises when an individual acting in an official capacity (public official, employee, professional, etc.) has private or personal interests sufficient to appear to influence the objective exercise of their duties. Conflicts of Interest interfere with professional responsibilities by clouding objective, professional judgment (Michael McDonald, Centre for Applied Ethics, University of British Columbia).

There are three key elements in defining a Conflict of Interest:

- **Private or personal interest:** The pursuit of private or personal interests does not create a conflict of interest unless it occurs during the exercise of official capacity.
- **Exercise of official capacity:** Duties and obligations that are part of an office or official capacity must prevail over private or personal interests.
- **Responsibility to use objective professional judgment:** Professionals are expected to provide sound, objective and independent advice. Factors that interfere (or appear likely to interfere) with professional objectivity are a matter of legitimate concern to those who rely on this advice.

In addition to *actual* Conflicts of Interest, *apparent* and *potential* conflicts should be avoided.

- **Apparent Conflict of Interest:** a situation in which a reasonable person would believe that the professional’s judgement is likely to be compromised.
- **Potential Conflict of Interest:** a situation that could develop into an actual conflict of interest.

The key in discovering a personal Conflict of Interest is to determine if the situation is likely to interfere, or appears to interfere, with the independent judgement expected in performing your official duties. Trust is the core issue. Conflicts of Interest involve an abuse (actual or potential) of the trust that people have in professionals. In addition to direct damage to particular clients and employers, Conflicts of Interest injure the entire profession by reducing the confidence that people have in professionals.

An excellent diagnostic tool is the “trust test”: *Would relevant others (employer, clients, colleagues, general public) trust my judgment if they knew I was in this situation?*

When a personal Conflict of Interest is recognized, the ethical responses are:

- Reveal your private interest to the relevant parties.
- Remove yourself from the decision making process or advice-giving role.

APPENDIX I: The Canadian Wheat Workers Code of Ethics

This seed is being distributed (or received) in accordance with the “Canadian Wheat Workers’ Code of Ethics,” last revised by the Canadian Wheat Improvement Network on 25 February 2010.[†]

1. The originating breeder, institution or company has certain rights to the germplasm. These rights remain with the originator and are not waived with the distribution of seeds or plant material. A seed recipient is defined as an individual who directly contributes data for the trial in which the germplasm is being evaluated.
2. The recipient of seeds or plant material shall make no secondary distribution of the germplasm without the permission of the owner/breeder.
3. The owner/breeder, in distributing seed or other propagating material of the germplasm, grants permission for its use in trials under the recipient’s control and as a male parent for making crosses from which selection will be made. As a courtesy, it is suggested that the owner/breeder be notified of the intent to use the germplasm in crosses.
4. Uses of all germplasm for which written approval of the owner/breeder is required include the following:
 - a) Testing in regional trials or international nurseries.
 - b) Use as a check in registration trials.
 - c) Increase and release as a cultivar.
 - d) Reselection from within the stock.
 - e) Use as a parent of a commercial F₁ hybrid, synthetic, or multi-line cultivar.
 - f) Use as a recurrent parent.
 - g) Mutation breeding.
 - h) Selection of somaclonal variants.
 - i) Use as a recipient parent for asexual gene transfer, including gene transfer using molecular genetics techniques.
5. Germplasm distributed in public registration trials shall not be used for seed increase except for the purpose of creating a common seed source for further testing. Reasonable precautions to ensure retention or recovery of the germplasm shall be taken.
6. Germplasm with patented traits (e.g.: Clearfield[®] herbicide resistance) falls under these guidelines. When a line with a patented trait is used as a parent for crossing, active selection against the trait must be practiced. The consent to cross to germplasm with patented traits does not constitute any type of agreement with the owner of the trait.
7. The Canadian Wheat Workers’ Code of Ethics does not apply to lines in private trials unless explicitly stated by the owner of the germplasm.
8. It is encouraged that a copy of this code accompanies any distributed germplasm to which it will apply. It is further suggested that the individual distributing the germplasm should sign and list the distributed material on the back of the copy. Signatures are not required for germplasm distributed in Canadian public registration trials.

[†] Although this code was developed for lines entered into publicly run trials, it is hoped that the distribution of all germplasm will be done in a spirit of collaboration, as demonstrated herein. The Canadian Wheat Workers’ Code of Ethics is based on a similar code developed by the National Wheat Improvement Committee of the USA.

