

# **PRAIRIE RECOMMENDING COMMITTEE FOR OAT AND BARLEY**

## **Operating Procedures**

(Revised March 2, 2017)

# Contents

<b>1 OVERVIEW</b>	<b>1</b>
1.1 <i>Introduction</i>	1
1.2 <i>Legislation and Authority</i>	1
1.3 <i>Role of the Variety Registration Office</i>	1
<b>2 ROLE AND MANDATE</b>	<b>2</b>
2.1 <i>Responsibility</i>	2
2.2 <i>Mandate</i>	2
<b>3 COMMITTEE STRUCTURE &amp; MEMBERSHIP</b>	<b>3</b>
3.1 <i>Structure and Operation</i>	3
3.2 <i>Executive Committee</i>	3
3.3 <i>Evaluation Teams</i>	3
3.4 <i>Membership</i>	4
3.4.1 <i>Full (Voting) Member</i>	4
3.4.2 <i>Associate (Non-Voting) Members</i>	5
3.4.3 <i>Ex Officio (Non-Voting) Members</i>	5
3.4.4 <i>Privilege of Membership</i>	5
3.5 <i>PRCOB Executive</i>	5
3.6 <i>PRCOB Meetings</i>	6
3.6.1 <i>Crop experts and visitors</i>	6
3.7 <i>Operating Procedures</i>	6
<b>4 THE REGISTRATION PROCESS</b>	<b>6</b>
4.1 <i>Recommendation for Registration</i>	6
4.1.1 <i>National Registration</i>	7
4.1.2 <i>Interim Registration</i>	8
4.1.3 <i>Contract Registration</i>	8
4.2 <i>Role of the Evaluation Team</i>	9
4.3 <i>Role of the PRCOB</i>	10
4.4 <i>Voting Procedures</i>	10
4.4.1 <i>Evaluation Team Votes</i>	10
4.4.2 <i>PRCOB Votes</i>	11
4.5 <i>Appeal of PRCOB Recommendation</i>	11
4.6 <i>Use of Discretion</i>	12
4.7 <i>Application for Registration</i>	12
<b>5 CONDUCT OF CO-OPERATIVE &amp; OTHER REGISTRATION TRIALS</b>	<b>12</b>
5.1 <i>Definition and Mission</i>	12

5.2	<i>Entries and Locations</i>	13
5.2.1	Locations	13
5.2.2	Entries	13
5.2.3	Advancement of Entries within a Co-op test	15
5.2.4	Number of years required in Co-op tests prior to registration	15
5.2.5	Acceptance of non-Coop supplemental data	15
5.3	<i>Logistics of the Coop Test</i>	15
5.3.1	Check varieties	15
5.3.2	Fees	15
5.3.3	Site Examinations	15
5.4	<i>Protocols for data collection in Barley Coop trials</i>	16
5.4.1	Barley Agronomy	16
5.4.2	Barley Diseases	24
5.4.3	Malting Barley Quality	32
5.4.4	Food Barley Quality	37
5.4.5	Advisory Groups for the Barley Quality Evaluation Team (BQET)	38
5.5	<i>Protocols for data collection in Oat Co-op trials</i>	38
5.5.1	Oat Agronomy	38
5.5.2	Oat Diseases	41
5.5.3	Food Oat Quality	44
5.6	<i>Check Varieties 2016 Tests</i>	45
5.6.1	Western Cooperative 6-row Barley Registration Tests	45
5.6.2	Western Cooperative 2-row Barley and Collaborative* Registration Tests	46
	• Western Cooperative Hulless Barley Registration Test	46
5.6.3	Western Cooperative Forage Barley Registration Test	46
5.6.4	Western Cooperative Oat Registration Test	46
5.6.5	Western Cooperative Hulless Oat Registration Test	46
<b>6</b>	<b>Addendum to section 4.5.3 of SOP Oat Groat Percentage</b>	<b>47</b>
6.1	<i>Introduction</i>	47
6.2	<i>TEST PROCEDURE</i>	47
6.2.1	Equipment Preparation	47
6.2.2	Sample Preparation	48
6.2.3	Method	48
6.2.4	Data Calculations	48
6.2.5	General Notes:	48
<b>7</b>	<b>Appendix: Data Release Policy</b>	<b>49</b>
<b>8</b>	<b>Appendix B: Conflict of Interest Guidelines</b>	<b>50</b>

<b>9</b>	<b>Appendix C: Contract registration – Operating Procedures and Data Requirements</b>	<b>51</b>
9.1	<i>Contract Registration Committee (CRC)</i>	51
9.2	<i>Eligibility requirements for testing under Contract Registration</i>	51
9.3	<i>Decisions on acceptability for testing under Contract Registration</i>	51
9.4	<i>Conduct of Trials &amp; Minimum Data Requirements</i>	52
<b>10</b>	<b>Appendix D: Authority provided under section 65.1 in the Seeds Regulations</b>	<b>54</b>
<b>11</b>	<b>Appendix E: Eligibility Requirements for Variety Registration</b>	<b>55</b>
Figure 1.	Field stem rust infection responses.....	26
Figure 2	Seedling infection type (IT) scale for stem rust. ....	27

# PRAIRIE RECOMMENDING COMMITTEE FOR OAT AND BARLEY

---

## 1 OVERVIEW

### 1.1 Introduction

This document outlines the pre-registration testing system protocol and evaluation process for the Prairie Recommending Committee for Oat and Barley (PRCOB). The PRCOB (also referred to as “committee” in this document) evaluates candidate lines of oat and barley on a merit-basis as a part of pre-registration requirements and makes a recommendation to the Variety Registration Office (VRO) for registration for the Western region of Canada. The procedures for entering a line for testing are documented and reviewed annually by the committee, and are available to the public on the PRCOB website at [http://www.pgdc.ca/committees\\_ob.html](http://www.pgdc.ca/committees_ob.html) or upon request from the secretary or chair of the PRCOB.

As required by the Seeds Regulations paragraphs 65.1 (1) (e) and (2) (c), the PRCOB shall function transparently and deal with lines in a fair and consistent manner.

“Merit” means, with respect to a line, that the line is equal or superior to appropriate reference varieties with regard to any single characteristic or combination of characteristics that renders the line beneficial for a particular use in a specific area of Canada.

### 1.2 Legislation and Authority

The Seeds Act is the legislative authority for the Seeds Regulations. In section 65.1 of the Seeds Regulations (Appendix D) there is a provision for the Minister of Agriculture and Agri-Food to approve crop-specific variety registration recommending committees. The purpose of the PRCOB is to establish and administer protocols for testing lines of crop kinds listed in Parts I and II of Schedule III of the Seeds Regulations, to determine the merit of lines of crop kinds listed in Part I and, subsequently, to make registration recommendations to the Registrar, VRO. In practice, the Minister’s authority to approve the PRCOB is delegated to the Registrar (currently the National Manager, Seed Section, CFIA).

### 1.3 Role of the Variety Registration Office

The VRO reviews and approves the PRCOB’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 committee to ensure that the committee is functioning transparently and that lines 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 the recommending committee as required. The model operating procedures

(MOPs) document is an example of this. The committee provides their expertise and advice to the VRO, and this 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 committee with regards to the MOPs, or the Seeds Regulations, the first step being to contact the committee itself with the grievance.

The current, recognition of the PRCOB can be found on the following CFIA website at:

<http://www.inspection.gc.ca/plants/variety-registration/registration-procedures/recommending-committees/eng/1359958262947/1359958370983>

## **2 ROLE AND MANDATE**

### **2.1 Responsibility**

PRCOB role is solely to make variety registration recommendations to the VRO. As such the PRCOB will act to coordinate testing and evaluation of barley and oat candidate lines for use in recommendations to the VRO of the Canadian Food Inspection Agency for their registration in western Canada.

As noted in the overview, the PRCOB puts in place procedures and processes, including testing protocols, to ensure fair, transparent, and consistent determination of merit for lines of crop kinds listed in Schedule III, Part I crop kinds, (oat and barley).

In addition, the committee’s role in determining the merit of a candidate line is to foster innovation in the crop while mitigating the risk of registering varieties lacking in merit and to provide increased value to the crop sector.

When recommending lines for registration the committee will balance the value of accelerating time to market, encouraging crop innovation, and rapidly improving the crop with the value of ensuring varieties are clearly beneficial (based on precision of prediction).

The overall effect of the committee’s requirements and processes on Canada’s international competitiveness in oat and barley also will be considered. A balance will be struck between fostering innovation, determining the merit of a line, and keeping the market risk tolerable. The categories and number of merit criteria will be reviewed on a regular basis with these considerations in mind.

### **2.2 Mandate**

- 1 To determine merit criteria to be used in evaluating candidate lines (as defined in the Seeds Regulations), to establish practical and science-based test protocols, and to develop a written procedures manual.
- 2 To co-ordinate trials to evaluate the performance of potential lines of barley and oats
- 3 To evaluate trial data to determine the merit of candidate lines of barley and oats.
- 4 To advise on the performance of lines in registration trials and make recommendations in support of registration to the VRO, Canadian Food Inspection Agency.

The committee has no registration recommending authority outside of the region of Canada for which it is recognized.

## 3 COMMITTEE STRUCTURE & MEMBERSHIP

### 3.1 Structure and Operation

The PRCOB consists of five teams: one Executive and four evaluation teams (ET). Evaluation Teams are responsible for the assessment of agronomic performance, disease resistance, and end-use quality (separate teams for barley and oat).

### 3.2 Executive Committee

The executive will be responsible for the running of annual meetings, ensuring that information pertaining to function of the PRCOB is conveyed to the members. Further, PRCOB ensures that it operates according to the procedures approved by its members and VRO. The team executives shall be elected from the members and consist of:

1. Chair and Secretary of executive
2. Chairs and Secretaries of evaluation team

### 3.3 Evaluation Teams

Crop-specific experts and stakeholders will be members of an evaluation team that reflects their expertise and interest. Each ET will elect a chair and secretary from among their members to conduct meeting(s) of the evaluation team. ETs will be responsible for reviewing the operating procedures on an annual basis to ensure that merit is being properly assessed. ETs are also responsible for reviewing its membership and removing retired or non-functioning members (no input over three years unless excused), and adding new members with expertise pertaining to the mandate of the evaluation team. The four ETs of the PRCOB are:

- a. **Breeding & Agronomy (BAET)** – role is to determine protocols and evaluation of oat and barley lines for agronomic traits, and to identify cooperative trial coordinators for oat and barley. The assessment of agronomic traits and operation of cooperative trials will be done as described in section 5.4.1 (barley) and 5.5.1 (oat) of the operating procedures (OPS).
- b. **Disease (DET)** – role is to determine protocols for testing and evaluation of oat and barley lines for reaction to diseases of importance to crop production in western Canada. The disease assessments will be done as described in section 5.4.2 (barley) and 5.5.2 (oat) of the OPS.
- c. **Barley Quality (BQET)** – role is to determine protocols for testing and evaluation of barley lines for malt and food quality. The assessment of malting quality will be done as described in sections 5.4.3, 5.4.4 and 5.4.5 of the OPS.
- d. **Oat Quality (OQET)** – role is to determine protocols for testing and evaluation of oat lines for milling quality. Milling quality assessments will be done as described in section 5.5.3 of the OPS.

At the discretion of the PRCOB, 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. At the discretion of the PRCOB subcommittees may be established for specific purposes (e.g., selection of new check varieties, recommendations on quality, pathology, agronomy of candidate lines) culminating in a report to the PRCOB with recommendations to be voted on.

### **3.4 Membership**

In accordance with paragraphs 65.1 (1) (a) and (b) of the Seeds Regulations, members of the committee will have the knowledge and expertise required to establish and administer testing protocols and to determine the merit of lines of oat and barley for production in western Canada. The committee members are members of one or more evaluation teams of the PRCOB.

The committee reflects the full value-chain of stakeholders: individuals actively engaged in variety development, production, processing, marketing, and seed trade of varieties. The committee includes representation from three broad-based value-chain stakeholder groups for oat and/or barley:

- Variety/Trait Developer and Assessor representation: This may include plant breeders, agronomists, pathologists, entomologists, molecular geneticists, and business leaders with expertise in one or more aspects of oat and/or barley.
- Producer representation: This may include representatives chosen by oat and barley producer and seed grower organizations.
- End User representation: This may include the seed trade representatives chosen by organizations representing domestic and export markets for example grain traders/marketers, processors, food, malting, brewing, and shochu companies.

The committee members will discuss changes to the operating procedures, including governance and setting of future goals for merit in oat and barley with members from all evaluation teams present at the meeting to obtain consensus. Committee members will then vote on any subsequent changes.

Committee members will serve on the committee for as long as they maintain a professional expertise in oat and/or barley. The committee votes on the upcoming changes to its membership via a simple majority. If representation by organization is part of the committee structure then this is simply a procedural function to ratify already appointed new members. There are three types of membership within the PRCOB:

- 1 Full Members (voting privileges)
- 2 Associate Members (non-voting)
- 3 Ex officio Members (staff members of the VRO, non-voting).

All members are proposed by Evaluation Teams and are approved by majority vote of the PRCOB. A membership list will be maintained by the secretary of the PRCOB and used for voting.

#### **3.4.1 Full (Voting) Member**

Full members of the PRCOB are individuals actively engaged in the production, development and/or evaluation of potential barley or oat varieties for western Canada and who possess the expertise to do so. Voting privileges on an ET are based on their area of interest and expertise. Membership may be held on one or more ETs, depending on the expertise and interest of the individual, but voting can be done only through one ET.

Positions on the PRCOB are also allocated to producers and representatives of producer organizations such as Farmer organization members, Canadian Seed Growers' Association. Members representing a producer organization will sit on an ET as a representative for the organization. In the event that a representative from a member organization is unable to attend, an alternative representative chosen by their member organization may act as a proxy on their behalf. The organization must inform the PRCOB secretary in advance who the proxy is so that they may



receive pertinent information. This representative's role will only be for the duration of the meeting unless the producer organization indicates otherwise.

It is expected that members will vote impartially and attend the annual meeting regularly. Voting members who fail to attend three consecutive meetings, without an acceptable explanation, are relegated to Associate membership.

ETs membership lists, with appointed Chairs and Secretaries, will be maintained and published on the password protected area of the PRCOB website to indicate major area of expertise.

### **3.4.2 Associate (Non-Voting) Members**

Associate members are individuals with a legitimate interest in the activities of the PRCOB, such as: representatives of Agriculture and Agri-Food Canada administration, Provincial Government Agriculturists, University Administrators or Business Managers whose organizations are active in variety production, development or evaluation. Associate Members do not have voting privileges but are allowed a voice during PRCOB and ET meetings. The appointment of Associate Members is subject to PRCOB approval. Associate Members may be removed from membership if they do not regularly attend meetings and miss four or more meetings in a row or if they indicate they no longer wish to be on the committee or if they do not actively maintain/update their contact information with the secretary of the PRCOB.

### **3.4.3 Ex Officio (Non-Voting) Members**

Employees of the Variety Registration Office (VRO) will be considered as Ex Officio Members. The VRO should inform the Chair and Secretary of the PRCOB who they would like to be ex officio members.

