PRAIRIE RECOMMENDING COMMITTEE

FOR

WHEAT, RYE AND TRITICALE

OPERATING PROCEDURES

- FINAL DRAFT -

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1. INTRODUCTION

Introduction

This document outlines the pre-registration testing system protocol and evaluation process for the Prairie Recommending Committee for Wheat, Rye and Triticale (PRCWRT). The PRCWRT evaluates candidate varieties of wheat, rye and triticale for merit as a part of pre-registration requirements and makes a recommendation for registration, which is a requirement for registration by the Variety Registration Office (VRO), Canadian Food Inspection Agency (CFIA) for cultivation in the western region of Canada. The procedures for entering a variety for testing are documented and reviewed annually by the PRCWRT, and are readily available to the public on the PRCWRT web page at http://pgdc.ca/committees_wrt_pd.html .

As required by the *Seeds Regulations* paragraph **65.1** (1) (e), PRCWRT functions transparently and deals with varieties in a fair and consistent manner.

Legislation and Authority

The *Seeds Act* is the legislative authority for the *Seeds Regulations* and pursuant to section **65.1** of the *Seeds Regulations* (Appendix I) the Minister of Agriculture and Agri-Food approves crop-specific variety registration recommending committees. **The purpose of the** PRCWRT **is to establish and administer protocols for testing varieties of wheat, rye and triticale to determine the merit of varieties and, subsequently, to make registration recommendations to the Registrar, VRO.**

The PRCWRT is an integral part of the variety registration system in Canada and serve to provide expertise and guidance to the Registrar.

The *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, paragraph 3. (1) (b)). The CFIA registers cultivars of spring wheat, winter wheat and durum wheat, spelt, rye and triticale. Recommending committees establish science-based criteria to determine merit of a variety in order to make a recommendation on registration of the variety. The current variety registration system for a given crop consists of one of three regulatory tiers of varying registration requirements (Schedule III, Parts I, II, and III). 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, which include oilseed, soybean and forage crops, have basic registration requirements. Application is made directly to the CFIA-VRO.

Part I crops, which includes wheat, rye, triticale, require testing prior to registration with official oversight and merit assessment to ensure that cultivars meet minimum standards. Registration requires a recommendation from a CFIA recognized crop specific Registration Recommending Committee (RRC). “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” (*Seeds Regulations* **63.**). Merit is determined by the crop specific recommending Committees. Merit assessment is only required for crops in Schedule III, Part I variety registration.

Role of the Variety Registration Office

The VRO reviews and approves PRCWRT's (and other recommending committee's) operating procedures document annually. Any changes to this document require approval by the committee members and subsequent approval by the VRO. The VRO issues an annual approval letter, signed by the Registrar on behalf of the Minister to each variety recommending committee in Canada. This letter recognizes the committee as the sole authority in that region to provide variety registration recommendations to the VRO for the year.

The VRO has regulatory oversight of the recommending committees to ensure that the committees are functioning transparently and that varieties are dealt with in a fair and consistent manner, in accordance with the approved committee operating procedures and in compliance with the *Seeds Regulations*. The VRO provides guidance on the requirements of the *Seeds Act* and the *Seeds Regulations* to all the recommending committees as required. In the Fall of 2015, the VRO released a model operating procedures (MOPs) guidance document for all registration recommending committees in Canada. The committees provide their expertise and advice to the VRO, which is considered by the Registrar in rendering a decision on variety registrations.

The VRO (the Registrar) is also the 'court of last resort' for stakeholders taking issue with the compliance of the recommending committees with the model operating procedures (MOP), or the *Seeds Regulations*; however, the first step is to contact the committee itself with the grievance.

The list of all current, recognized recommending committees can be found on the following CFIA website at: http://www.inspection.gc.ca/plants/variety-registration/registration-procedures/recommending-committees/eng/1359958262947/1359958370983

1.1 Procedural Framework

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 as one of the requirements for applying for registration with the CFIA-VRO. The PRCWRT is the recommending committee (RC) for western Canada (MB, SK, AB, BC). Recommendations to "support" or "do not support" 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 registration trials.

The PRCWRT has established protocols for the concurrent determination of the value for cultivation and the end-use properties of each variety. For western wheat varieties, merit is defined as including agronomic, phytopathological and end-use properties. The market classification of each variety is the responsibility of the Canadian Grain Commission (CGC) as per the Canada Grains Regulations, which has access to the end-use property data generated under the authority of, or submitted to, the PRCWRT to assign variety classification.

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 (including durum and spelt), rye, and triticale candidate cultivars for registration in the various agro-ecozones of western Canada. This includes spring and fall/winter types as well as hybrid cereals. 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.

Wheat or durum lines that are not candidates for existing end-use categories may be eligible for interim or contract registration. Candidates for Interim registration are advised to consult with the Canadian Grain Commission (CGC). The 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. It should be noted that the approval of a registration trial protocol does not imply that the infrastructure to accommodate it will exist.

2. THE PRAIRIE RECOMMENDING COMMITTEE FOR WHEAT, RYE AND TRITICALE

2.1 Operating Procedures

The PRCWRT operating procedures developed and approved by the PRCWRT are submitted to, and approved by, the CFIA-VRO. Although the operating procedures undergo a regular full review, changes may be proposed at membership and/or CFIA at any time. All changes to the operating procedures or their appendices require a Committee motion supported by a simple majority vote. 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 to operating procedures 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 simple majority vote where a quorum is present (35% of voting members for operating procedures). 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

The core mandates of the PRCWRT are to:

1. To establish test procedures and co-ordinate trials to evaluate the merit of potential cultivars of wheat, rye, and triticale found in Schedule III, Part I, *Seeds Regulations*.