APPENDIX J: Registration Trial Inspection Report

Year: _____
 Registration Trial: _____
 Inspection Date: _____
 Crop Stage: _____

Location: _____
 Contact Name: _____
 Contact Tel/Cell: _____

GPS Coordinates: North: _____ West: _____

1. Based on the randomization, do the check cultivars appear in the right places?

Check Variety	Rep 1	Rep 2	Rep 3	Rep 4

Check Variety	Rep 1	Rep 2	Rep 3	Rep 4

2. Do distinguishable lines appear in the right places within each rep? _____

3. Does the trial have adequate border plots? _____

4. Are there any visible gradients within the trial area? Within reps? Within plots?

5. Problems? E.g. uneven stand, winter kill, plant stress, poor weed control, herbicide damage, animal damage, prevalent diseases, lodging, shattering, other.

6. Recommendation: Acceptable: _____ Unacceptable: _____ Conditional: _____

Comments: _____

Inspected By: _____ Signature: _____

Appendix K: Operating Principles used in the Cooperative Registration Trials

Traditionally, plant breeders, agronomists, plant pathologists, and cereal quality specialists worked together to evaluate candidate cultivars in each market class of wheat, as well as winter rye and spring triticale. These collaborative trials became known as “Co-operative Registration Trials”, “Co-ops”, or “C-Level Tests”. The operation of co-op trials is the responsibility of the co-operators in the test, subject to Committee approval. Co-operators in a particular co-op trial are those scientists and field trial managers responsible for conducting the various tests and sponsors submitting candidate cultivars to the registration trial.

The following general principles apply to the Co-operative Registration trials:

- a) Locations: Locations are determined by the test co-operators. They may be conducted by the private or public sector and are chosen to represent areas of adaptation for the crop. Growing tests in multiple environments provides the opportunity for assessment of agronomic and end-use quality performance under different growing conditions.
- b) Acceptance of entries for testing: As a general principle, six station years of data from the area of its intended commercial production, along with that of appropriate check cultivars, are required for entry into co-operative tests. The test co-ordinator decides the eventual list of entries that are tested, consulting with submitters of entries as required. It is expected that only lines competitive with the checks will be submitted. Plants known to have novel traits (PNT) must have unconfined release status for such material before acceptance into co-operative tests. Plants known to have novel traits that do not have unconfined release can only be tested in Private Registration Trials (Section 2.2). If a failed entry is to be re-entered into a registration trial, permission by the Committee is required.
- c) Limits on entry numbers: Every attempt is made to accept all qualified entries. However, resource restrictions require limits to be imposed. The co-operators, subject to approval by the Committee, determine the acceptance of entries.
- d) Security of entries: Test co-ordinators and co-operators will take reasonable precautions to ensure the security of test entries.
- e) Check varieties: Check varieties are chosen by the Committee to represent specific classes, types and adaptation. Check varieties are normally the best commercially available cultivars for each class or type. In some instances checks are chosen to provide a basis of comparison for quality or disease evaluation. Candidate cultivars will be compared to the appropriate check(s) of the class for which they are being considered. Note that this may not be the same check as the one used when the line was entered into the registration trial. The candidate will not be compared to other lines in the test for registration recommending purposes. When interpreting results, a candidate will not be compared to a check variety for a specific trait when the check is known to perform poorly for that trait.
- f) Disposition of entries: The owner of a line can withdraw it at any time. Lines are retained in the registration trials based on the request of the owner and the approval of the co-operators and the Committee. A line will only be kept in trials for a year beyond the minimum testing requirement upon agreement of the Committee.
- g) Fees: The PRCWRT may establish a fee structure and a mechanism for handling the fees to ensure that they are applied to the costs of operating the tests. Such fees are subject to annual review. Contact the test co-ordinator for details.
- h) Condition of acceptance: It shall be a condition of acceptance of a candidate cultivar for testing, that the party submitting the candidate cultivar agrees that the testing and evaluation procedures used by the PRCWRT are appropriate and that these testing and evaluation procedures, however defined, shall not justify an appeal of a Committee decision.
- i) Limitation of liability: It is a condition of acceptance of a candidate cultivar for testing that the party submitting the candidate cultivar acknowledges that neither the PRCWRT nor its members and agents shall in any way be liable for any error or omission occurring as a result of the testing and evaluation process.

- j) Ethical conduct: Co-operative Registration Trials are subject to the provisions of the Canadian Wheat Workers' Code of Ethics as defined and periodically updated by the Canadian Wheat Improvement Network (CWIN).

Co-op trials are managed on behalf of the Committee by a test co-ordinator and the co-operating group. It is the collective responsibility of the participants in the co-op trial to ensure unbiased and accurate testing of the candidates. A current list of co-ordinators can be obtained from the PRCWRT Secretary.

