Ontario Pulse Crop Committee

Variety Trial Methods and Testing Procedures (Version 3.0)

(Updated: September 2025)

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1.0 General Information

1.1 Purpose

This document provides the approved guidelines and standards for the Ontario Pulse Crop Committee's (OPCC) registration and performance trials. These procedures apply to all tests from which data is collected and submitted for registration consideration on all varieties/cultivars of dry beans (*Phaseolus vulgaris*) in Ontario. Trial cooperators who wish to deviate from the following procedures or who are uncertain as to the appropriate course of action must consult with the trial coordinator before making changes.

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1.2 Trials

OPCC trials include the Ontario Minor Market Class registration and performance trial, the Ontario Kidney and Cranberry bean registration and performance trial, and the Ontario white bean registration and performance trial.

In addition to OPCC trials, all private trials from which data will be submitted for registration consideration must adhere to the following standards.

1.3 Deadlines

Item	Deadline	Description
Notice of intent to establish a private trial	January 31	All companies intending on submitting private trial data for consideration by (OPCC) must contact the chair with trial protocols by this deadline.
Entry forms	April 15th	Entry forms for variety submission are due to Emily Morneau.
Seed shipment	April 15th	All seed must be shipped from seed supplier to trial coordinator (AND received by May 1st).
Seed packet requirements from trial site cooperators	February OPCC Annual Meeting	Site cooperator seed packaging requirements are provided to the trial coordinators.
Trial treatment numbers sent out to site coordinators	April 20th	Trial coordinators will send out an email with treatment numbers in order to allow for layouts and land requirements to be determined.
Randomizations sent to site cooperators	May 15th	Trial coordinators send out trial randomizations to site cooperators.
Private trial site information due	July 15th	Private trial coordinators are required to provide locations, trial maps, randomizations and agronomic management information to the OPCC chair and secretary.
Harvest locations selected for seed quality sampling	October 1st	Notification sent to site cooperators selected to submit samples for seed quality trait analysis.
Seed samples for quality traits due	November 10th	Seed samples sent to AAFC-Harrow.
Data	November 15th	Raw data from registration and performance trials provided to trial coordinators.
Cooking samples shipped	November 15th	Seed samples for cooking quality shipped to AAFC- Lethbridge.
Trial summaries	December 1st	Trial reports prepared and distributed for OPCC review to meet seed guide publication deadline.

Private trial data	January 1st	All private trial data intended to be used for variety registration purposes must be provided to the OPCC for review.

1.4 Timing of assessments

The following table can be used as a guideline for the planning of note collection over the course of a growing season. All timeframes are based on mid season locations, and may vary depending on location.

Timing (Days After Planting)	**Character Assessment**
25-50	Plot quality
35-50	Flowering date
35-50	Flower colour
35-50	Growth habit
35-40	Root rot
40-60	SCN evaluation
50-60	Common bacterial blight
45-55	Bacterial brown spot
50-75	Halo blight
100-110	White mold
80-100	Maturity
100-110	Harvestability
100-110	Green stem

2.0 Agronomy and Trial Procedures

2.1 Site suitability

When considering trial locations the following should be considered:

- Previous seasons crop and herbicide history
- Previous weed pressure, particularly perennial weeds
- Soil type, soil pH and drainage (uniform)
- Trials should be sited away from trees, hedges, headlands and other features which are likely to cause uneven growth and growing conditions
- If a tree line is present it is recommended that the trial be placed away from the tree line by 1.5 times the height of the tree
- Direction of cultivation and drainage tile should be considered when planting the trial
- If site is moldboard plowed, avoid a dead furrow in the trial area
- If possible, it is useful to observe the crop growing the year before field trials are established to avoid placing plots in any problem areas in the field
- Establishing plots on previous years plots, regardless of the previous crop, is not recommended
- Avoid planting dry bean crops on the same piece of land in consecutive years

2.2 Trial design

The trial coordinator will supply the site cooperators with the final sowing list, randomization, and plot seed by May 15th. Trial design should be a lattice or RCBD with 4 replications. Field map design is left to the discretion of the site cooperators, unless otherwise specified, in order to take field conditions into consideration while mapping.

2.3 Seed

Seed packaging requirements (envelope preferences and seed numbers) are due to trial coordinators by the OPCC Annual Meeting in February. Seed will be shipped to site coordinators mid-May. Packaged seed will be adjusted to account for 85% germination, and shipped via mail or courier to coordinator locations. All seed will be treated with Cruiser Maxx Bean plus Dynasty seed treatments.