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.

Additional objectives include:

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 Membership and Structure

2.3.1 Full Membership of the PRCWRT

In accordance with paragraphs **65.1** (1) (a) and (b) of the *Seeds Regulations*, the PRCWRT must have the knowledge and expertise required to establish and administer testing protocols, and to determine the merit of varieties of that species, kind or type of crop for the specific region(s).

The PRCWRT includes membership representing the full value chain of wheat, rye and triticale stakeholders including variety development, production, processing, marketing, and seed trade of varieties.

The committee includes representation from three broad-based value chain stakeholder groups:

- **Variety/Trait Developer and Assessor** representation (this includes plant breeders, agronomists, pathologists, entomologists, molecular geneticists, and business leaders with expertise in one or more aspects of the specific crop)

- **Producer** representation (representatives chosen by crop specific producer and seed grower organizations)

- **End-User** representation (includes cereal/chemist/quality experts, the seed trade, and representatives chosen by, for example, a miller's organization, grain traders' organization representing domestic and export markets (marketers) for the specific crop and processors).

The identification, affiliation and area of expertise of the committee members will be provided to the VRO and to the committee membership: the name of the person, title on the committee, expertise criteria (e.g., agronomy, pathology, quality, milling, processing, exporting/marketing etc.), title in his/her organization, identification of their organization, and contact information.

All PRCWRT full 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.

Full members who do not attend the PRCWRT annual meeting for two (2) consecutive years, and do not provide an acceptable excuse to the Committee Chair, will be moved to Associate Member status on the third consecutive year of non-attendance.

2.3.2 Associate Members (non-voting)

Associate members are experts and stakeholders who are not PRCWRT members (those who do not vote on variety recommendations). Associate members will be eligible to attend and participate in general meetings. They do not have the vote on variety registration recommendations but may be appointed to PRCWRT subcommittees (e.g. the evaluation teams) at the discretion of the voting membership. Associate members will have an opportunity to be recognized by the Chair and provide constructive input to the voting committee and will be granted full access to the proprietary area of the PRCWRT website.

Associate Members who do not attend the PRCWRT annual meeting for two (2) consecutive years, and do not provide an acceptable excuse to the Committee Chair or if not still actively engaged in the Wheat, Rye or Triticale industry, will be removed from the membership list on the third consecutive year of non-attendance.

2.3.3 Guests (non-voting)

There is a provision for visitors with an interest and/or expertise in the crop sector to attend the meetings (e.g., students, educators and researchers, members of the press, interested parties). Attendance of guests must be approved by the Chair of the PRCWRT. Guests at the meetings have a voice and will have an opportunity to engage in discussions at both the Evaluation Team and RC levels

2.3.4 Structure of the PRCWRT

The PRCWRT (Recommending Committee) consists of three Evaluation Teams and the Cultivar Voting Panel (CVP). The three evaluation teams are:

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

All full members will be associated with one evaluation team. The Evaluation Teams are responsible for

a) Defining merit

b) Determining testing and evaluation protocols

c) Assessing the merit for agronomic performance, disease/pest resistance and end-use quality (milling, protein quality & quantity, enzymes, and end-use products).

Each Evaluation Team must have a Chair and Secretary. These six individuals form the PRCWRT Executive. 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.

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.

At the discretion of the PRCWRT, ad hoc working sub-committees can be struck. These sub-committees may be made up of either committee members and/or non-voting crop specific value chain stakeholder experts attending the meeting. Subcommittees may, at the discretion of the PRCWRT, be established for specific purposes (e.g., selection of new check varieties, recommendations on quality, pathology, agronomy of candidate varieties) culminating in a report to the PRCWRT to aid them in assessing merit and voting on registration recommendations.

The Cultivar Voting Panel (CVP) reports to the RC and recommends to the PRCWRT to either support or reject candidate cultivars in which one or more of the Evaluation Teams have indicating a deficiency of merit for their particular area of expertise.

The CVP consists of experts and organizations of Full PRCWRT members who represent various sectors of the wheat, rye and triticale value chain.

The current list of value chain representatives for the CVP are:

Evaluation Team	**Value Chain Role**
AET:	Alberta Wheat Commission
	Saskatchewan Wheat Development Commission
	Manitoba Crop Alliance
	Agronomist
	Private breeder
	University breeder
	AAFC breeder
DET:	Disease Expert (Stem Rust)
	Disease Expert (Leaf Rust)
	Disease Expert
	Disease Expert
	Insect Expert
	Disease Expert
	Producer organizations representative
QET:	Hexaploid wheat quality specialist
	Durum wheat quality specialist
	Milling industry representative
	Baking Industry representative
	Western Grain Elevator Assoc. representative

	Canadian Grain Commission representative Canada branding / technical & market support (CIGI)
Other:	Canadian Seed Growers Association representative Seeds Canada representative

2.4 Voting Procedures

Voting for changes to the PRCWRT operating procedures and for variety registration recommendation are by a simple majority vote: 50 per cent plus one person. There are only three possible voting options for committee members:

1) To **support** (the motion),

2) To **object** to (the motion) or, rarely,

3) To **abstain** from voting.

The Chair only votes in the case of a tie and the Secretary votes if they are a *bona fide* voting member. The committee may see value in having a non-voting Secretary, e.g., a hired professional, instead of having that position being taken on by a value-chain stakeholder with a vote.