### **3.4.4 Privilege of Membership**

All members will have access to the password protected website of the PRCOB and the documents housed on the site. These documents include coop reports, coordinator's reports, ET reports, requests for support, and minutes of meetings. All members will have input into the pre-registration system for Oat and Barley. Full members will be able to sponsor entries into coop tests and have voting privileges.

## **3.5 PRCOB Executive**

The executive of the PRCOB will consist of chair, vice-chair and secretary of the PRCOB and the chairs and secretaries of all the ETs. The chair, vice-chair and secretary of the PRCOB will be chosen from among all members of the PRCOB. Evaluation Team chairs and secretaries are chosen from among their respective ET's. All positions are for a three-year renewable term, with one renewal, and commencing on April 1. The chair and secretary of the PRCOB will sit on the executive of the Prairie Grain Development Committee (PGDC). The PRCOB's chair, vice-chair and secretary are approved by a simple majority vote (50 per cent plus one) of the voting members in attendance at the annual meeting (or via electronic vote). If the chair or secretary is unavailable to act in his/her position for the annual meeting, the vice-chair will assume that role for the duration of the meeting. When an executive member is unable to continue in his/her role, a new chair, vice-chair or secretary will be elected at the annual meeting or via electronic vote if necessary and will assume duties beginning as soon as the election results are compiled.

### **3.6 PRCOB Meetings**

The PRCOB normally meets annually in the third or fourth week of February at a location determined by the Prairie Grain Development Committee (PGDC) at the previous year's meeting. Extraordinary meetings may be called on 30-day notice or with less notice upon the consensus of the membership. ET may call meetings at their discretion upon consensus of their membership.

Meetings are open to all interested parties. The PRCOB or ETs may, by a majority vote, conduct 'in camera' portions of meetings as necessary. Meetings will operate under rules as in 'Procedures for Meetings and Organizations 3rd Edition', M.K. Kerr and H.W. King.

The normal sequence for the February annual meeting is as follows (logistics may result in changes):

- Joint plenary session with other recommending committees of the PGDC.
- Individual Evaluation Teams meetings.
- PRCOB meeting as a whole.

Voting at meetings of PRCOB as a whole and ETs will be conducted as presented in section 4.4.

#### **3.6.1 Crop experts and visitors**

Crop-specific experts and stakeholders who are not committee members (those who vote on variety recommendations) will be eligible to attend and participate in general meetings. Visitors with an interest and/or expertise in the crop sector may attend the meetings (e.g., students, educators and researchers, members of the press, interested parties) with the approval of the chair or secretary of the PRCOB. Visitors, stakeholders and experts who are not committee members will have an opportunity to be recognized by the Chair and provide constructive input to the voting committee. They may participate in the meetings, but may not vote on motions or resolutions.

### **3.7 Operating Procedures**

Operating procedures of the PRCOB are generally reviewed annually and revised as needed including any changes to the check varieties. All revisions are presented and approved at the annual meeting of the PRCOB or when necessary, operating procedures may be revised during the year, circulated to the membership, and an electronic vote will be held to adopt them as circulated. A simple majority is needed to adopt the changes. The operating procedures are available on the website and by request from the chair, or secretary of the PRCOB. The operating procedures are submitted annually along with a letter of request for status as a recommending committee to the VRO of the Canadian Food Inspection Agency. Changes are to be recorded in the minutes and in an updated version of the Operating Procedures. The VRO must be notified of any changes for their review prior to implementation of the changes. Operating procedures are to be reviewed at least once every three years.

The over-riding principle of the PRCOB in its operation is the use of open discussions and the democratic principle in all PRCOB decisions.

## **4 THE REGISTRATION PROCESS**

### **4.1 Recommendation for Registration**

The PRCOB will recommend candidate barley and oat lines for registration for western Canada. Recommendations to "support" or "object" to a candidate line are made on the basis of information provided to the PRCOB via the registration trials and evaluation by the ETs.

Recommendations to support the registration of a candidate line are in effect for three years from the date of recommendation. Candidate sponsors submitting PRCOB recommended lines to the VRO that are more than two years old will be required to obtain a letter from the secretary of the PRCOB stating that the recommendation is still valid with a new date on the letter of support.

The candidate sponsor will provide to the PRCOB secretary an electronic copy of their “Request for Support for Registration”. The deadline for sending the file to the Secretary is 12PM MST – 12 days prior to the meeting (generally the second Friday in February). The deadline for posting on the PGDC Website is one (1) week prior to the PRCOB annual meeting. Requests for Support for Registration do not have a set format but generally consist of the name of the line and test numbers, a page with a brief description of the lines with its strengths, neutral traits, and weaknesses, followed by data extracted from the Coop reports for the line and the check varieties. Supplemental data may be included but must meet requirements as described in section 5.2.4.

In the event that the PDGC website is not available for postings, the PRCOB Secretary will distribute the “Requests for Support for Registration” by e-mail at least one week prior to the PRCOB meetings. It is incumbent upon the members to inform the Secretary of changes to their e-mail addresses, and non-receipt of “Requests for Support for Registration” due to a change in e-mail address will not be considered grounds for ineligibility of consideration of candidate lines.

The PRCOB may refuse to consider a request on the grounds of late circulation, illegibility, or inaccuracy. The PRCOB may suspend a particular guideline to allow consideration of a candidate by a two-thirds majority vote. The rationale for such action and the record of the empowering vote will form part of the recorded decision.

The committee has three primary registration options to consider when recommending a variety:

- National registration;
- Interim registration; or
- Contract registration.

Based on the result of the trials, the committee will provide recommendations to the VRO of the CFIA as follows:

- That they ‘support’ or ‘do not support’ candidate lines for registration.
- That they ‘object’ or ‘do not object’ to the National registration of a candidate. Some varieties may be desirable in one region but could be deemed to be a threat to crop production in other regions. In this case, the VRO consults recommending committees other than the supporting regional committee (RC) to see if they object or do not object to the National registration of the candidate being recommended.

#### **4.1.1 National Registration**

Candidate lines which have merit, as determined by the committee, will be recommended for registration. By default, all recommendations from the Committee will be for National registration. After the committee’s recommendation and during the variety registration process, other RCs that exist for Oat or Barley will be contacted to see if they have any objection to the National registration of the variety. An objection by another RC of the same crop in a different region can only be based on the candidate variety being assessed as a potential harm to the given crop sector in a given region of Canada (e.g., due to disease susceptibility or to significantly inferior end-use characteristics). As a result, a restricted National registration (a regionally restricted registration) may be applied by the Registrar. Candidate lines which have merit, as determined by the committee, will be recommended for registration.

### **4.1.2 Interim Registration**

The committee may consider a recommendation for interim registration in situations where, after a minimum of one year of testing, the data indicates that a candidate has sufficient merit that it may be eligible for registration. This provision is intended to be used in situations such as:

- Where a variety proponent brings forward an innovative variety with (a) valuable characteristic(s) not necessarily captured in the merit assessment, viewed as being of benefit to the crop sector and worth bringing to the market quickly. It may be slightly deficient in one or more merit characteristics but its attributes outweigh its deficiencies. Normally such a variety would be considered for interim registration and concurrent (continued) testing for the purposes of full registration.
- Where a variety demonstrates outstanding merit after the one year of testing. The committee has the option, if they deem it appropriate, of considering the variety for interim registration and further, concurrent testing for the purposes of full registration.
- Where a variety is brought forward that is deficient in one or more merit criteria, but the proponent has evidence (presented to the committee) of commercial interest in an identity preserved (IP) production program between the developer and an end user (this can be a tool to allow a variety to establish a niche market in a closed loop system).

Interim registrations are recommended for three years initially for the purpose of generating new data. These data are to be brought back to the committee during that time frame in order to support either a request for recommendation of National registration or a request for extension of the Interim registration up to a total maximum of five years.

The registrant has the option of coming back to the committee and making a request for an extension of interim registration for an additional one or two years but the total cannot exceed five years. They do this by submitting the full data package to the committee including data collected since registration. Interim registrations expire after their designated term.

#### **4.1.2.1 Reference: 68. (2) (a), Seed Regulations**

The Registrar shall make the registration of a variety subject to the following terms and conditions, where applicable:

“in the case of a variety of a species, kind or type of crop that is listed in Part I or II of Schedule III, if a minimum of one year of testing demonstrates that the variety may be eligible for registration but that further testing is required before a final decision can be rendered, the registration shall be limited to an initial period of not more than three years that shall be extended on written request by the applicant if eligibility for registration continues to be demonstrated, but under no circumstances shall the total duration of the registration exceed five years.”

### **4.1.3 Contract Registration**

Contract Registration is available for candidate lines where biochemical or biophysical characteristics distinguish them from the majority of registered varieties of the same kind or species. Further, it must be shown that these characteristics could compromise the end-use suitability of varieties registered for traditional commodity markets. Thus, to qualify for Contract Registration, the owner/sponsor of the line must demonstrate the possibility of industry harm if granted an unrestricted registration. Definitions of harm for each commodity crop are to be determined by the PRCOB and are to be based on scientific assessment of quality, agronomic, and disease reactions of the candidate line and not on socio-economic factors. The determination of whether a variety has the potential to cause harm is a scientific process where it is determined

whether the variety has the potential to have an adverse effect on the identity of other registered varieties of that crop kind or if the variety or progeny thereof may be detrimental to human or animal health and safety of the environment.

Contract registration is not to be used as a substitute for traditional forms of registration (full or interim) in situations where the PRCOB has objected to the registration of the candidate line based on deficiency in merit. However, the PRCOB may suggest that the candidate be considered for Contract Registration where there is rationale to do so. In this case, a meeting of the Contract Registration Committee (CRC), which will be struck as needed, may be required to consider the case and determine if the required conditions for Contract Registration have been met. (CRC Operating Procedures – see Appendix C)

Contract Registration may be granted as Full Contract Registration, or, if further assessment is required, as Interim Contract Registration. Interim Contract Registration may be requested for initial periods of one to three years with possibility of renewal for an additional two years up to a maximum of five years. Renewal of Interim Contract Registration requires the recommendation of the PRCOB and approval by the Variety Registration Office.

#### **4.1.3.1 Reference: 68. (2) (c) (i to iv) of the Seed Regulations**

Where the biochemical or biophysical characteristics of a variety 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 registrant shall:

- Establish and maintain a quality control system for the management of potentially adverse effects of the variety, including management responsibility, contract review, product identification and traceability, inspection, testing, control of nonconforming product, corrective and preventive actions, records and training of personnel.
- Describe the quality control system in a document and submit the document and any subsequent amendments to that document to the Registrar for review and approval,
- Implement the quality control system.
- Agree in writing, for the purpose of verifying compliance with subparagraph (iii), to provide the Registrar with information relating to the distribution, use and disposition of any seed of the variety or any progeny thereof.

## **4.2 Role of the Evaluation Team**

Each Evaluation Team (Breeding & Agronomy, Disease, and Quality) will consider the merit of candidate lines proposed for registration prior to the PRCOB meeting. The recommendation arising from this evaluation, and its basis, will be provided by the ET Chair/Secretary to the PRCOB at the time of candidate deliberations.

It is recognized that in the case of the Disease and Quality Evaluation Teams, only those specific traits are considered but the Breeding and Agronomy Evaluation Team will discuss disease reaction and quality parameters, as they constitute part of the “breeding” package.

Under unusual circumstances the committee may deal with the case of a candidate line without individual team considerations. A majority vote of the PRCOB is required to take this course of action.

### **4.3 Role of the PRCOB**

The purpose of the PRCOB is to provide a recommendation to “support” or “object” to the application for registration of a candidate line for grain or forage, based on information provided by the registration trials and interpretation of the data by the Evaluation Teams.

It is the responsibility of the PRCOB Secretary to inform the Registrar, VRO, Canadian Food Inspection Agency in writing of the decision of the PRCOB with copies to the candidate sponsor(s) and the PRCOB Chair. Copies of the statements from the Evaluation Teams will also be provided to the candidate sponsor(s) and to the Registrar.

### **4.4 Voting Procedures**

- Voting is valid only when a quorum is present. The quorum for Evaluation Team and PRCOB meetings shall be fifty percent of the voting members. It is expected that all members will vote impartially.
- Voting for the Evaluation Teams is normally by a show of hands, but a secret ballot may be held if a majority supports a motion to do so. Voting in the PRCOB is by secret ballot. However, a show of hands may be held if a majority supports a motion to do so. The Chair is allowed to actively participate in the discussions and is entitled to vote. A simple majority will constitute a positive recommendation. In the event of a tie, a revote will be conducted in which the Chair, the Secretary and the sponsor of the line will not cast a vote.
- In extraordinary circumstances and at the discretion of the pertinent Chair, votes may be conducted using regular mail, facsimile or electronic mail. The quorum for this type of vote shall be a response from fifty percent of the voting members.
- Where the number of abstentions is equal to or greater than one-third of the votes cast, the Chair will ask for a revote. If the revote results in the number of abstentions being equal to or greater than one-third of the votes cast, the Chair will file a report stating that no recommendation could be made.
- A member may only have one vote, so if the member sits on more than one evaluation team, he/she must indicate under which evaluation team they will cast their vote prior to the annual meeting.
- Counting of secret ballots is done by the secretary of the Evaluation Team (or chair if the secretary is not available). Each team collects and counts the ballots for their team. The secretary of the PRCOB acts as a scrutinizer to ensure counts are added correctly and all ballots are signed. The PRCOB secretary collects all ballots and ensures they are destroyed as voted on in the annual meeting. In the event that a secretary (either ET or PRCOB) has a candidate line up for registration, they will reclude themselves from the counting and an alternate will be appointed.

#### **4.4.1 Evaluation Team Votes**

At Evaluation Team deliberations, the attributes of the candidate lines will be considered on the basis of individual disciplines (Breeding & Agronomy, Disease, Barley & Oat Quality). The Evaluation Team Chair will call for a vote of those in favour of each of the following Categories:

- Support: The candidate’s total attributes for the traits being considered are an improvement over those of the check variety(s) and/or an improvement over those specified in agreed-to performance guidelines.
- Do Not Object: The candidate’s attributes for the traits being considered are similar to those of the check variety(s).

- Object: The candidate's attributes for the traits being considered are inferior to those of the check variety(s).
- Abstain: Abstentions are only expected in the case of an openly declared conflict of interest or in the absence of information on which to base a decision.

#### **4.4.2 PRCOB Votes**

At the PRCOB level, members will consider the overall attributes of the candidate (the balance of agronomy, disease and quality traits) based on information provided by the registration trials and interpretation of the data by the Evaluation Teams. Deficiencies in one characteristic may be compensated for by strength in another character.

The written reports from each ETs will be presented orally by the Chair or Secretary of the ET. A motion to support the registration of the candidate line follows. If necessary, upon the discretion of the PRCOB Chair, the case for support is then presented by the breeder or designate. This should only be necessary if one or more of the ETs have raised concerns about attributes of the candidate line. The applicant can request that the committee set aside the rules to consider the merit of a line that otherwise has failed to meet the standard in one or more required characteristics. All members (including, if an eligible voting member, the candidate sponsor) will cast a vote following the discussion.