Test co-ordinators are appointed by the co-operators in the test, subject to approval by the Committee. Co-ordinators are responsible, in consultation with the co-operators, for deciding on admission of new candidates, general co-ordination of the trial, for compiling and analysing the data, and for preparation and distribution of the annual report. Annual reports of the Registration Trials must be available to the PRCWRT membership at least seven days prior to the February annual meeting, where the tests and the disposition of entries are reviewed. Co-ordinators are reminded that participants in the Registration Trial will require the reports in advance of general availability so that *Requests for Support of Registration* can be prepared. Revised reports are included in the Committee minutes and are circulated to the membership following the meeting.

Candidate cultivars in a co-op trial will have sufficient merit to warrant registration testing and the consumption of limited research resources. Lines are admitted or retained by consensus among the co-operators based on the performance of the candidates relative to the check cultivars and the likelihood of their ultimate registration. Numbers of entries in the co-op will be kept low enough to ensure precision and avoid undue demands on those performing the testing. Candidates accepted for testing under Contract Registration Procedures (Section 4) will not normally be tested in co-op trials.

Entry of candidates into a co-op trial typically requires six station-years of acceptable yield data from the targeted agro-ecological zone, plus satisfactory evaluations for important agronomic, disease and end-use quality traits. To control the number of qualified candidates in a co-op trial, entry requirements may be temporarily waived or increased by consensus of the co-operating group. There is no guarantee that all lines proposed for co-op testing will be admitted. Where there is serious concern that the requirements for testing a particular candidate(s) would seriously jeopardize the normal operation of the co-op trial, the co-operating group may refuse entry to the registration trial.

Seed stocks for candidate cultivars used in the registration trials must be of reasonable purity. As a guideline, the standards for germination should be similar to that required for Certified Seed, as defined by the *Seeds Regulations, Part I*.

As candidate cultivars have not been through the rigors of breeder seed development, morphological off-types may be expected, but should not exceed five percent. Acceptable off-types are those plants that exhibit phenotypes or genotypes that can be reliably removed during the process of breeder seed development; for example, seed colour, plant height, rust reaction. A line that has a trait that is difficult to reliably select against during breeder seed development will not be acceptable. The testing conditions, number of plants in yield plots (typically about 1000), and proximity to other cultivars precludes reliable detection of variants.

Retention of candidates for second and third years of testing should focus on performance in the co-op trial. Justification for retention will be required for lines that have been rejected by any of the Evaluation Teams. Candidates will not be tested beyond the three years required for registration unless there is agreement among the co-operating group to do so. In some cases, candidates retained for a second or third year of testing in one co-op trial may "cross-over" to another co-op trial if a suitable case is made (e.g.: Western Bread Wheat co-op to Central Bread Wheat co-op).

Candidate cultivars that fail to meet end-use quality specifications of the intended wheat quality class following a year of registration testing will not be re-entered into the same registration trial without agreement by the appropriate Evaluation Team Chair.

In the event of an unresolved conflict within a co-operating group, the decision of the Committee will be final.

Co-operators should meet all reasonable requirements set by the test co-ordinator with regard to quality, quantity, and time for submission of seed, provision of data for consideration of candidates, and attendance at meetings to determine the disposition of candidates. Failure to meet these requirements may result in deletion of the candidate from the co-op trial. While the co-ordinator may arrange for increase of the candidates under test, roguing and monitoring of seed purity is the responsibility of the sponsor of the candidate.

Although co-op trials may be run without charge, co-operators are reminded that testing candidate cultivars is expensive. The Committee has the authority to institute a system of charges if the costs and benefits of operating the co-op trials become unbalanced. Institutions that do not make a substantial contribution towards the co-op testing system may be charged a candidate entrance fee to help defray the costs of testing. An offer of payment for testing does not assure entry or retention of a candidate in the co-op trial. A description of any such charges will be documented in the appendices as a requirement for entry.