Seed within the trials must be disease-free (e.g. produced in Idaho, if possible) and obtained from a pure seed source. Seed envelopes will be labelled with test, location, entry, year, name and plot number prior to shipping to sites. A plot number system starting at 101 will be used, with new blocks/replications increasing the number by 100 (e.g. 101,201, etc.).

2.4 Sowing the trial

All plots must be a minimum of 4 m after trimming. Each site should remove end of plot variability by trimming or mowing alleyways after plant stand is established, prior to flowering.

The starting plot length at planting is up to the discretion of the site coordinator. All sowing requirements must be calculated at each site, with population density remaining constant across locations. For example, if a site will have plots planted at 6m length, and trimmed to 5m after plant establishment, the seeding rate will be calculated for the 6m plot based on population stand guidelines (below).

Seeding rates with at least 85% germination are as follows (all locations must follow rates appropriate to their machinery):

Seeding rates for minor market class dry beans based on 85% germination		
Seeding rate	**Population density**	**Row widths**
13 sd/m of row	35 seeds/m^2	36 cm (14.5 inch) row
15 sd/m of row	28 seeds/m^2	53 cm (21 inch) row
17 sd/m of row	22 seeds/m^2	76 cm (30 inch) row

Seeding rates for kidney and cranberry dry beans based on 85% germination		
Seeding rate	**Population density**	**Row widths**
12 sd/m of row	23 seeds/m^2	53 cm (21 inch) row
15 sd/m of row	20 seeds/m^2	76 cm (30 inch) row

Plot seeders are to be set up, calibrated and used only when conditions are fit for planting. Care must be taken to ensure planting depths are appropriate for soil type, and uniform across the trial. Planting into moisture is critical, with ideal depths falling between 1-2 inches deep. Precautions should be taken to prevent seed carry over from plot to plot. Missing or partial rows must be noted and included in the trial datasheets (Appendix M or downloaded from the OPCC documents section of GoBeans.ca) under “general problems”.

Row widths are at the discretion of the site cooperators, with the following restrictions:

- All kidney and cranberry bean trials must be seeded to wide rows (53-76cm rows).
- Kidney and cranberry bean, wide row trials are to be two rows of at least 4m.
- Minor market class trials are to be planted as two rows with wide spacing (>53cm) or four rows with narrow spacing (36-52cm).
- It is encouraged that locations plant minor market class trials with narrow row spacing to best represent industry practices.

Planting date should be as close to recommended dates set forth by OMAFRA’s Agronomy Guide for Field Crops (publication 811). Ideal germination occurs in soil temperatures of 15°C or above. Recommended plant dates are:

- May 26-June 6 for less than 3000 CHUs (crop heat units)
- May 30-June 10 for 3000-3200 CHUs

- May 30- June 20 for more than 3100 CHUs.

2.5 Agronomic Practices

Agronomy: The crop protection methods for OPCC trials should use the OMAFRA Agronomy Guide for Field Crops (Publication 811) as a guide. Trials must be reflective of farm practices employed by growers in Ontario.

Fertilizer application: It is best to apply fertilizer perpendicular to the direction of plots. All sites must conduct a soil test for detection of inherent fertility, and levels should be adjusted following OMAFRA recommendations. At minimum, a soil test for nitrogen, phosphorus, potassium, sulfur, and pH must be conducted. Following the higher end of application rates is suggested to maximize plant growth within yield plots. Results of the soil test must be included in the Agronomic Management Datasheet (Appendix N).

Weed Control: Weeds should be controlled with appropriate registered herbicides. The first three weeks post plant is critical for weed management. Exceptional weed control measures (hoeing) may be needed if pressures are high or inconsistent. All herbicide applications should be listed in the Agronomic Management Datasheet for the trial (Appendix N). The incidence and severity of weed escapes must be noted before harvest. Crop stunting due to weed interference should be determined.

Insect Control: Severe pest infestations (such as potato leafhoppers) should be controlled with the use of registered pesticides. Timing, rate and frequency should be based on product label. All insecticide applications should be listed in the Agronomic Management Datasheet for the trial (Appendix N).

Foliar Disease Control: Registered fungicides should be used to prevent the spread of foliar leaf diseases (anthracnose and white mold). Preventative sprays should be used in years with conditions favorable for disease. All fungicide applications should be listed in the Agronomic Management Datasheet for the trial (Appendix N).