Votes are cast in one of three categories (Support, Object, Abstain) based on the data supplied. Members are reminded that at PRCOB deliberations, abstentions are expected only in the case of an openly declared conflict of interest.

If erroneous data or omission of pertinent data is used as a basis of decision, the candidate sponsor may call for a re-vote. This request must be in writing with an explanation and a new supporting document. The Chair and Secretary will determine if there was an omission or error and if this information may have changed the original decision. If so, the PRCOB will be informed and a re-vote will be conducted. If the PRCOB meetings have concluded, the vote will be carried out using regular mail, facsimile or electronic mail.

Any disagreement with interpretation of procedure will be raised at the PRCOB meeting and settled by majority vote.

#### **4.5 Appeal of PRCOB Recommendation**

Decisions of the PRCOB are based on the collective expert judgment of the members using prescribed procedures. The judgment exercised is not subject to appeal. Appeals will be heard strictly on the basis of failure to follow procedures or the use of incorrect information in the decision-making process. If the sponsor wishes to make such an appeal, a written application must be directed to the Executive of the PRCOB. This application shall indicate the basis of the appeal and include a copy of the data package prepared for the candidate line in question. If the meeting is still in session, the appellant (candidate sponsor) shall be given the opportunity to present their case personally to an Appeals Committee. The committee will consist of the Executive of the PRCOB plus one member, who is not a member of PRCOB, selected by the appellant provided he/she is not a member of the same organization as the appellant, in which case an alternate will be selected. A chair will be selected from this group for the purpose of this meeting only. Following presentation of the arguments, the appellant will withdraw and a vote will be conducted. If the appeal is lodged after the PRCOB meeting is adjourned, the appellant will make the case in writing through the PRCOB Chair, with the vote conducted by regular mail, facsimile or electronic mail. The decision will be based on a simple majority of those Appeal Committee members present but there must be a quorum of at least 60%. In the event of a tie, a revote will be conducted in which

the Chair of the Appeal Committee will not cast a vote. The appellant will be informed of the decision and its rationale in writing within 30 days.

If the appellant wishes to appeal further, a three-person appeal board will be selected: one by the appellant, one by the PRCOB Chair, and one to be agreed upon by both the appellant and the PRCOB Chair. The appeal board will choose its own Chair and determine its own procedure. The appellant will pay the expenses of the appeal board at Government of Canada rates.

#### **4.6 Use of Discretion**

It is critical that ETs and PRCOB use good judgment when dealing with its Operating Procedures. Under extenuating circumstances, it may be necessary for the PRCOB to temporarily disregard its approved procedures. This should not be a common occurrence. The PRCOB should proceed very carefully when deviating from its operating procedures. Any proposed suspension of procedures must be put to a vote with a two-thirds or greater majority required for the motion to carry.

The PRCOB must notify the VRO of any candidate lines supported where its rules have not been adhered to and include the reasons for the special consideration.

#### **4.7 Application for Registration**

Full procedures for registration of crop varieties in Canada are available on the Canadian Food Inspection Agency web site (<http://www.inspection.gc.ca/plants/variety-registration/eng/1299175847046/1299175906353>). Applications for registration of the recommended candidate should be submitted on the Variety Registration Application Form available from the Variety Registration Office, or from the Canadian Food Inspection Agency's web site (<http://www.inspection.gc.ca/plants/variety-registration/registration-procedures/eng/1299176130568/1299176203043>). 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  
Nepean, ON K1A 0Y9  
Telephone: (613) 773-7148 Facsimile: (613) 773- 7261

## **5 CONDUCT OF CO-OPERATIVE & OTHER REGISTRATION TRIALS**

### **5.1 Definition and Mission**

The PRCOB evaluates candidate lines in a series of co-operative registration trials (Coops). A Coop trial is a multi-location agronomic performance trial supplemented by special tests for pest resistance, end-use quality, or other important traits as may be sanctioned by the PRCOB. The official Coop tests will include the word 'registration' in their names to clarify the function of these tests. The purpose of the registration trials is to provide data for evaluation by the PRCOB and Evaluation Teams. The data collected will be relevant to the test area of the Coop trial.

Contributors of Coop entries are voting members of the PRCOB. These contributors are plant breeders or associate plant breeders recognized by the Canadian Seed Growers Association (CSGA) or those actively involved in producing varieties for Canadian producers.



Coop trials are managed on behalf of the PRCOB by a Test Coordinator and run by Cooperators. Test Coordinators are appointed by mutual consensus, from amongst the PRCOB membership and are subject to approval by the PRCOB. The Test Coordinator's function includes the generation of test entry lists and randomizations, coordination of the movement of seed for test entries, collation of data from each testing site, data analysis, and production of a report for the PRCOB. Reports of Coop trials are circulated to the membership prior to the annual meeting where tests and the disposition of entries are reviewed. Revised reports are posted in the PRCOB website following the annual meeting. A current list of Test Coordinators can be obtained from the PRCOB secretary.

Coop trials are grown by Test Cooperators who consist of individuals willing and able to provide one or more test sites and the management of these sites as presented in 4.2.1. Test Cooperators may be PRCOB voting members, Associate members or simply those willing and able to grow Coop tests.

The PRCOB reviews, as required, the check varieties, evaluation methodology, relevance of current or new agronomic, disease, and end-use quality traits. Changes to the procedures, check varieties, traits evaluated, or methodology of evaluation require majority approval by PRCOB membership and are recorded in the minutes and the operating procedures of the PRCOB.

The Collaborative trials (Collabs) are trials conducted on behalf of the PRCOB for the evaluation of malting quality in advanced lines. They are non-replicated field trials used to produce seed of acceptable malting quality for malting barley lines. After first year assessment in Coop trials, selected lines are grown in Collabs. Lines may be in the Collabs for two years. The Coordinator of the Collabs is the Executive Director of the Brewing and Malting Barley Research Institute. Cooperators are those who are willing and able to provide one or more sites of the Collabs and management of these sites. Seed from sites with acceptable quality will be provided to the BMBRI for distribution to public or private laboratories for assessment of brewing and malting potential as outlined in section 4.4.3.

## **5.2 Entries and Locations**

### **5.2.1 Locations**

Locations are determined by the Cooperators. They may be conducted by the private or public sector and are chosen to represent areas of adaptation for the crop. Locations outside of western Canada will be considered as observation nurseries and data obtained from such nurseries will be provided in the Coop reports for information purposes only (i.e. not for consideration of support for registration).

### **5.2.2 Entries**

Each entry must be sponsored by a full member of the PRCOB. Requests for entry, along with appropriate data must be submitted to the appropriate Test Coordinator, in writing no later than one week prior to the start of the annual PRCOB meeting. If an entry does not meet the minimum criteria for quality, disease resistance or agronomic performance, a rationale must be presented as to the benefits which will arise from production of the line. Entry is subject to approval by the Breeding and Agronomy Evaluation Team (simple majority). Data for new entries must be compared with designated coop test checks.

With the exception of malting barley and forage barley, six (6) site years of data collected over a minimum of two years, along with data from appropriate check varieties, from sites in the PRCOB jurisdiction are required for entry into Coop tests.

In the case of malting barley, a minimum of four (4) site years of field data collected over a minimum of two years and a minimum of two years of malting quality data from plots grown under prairie conditions with comparison to the current quality checks are required.

In the case of forage barley, a minimum of four (4) site years of field data collected over a minimum of two years from plots grown under prairie conditions with comparison to the current checks are required for grain traits as well as two (2) site years of forage data with comparison to the current checks.

It shall be a condition of acceptance of a candidate line for testing, that the party submitting the candidate line agrees that the testing and evaluation procedures used by the PRCOB are appropriate and that these testing and evaluation procedures, however defined, shall not justify an appeal of a PRCOB decision. It shall also be a condition of acceptance that any regulatory requirements associated with the line have been met prior to entry.

The sponsor must supply seed to the Test Coordinator in a timely manner so that the tests can be distributed for spring seeding. Failure to provide seed to the Test Coordinator by April 1 may constitute grounds for non-inclusion of the entry into the tests. It is the responsibility of the sponsor to submit a distinguishable, uniform and stable line into the testing system. The standard of purity of the sample submitted for registration testing should be the same as or better than that stated for certified class seed of that crop kind. Lines failing to meet this standard may either be withdrawn from the test by the developer or removed from the test by the committee.

#### **5.2.2.1 Limits on entry numbers**

Every attempt is made to accept all qualified entries. However, resource restrictions may require limits to be imposed. The number of entries in a test is to be agreed to annually by the Test Coordinator and the Cooperators, subject to approval by the PRCOB.

#### **5.2.2.2 Security of entries**

Test Coordinators and Cooperators will take reasonable precautions to ensure the security of entries and will not distribute seed for purposes other than registration testing without the consent of the owner.

#### **5.2.2.3 Limitation of liability**

It shall be a condition of acceptance of a candidate line for testing that the party submitting the candidate line acknowledges that neither the PRCOB 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.

#### **5.2.2.4 Phytosanitary**

The committee may impose additional registration test requirements as necessary: for example, seed-borne disease testing prior to entering the public trial 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.

#### **5.2.2.5 Plants with novel traits (PNTs)**

Sponsors must inform the committee where a line is deemed to be derived from a PNT. The sponsor 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).

### **5.2.3 Advancement of Entries within a Co-op test**

Entries will only be advanced to a second (final) year at the request of the candidate sponsor and subject to the approval of the Breeding and Agronomy Evaluation Team (simple majority). A line will only be kept in trials for a year beyond the minimum testing requirement upon agreement of the PRCOB. The sponsor of a line can withdraw it from the Co-op tests at any time.

### **5.2.4 Number of years required in Co-op tests prior to registration**

Consideration of a candidate line for registration requires two (2) years of Cooperative test data. In the case of malting barley, two (2) years of Collaborative test data is needed. Under unusual circumstances, permission for additional testing may be granted by the PRCOB. Under certain conditions, where permission is granted by the PRCOB, one (1) year of testing may be sufficient.

### **5.2.5 Acceptance of non-Coop supplemental data**

Claims relating to a candidate line based on data generated outside of the cooperative testing system must be substantiated (data interpreted) in writing by relevant experts, groups or associations. Procedures leading towards such claims must be sanctioned by such relevant individual or body and accepted by the relevant Evaluation Team of the PRCOB. Approval for inclusion of supplemental data in Requests for Support requires a majority vote of PRCOB members present.

## **5.3 Logistics of the Coop Test**

### **5.3.1 Check varieties**

Check varieties will include widely grown, established varieties, varieties with specific superior quality traits, or recently registered varieties of superior merit. Changes in check varieties must be approved by the PRCOB and are listed in the annual PRCOB minutes and the operating procedures. Data collected for a check prior to its registration are considered to be check data. Candidate lines will be compared to the appropriate check of its class at the time of consideration. Note that this may not be the same check used when the line was entered into test. The candidate will not be compared to other lines in the test for the purpose of support for registration.

### **5.3.2 Fees**

The PRCOB 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. As the PRCOB has no current method to collect and disperse fees, the membership must approve changes at the annual meeting. Fee structures must be clearly outlined and posted on the PRCOB website.

### **5.3.3 Site Examinations**

Test examinations will be done at the discretion of the Test Coordinator. Test Cooperators must allow PRCOB tests to be examined when the Test Coordinator deems a need for such examination. Examination can be made by a person designated by the Test Coordinator at a time convenient for, and in accordance with site requirements of, the Cooperator. Test examinations may be requested if there are known or perceived problems with a site or a test (e.g. Hail damage, line admixtures or germination issues, disease). After completing the site examination, the examiner should report

his/her findings to the appropriate Test Coordinator, all parties who have lines entered into the affected test, and the secretary of the PRCOB. Findings of a site examination should be documented in the appropriate Coop Report.

## **5.4 Protocols for data collection in Barley Coop trials**

### **5.4.1 Barley Agronomy**

Each year at the Breeding and Agronomy Evaluation Team meeting, test coordinators are selected for each of the cooperative trials: Hulless Barley (HB), Forage Barley (FB), Two-row Barley (2R), and Six-row Barley (6R). If a coordinator cannot be found or if the Team decides that there is not enough interest in running a trial, it may be suspended for the next year or indefinitely. If there is interest in establishing a new coop and a Coordinator and Cooperators can be found then such interest is brought to the BAET for their approval. All decisions on coordinators and trials are made by a simple majority vote. The role of coordinators and cooperators are described in section 4.1, entry into a coop trial is describe in section 4.2, and logistics of the coop trials are described in section 4.3. Each year the members of the BAET review the data to be collected on the trials as set out below and if it is a merit trait (required) or not. Merit traits may not be measured at all sites due to time, skill, or other complications. Protocols for the collection of data and the minimum number of sites to collect such data are indicated below for each trait.

Data and required samples will be submitted by Cooperators to the Test Coordinator, or as designated by the Test Coordinator. The Test Coordinator will prepare a preliminary report for circulation to cooperators and line sponsors prior to the deadline for Requests for Support. Statistical analyses will be done using software available to the Test Coordinator and described in the Coop report. Inclusion of data is described for each crop type below. Data will be reviewed for accuracy and problems will be directed to the appropriate Test Coordinator. A draft copy of the report will be posted on the PRCOB website for review by all members prior to the annual meeting. At the annual meeting, the Test Coordinator will present the coop report. If additional changes are required, these will be noted in the minutes of the BAET meeting and the Test Coordinator will make changes before final submission to the Secretary of the PRCOB. All Coop Reports will be collected by the Secretary of the PRCOB, generally by April 1 following the annual meeting, and will be posted to the password protected area of the PRCOB website for a minimum of seven (7) years.

<b>Trait</b>	<b>Protocol</b>	<b>Required Data</b>
Yield (kg/ha)	As many sites as practical limitations will allow. A minimum of at least 3 sites for each of the four major soil zones on the Canadian Prairies is preferred. For the Hulless and forage barley Coop tests the test site numbers may be less than 3 sites for each major soil zone.	Yes
Maturity (d)	As many sites as practical limitations will allow. To be obtained on the basis of physiological maturity, visually, using 50% peduncle color loss within a plot or as %moisture (date of dry-down to 35%).	Yes

Heading (d)	To be obtained at sites where maturity cannot be measured using visual assessment, or where such assessment would be highly misleading. Measured from sowing to time of ear emergence on all replicates.	Yes
Height (cm)	Taken on at least one replicate, with a minimum of two measurements per plot. Taken near the center of the plot by measuring the entire plant, excluding awns.	Yes
Lodging (1-9 scale)	Taken on all three replicates. Taken only where good differential lodging is evident. Rated on a scale of 1 to 9, where 1=no lodging and 9=completely flat.	Yes, where it occurs
1000 Kernel weight (g)	Taken on one or a pooled sample. Recommended for all contributors sites.	Yes
Test weight (kg/hL)	Same as 1000 K wt.; except, add dirty test weight for Hulless Barley Co-op trial.	Yes
% Plumps	Using a sample of at least 50 g, over an appropriate slotted sieve. Size of sieve to be 5.5/64", 6/64" and 7/64" or as outlined in sections on malting barley quality, and food barley quality.	Yes
% Thins	Using a sample of at least 50g, under 5/64" slotted sieve.	2R, 6R, HB, only
Disease load	At the discretion of the cooperator, scale must be noted. Taken only where good differential disease is evident. 1-9 scale with 1 low and 9 high.	No
Forage Quality	By mutual arrangement with professionals having expertise in the quality parameter measured. Measurements must be clearly defined.	FB only

#### 5.4.1.1 Western Cooperative Hulless Barley Registration Trial

The trial design is a randomized complete block with 3 replications. Randomizations are done by the Test Coordinator for each cooperator site. Data are requested as shown in the table below. When data is returned the Test Coordinator analyses each trait and each site. Site data for yield is discarded if CV is greater than 15%. Other data may be excluded if the Test Coordinator feels after analyses that there are problems with it (i.e. lies outside the usual probabilities or range of measurements).