APPENDIX L: 2014-2015 PRCWRT Membership (Approved February 2015)

	Last Name	First Name	Title	Company/Institution	Committee Position
1	Pozniak	Curtis	Dr.	University of Saskatchewan	AET/Chair
2	Kirigwi	Francis	Dr.	Syngenta Seeds Canada	AET/Secretary
3	Aljarah	Mazen	Dr.	Alberta Agriculture & Food	AET
4	Altwasser	Allen	Mr.	Super Seed Inc.	AET
5	Cosmin	Badea	Mr.	Canterra Seeds Ltd.	AET
6	Beres	Brian	Dr.	Agriculture & Agri-Food Canada	AET
7	Bonis	Peter	Mr.	Seed Link	AET
8	Brûlé-Babel	Anita	Dr.	University of Manitoba	AET
9	Burt	Andrew	Dr.	Agriculture & Agri-Food Canada	AET
10	Chapman	Bill	Mr.	Alberta Agriculture & Food	AET
11	Cooper	Blake	Dr.	Limagrain	AET
12	Cuthbert	Richard	Dr.	Agriculture & Agri-Food Canada	AET
13	Davies	John	Dr.	Syngenta	AET
14	Degenhardt	Keith	Dr.	Western Grains Research Foundation	AET
15	DePauw	Ron	Dr.	Agriculture & Agri-Food Canada	AET
16	Durand	Claude	Mr.	Syngenta Seeds Canada	AET
17	Etienne	Mark	Dr.	Dow AgroSciences	AET
18	Ferguson	Tim	Mr.	Crop Protection Services	AET
19	Fotheringham	Doug	Mr.	Syngenta	AET
20	Fowler	Brian	Dr.	University of Saskatchewan	AET
21	Fritsche	Walter	Mr.	B.C. Grain Producers Association	AET
22	Gordillo	Andres	Dr.	KWS LOCHOW GMBH	AET
23	Graf	Robert	Dr.	Agriculture & Agri-Food Canada	AET
24	Holmstrom	Darrell	Mr.	Alberta Rye and Triticale Association	AET
25	Hucl	Pierre	Dr.	University of Saskatchewan	AET
26	Humphreys	Gavin	Dr.	Agriculture & Agri-Food Canada	AET
27	Huvenaars	Richard	Mr.	Alberta Soft Wheat Producers Commission	AET
28	Japp	Mitchell	Mr.	Saskatchewan Ministry of Agriculture	AET
29	Kemppainem	Arling		Bayer Crop Science	AET
30	Kotylak	Krista	Ms.	Agriculture and Rural Development	AET
31	Kubinec	Anastasia	Ms.	Manitoba Agriculture, Food & Rural Initiatives	AET
32	Kumar	Santosh	Dr.	Agriculture & Agri-Food Canada	AET
33	Larsen	Jamie	Dr.	Agriculture & Agri-Food Canada	AET
34	Love	Rick	Mr.	Canterra Seeds Ltd.	AET
35	Markert	Ron	Mr.	Canadian Seed Growers Association	AET
36	Maxwell	Dana	Ms.	AgQuest Inc.	AET
37	Merryweather	Rod	Mr.	FP Genetics	AET
38	Meyer	Leo	Mr.	Leo Meyer Grain Production Limited	AET
39	Fritsche	Walter	Mr.	B.C. Grain Producers Association	AET
40	Nelson	Ken	Mr.	AG Solutions Inc	AET
41	Ottmar	Philipp	Dr.	Plantomar LTD	AET
42	Randhawa	Harpinder	Dr.	Agriculture & Agri-Food Canada	AET
43	Rothenburger	Patti	Dr.	Manitoba Agriculture, Food & Rural Initiatives	AET
44	Ruan	Yuefeng	Dr.	AAFC	AET
45	Rutherford	Rick	Mr.	Winter Cereals Canada	AET
46	Spaner	Dean	Dr.	University of Alberta	AET
47	Tait	Glenn	Mr.	Saskatchewan Wheat Development	AET