2.4.1 Set Aside Rules

The PRCWRT can vote to set aside its normal operating procedures, including testing protocols and consideration of the merit of a candidate cultivar. For this to proceed, a two-thirds majority vote must be held to set aside the rules. For example, a new and valuable technology has been introduced in an otherwise partially deficient variety and the committee is being asked to make a decision on the new, valuable attributes not yet captured in the definition of merit for that crop kind.

In rare and extenuating circumstances, a proposer may bring forward a candidate cultivar with insufficient data because of “Acts of God”, urgent need, or to perform market development.

Any candidate cultivars considered as a result of setting aside the rules for merit assessment will be referred to the CVP.

2.5 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 day’s 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 recognized 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 that may contribute to the overall merit of a variety as determined by the PRCWRT.

3.2 Registration Trial and Protocol Endorsement

Registration trials may be conducted by the public or private sector, individually, or through collaborative arrangements. 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.

Any change to testing protocol must be approved by the PRCWRT. Where there is disagreement over the testing protocol, interpretation, or validity of data, the PRCWRT will make a majority decision (50 percent of voting members) based on the consultation/advice of appropriate Evaluation Teams. The decision of the PRCWRT will be final.

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 proposal for any new registration trial must be submitted to the PRCWRT no later than February 1 in the year of first planting. It is also advised that all Evaluation Team Chairs be notified of prior to the February 1 deadline to provide guidance to the requesting party.

Prior to the commencement of registration testing, the protocol used in the conduct of the registration trial must be supported by each Evaluation Team based on their recommendation to the RC as it relates to their expertise. This review and recommendation to the RC 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 recommended by the Evaluation Teams and implemented by the RC such that the protocol approved in the first year of testing may not necessarily be the same as that approved 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.

3.3.1 Testing in Lower Mainland British Columbia

For those wishing to register a cultivar specifically adapted to the lower British Columbia mainland, specifically, Fraser Valley, Metro Vancouver Regional Districts of southwestern British Columbia and Vancouver Island, the PRCWRT will examine each request on a case by case basis. It is expected that the proponent notifies the PRCWRT chairs of the AET, DET and QET prior to the commencement of testing to provide guidance on testing requirements and to develop valid testing protocols. The committee expects data for the cultivars to be generated in the lower British Columbia mainland, but will also consider relevant foreign data. In this case, the PRCWRT is willing to provide regionally restricted recommendations of support for registration only.

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.

For clarity, testing protocols of hybrid candidate cultivars of wheat, rye and triticale will be identical to those used for non-hybrid candidates.

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 ability to assess merit for yield and agronomic performance under a wide range of growing conditions typical of western Canada. 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 a candidate cultivar being considered for merit assessment. 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 in the registration trials, as determined by the PRCWRT for the various wheat classes, fall rye, spring and winter triticale, are summarized in Appendix C.

The first year of registration testing for a candidate cultivar may occur outside of approved registration trials (see section 3.2 and 3.3) provided that it follows testing protocols (including relevant check cultivars) as outlined in this section (3.4 – Merit Assessment).

3.4.1.2 Check Cultivars

The PRCWRT Standing Check Committee reviews and proposes check cultivars for each registration trial to the PRCWRT Committee for consideration and approval to define merit. Check cultivars will represent specific grain end-use category and adaptation. Check cultivars will be selected to represent established commercial varieties, special purpose varieties (e.g. solid stem cultivars resistant to wheat stem sawfly), or recently registered varieties 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 and all such exceptions are to be noted in the list of checks.

Check cultivars for assessment of merit for diseases and insect pests are established by the DET. These checks may be different to those used for merit assessment of agronomic/end-use quality traits. Please consult Appendix D and E for details of check cultivars

From time to time, check cultivars may be changed to reflect changes in merit criteria. Changes in check cultivars must be approved by the Committee and will be recorded in the annual Committee minutes as well as being incorporated into the committee Operating Procedures Document for the year in which they come into effect. In the case that a newly recommended candidate cultivar is approved as a check, past data collected during its registration testing are considered to be check data for those candidate cultivars evaluated in the same registration trials.

Candidate cultivars will be assessed relative to the range of the appropriate checks of the end-use category 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.

Before a check cultivar is approved, there must be sufficient seed quantity to support all approved registration trials. 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 equal to, or better than, that of 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 per site-year. Use of recognized experimental designs is required and use of a lattice design with sub-blocks is required to control localized field variation. Trials less than 25 entries can be arranged in a randomized complete block design. Seeding rate is expected to be consistent across entries in the trial and the seeding rate is to be adjusted based on germination rate of the seed lot used for the trial. Pre-plant soil testing is also expected to be completed at each site to provide total fertility input information for the registration trial report as per PRCWRT - Trial Conditions and Soil Properties - Template.

B. Site Inspections

The registration trial coordinator must ensure that at least one-third of the sites are inspected. Inspections are to be conducted by a recognized plant breeder (as defined by the Canadian Seed Growers Association – CSGA) and 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. In rare and extenuating circumstances, a proposer may bring forward a candidate cultivar with insufficient data because of "Acts of God". This would require a set aside of rules for normal operating procedures.

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 end-use category 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. A Committee approved site-blending formula for all checks and candidate cultivars in the trial will be used. These composite samples will be based on the CGC method of 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 End-use category: Canada Western Special 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, as long as these data are collected as per Appendix D and E. If it is deemed that there is insufficient disease resistance data to provide a recommendation, an additional 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.