Test information requested from Cooperators for the HB Registration Test						
Year:			Seeding Date	DD / MM / YY	Julian Date	
Location:			Harvest Date	DD / MM / YY	Julian Date	
PLOT INFORMATION:			Exp. Design			
Seeding rate:			Reps.			
Number of rows:			Blocks			
Length of rows:			Entries/Block			
Width of row spacing:			Entries			
Area harvested (m2):			Total Plots			
Conversion factor to kg/ha:						
Plot stand:	Dense					
	Normal					
	Sparse					
		kg/ha	%N	%P	%K	% Other
Applied Fertilizer & Rate (kg/ha):	1st					
	2nd					
Herbicides Applied & Rate:						
	1st					
	2nd					
OTHER OBSERVATIONS AND COMMENTS:						

(e.g. flooding, drought, deer grazing, FHB, frost, hail etc.)						
Precipitation from seeding to harvest:		_____ mm	Long-erm normal	_____ mm	% of Normal	

Measurements requested for the HB coop tests:	
Yield (g/plot or kg/ha)	all plots
Heading	all plots
Maturity	all plots
Height (cm)	all plots, optional
Lodging (1 - 9)	all plots, if measurable differences occur
D. Test Wt. (kg/hl)	composite sample of each entry
C. Test Wt (kg/hl)	composite sample of each entry
Kern. Wt (g/1000kern)	composite sample of each entry
Plump (%>5.5/64")	
SEED SAMPLES FOR MALTING & FOOD QUALITY ANALYSES:	
Please retain at least a 1500g (1.5kg) composite sub-sample of each entry from each of	
your location(s) after harvest as they may be selected for further malting and food quality assessments.	

#### 5.4.1.2 Western Cooperative Forage Barley Registration Trial

Two tests are organized, one for forage harvest at the soft-dough stage and the second for grain. The grain test may not be grown at all sites. The test designs are randomized complete blocks with

3 replications. Randomizations are done by the Test Coordinator for each cooperator site. Data are requested as shown in the table below. When data is returned the Test Coordinator analyses each trait and each site. Site data for grain yield is discarded if CV is greater than 15% and for forage yield if CV is greater than 20%. Other data may be excluded if the Test Coordinator feels after analyses that there are problems with it: (i.e. lies outside the usual probabilities or range of measurements).

Test Information requested for the Forage Barley Coop Test Cooperators			
SITE:			
TEST:			
PLEASE TAKE THE FOLLOWING NOTES:			
Heading - Days from seeding	all reps		
Heights - in cm	1 rep		
Lodging-1-9 9=severe	if measurable difference		
Visual Rating 1-9 9=best	all reps		
Disease load 1-9 9=severe	if measurable difference		
Maturity - Days from seeding	for grain plots only; all reps		
Yield - grams/grain : kg/forage	all plots; subsample for forage quality <b>N.B. See * below</b>		
1000kwt grams	composite sample of each entry; grain test only		
Test weight kg/hl	composite sample of each entry; grain test only		
Percent plumps ( <b>Hulled 6/64 screen</b> )	composite sample of each entry; grain test only		
<b>(Hulless 5.5/64 screen)</b>			
PLOT INFORMATION:			
NO OF ROWS		LENGTH OF ROWS	



WIDTH OF ROWS		AREA HARVESTED (SQ. M)	
SEEDING RATE:		FERTILIZER AND RATE:	
SEEDING DATE:			
HERBICIDES APPLIED:			
PRECIPITATION:			
DATE HARVESTED:			
OBSERVATIONS AND COMMENTS:			

**\*Instructions for sub-sampling for quality evaluation:** If at all possible, please sample every plot. Also, in order to help assure a truly representative sample, it would be preferred if, prior to any bulk harvest, that you cut a 0.5 m length of row, weigh it fresh, dry it intact, and weigh again (to obtain % gravimetric moisture). Then, return the completely intact 'sheaf' to us at the address below. If this is not possible, please try and assemble 'whole plant' samples from the bulk harvest and send that to us for analysis. Dr. Mario Therrien (deceased) found that 'snatch' samples, or composites from 'chop' tended to produce inconsistent results and reduced the accuracy of measurements of quality.

#### 5.4.1.3 Western Cooperative Two-Row Barley Registration Trial

The trial design is a randomized complete block with 3 replications. Randomizations are done by the Test Coordinator for each cooperator site. Data are requested as shown in the table below. When data is returned the Test Coordinator analyses each trait and each site. Site data for yield is discarded if CV is greater than 15%. Other data may be excluded if the Test Coordinator feels after analyses that there are problems with it: (i.e. lies outside the usual probabilities or range of measurements).

Test information requested from 2R Coop Test Cooperators.				
SITE:				
PLEASE TAKE THE FOLLOWING NOTES:				
Heading: days from seeding	See Introduction			

	for # of reps data			
Heights: cm				
Lodging: 1-9 ; 1=none, 9=severe				
Visual Rating: 1-9 ; 1=worst, 9=best				
Disease load: 1-9 ; 1=none, 9=severe				
Maturity: days from seeding				
Yield: grams				
1000 KWT: grams				
Test weight: kg/hl				
Plumps: % over 6/64" x 3/4" screen				
Thins: % through a 5/64" x 3/4" screen				
PLOT INFORMATION:				
SEEDING DATE: (IE; 135)			FERTILIZER AND RATE:	
Plots per rep			HERBICIDES APPLIED:	
NO OF ROWS:			HARVEST DATE: (IE; 210)	
WIDTH OF ROWS:			AREA HARVESTED (SQ. M):	
LENGTH OF ROWS:			Conversion Factor for KG/Ha	

SEEDING RATE:			PRECIPITATION:	
OBSERVATIONS AND COMMENTS:				

**5.4.1.4 Western Cooperative Six-Row Barley Registration Trial**

The trial design is a randomized complete block with 3 replications. Randomizations are done by the Test Coordinator for each cooperator site. Data are requested as shown in the table below. When data is returned the Test Coordinator analyses each trait and each site. Site data for yield is discarded if CV is greater than 15%. Other data may be excluded if the Test Coordinator feels after analyses that there are problems with it: (i.e. lies outside the usual probabilities or range of measurements).

Test information requested from the 6R Barley Coop Test Cooperators				
SITE:				
PLEASE TAKE THE FOLLOWING NOTES:				
Heading - Days from seeding (50% headed)	all reps			
Heights - in cm	all reps			
Lodging-1-9 9=severe	if measurable difference			
Visual Rating 1-9 9=best	all reps			
Disease load 1-9 9=severe	if measurable difference			
Maturity - Days from seeding (50% ripe)	all plots			
Yield - in gms	all plots			
1000kwt	composite sample of each entry			

Test weight kg/hl	composite sample of each entry			
Percent plumps (Over 6/64 screen)	composite sample of each entry			
Percent thins (Below 5/64 screen)	composite sample of each entry			
PLOT INFORMATION:				
NO OF ROWS			LENGTH OF ROWS	
WIDTH OF ROWS			AREA HARVESTED (SQ. M)	
SEEDING RATE:			FERTILIZER AND RATE:	
HERBICIDES APPLIED:				
PRECIPITATION:				
OBSERVATIONS AND COMMENTS:				

#### 5.4.2 Barley Diseases

Barley diseases are assessed on entries into the coop tests as presented in the following table. Assessments are done by experts in pathology as determined by the Disease Evaluation Team (DET). Coop Disease reports are made by Coordinators elected from the membership of the DET. Additional data may be generated on entries as arranged by the Coop Coordinator and these will be considered by the DET for veracity of methodology and completeness of assessments such that these data can be used in the requests for support.

Disease	2 & 6-Rowed Hulled Coop Test	2 & 6-Rowed Hulless Coop Test	Forage Barley Coop Test
<b>Barley Yellow Dwarf</b>	+ *	+*	+

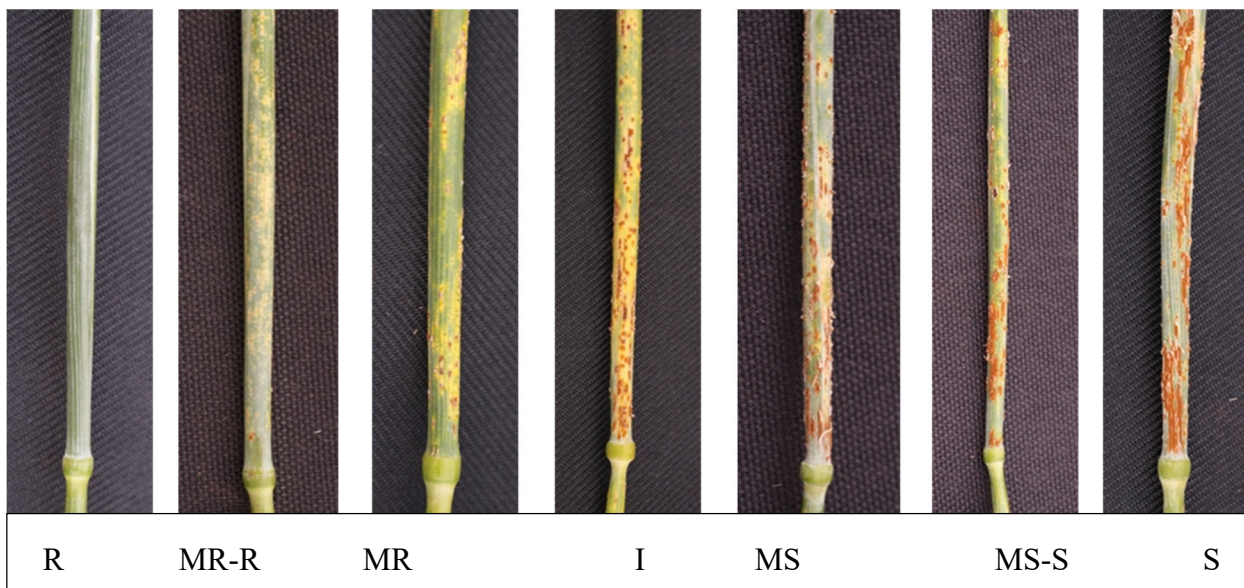
(seedling /or field)			
<b>Net Blotch (Net form)</b>			
(seedling)	+	+	+
Natural infection (field*)	+	+	+
<b>Net blotch (Spot form)</b>			
Natural infection (field*)	+	+	+
<b>Stem Rust</b>			
Mixture (field*)	+	+	+
<b>Scald</b>			
Natural infection (field*)	+	+	+
<b>Septoria 1988 (seedling)</b>	+	+	+
<b>Spot Blotch</b>			
Natural infection (field*)	+	+	+
<b>Smuts</b>			
U. nuda	+	+	+
U. hordei mixture	+	+	+
U. nigra mixture	+	+	+
<b>Fusarium Head Blight</b>			
Natural infection (field*)	+	+	+
* Checks and 2nd year entry evaluation only available for some diseases, while none is available for others.			

#### 5.4.2.1 Barley stem rust evaluation at the Brandon Research and Development Centre

Lines are screened at the adult plant stage in field stem rust nurseries (bulk inoculum) as well as in seedling tests (using race MCCF) 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 varieties ‘Q21861’ (Resistant check) and ‘Wolfe’ (Susceptible check) barley are inserted randomly in the nursery. Spreader rows are inoculated using a Microfit Herbi (EvenSpray Inc., Winnipeg) sprayer at 1g spores per L Soltrol oil (Phillips petroleum, USA), applied 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). These races represent a wide range of virulence to ensure that Rpg1 resistance is maintained in barley varieties. 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.

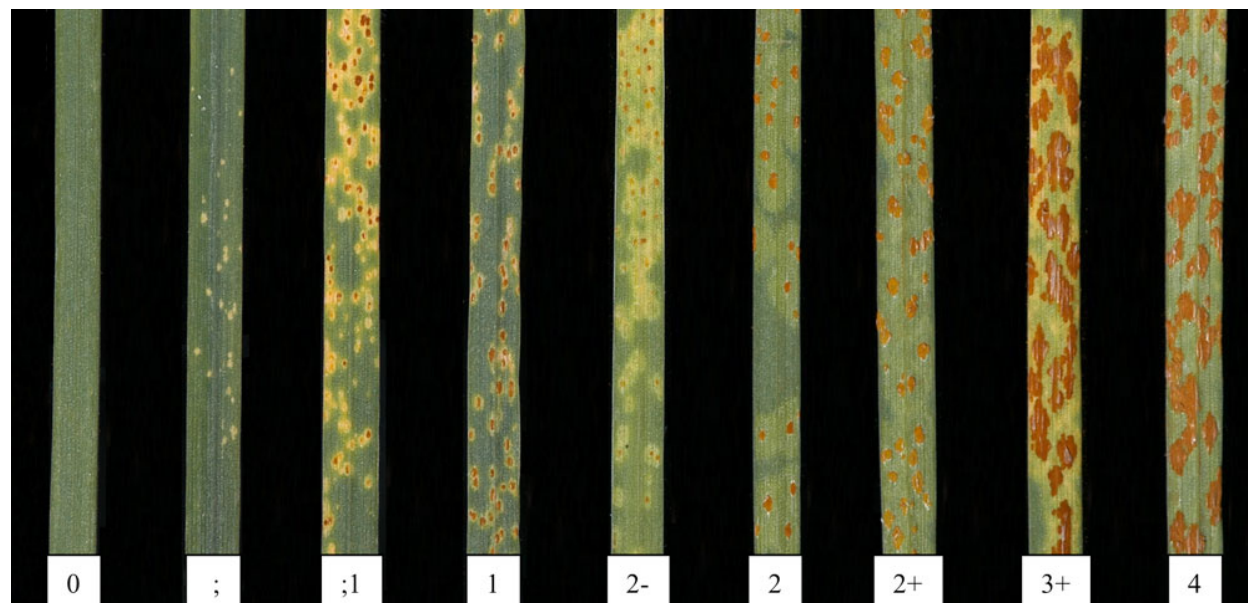
Lines are rated for disease when symptom expression is optimal, as indicated by the reactions on the check varieties ‘Q21861’ (range of 1-20% severity with a resistant to moderately resistant reaction) and ‘Wolfe’ (range of 30-70% severity and susceptible reaction). Usually this is at early dough stage, 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**

Seedling tests are conducted in a greenhouse using race MCCF to determine the presence of gene Rpg1. Seedlings are inoculated at first leaf fully expanded (7-8 d old) using rust inoculators pressurized at 2-3 psi. Inoculum concentration is 3 mg spores/0.7 ml Bayol oil in a 00 gelatin capsule and rate is 1 capsule per 98 conetainers (about 500 seedlings). Inoculated plants are

incubated in dew chambers for 16 hr, then put into greenhouse under high light and slow drying for two hours to complete infection. Seedlings are rated 14 d after inoculation using the Stakman et al 1962 scale, where ITs of 0-2+ are resistant and 3 or above are susceptible. Inoculation protocols are also available online (<http://www.tandfonline.com/doi/pdf/10.1080/07060661.2011.536650>).