Commission

48	Vos	Henry	Mr.	Alberta Wheat Commission	AET
49	Yau	Matthew	Dr.	Ag Quest	AET
50	Zatorski	Tom	Mr.	Bayer Crop Science	AET
51	Chopra	Satinder	Mr.	Syngenta Seeds Canada	DET
52	Comeau	André	Dr.	Agriculture & Agri-Food Canada	DET
53	Comin	Lauren	Ms.	Alberta Wheat Commission	DET
54	Court	Randy	Mr.	Court Seeds	DET
55	DeRocquigny	Pam	Ms.	Manitoba Agriculture, Food & Rural Initiatives	DET
56	Despins	Therese	Ms.	Agriculture & Agri-Food Canada	DET
57	Fernandez	Myriam	Dr.	Agriculture & Agri-Food Canada	DET
58	Fetch	Tom	Dr.	Agriculture & Agri-Food Canada	DET
59	Foroud	Nora	Dr.	Agriculture & Agri-Food Canada	DET
60	Gaudet	Denis	Dr.	Agriculture & Agri-Food Canada	DET
61	Gilbert	Jeannie	Dr.	Agriculture & Agri-Food Canada	DET
62	Haber	Steve	Dr.	Agriculture & Agri-Food Canada	DET
63	Hiebert	Colin	Dr.	Agriculture & Agri-Food Canada	DET
64	Khan	Jahangir	Dr.	AgQuest (Alta), Inc.	DET
65	Knox	Ron	Dr.	Agriculture & Agri-Food Canada	DET
66	Kutcher	Randy	Dr.	Crop Development Centre	DET
67	Lefsrud	Ed	Mr.	Seed Grower	DET
68	Martin	Richard	Dr.	Agriculture & Agri-Food Canada	DET
69	McCallum	Brent	Dr.	Agriculture & Agri-Food Canada	DET
70	McCartney	Curt	Dr.	Agriculture & Agri-Food Canada	DET
71	Mclean	Eric	Mr.	Manitoba Seed Growers Association	DET
72	Menzies	James	Dr.	Agriculture & Agri-Food Canada	DET
73	Stow	Jennifer	Ms.	Manitoba Seed Growers Association	DET
74	Tekauz	Andy	Dr.	Agriculture & Agri-Food Canada	DET
75	Turkington	Kelly	Dr.	Agriculture & Agri-Food Canada	DET
76	Xi	Kequan	Dr.	Alberta Agriculture & Food	DET
77	Arney	Sheilagh	Ms.	ADM Milling Co.	QET
78	Assefaw	Esey	Mr.	Canadian International Grains Institute	QET
79	Beswitherick	Daryl	Mr.	Canadian Grain Commission	QET
80	Briggs	Connie	Ms.	University of Saskatchewan	QET
81	Butti	Cathy	Ms.	Syngenta	QET
82	Dupuis	Brigitte	Dr.	Canadian Grain Commission	QET
83	Durand	Valerie	Ms.	Canada Bread Fresh Bakeries	QET
84	Dyck	Adam	Mr.	Warburtons	QET
85	Edwards	Nancy	Dr.	Cereal Grains Consultant	QET
86	Entz	Peter	Mr.	Richardson International	QET
87	Fu	Bin Xiao	Dr.	Canadian Grain Commission	QET
88	Hatcher	David	Dr.	Canadian Grain Commission	QET
89	Kieper	Richard	Mr.	Paterson Grain LTD	QET
90	Lekhi	Arun	Mr.	P&H Milling	QET
91	Nemeth	Lisa	Ms.	Cereal Grains Consultant	QET
92	Niziol	Dave	Mr.	Agriculture & Agri-Food Canada	QET
93	Santangelo	Paulo	Mr.	Ellison Milling Co.	QET
94	Sapirstein	Harry	Dr.	University of Manitoba	QET
95	Sarkar	Ashok	Mr.	Canadian International Grains Institute	QET
96	Scanlon	Martin	Dr.	University of Manitoba	QET

97	Schlichting	Linda	Ms.	Canadian Grain Commission	QET
98	Sopiwnyk	Elaine	Ms.	Canadian International Grains Institute	QET
99	Supene	Yvonne	Ms.	Canadian International Grains Institute	QET
100	Worden	Graham	Mr.	Paterson Global Food	QET
101	Bertholet	Jeff	Mr.	BASF Canada	AM
102	Capelle	Stephen	Mr.	Agriculture & Agri-Food Canada	AM
103	Comin	Lauren	Ms.	Alberta Wheat Commission	AM
104	Downey	Jim	Mr.	SeCan Association	AM
105	Feist	Gina	Ms.	Western Grains Research Foundation	AM
106	Gehl	David	Mr.	Agriculture & Agri-Food Canada	AM
107	Greig	Fred	Mr.	Canterra Seeds Ltd.	AM
108	Grenier	Mike	Mr.	Gowan Agro Canada	AM
109	Loiselle	Marc	Mr.	Saskatchewan Organic Directorate	AM
110	Mercer	Loyld	Mr.	Alberta Wheat Commission	AM
111	Nakonechny	Marvin	Mr.	Progressive Seeds	AM
112	Ntiamoah	Charles	Dr.	World Wide Wheat, LLC	AM
113	Nyachiro	Joseph	Dr.	Alberta Agriculture & Food	AM
114	Richardson	Sheldon	Mr.	World Wide Wheat LLC	AM
115	Smith	John	Mr.	Seed Depot	AM
116	Weik	Ron	Mr.	FP Genetics	AM
117	Woods	Bill	Mr.	CWB Director	AM
118	Wright	Brent	Mr.	ICMS Inc.	AM