3.4.5 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. This is to ensure data integrity due to genotype x environment interactions. 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. However, one year of data can be collected outside of official registration trials, and long as the minimum data requirement is met.

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 Forage Wheat

Varieties of forage wheat targeted for production in Manitoba, Saskatchewan, Alberta and the Peace River region of B.C.: forage yield and forage quality from a minimum of 8 trials (station-years) over two years with a minimum of one per prairie province per year. Up to three of the 8 trials will be conducted by independent cooperators (minimum of two independent cooperators).

Varieties of forage wheat targeted for production in the Lower mainland of British Columbia: a minimum of 3 station years over 2 years is required for forage yield and forage quality. Varieties brought forward from this data set in absence of Prairie data will only be eligible for recommendation for Regionally Restricted registration for the Lower Mainland of British Columbia.

Disease Evaluation for spring and winter forage wheats for Manitoba, Saskatchewan, Alberta and the Peace River Region; 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, as long as these data are collected as per Appendix D and E. If it is deemed that there is insufficient disease resistance data to provide a recommendation, an additional 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. No disease evaluation is required for spring and winter forage wheats for the Lower Mainland of B.C.

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

3.4.7 Foreign Data

U.S. 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 end-use category: Canada Western Special 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 recommended by the Quality Evaluation Team.

Other Foreign Data:

In principle, the PRCWRT will entertain requests and rationale from breeders to support the partial use of foreign generated data in meeting the appropriate registration trial(s) and data requirements for that crop, variety, and intended end use category on a case by case basis. A presentation of these data must be approved by appropriate evaluations teams prior to considering a request for support for a candidate cultivar. Use of these data is at the discretion of the recommending committee and based solely on scientific criteria. The decision of the PRCWRT to allow or not allow these data are final.

3.5 Service Fees

Registration trial testing may be conducted under a fee-for-service arrangement, if resources permit. However, the establishment and management of these arrangements is not a function of the PRCWRT.

3.6 Trial Reporting

Annual reports of ALL registration trials will be made available to the PRCWRT membership and evaluation teams, and the candidate cultivar proponents involved at least fourteen 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. Also mandatory for annual reports are presenting pre-plant soil test results and a short statement on planting and growing conditions for each site. 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.

Inclusion of pedigree information in registration trial reports is useful, but not a requirement of the PRCWRT.

If errors in the registration trial annual report are noted 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 Introducing New Crop Kinds

3.7.1 Preface

Spring rye, winter triticale (including hybrids), and non-standard types of wheat (e.g. rivet, spelt/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.

3.7.2 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.

3.7.3 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 National, Regional or Interim Registration

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 national 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.

Those wishing to seek *interim registration* must provide a clear reasoning at the top of their Request for Support document. Please use the definitions and examples provided below for market development and urgent need and as a guide.

1) Production of Grain or commodity for market acceptability tests: The definition of market development for the purpose of this committee is “a broad description of activities designed to explore new market potential”. To allow assessment of the interim registration request for market acceptability development, the committee requires that a Request for Support (submitted at the

normal time) containing the two years of data on the candidate's performance. The Request for Support will address the following items:

- Declaration of intent
- Rationale
- market development outline

2) Urgent Need: An emergency need of a trait, for example, disease or insect resistance which would reduce the impact of a catastrophic issue with production/quality. Urgent need is not associated with a significant increase in yield or new or unique quality or agronomic trait.

In all cases the Request for Support for Interim Registration must outline how the candidate is different than what is currently available on the market, based on valid scientific data, and why interim registration versus full registration is justified.

Additional supporting information can be in the form of a letter of support from industry outlining the impact of the new candidate with a unique trait or performance profile, or the impact of entering a new market segment. In all cases, the PRCWRT reserves the right to consider the information provided and determine if the reasoning provided warrants consideration for interim registration.

it is advised that the CGC be consulted prior to seeking interim registration, since market classification and the establishment of experimental grades are necessary.

The Committee may make an initial recommendation for interim registration for up to 3 years; however, the maximum period for interim registration is five years. Request for support for consideration of a full National registration may follow interim registration or the variety proponent has the option to present to the Committee a compelling rationale for an extension of interim registration for a period of an additional two years. Candidate cultivars considered for national registration will evaluated as per normal operating procedures with all appropriate data packages considered by the PRCWRT.

Any PRCWRT registration recommendation is valid for two years from the annual meeting data in which the candidate cultivar was considered. The PRCWRT will not conduct a revote on candidate cultivars that have missed variety registration within this deadline.

Recommendation for registration does not include information on distinguishability, uniformity, and stability 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 for Support 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 intended end-use category for which the line is a candidate, the registration category being sought (National 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. While pedigree information is useful, it is not required in the description of the candidate.

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* (in its entirety). As such, 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 re-analyzed, 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. For clarity, comparison must be made to all check varieties for which those traits are a check. Data collected for a check prior to its registration is considered to be check data.

For evaluation by the AET, the proposer is required to submit as part of the request document a completed “AET Merit Assessment Tool” form. This Excel format form is updated from time to time and current versions are available from the Chair of AET or from the PRCWRT website. The form is designed to compare the candidate line to appropriate checks and flag the candidate for discussion at the team level should the line be poorer than the appropriate check cultivars.

4.2.3 Definition of Merit

Candidate cultivars of wheat, rye and triticale must exhibit merit to be eligible for registration as prescribed by the *Seeds Regulations* (Schedule II, Part I crop kinds). Candidates that exhibit merit will be equal to or better than the designated 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.