**Figure 2 Seedling infection type (IT) scale for stem rust.**

#### 5.4.2.2 Loose smut in barley at the Morden Research and Development Centre

- Inoculum: Currently, collection 72-66 is used to test the reaction of lines or varieties. This collection has the virulence found in approximately 80% of current field collections on the prairies. Small amounts of inoculum of 72-66 can be obtained from James Menzies at [jim.menzies@agr.gc.ca](mailto:jim.menzies@agr.gc.ca). The inoculum can be stored for several years in a refrigerator, but it loses viability after a few months at room temperature. The inoculum is prepared by mixing ~1g of teliospores in 1 L of water. The inoculum should look like weak tea. If the suspension is stored at 5C and only removed for inoculation purposes, it can last up to 5 days, but making a new suspension every day is recommended.
- Inoculation: Grow 4 plants of each line in a 15 cm pot; include a pot of a susceptible variety as a control. Secondary tillers may be cut off to promote growth of primary tillers. Inoculate 2-5 spikes at anthesis. In barley, the optimum time is when the heads are just emerging from the boot to when they have fully emerged from the boot; just prior to anthesis. Mark inoculated spikes by snipping off the awns. A 5-10 mL syringe with 21-24 gauge, 0.5 to 1 inch needle is used to inoculate the florets. Simply inject enough inoculum into the floret to fill it. Start at the bottom of the spike and work up the florets.
- Evaluation: After maturation of the seed, plant 40 to 50 seeds of each line and establish a percent infection at heading. Normally a susceptible control line is included in the tests to ensure proper inoculation and infection occurred. Norman is susceptible to loose smut and could be included for these purposes.

### 5.4.2.3 Covered and False Loose smuts of barley at the Morden Research and Development Centre

- Inoculum: The inoculum used in these tests is a composite of all the different isolates that are collected from field surveys. Small amounts of inoculum can be obtained from James Menzies at [jim.menzies@agr.gc.ca](mailto:jim.menzies@agr.gc.ca). The dry inoculum can be stored for several years in a refrigerator, but it loses viability after a few months at room temperature. For inoculation, the inoculum is prepared by mixing ~1g of teliospores in 1 L of water. The suspension should look like weak tea. The teliospore suspension should be prepared just before inoculation. The suspension can be stored for 1 to 2 days at 5C, but this is not recommended.
- Inoculation: The procedure consists of placing ~ 4 g of seed in the jar of a Waring Blender, adding the spore suspension to cover the seed and the blades of the blender and agitating the seed for 10 to 25 seconds. The blades of a commercial Waring Blender should be modified so that they are not sharp to reduce the amount of damage to the seed. The contents of the blender jar are then poured into a sieve to separate the seed from the spore suspension (which can be re-used). The seed is then packaged into a coin envelope and allowed to slowly dry at room temperature for 2 days.
- Evaluation: The seed is planted in a row in the field and at maturation, a percent infection of the plants established. The above procedure can also be used for Loose and Covered smut of oats. Control lines should be included in the tests to ensure proper inoculation and infection occurred. A susceptible line such as Norman should be included, as well as an intermediate line, such as AC Metcalfe. Reference [Popp, W., and W.J. Cherewick. 1953. An improved method of inoculating seed of oats and barley with smut. *Phytopathology* 43: 697-699.].

### 5.4.2.4 Barley Leaf Disease Nurseries

Entries to the Western Co-operative Barley Registration Tests are annually rated for their reaction to leaf disease by the Crop Development Centre, in Barley Leaf Disease Nurseries located at the University of Saskatchewan, North Seed Farm (NSF), Saskatoon, SK and the AAFC Research Station at Melfort SK. Two hill-plots (15 – 20 seeds/30 cm rows) of each Co-op entrant are planted as part of each nursery in May. Nursery is sprayed for weeds using tank-mixed Infinity/Axial at 3 – 5 leaf stage of crop development.

Spot blotch (*Cochliobolus sativus*) infested barley residue is spread among NSF hill-plots at 4 – 6 leaf stage. The nursery is irrigated using fine spray for 10 -15 minutes at dusk and dawn daily (except when raining) to promote leaf disease epidemic. Entries are rated for reaction to spot blotch during dough stage of development, using a 0 – 9 scale: where 0 = no disease symptoms and 9 = 50+% infection level of lower, middle and upper canopy. Spot blotch is the predominant leaf disease in this nursery, however, the net-form of net blotch (*Pyrenophora teres* f. sp. *Teres*), spot-form of net blotch (*Pyrenophora teres* f. sp. *maculate*) and occasionally scald (*Rhynchosporium secalis*) are observed in the nursery. Spot blotch field reactions are reported as means of two replicate hill-plot ratings.

Net-form net blotch (*Pyrenophora teres* f. sp. *Teres*) and spot blotch (*Cochliobolus sativus*) epidemics are allowed to develop naturally at the Melfort leaf disease nursery. This nursery is not irrigated. Entries are given separate ratings for reaction to net blotch and spot blotch during dough stage of development, using a 0 – 9 scale: where 0 = no disease symptoms and 9 = 50+% infection level of lower, middle and upper canopy. Spot blotch is the predominant leaf disease in this nursery, however, net-form net blotch is also common and occasionally scald (*Rhynchosporium*



secalis) is observed in the nursery. Net blotch and spot blotch field reactions are reported as means of two replicate hill-plot ratings.

#### **5.4.2.5 Barley Covered Smut Reaction at the Crop Development Centre**

Covered smut reaction testing is achieved using a modified technique of Tapke and Bever (1942). Approximately 80 seeds of each entrant are inoculated by shaking vigorously with a spore suspension (1 g mixture of *Ustilago hordei* teliospores/1 litre distilled water), followed by incubation at room temperature for 15 min. The excess suspension is decanted and the seeds are allowed to dry on paper towels at room temperature. Inoculated seed is sown within a few days into one of four 30 cm rows (hill-plots). At maturity, covered smut reaction is reported as the percentage of infected versus total heads produced in the hill-plots of each entrant.

#### **5.4.2.6 Leaf Spot Pathogens *Pyrenophora teres* and *Cochliobolus sativus* at the Morden Research and Development Centre**

##### 5.4.2.6.1 Isolation and Preparation of Single-spore Cultures

- Place fresh or dried leaf sections (10 – 20 x 5 mm) infected with WRS 857, WRS 858 (*P. teres*), or WRS 1903 (*C. sativus*) on dry filter paper in bottom of a small (100 x 20 mm) petri dish. Infected leaves can be surface sterilized to reduce saprophytic flora (15 seconds in 50% ethyl alcohol, 30 seconds in 2% NaOCl, rinse in sterile distilled water).
- Place a second piece of filter paper in cover of the dish. Wet only this paper.
- Incubate at 20°C, 12/12 hour light/dark cycle for 3 to 5 days.
- Using a fine sterile needle, transfer single spores to test tube slants of 10% V-8 juice agar.

##### 5.4.2.6.2 Multiplication of Inoculum

- Incubate single-spored test tube slants for 10 days (as above), in near-horizontal position, near a fluorescent/incandescent light-source.
- Using sterile technique (flaming, sterile distilled water, etc.) add 8 ml H<sub>2</sub>O to slants. Gently scrape surface culture with a wire loop, suspend, and pour into a 150 mm Petri dish of 10% V-8 juice agar. Manipulate dish to distribute suspension over entire surface.
- Incubate Petri dish(es) for 6 days (as above).

##### 5.4.2.6.3 Preparation of Inoculum

- Flood the 150 mm petri dishes with sterile distilled water and gently scrape off surface culture (mainly conidia and conidiophores, depending on isolate) using a wire loop, glass rod, etc.
- Place suspension in container (Waring Blender unit) and blend for 60 – 90 seconds. Strain through a single layer of fine cheesecloth or several layers of coarse cheesecloth.
- Adjust suspension to 10 x 10<sup>3</sup> spores per ml for *P. teres* net-form isolates, 7 x 10<sup>3</sup> spores for *P. teres* spot-form isolate and 5 x 10<sup>3</sup> per ml for *C. sativus*.
- Add 1 drop of Tween 20 per 50 ml of suspension.

##### 5.4.2.6.4 Seedling Inoculation

- Apply 30 ml of spore suspension (2,000 spores/ml) per pot of 4 clumps of 8 barley plants. A DeVilbiss nozzle and electric air pump operating at 10 psi is suitable.
- Plants are 2-weeks old when inoculated. Grown at 17/15°C, 17/7 hours light/dark cycle, respectively.

- Humidify for 24 hours (all *P. teres*) or 18 hours (*C. sativus*) in the dark or at 12/12 light/darkness at 20°C.
- Return plants to growth cabinet at 15°C for 7 to 9 days.
- Assess reactions 7 – 8 days after inoculation using a 0 – 10 or a 0 – 9 rating scale, where 0= immune (unknown), 1= R (resistant), 9= S (susceptible); 10= VS (very susceptible, re. *P. teres* net-type).

#### **5.4.2.7 Leaf Blight Pathogens *Rhynchosporium secalis* and *Septoria passerinii* at the Morden Research and Development Centre**

##### **5.4.2.7.1 Multiplication and Preparation of Inoculum**

- For inoculum multiplication, *Rhynchosporium secalis* and *Septoria passerinii* are grown in sterilized potato sucrose water (PSW) in glass tissue culture bottles (40 ml PSW in 200 ml size bottles with one flat side).
- Add 8 ml sterile distilled water to each potato sucrose peptone agar (PSPA) reference slant of *R. secalis* 1493 or *S. passerinii*, 1998, scrape culture from surface with a wire loop, and pour contents into culture bottles above.
- Incubate at 20°C, 12/12 h light/dark cycle for 7 days (bottles lie flat).
- Shake bottle, pour contents into container (Waring Blender) and blend for 60 sec.
- Strain through a single layer of cheesecloth, and adjust concentration to 0.8 - 1.0 x 10<sup>6</sup> conidia per ml.
- Add 'Tween 20' as a spreader/sticker, at one drop per 50 ml inoculum.

##### **5.4.2.7.2 Inoculation**

- Plants are grown in 30 cm pots, as 4 clumps of 8 plants, at 17°C /15°C and a 17/7 h light/dark cycle, respectively. Inoculate when 2-weeks old.
- Apply inoculum as a fine spray; a DeVilbiss atomizer nozzle fitted to an electric air pump operating at 10 psi is suitable, as is an artist's air brush, or a 'hand-pumped' misting bottle. Inoculum is applied at a rate of 30 ml per pot.
- Humidify for 48h, at 17°C for *R. secalis* and 22°C for *S. passerinii* and keep plants at this temperature following incubation.
- Assess reactions 14 days after inoculation using an R (resistant) to S (susceptible) rating scale. For *R. secalis*, R= no lesions, S= large coalescing lesions; for *S. passerinii*, R= no lesions, or lesions small to large but without pycnidial formation, S= lesions with visible pycnidia (black spots).

#### **5.4.2.8 Protocol for field evaluation of scald, and net-form and spot-form net blotch reactions in Alberta**

For each growing season seed is sent to AAFC Lacombe and is hand seeded in scald nurseries at AAFC Lacombe and AF Crop Development Centre North, Edmonton in hill plots (approximately 10 seeds per hill plot) on approximately 50 cm spacing. Three to four weeks after seeding, each hill plot at both Edmonton and Lacombe are inoculated with infected barley residue (if available) obtained from the previous growing season. In addition, plots at both sites are spray inoculated with a suspension of *Rhynchosporium commune* (formerly *Rhynchosporium secalis* (Oudem.) J. J. Davis) spores at 1 x 10<sup>5</sup> spores per ml. Individual hills are inoculated until runoff. Throughout the growing season a mist irrigation system is used to facilitate disease development.

Disease assessments are done on individual hill plots twice at Lacombe and once at Edmonton. At both Lacombe and Edmonton, ratings are based on a 0 to 9 scale, where 0 is no disease and 9 represents a plant with greater than 50% of the lower, middle and upper leaves diseased (Couture 1980). At Lacombe, the initial rating is typically done in early July and then three weeks later. At Edmonton the one rating is typically done at the beginning of August. Ratings from the last date of assessment at each site are used for evaluation of cooperative trial entries.

For each growing season seed is sent to AAFC Lacombe and is hand seeded in net-form and spot-form net blotch nurseries at AAFC Lacombe in hill plots (approximately 10 seeds per hill plot) on approximately 50 cm spacing. Net-form and spot-form net blotch are caused by *Pyrenophora teres* f. *teres* and *P. teres* f. *maculata*, respectively. Spreader rows of susceptible barley are also seeded every 4th row in the hill nurseries to facilitate disease infection. Four to five weeks after seeding, each hill plot is inoculated with infected barley residue obtained from the previous growing season. In addition, in the net-form net blotch nursery each hill plot is inoculated with a mixture of two *P. teres* f. *teres* isolates and in the spot-form net blotch nursery each hill plot is inoculated with a mixture of three *P. teres* f. *maculata* isolates that have been grown on autoclaved winter wheat. The dried inoculum is spread at four to five weeks after seeding and again one to two weeks later. Approximately 9-12 grams of dried inoculum are sprinkled onto each hill plot that has been recently irrigated. Irrigation is used daily, if necessary to facilitate disease infection.

Disease assessments are done on individual hill plots twice (middle of July and then three weeks later) in the season. The ratings are based on a 0 to 9 scale, where 0 is no disease and 9 represents a plant with greater than 50% of the lower, middle and upper leaves diseased (Couture 1980). Ratings from the last date of assessment at each site are used for evaluation of cooperative trial entries.

#### **5.4.2.9 FUSARIUM HEAD BLIGHT (FHB) Nursery at Brandon Research and Development Centre and the Morden Research and Development Centre**

##### **5.4.2.9.1 Preparation of Inoculum:**

- Inoculum is comprised of 4 isolates of *Fusarium graminearum* of 2 chemotypes: 15ADON Chemotypes: WRS1915, WRS1918, and 3ADON chemotypes: WRS2065 and WRS2067 (Originally obtained from Dr. A. Tekauz, Cereal Research Centre and may vary by year). Initiate *F. graminearum* cultures using Potato-Dextrose-Agar (PDA) media plates. Incubate at 20°C 12 hr L:12 hr D under fluorescent lights for 1 week.
- Cut core plug from PDA colony and transfer to individual PDA plates. Incubate at 20°C 12 hr L:12 hr D under fluorescent lights for 2 weeks. Place media plates in a plastic sleeve and store within refrigerator until required.
- Place 4 kg of corn in a stainless steel pan (4" deep, restaurant-style pan) and soak within 6 L of distilled water for at least 24 hours.
- Pour off any excess water from the pan, and level corn. Cover pan with two layers of aluminum foil. Autoclave corn at 121°C for 1 hour, and let stand to cool overnight.
- Within a biosafety cabinet, add one fusarium infected PDA plate to the sterilized pan. Cover the pan with aluminum foil, and incubate at room temperature for 2-3 weeks.
- Spread the infected corn out to dry on a baker's rack, covered by a plastic coat and linked to an exhaust system to create continuous air movement. Once the corn is dry (3-4 days), it is bagged and stored in a cool dry place for later use.

#### 5.4.2.9.2 FHB Nursery:

Each Co-op entry (30-40 seeds/ row) is planted in 0.9 m rows on approximately 0.3 m spacing with the entire test replicated 3 times. Two sets of checks are placed alternatively after every 50 rows of Co-op material: Set 1 - AC Metcalfe (MRMS), CDC Mindon (MR), CDC Bold (S); Set 2 - Quest (MR-MRMS), Chevron (MR), Stander (S). Corn inoculum (5 g / row; at a ratio of 1:1 – 15ADON: 3ADON chemotype) is initially spread 2 weeks before the first material begins to head out, and then applied weekly thereafter (3-4 applications in total). Material is irrigated by a NAAN-501 sprinkler system (yellow nozzle) set on a timer which administers a fine water spray for a 5 min period every ½ hr between (6-8 pm) and (4-8 am). The number of days to 50% heading is recorded for each row. A visual Fusarium rating is taken 3 weeks following heading based on a scale (0 = no infection; 1 = incidence low, up to 5% of spikes; 2 = incidence low to moderate, 5 to 15% of spikes infected; 3 = incidence moderate, 15 to 30% of heads; 4 = incidence moderate to high, 30 to 50% of spikes infected; 5 = incidence high, 50% or more spikes affected). For each Co-op entry, 20 g subsamples of cleaned seed from all 3 replicates is combined and ground together in a 3610 Perten © Lab mill. DON (deoxynivalenol) levels are assessed on a 1 g subsample from this composite (analysis performed using ELISA technique at the Ottawa Research and Development Centre).

### 5.4.3 Malting Barley Quality

Barley malting quality is assessed on entries into the coop and collaborative tests when entries are indicated as malting types. Assessments are done by experts in quality as determined by the Barley Quality Evaluation Team (BQET). A Coop Malting Report is prepared by the Grain Research Laboratory (GRL) and the Collaborative Malting Reports is prepared by the Brewing and Malting Barley Research Institute (BMBRI). Additional data may be generated on entries as arranged by the Coop Coordinator or entry sponsor and these will be considered by the BQET for veracity of methodology and completeness of assessments such that these data can be used in the requests for support.

#### 5.4.3.1 Hulled Malting Barley

- Quality data will be generated on harvested samples from at least 3 test sites of the Western Co-operative Two-Row and Six-Row Barley Trials (Co-op Trials) per year. The sites are selected based on acceptable protein levels and kernel characteristics.
- Quality tests will be coordinated by the Grain Research Laboratory (GRL) with testing to be performed by GRL and industry.
- Quality data for the second (2nd) year of Co-op Trials will be collected in a manner similar to the first year. Testing of lines for a third (3rd) year of Co-op Trials will only be required if satisfactory data were not obtained in the first two years of Co-op testing.
- Collaborative Two-Row Barley Trials, that are supplementary to the Co-op Trials, will be coordinated by the Brewing and Malting Barley Research Institute (BMBRI) with quality tests to be performed by industry and the GRL.
- Collaborative testing of an entry can begin during its second (2nd) year of Co-op testing.
- Collaborative samples will not be brewed on a routine basis. Emphasis is placed on malting which should accommodate all first year Co-op entries that showed malting potential, and second year lines which continued to show malting potential in second year Co-op testing and first year Collaborative testing.
- The second (2nd) year of the Collaborative Trials will be carried out in a manner similar to the first year.

- Two-rowed candidate lines will be proposed for full registration (except in special cases when interim registration will be used) on the basis of 2 years (more if necessary) of malting quality data collected in the Co-operative Trials (3 test sites per year) plus 2 years of data (more if necessary) collected in the Collaborative Trials.
- Six-rowed candidate lines will be proposed for full registration (except in special cases when interim registration will be used) on the basis of 2 years (more if necessary) of malting quality data collected in the Co-operative Trials (3 test sites per year) plus an additional year of malting quality data obtained from a qualified laboratory.
- Malt barley varieties accepted for commercial use in the USA do not necessarily require Collaborative testing.
- At the time of recommending candidate lines for interim registration, the minutes of the appropriate Evaluation Team (Barley Quality) will note specific requirements for potential recommendation for full registration.
- The table below lists the traits which the Barley Quality Evaluation Team uses in assessing two- and six-rowed hulled lines for malting. Results are evaluated with respect to appropriate checks and must be equal or better than the appropriate check varieties assessed by the same procedures/ tests.

<b>Quality Trait / Test</b>	<b>2- and 6-Rowed Hulled Malting Barley Cooperative Trials</b>	<b>2- Rowed Hulled Malting Barley Collaborative Trials</b>
<b>Barley</b>		
Kernel plumpness (% > 7/64")	OP	OP
Kernel plumpness (% > 6/64")	+	+
1000 kernel weight (grams)	+	+
Barley protein (% , dry basis, (db))	+	+
Barley peeling (% by weight)	-	OP
Germination Energy, 4 ml (%)	+	+
Germination Energy, 8 ml (%)	+	+
<b>Malt and Wort</b>		
Fine Extract (% , db)	+	+
Wort $\beta$ -Glucan (ppm)	+	+
Wort Viscosity (cps)	+	+
Malt Protein (% , db)	+	+
Wort Soluble Protein (%)	+	+
Kolbach Index [KI = (Sol/Tot Protein) x100%] (%)	+	+
Wort Free Amino Nitrogen (FAN) (mg/L)	+	+
Diastatic Power (DP) ( $^{\circ}$ L, db)	+	+
Alpha-Amylase (DU, db)	+	+
Malt Peeling (% by weight)	+	+
Malt Friability (%)	+	+
Partially Undermodified Grain (PUG) (%)	OP	OP
Dimethyl Sulphide (DMS) (ppm)	-	OP

Dimethyl Sulphide Precursor (DMSP) (ppm)	-	OP
---	---	----

+ Required test; OP Optional test; - Not required test

The malt quality requirements may differ depending on the specific use and needs of the brewing industry. The table below lists the malt quality guidelines recommended currently (2016) by the Brewing and Malting Barley Research Institute (BMBRI).

Quality Trait	All Malt 2-rowed Brewing (Craft)	Adjunct 2-rowed Brewing*	Adjunct 6-rowed Brewing*
Fine Extract (% db)	>80	>80	>79
Barley Protein (% db)	<11.5	>11.5	>11.5
Wort Soluble protein (%)	<5.0	>5.0	>5.0
KI (S/T) (%)	38-45	42-47	42-47
Diastatic Power (DP) (oL, db)	low/med 100-120 / 120-140	med/high 120-140 / >140	med/high 125-145 / >145
Wort $\beta$ -Glucan (ppm)	variable, 135 max	low as possible	low as possible
FAN (mg/L)	<200	>200	>200

\*Both 2-rowed and 6-rowed varieties are used in this category, either as single varieties, blends of 2-rowed varieties, blends of 6-rowed varieties, or blend of 2- and 6-rowed varieties. Generally, for brewing with solid adjuncts, high extract is required as well as higher enzymes and higher FAN for efficient fermentation. For brewing with liquid adjuncts, more moderate enzyme levels are acceptable and the enzyme levels will vary based on individual brewer's requirements. Use of 6-rowed varieties is declining while use of 2-rowed varieties is increasing for this category.

#### 5.4.3.2 Hulless Malting Barley

Quality data will be generated on harvested samples from at least 3 test sites of the Western Co-operative Hulless Barley Trial (Co-op Trial) per year. The sites are selected based on acceptable protein levels and kernel characteristics. Quality data for the second (2nd) year of Co-op Trials will be collected in a manner similar to the first year. A third (3rd) year of Co-op Trials will only be required if satisfactory data were not obtained in the first two years of Co-op testing.

Quality tests will be coordinated by the GRL with testing to be performed by GRL and/or industry.

Special Hulless Barley Testing Trials may be organized to further test Co-op entries which showed malting potential. Malting quality data may be provided by a qualified laboratory.

Hulless candidate lines will be proposed for full registration (except in special cases when interim registration will be used) on the basis of 2 years (more if necessary) of malting quality data

collected in the Co-operative Trials (3 test sites per year) and an additional year (more if necessary as recommended by the BQET) of malting quality data obtained from a qualified laboratory.

At the time of recommending candidate lines for interim registration, the minutes of the appropriate Evaluation Team (Barley Quality) will note specific requirements for potential recommendation for full registration.

The table below lists the traits which the Barley Quality Evaluation Team uses in assessing hulless barley lines for malting. Results are evaluated with respect to appropriate checks and must be equal or better than the appropriate check varieties assessed by the same procedures/ tests.

<b>Quality Trait / Test</b>	<b>Hulless Malting Barley Cooperative Trials</b>
<b>Barley</b>	
Kernel plumpness (% > 5/64")	+
1000 kernel weight (grams)	+
Barley protein (% , dry basis, (db))	+
Dirty test weight (kg/hL)	+
Clean test weight (kg/hL)	+
Germination Energy, 4 ml (%)	+
Germination Energy, 8 ml (%)	+
<b>Malt</b>	
Adhering Hulls (%)	
Malt Friability (%)	+
Malt Protein (%)	+
Diastatic Power (DP) (°L, db)	+
Alpha-Amylase (DU, db)	+
<b>Wort</b>	
Fine Extract (% , db)	+
Wort β-Glucan (ppm)	+
Wort Viscosity (cps)	+



Wort Soluble Protein (%)	+
Kolbach Index [KI = (Sol/Tot Protein) x100%] (%)	+
Wort Free Amino Nitrogen (FAN) (mg/L)	+

+ Required test; OP Optional test; - Not required test

#### 5.4.4 Food Barley Quality

Barley food quality is assessed on entries into the coop and collaborative tests when entries are indicated as food types. Assessments are done by experts in quality as determined by the Barley Quality Evaluation Team (BQET). Additional data may be generated on entries as arranged by the Coop Coordinator or entry sponsor and these will be considered by the BQET for veracity of methodology and completeness of assessments such that these data can be used in the requests for support.

##### 5.4.4.1 Hulless Food Barley

Below are the traits which the Barley Quality Evaluation Team uses in assessing hulless barley lines for food. Results are evaluated with respect to controls and must be equal to or better than the appropriate check varieties assessed by the same procedures/tests.

Quality trait	Test	Desired/Recommended Target Values	
		<b>High Beta-Glucan Hulless Food Barley</b>	<b>Hulless Food Barley</b>
Hull retention	+	Better or equal to a high $\beta$ -glucan check (target <5%)	Better or equal to an appropriate check (target <5%)
Dirty test weight	+	Better or equal to a high $\beta$ -glucan check	Better or equal to an appropriate check
Clean test weight	+		
Kernel Plumpness	+	Better or equal to a high $\beta$ -glucan check	Better or equal to an appropriate check
Grain $\beta$ -Glucan	+	Better or equal to a high $\beta$ -glucan check (min target 6.5%, db)	Better or equal to an appropriate check
Mycotoxins (e.g., DON)	OP	Better or equal to checks	Better or equal to checks
Total Dietary Fibre (TDF)	OP	Soluble and Insoluble	

Starch composition: waxy, high amylose	OP		
Flour Yield	OP	Better or equal to the appropriate check	Better or equal to the appropriate check

+ Required test; OP Optional test; - Not required test

Health Canada has concluded that scientific evidence exists in support of the therapeutic claim linking barley grain products to a reduction of blood cholesterol and that the daily amount of fibre shown to help lower cholesterol is 3 grams of barley beta-glucan.

#### **5.4.4.2 Hulled Food Barley**

For evaluation of quality of covered barley lines bred for specific food uses (e.g., barley tea, shochu, pearled barley, etc.), it is up to the sponsor to provide data for appropriate traits in comparison with appropriate check varieties for evaluation of the BQET in the request for registration. These tests will depend on the intended end use of the barley.

#### **5.4.5 Advisory Groups for the Barley Quality Evaluation Team (BQET)**

The BQET may nominate from its members, Leaders of Advisory Groups on quality factors for which the BQET lacks adequate expertise (i.e. feed barley quality, food barley quality, etc.). Leaders will bring comments and recommendations of Advisory Groups to the BQET for consideration by the full team. These Groups can be established and dismantled by a majority vote of the BQET.

### **5.5 Protocols for data collection in Oat Co-op trials**

#### **5.5.1 Oat Agronomy**

Each year at the Breeding and Agronomy Evaluation Team meeting, test coordinators are selected for each of the cooperative trials: Hullless Oat, Hulled Oat. If a coordinator cannot be found or if the Team decides that there is not enough interest in running a trial, it may be suspended for the next year or indefinitely. The decision is made by a simple majority vote. The role of coordinators and cooperators are described in section 4.1, entry into a coop trial is described in section 4.2, and logistics of the coop trials are described in section 4.3. Each year the members of the BAET review the data to be collected on the trials as set out below and if it is a merit trait (required) or not. Merit traits may not be measured at all sites due to time, skill, or other complications. Protocols for the collection of data and the minimum number of sites to collect such data are indicated below for each trait.

Data and required samples will be submitted by Cooperators to the Test Coordinator, or as designated by the Test Coordinator. The Test Coordinator will prepare a preliminary report for circulation to cooperators and line sponsors prior to the deadline for Requests for Support. Statistical analyses will be done using software available to the Test Coordinator and described in the Coop report. Inclusion of data is described for each crop type below. Data will be reviewed for accuracy and problems will be directed to the appropriate Test Coordinator. A draft copy of the report will be posted on the PRCOB website for review by all members prior to the annual meeting. At the annual meeting, the Test Coordinator will present the coop report. If additional

changes are required, these will be noted in the minutes of the BAET meeting and the Test Coordinator will make changes before final submission to the Secretary of the PRCOB. All Coop Reports will be collected by the Secretary of the PRCOB, generally by April 1 following the annual meeting, and will be posted to the password protected area of the PRCOB website for a minimum of seven (7) years.