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 simple majority vote 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.

4.2.5 Confidentiality of RC Test Data

Variety merit assessment test data either provided to the RC or generated in approved registration trials under the auspices of the PRCWRT is to be treated as confidential data of the variety developer and is to be used for the sole purpose of determining merit and making a recommendation to the VRO. Its use is restricted to this function only. Any other use requires that express permission is obtained from the variety developer prior to registration. However, if the candidate cultivar is recommended and registered, the test data that accompanies the registration will become public domain. Moreover, data on check varieties or registered varieties in any of the registration trials will be considered public domain.

Data generated by PRCWRT is generally used to allow the CGC to determine wheat variety classification. An option for the PRCWRT to share these data with the CGC for the sole use of classification should be declared by the proposer in the request for support document.

4.3 Role and Conduct of the Evaluation Teams and Committee

4.3.1 Evaluation teams

The PRCWRT has three designated evaluation teams tasked with defining merit and providing expert evaluation on candidate cultivars with regard to the three core components of merit: agronomy,

disease resistance, and end-use quality. (See Section 2.3.4) Their role is to provide expertise and recommendations to the PRCWRT for overall merit assessment and a final decision on variety registration recommendation.

For the consideration of candidate cultivars proposed for registration, each Evaluation Team will consider merit according to their expertise (Agronomy, Disease Resistance, Quality). 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. However, changes to merit criteria and threshold values can only be made by the PRCWRT membership during their annual meetings, a year prior to the changes taking effect. The Evaluation Team Chair must communicate these recommendations to the PRCWRT during the annual meeting

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

- ENDORSE: the collective attributes of the candidate for the traits being considered are “better than or equal to” those of the check cultivars or exceed the “Do-not-object” level.
- FLAG: 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. A “FLAG” indicates that further assessment of merit by the PRCWRT is required.

Non-binding guidance (feedback on merit) 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 protocols 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 procedures are to be ratified by the PRCWRT via a simple majority vote. 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 provided a recommendation indicating a deficiency of merit for their particular area of expertise 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.

Where possible, member organizations will designate their choices and a designated alternate and these will be approved by PRCWRT as a matter of procedure. In those cases where experts are required (see section 2.3.4) for elevation teams, these and their designated alternate will be chosen by the evaluation subcommittee and approved by the PRCWRT membership. The term for CVP members is three years but may be renewed.

In the situation where a CVP member is unable to attend the meeting, notice should be provided to the Committee Chair and their designated alternate prior to the meetings. Should the CVP and designated alternate be unable to attend the meeting a member organization or group will provide an alternate. As a matter of procedure the new member needs to be voted in and recognized by the Committee.

The RC will evaluate and consider the overall attributes of the candidate (the balance of agronomic, disease resistance and end-use quality traits which are part of the merit definition) 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 will report a summary of the findings for each merit criterion and the recommendation. The proponent of the line under consideration will then be given the opportunity to make a short presentation to the committee making their case for recommendation

For evaluation of candidate cultivars, each evaluation team will vote as “ENDORSE” or “FLAG”. For clarity, all candidate cultivars meeting minimum merit criteria (as established by the evaluation teams) will receive an “ENDORSE”. All candidates for registration that received an “ENDORSE” from all three of the Evaluation Teams will be added to a list, provided to the PRCWRT who will then vote en masse to recommend registration.

A candidate cultivar not meeting the merit criteria, but for which the proponent wants its strengths to be taken into account, may be brought before the PRCWRT membership and considered by the Cultivar Voting Panel. The applicant will be requested to make a presentation of the attributes of the variety and why it should be recommended for registration. The CVP will consider this presentation when voting, weighting the collective strengths and weaknesses of the variety. The CVP members will assess if the candidate cultivar demonstrates merit with the information provided or it fails to do so and votes are cast accordingly.

For those lines considered by the CVP, voting will be by secret ballot with only three possible voting options:

1. To **SUPPORT** recommendation;
2. To **OBJECT** to recommendation;

3. To **ABSTAIN** from voting.

The results of the CVP vote will be reported to the PRCWRT for endorsement by block vote. Abstaining is only appropriate if there is a real or perceived conflict of interest. It is expected that all members of the committee will vote impartially.

Votes will be counted by an associate committee member and scrutinized following presentation of all candidate cultivars being considered by the CVP. The scrutineer 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 scrutineer's review of the ballots will be communicated to the membership upon receipt of the vote report.

A motion by PRCWRT to accept the recommendations of the CVP will be considered *en mass*.

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. A motion to destroy ballots will be considered after reporting of vote results.

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% plus one of the RC members.

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 decision not to support a variety registration recommendation 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 Committee did not act in accordance with the CFIA Model Operating Procedures document.

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 PRCWRT members (including the current Chair and Secretary). 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.

If the appeal is centered upon the recommendations of a particular Evaluation Team, then an appeal board member should be chosen who has that particular expertise. 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. If a face-to-face appeal is chosen, 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
Facsmile: 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 appropriate for candidate cultivars where biochemical or biophysical characteristics distinguish it from the majority of registered varieties of the same kind or species and it may have an adverse effect on the identity of those registered varieties. The owner/sponsor of the candidate cultivar must make evident the possibility of industry harm if granted an unrestricted registration.