<b>Trait</b>	<b>Protocol</b>	<b>Required Data</b>
Yield	As many sites as practical limitations will allow. A minimum of at least 3 sites for each of the four major soil zones on the Canadian Prairies is preferred.  Hulless oats require a minimum of 3 sites from 3 of the major soil zones. Measured on all replicates.	Yes
Maturity	As many sites as practical limitations. To be obtained on the basis of physiological maturity, visually, using 50% peduncle color loss within a plot or as a % moisture. Measured on all replicates.	Yes
Heading	To be obtained at sites where maturity cannot be measured using visual assessment, or where such assessment would be highly misleading. Measured from sowing to time of panicle emergence on all replicates.	Yes
Height	Taken on at least one replicate. At least two measurements per plot, taken near the center, measuring the entire plant.	Yes
Lodging	Taken on all three replicates. Taken only where good differential lodging is evident. Rated on a scale of 1 to 9, where 1=no lodging and 9=completely flat.	Yes, Where it occurs
1000 K wt	Recommended for all contributors sites.	Yes
Test wt.	Same as 1000 K wt.  Dirty test weight required for the Hulless Oat Co-op for determination of % hull retention).	Yes
% Plumps	Using a sample of at least 50g, over an appropriate slotted sieve.	Yes
Disease load	At the discretion of the user, scale must be noted.	No

### **5.5.1.1 Western Cooperative Oat Registration Trial**

The test is normally organized as a 6x6 Lattice, to manage the error with the blocking but it can also be analyzed as an RCBD if necessary. Randomizations are done by the Test Coordinator for each cooperator site. Data are requested as shown in the figure below. When data are returned the Test Coordinator analyses each trait and each site. Site data for yield is discarded if CV is greater than 15%. Other data may be excluded if the Test Coordinator feels after analyses that there are problems with it: (i.e. lies outside the usual probabilities or range of measurements).

### **5.5.1.2 Western Cooperative Hulless Oat Registration Trial**

The test is normally organized as a RCBD with three replications. Randomizations are done by the Test Coordinator for each cooperator site. Data are requested as shown in the figure below (same as for the Western Cooperative Oat Registration Trial). When data are returned the Test Coordinator analyses each trait and each site. Site data for yield are discarded if CV is greater than 15%. Other data may be excluded if the Test Coordinator feels after analyses that there are problems with it: (i.e. lies outside the usual probabilities or range of measurements).

# Western Cooperative Oat Registration Trial (WCORT)

Test Design: <input type="text" value="6x6 Lattice"/>		Year: <input type="text" value="2016"/> Location: <input type="text" value="Lacombe"/> Cooperator: <input type="text" value="Wes Dyck"/> E-mail: <input type="text" value="Wes.Dyck@agr.gc.ca"/> Coordinator: <input type="text" value="Jennifer Mitchell-Fetch"/>	Tech: <input type="text" value="Kali Stewart"/> AAFC-BRC <input type="text" value="204-578-6695"/> 2701 Grand Valley Road Brandon, MB R7A 5Y3 <input type="text" value="Kali.Stewart@agr.gc.ca"/>	
Repetitions: <input type="text" value="3"/> Blocks: <input type="text" value="3"/> Entries per ibloc: <input type="text" value="6"/> <b>Do not break iblocs.</b> Number of iblocs: <input type="text" value="6"/> Entries: <input type="text" value="36"/> Total Plots: <input type="text" value="108"/>				
SOWING DATE:    day   month   year    or Julian Date: <input type="text"/>		EMERGENCY DELAYED BY DRY SEED BED (Y/N)? <input type="text"/>		
HARVEST:    date    day   month   year    or Julian Date: <input type="text"/>		sparse <input type="text"/> normal <input type="text"/> dense <input type="text"/>		
PLOT DIMENSIONS:		SOWN:    number of rows <input type="text"/> length of rows <input type="text"/> m space between rows <input type="text"/> cm cover crop between plots (Y/N)? <input type="text"/>		
HARVESTED:    number of rows <input type="text"/> length of rows <input type="text"/> m		plot area sown: <input type="text"/> m <sup>2</sup> plot area harvested: <input type="text"/> m <sup>2</sup> conversion factor: <input type="text"/>		
YIELD GIVEN IN:    g/plot <input type="text"/> kg/plot <input type="text"/> kg/ha <input type="text"/>				
COMMENTS ON PROBLEMS AND PLANT STRESSES (excluding weather, example: FHB, Rust, Leaf Spot, Sawfly, Midge, ...)				
COMMENTS ON ABIOTIC STRESS and WEATHER (example: salt damage, flooding, drought, weather deviations from normal, ...)				
FERTILIZER APPLIED:    Specify unit of fertilizer applied if different from kg/ha <input type="text"/>				
Application    kg/ha    quantity	[%N]    [%P <sub>2</sub> O <sub>5</sub> ]    [%K <sub>2</sub> O]    other element (s)			
1 <sup>st</sup>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
2 <sup>nd</sup>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
3 <sup>rd</sup>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
HERBICIDE APPLICATION:    1 <input type="text"/> 2 <input type="text"/> 3 <input type="text"/>				
PESTICIDE APPLICATION: <input type="text"/>				
Precipitation from sowing to harvest: <input type="text"/> mm		Historical Normal: <input type="text"/> mm	Percent of Normal: <input type="text"/>	
<b>INSTRUCTIONS</b>				
Plant height (cm)    Min. of 2 blocks Lodging (1 - 9)        All reps. Maturity (actual)     All reps. Yield in grams/plot    All reps.	1. Please complete and e-mail the <b>fieldbook coversheet</b> and <b>agronomic spreadsheet</b> to Kali Stewart (Kali.Stewart@agr.gc.ca) 2. Cleaning of samples and determining of test weight (tw) and 1000 kernal weight (Mkwt) <b>ARE NOT</b> required unless requested. 3. Identify each sample bag inside and outside with: <b>YEAR, LOCATION, TEST NAME, KEY NUMBER and IDENTITY.</b> 4. Please list on the outside of the shipping container the <b>NAME, LOCATION and TEST NAME</b> of the enclosed test.			

## 5.5.2 Oat Diseases

Oat diseases are assessed on entries into the coop tests as presented in the following table. Assessments are done by experts in pathology as determined by the Disease Evaluation Team (DET). Coop Disease reports are made by Coordinators elected from the membership of the DET. Additional data may be generated on entries as arranged by the Coop Coordinator and these will be considered by the DET for veracity of methodology and completeness of assessments such that these data can be used in the requests for support.

<b>Disease</b>	<b>Oat Co-op Test</b>
<b>Crown Rust</b>	
(seedling and field*)	+
<b>Fusarium head blight</b>	
(field*)	+
<b>Smuts</b>	
mixture	+
<b>Stem Rust</b>	
(seedling and field*)	+
<b>Barley Yellow Dwarf</b>	
(seedling and field*)	+
*Isolates and evaluation procedures are in the disease testing protocol of the DET minutes which are part of the PRCOB minutes. Some diseases may be evaluated only on the 2nd year entries and checks	

### 5.5.2.1 Oat stem rust: Morden Research and Development Centre

Co-op entries are screened at the adult plant stage in a field stem rust nursery near Morden and at the seedling stage in greenhouse tests. Data from both tests will be used to determine the stem rust rating. Planting, inoculation, and disease assessment procedures for the field nursery are the same as for the barley stem rust nursery listed previously. The stem rust pathotypes used for both the oat field nursery and seedling evaluations are NA8, NA16, NA25, NA27, NA28, NA55 and NA67. Pathotypes are mixed for the field inoculation, but are individually inoculated onto coop entries for seedling evaluations.

For the seedling plant reaction, coop entries are seeded in flats and inoculated individually at the two leaf stage (See barley stem rust protocols). Inoculated seedlings are placed in a chamber at an RH near 100% for 16 hr in the dark. Seedlings are then removed from the chamber and then placed into a greenhouse at 20C and light intensity at or exceeding 250  $\mu$ E and allowed to slowly dry off. Coop entries are evaluated about 14 days later for pustule type (0, ;, 1, 2, 3, or 4). Infection types 0, ;, 1, and 2 are indicative of a resistant response while ITs 3 and 4 are indicative of a susceptible response (IT3 reactions with chlorosis indicate some level of resistance).

### 5.5.2.2 Covered and Loose Smut of Oats: Morden Research and Development Centre

The inoculum used in these tests is a mixture of three races, A13, A60 and A617. Small amounts of inoculum can be obtained from James Menzies at [jim.menzies@agr.gc.ca](mailto:jim.menzies@agr.gc.ca). The inoculum can be stored for several years in a refrigerator, but it loses viability after a few months at room temperature. The inoculum is prepared by mixing ~1g of teliospores of each race in 1 L of water.

The inoculum should look like weak tea. The teliospore suspension should be prepared just before inoculation, but it can be stored for 1 to 2 days at 5C.

- Inoculation: Seed should be placed in plastic vials; the size of the vial will depend on the amount of seed you have to inoculate, 4 g should be sufficient. The vial should not be filled more than 1/4 full with seed. Each vial should be filled to 2/3 full with the teliospore suspension and allowed to sit for a few minutes so the seed can start to absorb the inoculum. The level of the spore suspension should then be re-adjusted back to the 2/3 full level. The vials containing seed and inoculum should then be placed in a desiccator and covered with a filter paper. Two or three weights should be put on the filter paper to prevent the seeds from splashing out and contaminating other vials during in the inoculation process. Seal the desiccator and gently apply vacuum. Carefully monitor the vials until the inoculum starts to boil. Let the inoculum boil for 5 minutes and then remove the vacuum source and let the desiccator return to room pressure rapidly. This cycle should be repeated at least once. The contents of the vial are then poured into a sieve to separate the seed from the spore suspension (which can be re-used). The seed is then packaged into a paper coin envelope and allowed to slowly dry at room temperature for 2 days.
- Evaluation: The seed is planted in a row in the field and at maturation, a percent infection of the plants established. Control lines should be included in the tests such as AC Morgan, which has an intermediate reaction to the surface borne smuts, and HiFi, which has a moderately susceptible reaction.

### 5.5.2.3 Crown rust: Morden Research and Development Centre

Entries of the Western Cooperative Oat Test are evaluated for seedling reactions to crown rust in the greenhouse. The crown rust isolates currently used are CR13 (race SJQL-96), CR223 (NGCB-94), CR241 (DSGB), CR254 (LRBG), CR257 (BRBG-94), CR258 (NTGG) and CR259 (LQCB-91). These isolates represent races useful for postulating the resistance genes currently being deployed in oat breeding programs. The entries are planted in flats and inoculated at the one-leaf stage by spraying the urediniospores of individual isolates suspended in a light industrial oil (e.g. Bayol, Esso Canada; 4 mg/450 µL) onto the leaves. The inoculated seedlings are incubated in a high humidity (100%) chamber overnight and subsequently grown in a greenhouse maintained between 18-25°C with supplemental fluorescent or high pressure sodium lighting. The crown rust infection types (ITs) are scored at 10-12 days after inoculation using a 0-4 type scale as follows:

- 0 = no visible sign of infection,
- ; = necrotic or chlorotic flecks, but no pustules,
- 1 = small pustules surrounded by chlorosis or necrosis,
- 2 = small to medium size pustules in chlorotic areas,
- = medium size pustules in chlorotic areas, and
- = large pustules without necrosis or chlorosis.

Infection types (ITs) of 0-2 are considered to be a resistant response and ITs of 3-4 a susceptible response.

For field reactions, cooperative entries are planted in short (one-metre) rows in the crown rust nursery at Morden, MB, with spreader rows of susceptible oat varieties planted at every sixth row. When the susceptible plants in the spreaders are at the jointing stage of development, the spreader rows are inoculated with a composite of crown rust isolates collected from annual surveys in Manitoba and Saskatchewan in the previous year. This ensures that the inoculum is representative of the isolates in the current rust population. Urediniospores suspended in Bayol oil (0.6 g urediniospores/litre) are sprayed on the spreader rows using a backpack mist blower (Solo Mist

Blower Model 450). Inoculation of the spreader rows should begin around the time when the plants in the spreader rows are at the 3 to 4 leaf stage, around mid-June, when conditions favour infection. Infections occur in dewy nights at temperature above 12°C. In some years the entire nursery will be inoculated several times to aid in increasing the inoculum pressure in the nursery. Field reactions are evaluated generally at about the mid-dough stage of development or when symptom expression on the susceptible checks is optimal. Crown rust severity is rated by using the modified Cobb scale to note the percent area of leaf infected, in combination with infection types described below:

- 0 = immune with no visible symptoms,
- R = resistant; presence of chlorotic or necrotic flecks but no sporulation,
- MR = moderately resistant; presence of small sporulating pustules,
- MS = moderately susceptible; presence of medium size of pustules with or without chlorosis or necrosis,
- S = susceptible; presence of large pustules without chlorosis or necrosis.

Control lines should be included in the tests such as AC Morgan, which is susceptible to crown rust, and CDC Dancer, which has an intermediate reaction.

### **5.5.3 Food Oat Quality**

Traits are determined by the oat quality committee for assessing lines as food oat. Parameters are assessed under conditions that reflect the commercial practices for milling oat. Results are evaluated with respect to controls and must be equal to or better than the appropriate check varieties assessed by the same procedures of this test.

- Hull Colour – white to yellow preferred, but coloured oat will not be excluded.
- Groat Colour – white to cream, similar to the checks.
- Plumpness – for uniformity and elimination of thin and double oat. Using a sample of at least 50g, measured as % by weight remaining on 5.5/64 X 3/4 inch slotted screen/sieve.
- Thin Oats –measured as % by weight passing through a 5/64 X 3/4 inch slotted screen/sieve.
- Test Weight –Kg/hl
- Kernel Weight –g per 1000 kernels
- % Groat – acceptable method Lab Codema
- % Breakage – visual score 1-9 during dehulling (Lab Codema dehuller).
- Commercial Laboratory Assessment of Milling.
- % groat Protein (Nx6.25)
- % groat Oil – Comparable to the values for the check varieties.
- % groat B-Glucan
- % groat Total Dietary Fiber



Compositional specifications for food oat.

Quality Trait	Recommended Target Values
Hull Colour	White to yellow preferred
Groat Colour	white to cream, similar to checks
Plumpness	>50% Over
Thin Oats	2%
Test Weight	48.6Kg/hl (38# Winchester bushel)
Kernel Weight	>30g /1000
% Groats	Target 75%
Total Dietary Fiber <sup>1</sup> , minimum:	>10% dwb
%Oil, maximum:	8.0 % dwb
Protein <sup>3</sup> , minimum:	>13 % dwb
β-glucan <sup>4</sup> , minimum:	>4.5% dwb
1AOAC 991.43, 2AOAC 996.06, 3AACC 46-30 /*corresponds to AOAC 992.23	
4AOAC 995.16 or AACC 32-23	

**Note:** Specifications for the oat TDF, oil, protein, B-glucan are based on a groat, dry weight basis. These are derived from the U.S. Code of Federal Regulations 21: 101.81 (April 1, 2000 edition, pg. 138.) and Health Canada’s “Summary of Assessment of a Health Claim about Oat Products and Blood Cholesterol Lowering” (November 2010) (TDF and B-Glucan only).

Note: In the case of hullless oat lines in the test, data must be converted to a groat basis, using values for % hull for all hulled varieties.