Socio-economic factors including market access of CFIA approved Plant with Novel Traits (PNTs), GMO or otherwise, 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, one of the roles of the PRCWRT is to advise the CFIA-VRO of any potential harm that a cultivar (contract

registered or otherwise) may present to Canadian agriculture. The Registrar has the authority to cancel a variety registration for cause, under the *Seeds Regulations* (74. (a) to (i)).

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. They are also encouraged to consult with the CGC regarding the manual and their precautions for keeping the variety segregated from the commodity market. 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 on the basis of 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 to the CRC:

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) 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 the required Quality Control System documentation and process it accordingly.

6.6 Special Requirements

Phytosanitary

The Committee may, from time to time, impose additional registration test requirements as necessary: for example, seed-borne disease testing prior to entering the Canadian trials as a phytosanitary measure to protect a given geographical area, a province, or Canada as a whole. This may or may not also be the result of a specific provincial requirement.

Plant with novel trait(s) (PNTs)

Proponents must inform the committee where a variety is deemed to be derived from a PNT. The proponent must confirm to the RC that Food, Feed and Environmental Safety approvals are in place and that the PNT has "unconfined release status" or the equivalent (e.g., an exemption letter from the CFIA Plant Biosafety Office). The committee cannot refuse entries into the registration test system where the necessary domestic approvals are all in place (e.g., they cannot refuse entry on the basis of a lack of major foreign market approvals).

Security of entries

All persons and institutions involved in conducting trials on behalf of the PRCWRT will agree to abide by a written "Code of Ethics" (including the Code of Ethics for Plants Breeders and Co-operators Conducting Variety Evaluation Trials in Canada and also including trial inspectors). The RC will develop and include this/these code of ethics in the procedures document.

The seed of candidate entries is proprietary property and should be handled as such. Under no circumstances will seed submitted for these trials be redistributed in any manner other than for the purpose of conducting the registration trials, both cooperative and private.

Withdrawal of Entries

A proposer may withdraw a candidate cultivar at any time during the trialing process or during committee deliberations. Typically, such requests are made to the trial coordinator who passes them along to the Chair of the committee. Under this circumstance, data summaries and performance

information are not included in any formal documents generated after the request has been accepted and approved by the RC.

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: S. Kumar – AAFC-Brandon Research and Development Centre (Brandon, 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 - Swift Current Research and Development Centre (Swift Current, SK)

Canada Northern Hard Red Co-op: Adaptation of candidate cultivars of CNHR wheat to wheat in the black and brown soil zones and the central and southern parkland area.
Co-ordinator: C.J. Pozniak and P.J. Hucl, CDC – University of Saskatchewan (Saskatoon, SK)

High Yielding Red Wheat Co-op: Adaptation of candidate cultivars of CPS wheat in the black and brown soil zones and the central and southern parkland area.
Co-ordinator: H.S. Randhawa, Lethbridge Research and Development 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-ordinator: D.M. Spaner, U. Alberta (Edmonton, AB)

Hard White Wheat Co-op: Adaptation of candidate cultivars of CWHWS wheat for all growing areas of the Prairies.
Co-ordinator: R. Cuthbert, AAFC - Swift Current Research and Development Centre (Swift Current, SK)

Western Soft White Spring Wheat Co-op: Adaptation of candidate cultivars of CWSWS 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: Y. Ruan, Swift Current Research and Development Centre (Swift Current, SK)

Special Purpose Spring Wheat Co-op: Adaptation of candidate cultivars of spring wheat for the CWGP class in western Canada.
Co-ordinator: Dana Maxwell – Ag-Quest Inc. (Minto, MB)

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 and Development Centre (Lethbridge, AB)

Western Fall Rye Co-op: Adaptation of candidate cultivars of fall rye in western Canada.
Co-ordinator: R. Ragupathy, Lethbridge Research and Development Centre (Lethbridge, AB)

Western Spring Triticale Co-op: Adaptation of candidate cultivars of spring triticale to western Canada.
Co-ordinator: M. Aljarrah, Field Crop Development Centre – Alberta Agriculture and Forestry (Lacombe, AB)

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)

Winter Triticale Co-op: Adaptation of candidate cultivars of winter triticale in western Canada.
Co-ordinator: M. Aljarrah, Field Crop Development Centre – Alberta Agriculture and Forestry (Lacombe, AB)

Ag Quest Wheat Registration Trial: Adaptation of CWRS and CPSR candidate cultivars to western Canada.
Co-ordinator: D. Maxwell, AgQuest (Minto, MB)

Limagrain Cereals Canada Trial: Adaptation of CWRS and CPSR candidate cultivars to western Canada.
Co-ordinator: Jason Reinhmeier, Limagrain Cereals Canada (Saskatoon, SK)

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)

BASF Agricultural Solutions Canada Trial: Adaptation of CWRS and CPSR wheat candidate cultivars to western Canada.
Co-ordinator: David Bonnett, BASF Agricultural Solutions Canada (Saskatoon, SK)

APPENDIX B: Registration Trial Check Cultivars – 2021

CWRS – East & West (Central & Western Bread Wheat) *(3 replicates)*

Checks: Glenn
Carberry
AAC Viewfield
AAC Brandon

CWRS – Northern Regions (Parkland Wheat) *(3 replicates)*

Checks: Parata
Glenn
Carberry
AAC Brandon

CPS-R (High Yielding Red Wheat) *(3 replicates)*

Checks: AAC Foray
CDC Terrain
AAC Penhold
Carberry
AAC Brandon

CNHR (Canada Northern Hard Red) *(3 replicates)*

Checks: Carberry
Faller
Conquer
AAC Penhold
AAC Brandon

Special Purpose Spring Wheat *(3 replicates)*

Checks: AC Andrew
Pasteur
AAC Awesome

Hard White Wheat *(3 replicates)*

Checks: Whitehawk
Snowstar
AAC Cirrus

Western Soft White Spring Wheat *(4 replicates)*

Checks: AC Andrew
Sadash
AAC Indus

Durum Wheat *(4 replicates)*

Checks: AAC Navigator
Stongfield
CDC Precision

AAC Cabri
Brigade
DT2009

Spring Spelt Wheat Registration Trial:

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

Western Spring Triticale *(4 replicates)*

Checks: Pronghorn
AC Ultima
Brevis
AC Andrew

AC Andrew – check for yield of high yielding wheat

Western Winter Wheat *(3 replicates)*

Checks: CWRW: CDC Buteo
Moats
AAC Elevate
W583
W601

CWSP: CDC Falcon
Sunrise
W520

Winter Triticale Registration Trial

Bobcat
Metzger
Hazlet (fall rye)
Pintail (winter wheat)
Luoma

Western Fall Rye *(3 replicates)*

Checks: Prima
Hazlet
Bono
KWS Trebiano
KWS Serafino

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 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 Registration Trials.

Limagrain Cereals Research Canada Registration Trial:
Checks: As designated for corresponding class (CWRS/CPS), identified in Appendix B of the PRCWRT Operating Procedures

BASF Agricultural Solutions Canada Trial:
Checks: As designated for corresponding class (CWRS/CPS), identified in Appendix B of the PRCWRT Operating Procedures

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	Special Purpose Wheat	Western Winter Wheat	Fall Rye	Spring Triticale	Winter Triticale	Forage Whet
Number of Replicates	3	3	3	3	3	3	4	3	3	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 composite of all replicates.

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 and provide expert advice to the RC on 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 evaluated 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 recommended by the DET and voted on by PRCWRT to establish the disease reaction standard that will be required. 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 to make recommendations tothe PRCWRT ratify them

Disease Reports

DET members appointed by the DET 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^{o} 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

<u>Bunt Checks</u>

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

R MR-R MR I MS MS-S S

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, TJBJ, 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.

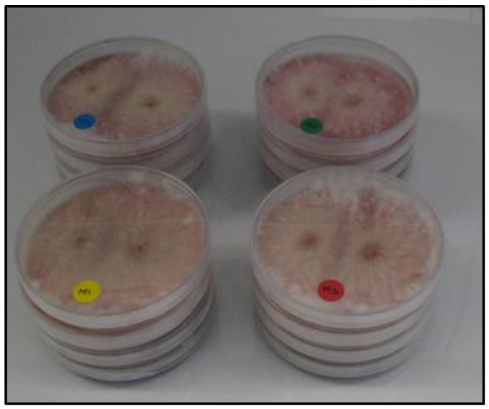
The VRI or FHB Index and DON data (ppm) are provided in the DET reports. Additionally, the Incidence/Severity/DON value (ISD) = (0.3 Incidence) + (0.3 Severity) + (0.4 DON) is calculated to give a measure of damage due to the fungus and to DON accumulation.

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 stipe 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 x 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

. To be evaluated by the Quality Evaluation Team of the PRCWRT, 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 Testing Laboratories_2019-03-12.XLSX" can be found at: http://www.pgdc.ca/committees_wrt_pd.html

This section provides the breeding institution and/or trial coordinator with instructions on how to create a composite from the various trial locations. Grading information, test weight, and protein content from the check varieties for a trial are used to determine the desired composite percentage to be selected from each location. The CGC, as a service to the PRCWRT, will assess 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 to prepare composites for each check variety and each candidate line. The composite samples will then be submitted to the testing laboratory for the required testing based on trial category.

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

CRITERIA	TESTS/PARAMETERS	Red Spring Wheat (Central, Western, Parkland)	Hard White	High Yielding (CPSR)	Red Winter	Soft White Spring	Durum	Canada Northern Hard Red
WHEAT & FLOUR / SEMOLINA CHARACTERISTICS	Grade	✔	✔	✔	✔	✔	✔	✔
	Hard vitreous kernels (HVK), %						✔	
	Cadmium, ppb						✔	
	Protein (wheat^), %	✔	✔	✔	✔	✔	✔	✔
	Protein (flour**/semolina**), %	✔	✔	✔	✔	✔	✔	✔
	Protein loss (wheat to flour), %	✔	✔	✔	✔	✔		✔
	Falling number (wheat^), s	✔	✔	✔	✔	✔	✔	✔
	Amylograph peak viscosity, BU	✔	✔	✔	✔	✔		✔
	Gluten index (semolina**), %						✔	
	Solvent retention capacity, %					✔ ¶		
MILLING PERFORMANCE	Milling yield, clean wheat basis, %	✔	✔	✔	✔	✔	✔	✔
	Milling yield, 0.50% ash basis, %	✔	✔	✔	✔	✔		✔
	Semolina yield, %						✔	
	Ash (flour**/semolina**), %	✔	✔	✔	✔	✔	✔	✔
	Starch damage, %	✔	✔	✔	✔	✔		✔
DOUGH PROPERTIES	Farinograph • Absorption, % • Dough development time, min • Stability, min	✔	✔	✔	✔			✔
	Alveograph • P (height x 1.1), mm • L (length), mm • P/L • W, x 10^{-4} J					✔	✔ †	
	Extensograph (90 or 135 min rest)‡ • Area, cm^2 • Rmax, BU • Length, cm	✔	✔	✔	✔			✔
COLOUR	Water Dough Colour (2 h; L* a* b*)	✔	✔	✔	✔	✔		✔
	Total yellow pigment content, ppm						✔	
END-PRODUCT QUALITY	Bread quality (lean no time method) • Baking absorption, % • Peak time, min • Mixing energy, Whr/kg • Loaf volume, cm^3/100 g flour • Loaf top ratio (LTR)	✔	✔	✔	✔			✔ §
	Spaghetti quality • Colour (a* b*)						✔	
	Cookie quality (sugar snap) • Spread (mm) • Ratio (width/thickness)					✔		

^Results are reported on a 13.5% moisture basis.

**Results are to be reported on a 14.0% moisture basis.

¶ Only water and lactic acid solvents need to be tested.

† Only on those durum lines where Gluten Index is greater than 75%; only P/L must be reported.

‡ Method can be performed using the standard method or pin mixer method.

§ Baking only required for 2nd and 3rd year candidate cultivars.

Part 3. Laboratory testing methodology

Details on the methods used to assess trial composites can be found at the following URL:

https://www.grainscanada.gc.ca/en/grain-research/export-quality/cereals/wheat/methods-tests.html

Other testing laboratories may use different equipment or different methods to perform the tests detailed in Part 2. 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 Secretary should be consulted for any clarification of testing methodology or registration trial requirements as early as possible.

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 entire registration trial process.

Part 4: Reporting of data

Required Documents:

1. **Introduction:**
   a. Prepared by the breeder/trial coordinator
   b. A 1-page summary that provides details on the trial makeup including number of entries, trial locations and any seeding, growing or harvest issues that influenced the composite preparation.
   c. 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*** **(*Guidelines for Trial Coordinators and Testing Laboratories_2019-03-12-XLSX)***
   a. Provides results by trial location of check varieties for grading, protein and composite blending calculations as provided by the CGC.
   b. Also provides grading results, including downgrading factors, for the composites (check varieties and candidate lines) as provided by the CGC.
3. **Quality data sheets:**
   a. Templates for the trials listed below are available at http://www.pgdc.ca/committees_wrt_pd.html
      i. Red Spring Bread Wheat
      ii. Hard White Wheat
      iii. High Yielding
      iv. Western Red Winter
      v. Soft White Spring
      vi. Durum
      vii. Canada Northern Hard Red
      viii. Note: quality testing is not required for candidate lines in the Canada Western Special Purpose (CWSP) class.
   b. All data from testing of check varieties and candidate lines for each trial must be reported in a standardized spreadsheet for evaluation by the PRCWRT Quality Evaluation Team. Use of the standardized spreadsheet provides a consistent format for reviewing quality data relative to check varieties and colour codes data cells based on quality guidelines established for each trial by the Quality Evaluation Team in relation to the check varieties (as shown below).

Rating	Cell Colour
Excellent	
Improvement	
Satisfactory	No colour applied
Flag	
Poor	

   c. Data for 1st and 2nd year candidate lines for Red Spring Bread Wheat, Hard White Wheat, Western Red Winter and High Yielding trials will be assessed using an automatic tool developed by the Quality Evaluation Team that provides greater transparency and improves efficiency and consistency in making assessments regarding candidate lines. The tool uses a set of seven primary factors to assess candidate lines (detailed below). Lines determined by the tool to meet the quality requirements can be voted on by the Quality Evaluation Team in a block vote (no discussion) or a member can call for discussion on an individual candidate line (removing it from a block vote).
      i. Primary factors: wheat protein, falling number, flour yield (0.5% as basis), amylograph peak viscosity, farinograph absorption, extensograph Rmax, extensograph length.

APPENDIX G: Data Release Policy

Operating Procedures used by the PRCWRT will be made publicly 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.

Registration trial data for candidates once they are registered, may be used in "provincial government variety guides" without request for permission. Prior to registration this data is confidential business information.

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). It was generated solely for the purpose of evaluating the eligibility of candidate cultivars for variety registration recommendation. 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 variety owner and 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.

a) Prior to registration, any and all data of candidate entries in trials are confidential business information and cannot be provided outside the recommending committee. Historical data for unregistered lines is confidential. The Chair may, at their discretion consider the anonymized use of data. Guidelines to the Chair in granting permission to use portions of PRCWRT data are as follows: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 assess the merit 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: PRCWRT Registration Trial Participants Code of Ethics

This seed is being distributed (or received) in accordance with the "Code of Ethics for Participants in Registration Trials" last revised by the PRCWRT on (fill in date).

1. The originating breeder, institution or company has certain rights to the germplasm. It is their proprietary intellectual property. 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. Seed of a line provided for trials and any plant part derived from it are provided solely for the purpose of variety registration eligibility assessment and will not be used in any way for any purpose other than this.

APPENDIX J: Registration Trial Inspection Report

Year: _____ Location: _____
Registration Trial: _____ Contact Name: _____
Inspection Date: _____ Contact Tel/Cell: _____
Crop Stage: _____

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 end-use category 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) and in compliance with the CFIA Plant Biosafety Office requirements. 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. Withdrawn lines will not be reported on (no data).
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 PRCWRT Registration Trial Participants` Code of Ethics (Appendix I) 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. In those cases, proposers can choose to establish a registration trial that follows protocols as outlined by the PRCWRT.

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 CSGA Certified Seed of that crop.

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, rogueing 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: PRCWRT Membership (Approved March 2021)

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