## 5.6 Check Varieties 2016 Tests

### 5.6.1 Western Cooperative 6-row Barley Registration Tests

- AC Ranger
- \*CDC Mayfair
- Vivar
- \*Celebration
- Amisk

## **5.6.2 Western Cooperative 2-row Barley and Collaborative\* Registration Tests**

- \*AAC Synergy
- \*AC Metcalfe
- CDC Austenson
- \*CDC Copeland
- Champion
  
- **Western Cooperative Hulless Barley Registration Test**
- \*AC Metcalfe
- \*CDC Clear
- CDC McGwire
- CDC Rattan
- Tyto

## **5.6.3 Western Cooperative Forage Barley Registration Test**

- AC Ranger
- CDC Austenson
- Gadsby
- Vivar
- CDC Cowboy

## **5.6.4 Western Cooperative Oat Registration Test**

- AC Morgan
- CDC Dancer
- Leggett

## **5.6.5 Western Cooperative Hulless Oat Registration Test**

- AC Gwen
- Paul
- Gehl
- CDC Dancer
- Summit

\*(malting checks)

## **6 Addendum to section 4.5.3 of SOP Oat Groat Percentage**

### **6.1 Introduction**

Candidate food oat lines entered into pre-registration testing for the Prairie Recommending Committee for Oat and Barley (PRCOB) of Western Canada are evaluated for numerous grain quality traits. These evaluations are intended to mirror current industry methods used to assess milling oats for food use in Canada and will indicate merit to the Oat Quality Evaluation Team. One such assessment on oat is groat percentage.

Groat percentage is a measure of the proportion of oat groat (caryopsis) in relation to the overall seed (hull and groat combined). As oat millers purchase whole seed and are required to remove the hull to process the groat, the hull represents an economic limitation. Presently, the PRCOB Operating Procedure state a recommended target groat percentage of 75% measured by Lab Codema, NIR, hand dehulling, or Lab Impact Dehulling methodology. Currently, all entries from six selected sites of the pre-registration test, the Western Cooperative Oat Registration Test (WCORT) are evaluated for groat percentage at the Crop Development Centre, University of Saskatchewan on behalf of the PRCOB, using a Codema Laboratory Oat Huller with the protocol as described below.

### **6.2 TEST PROCEDURE**

(Adapted from Codema, LLC™ Laboratory Oat Huller Instructions for Operation)

Materials/Equipment Needed

- Codema, LLC™ Laboratory Oat Huller
- Model: Laboratory Oat Huller LH5095
- Manufacturer: Codema, LLC, 11790 Troy Lane North, Maple Grove, MN, 55369, USA
- Compressed air sustainable at 100 psi for a minimum of 90 seconds
- Air adjustment sleeve setting about 9mm
- Discharge blast gate setting about 16mm
- 2-decimal place balance (draft-free location)
- Weighing pan
- 1 minute timer
- Personal protective equipment – ear and eye protection mandatory

#### **6.2.1 Equipment Preparation**

Set air regulator to 100 psi, air adjustment sleeve setting about 9mm and discharge blast gate setting about 16mm so that groat breakage is minimal and few groat pieces are diverted into the liftings (waste) canister with testing.

Ensure compressed air line is free from internal moisture.

Empty groat and liftings canister.

Test new crop-year sample of known trial checks to ensure proper dehulling (90-95% dehulled within 60 seconds) and minimal groat breakage (<5%) within the specified air pressure and dehulling time. Check liftings canister has zero to minimal groat pieces. No whole groats should be present.

## 6.2.2 Sample Preparation

Ensure seed samples are clean (free from chaff, unthreshed panicles, straw, soil), unsized and uniform in moisture content (equilibrated to environment for two-three days).

Weigh about 50.0-50.5 g seed into suitably sized envelopes.

If performing dehulling procedure promptly within a few hours, you may also record the seed weight (“Total Seed Weight before dehulling”)

If not dehulling promptly, do not record the seed weight until ready to dehull as evaporation/humidity may cause seed weight changes.

## 6.2.3 Method

- Handling one trial site together as a unit, record the weight of each entry’s 50-gram seed sample as “Total Seed Weight (g) before dehulling”.
- Dehull each sample individually at 100 psi for 60 seconds (or adjusted to current crop-year based on pre-testing dehulling observations) according to the manufacturer’s instructions, keeping dehulling conditions consistent with all entries.
- Collect groat sample from groat canister and discard hull debris from liftings canister. Gently aspirate any remaining hull material from groat sample.
- After dehulling, weigh groat sample. Record as “Groat+Whole Seed Weight (g) after dehulling”.
- If present, separate and weigh whole “non-dehulled” seeds from groat sample. Record as “Whole Seed Weight (g) after dehulling”.

## 6.2.4 Data Calculations

Groat Percentage is determined by dividing the “Groat Weight after dehulling” by the “Total Seed Weight before dehulling”, correcting for whole seeds not dehulled and multiplying by “100”.

% Groat = (“Groat+Whole Seed Weight (g) after dehulling” – “Whole Seed Weight (g) after dehulling”) X 100

(“Total Seed Weight before dehulling (g)” – “Whole Seed Weight (g) after dehulling”)

## 6.2.5 General Notes:

More information can be found in “Factors Affecting Groat Percentage in Oat”

Source: Crop Science [0011-183X] Doehlert, Douglas yr:1999 vol:39 iss:6 pg:1858 -1865

## 7 Appendix: Data Release Policy

Reports and minutes of the PRCOB will only be available from the Chair, Secretary, or the password protected area of the PRCOB website for six years after the PRCOB annual meeting.

The PRCOB minutes will be available on the PRCOB website to all members. Included in this report will be the voting results (Evaluation Team and PRCOB votes) for each candidate line considered. The report will include minutes of the Evaluation Teams.

Reports of the PRCOB will be available to all members of the PRCOB. General access and availability of these reports will be posted on the password protected area of the PRCOB website after PRCOB voting and approval. A disclaimer indicating the restricted distribution of the report and limitations of the data will be included on the first page of each document.

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

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

Disclaimer to be published with the PRCOB minutes:

- The data contained in this document is the copyright property of the Prairie Recommending Committee for Oat and Barley (PRCOB). 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 PRCOB Chair.
- The data contained in this document are collected from several sources. The PRCOB does not guarantee the veracity of subsets of these data.
- The members/experts of the PRCOB evaluate the merit of genotypes/varieties 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 PRCOB Chair.

Guidelines to Chair in granting permission to use portions of the PRCOB data:

- 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.
- The data for the checks is considered public domain and a request for use will be approved unless it conflicts with point 1.
- The use of data specific to entries may be approved with the express written consent of the relevant breeder/sponsor.
- The Chair, in granting permission to use the data, will consider and respect information that is proprietary.

## 8 Appendix B: Conflict of Interest Guidelines

The PRCOB has as one of its mandates, the responsibility “to advise on the performance of lines in test and make recommendations to the Variety Registration Office of the Plant Products Division, Canadian Food Inspection Agency.” The process is based on participation of the pool of expertise contained in the membership of the PRCOB and is carried out in a democratic and transparent manner. It is recognized that this in itself incurs a degree of conflict of interest but this is accepted as a desirable element of involving the most knowledgeable professionals. Thus it is not a conflict of interest for a sponsor to vote for their own candidate line. While members are expected to vote impartially, abstaining from a vote is appropriate only when sound ethical judgment indicates a ‘Conflict of Interest’.

According to Dr. Michael McDonald, Director of the Centre for Applied Ethics at the University of British Columbia, 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.

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 judgment 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 judgment 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.

## **9 Appendix C: Contract registration – Operating Procedures and Data Requirements**

### **9.1 Contract Registration Committee (CRC)**

The Contract Registration Committee (CRC) will consist of three (3) individuals appointed by the PRCOB, one from each of the following disciplines or areas of specialization:

- Oat or barley breeder
- A pertinent quality expert
- A pertinent pathology expert

Appointments will be made as required. A Chair of the CRC will be chosen from among its members. In cases where confidentiality of data is important, the owner of the proposed candidate may request an alternate member to be appointed by the remaining members of the CRC. Members of the CRC will act to protect the confidentiality of data where required.

### **9.2 Eligibility requirements for testing under Contract Registration**

Before a line will be considered suitable for testing under Contract Registration procedures, the owner/sponsor (or designate) must provide the rationale for Contract Registration. A written document, addressing the following points, must be received by the PRCOB at least one week prior to the PRCOB annual meeting.

- The candidate line possesses unique biochemical or biophysical characteristics specific to a defined end-market and could cause industry harm if produced outside of a closed system. An end user/purchaser exists for the contract registered variety. A closed system for the production of the candidate is achievable. The closed system provides assurance that “off-grade” production shall not enter the normal marketing system for the commodity crop.
- Upon the endorsement that testing of the line under Contract Registration procedures is appropriate; the Variety Registration Office will be informed of the decision and any additional data requirements prescribed by the CRC.
- Owners/sponsors of candidates being tested under Contract Registration procedures are urged to contact the Varietal Registration Office for details on the required Quality Assurance Manual, which must be complete before registration is granted.

### **9.3 Decisions on acceptability for testing under Contract Registration**

Upon receiving appropriate documentation and/or data summaries from the owner/sponsor of a candidate, the CRC will inform the owner/sponsor of the date and time of the CRC meeting where they will be allowed to address the committee. Following the meeting, the CRC will have up to ten (10) 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 of the line may contest a CRC decision in two general areas:

- If the candidate is deemed ineligible for testing under Contract Registration procedures.
- If the CRC objects to the Contract Registration of the line.

Appeals will be referred to a PRCOB Appeal Committee and conducted as outlined in the PRCOB Operating Procedures. Costs incurred in convening any extra-ordinary meeting of the Executive shall be borne by the owner/appellant.

#### **9.4 Conduct of Trials & Minimum Data Requirements**

The following are minimum data requirements for Contract Registration of a candidate line. The CRC may set additional requirements within ten (10) days following the meeting called to determine the suitability of the candidate for Contract Registration procedures.

It is a condition that, upon acceptance of a candidate for testing under Contract Registration procedures, the owner/sponsor agrees that the testing and evaluation protocols defined by the CRC are appropriate and that these protocols, however defined, will not justify an appeal.

- A minimum of two (2) years of testing is required.
- Testing must be conducted in the region where production is intended to take place. The geographic region(s) may vary in area from all of western Canada to a smaller region within a province.
- Testing will provide comparisons with the appropriate checks, as currently used in regular registration (cooperative) testing, or as determined by the CRC.

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 (8) station-years of agronomic data are required, with a minimum of three (3) station years in each of two (2) calendar years. A minimum of three (3) of the eight station-years of data shall be conducted by an individual or organization that is independent from the candidate proposer, with a minimum of one (1) station year in each of the calendar years tested. The independent test organization must be disclosed to the CRC prior to conducting trials for approval.

An independent third party PRCOB member will be identified by the CRC to inspect all field trials.

- Disease evaluation will take place in each of two (2) years of testing and shall be conducted under the auspices of the Disease Evaluation Team. Candidates must meet minimum disease resistance requirements in place for traditional varieties (general registration), unless the owner of the candidate can demonstrate that susceptibility to a particular disease will not endanger production of traditional varieties in, or adjacent to, the geographic region(s) identified for contract production.
- Agronomic performance and disease reaction data will not be considered confidential.
- Grain quality and the trait deemed to cause potential harm will be evaluated each year of testing, relative to the appropriate check varieties for the crop kind. These data will be evaluated by the CRC in consultation with appropriate grain quality experts if deemed appropriate or necessary. The CRC will respect the confidential nature of the data in soliciting expert advice. The purpose of this evaluation is to confirm that the candidate has the quality claimed by the owner/sponsor and that such quality requires production within a closed, contract system.
- All costs for data collection for Contract Registration shall be borne by the owner/sponsor of the candidate line.

Recommendations in support of contract registration will be made by the CRC, and these will be forwarded to the Variety Registration Office who will examine the request and rule on the applicability of the candidate for Contract Registration.





## **10 Appendix D: Authority provided under section 65.1 in the Seeds Regulations**

(To be included in all operating procedures documents)

Recommending Committees:

- a) 65.1(1) The Minister shall approve, for Canada or a region of Canada, a committee to establish and administer protocols for testing the varieties of a species, kind or type of crop listed in Part I of Schedule III, to determine the merit of the varieties and to make recommendations respecting their registration if
- b) The members of the committee have the knowledge and expertise required to establish and administer testing protocols for varieties of that species, kind or type of crop;
- c) The members of the committee have the knowledge and expertise required to determine the merit of the varieties of that species, kind or type of crop;
- d) The testing protocols established by the committee are appropriate for that species, kind or type of crop, are practical and are based on scientific principles;
- e) The procedures established by the committee for determining the merit of varieties of that species, kind or type of crop are appropriate for that purpose and are based on scientific principles;
- f) The operating procedures established by the committee will ensure that its functioning is transparent and that varieties are dealt with in a fair and consistent manner; and
- g) No other committee is approved as a recommending committee for that species, kind or type of crop for Canada or the region.

The Minister shall approve, for Canada or a region of Canada, a committee to establish and administer protocols for testing the varieties of a species, kind or type of crop listed in Part II of Schedule III and to make recommendations respecting their registration if:

- a. The members of the committee have the knowledge and expertise required to establish and administer testing protocols for varieties of that species, kind or type of crop;
- b. The testing protocols established by the committee are appropriate for that species, kind or type of crop, are practical and are based on scientific principles;
- c. The operating procedures established by the committee will ensure that its functioning is transparent and that varieties are dealt with in a fair and consistent manner; and
- d. No other committee is approved as a recommending committee for that species, kind or type of crop for Canada or the region.

In carrying out its functions, a recommending committee must apply the testing protocols it has established, act in accordance with its operating procedures and, in the case of a committee approved under subsection (1), apply the procedures it has established to determine the merit of varieties.

For the purposes of subsections 67(1) and 67.1(1), the recommendation of a recommending committee must be based on the following:

- a) In the case of a species, kind or type of crop that is listed in Part I of Schedule III, the results of testing the variety in accordance with the relevant testing protocols and a determination of whether the variety has merit.
- b) In the case of a species, kind or type of crop that is listed in Part II of Schedule III, the results of testing the variety in accordance with the relevant testing protocols.

SOR/2009-186, s. 2.

## **11 Appendix E: Eligibility Requirements for Variety Registration**

(To be included in all operating procedures documents)

67.1(1) A variety of a species, kind or type of crop that is listed in Part I of Schedule III is eligible for registration if:

- a) The variety has merit;
- b) The variety has been tested in accordance with the testing protocols of a recommending committee;
- c) The recommending committee has made a recommendation respecting registration of the variety;
- d) The variety or its progeny is not detrimental to human or animal health and safety or the environment when grown and used as intended;
- e) The representative reference sample of the variety does not contain off-types or impurities in excess of the Association's standards for varietal purity;
- f) The variety meets the standards for varietal purity established by the Association or these Regulations for a variety of that species, kind or type;
- g) The variety is distinguishable from all other varieties that were or currently are registered in Canada;
- h) The variety name is not a registered trademark in respect of the variety;
- i) The variety name is not likely to mislead a purchaser with respect to the composition, genetic origin or utility of the variety;
- j) The variety name is not likely to be confused with the name of a variety that was or currently is registered;
- k) The variety name is not likely to offend the public;
- l) No false statement or falsified document and no misleading or incorrect information have been submitted in support of the application for registration; and
- m) The information provided to the Registrar is sufficient to enable the variety to be evaluated.

(2) A variety of a species, kind or type of crop that is listed in Part II of Schedule III is eligible for registration if the requirements for eligibility set out in paragraphs (1) (b) to (m) are met.

(3) A variety of a species, kind or type of crop that is listed in Part III of Schedule III is eligible for registration if the requirements for eligibility set out in paragraphs (1) (d) to (m) are met.