2.6 Records

Trial Site Form: A Trial Site Form (Appendix M) must be completed for all locations prior to running a trial, from which data will be submitted to the OPCC. This includes all private trials and site locations for the OPCC registration and performance trials. Sites are required to submit one upon the first year a trial is run, only resubmitting if large changes to site protocol are made. All forms are submitted to the trial coordinators.

Agronomic Management Data Sheet: An Agronomic Management Data Sheet must be completed and submitted to each trial coordinator for all locations in order for the location to be considered valid. An example of this form is found in Appendix N and

trial specific copies can be found on the GoBeans.ca website under the OPCC documents section. Agronomic Management Datasheets should be submitted to trial coordinators along with the trial data by November 15th. The data sheet includes information on the trial coordinator, trial design, seeding and harvest dates, plot dimensions for seeding and harvesting, sections for comments on biotic and abiotic stresses observed during the trial, soil test results, fertilizer, herbicides, pesticides, weather and instructions on notes to take.

Plot Information Records: All data collected (traits outlined in section 3) should be entered into Microsoft Excel, and sent to the trial coordinators immediately after harvest. All trial data for each of the three OPCC trials must be sent to Emily Morneau by November 15th.

2.7 Harvest

Timing: Harvest should be based on location, with maturity and weather being considered.

Harvest Area: Plot dimensions should be measured prior to harvest. If it is necessary to reduce the size of any plots below current OPCC standards, details of the changes should be clearly recorded in the Agronomic Management Data Sheet (Appendix N).

Desiccation: The use of a desiccant product is not encouraged. Plots should be allowed to mature and dry down naturally. Exceptional weather and field conditions may however warrant the use of a desiccant in some years. The use of desiccants must be noted in the Agronomic Management Data Sheet (Appendix N).

Harvesting Method: All plots should be harvested via direct combining. Harvest method must be consistent throughout the trial. Combine settings should be adjusted according to the crop (large seed vs. small seed) and conditions. In some cases hand harvesting is required to maintain trial data integrity (e.g. very early cultivar shattering before the entire trial is ready to harvest). Hand harvesting should be limited in practice as standard protocol is to direct harvest.

Harvest Sample: Plots should be harvested in their entirety, and retained until March 1st of the following year (approximately 4-5 months). It is essential that all harvest samples are stored under low humidity conditions with a seed moisture of less than 18% and greater than 10%. Harvested material should be clearly labelled and kept for further analysis, if required.

3.0 Trial Characteristics for Assessment

The following characteristics must be recorded for each entry in a trial. The priority and number of reps for data collection is indicated in the event only partial notes can be taken. Please review note details (sections 3-6) for further standards on recording each characteristic. Note some characteristics are not to be noted at yield trial sites.

Assessment	**Characteristic**	**Number of Reps**	**Priority**	**Location**
Yield	Yield (kg/ha) adjusted to 18% moisture	4	**Mandatory**	All yield sites
	Moisture	4	**Mandatory**	All yield sites
Seed Quality	100 sd weight (g) adjusted to 18% moisture	4	**Mandatory**	All yield sites
	Protein and sugar content	1	Optional	Selected sites only
	Cooking and Canning Quality	4	**Mandatory**	Selected sites only
	Marsh spot	4	Optional	All kidney and cranberry sites
Maturity	Maturity date after planting	3	**Mandatory**	All yield sites
	Flowering date	3	Optional	All yield sites
Resistance to disease	Plot disease observations	4	**Mandatory**	All yield sites
	Common bacterial blight	3	**Mandatory**	Harrow
	Anthracnose	3	**Mandatory**	Elora
	Bacterial brown spot	2	Optional	London
	White mold	2	Optional	London
	Root rot	2	Optional	Harrow
	Bean common mosaic virus	3	**Mandatory**	Harrow
Reaction to environment	Harvestability	4	**Mandatory**	All yield sites
	Plot quality notes	4	Optional	All yield sites
	Green stem	4	Optional	All yield sites
Plant traits	Growth habit	3	Optional	All yield sites
	Flower colour	3	Optional	All yield sites

3.1 Flowering date

The date in which 50% of the plants in the plot have one or more flowers. Although not of high importance, this date allows for rate of yield and uniformity of pod set to be calculated. The flowering date should be expressed as a Julian calendar date from January 1.

3.2 Flower colour

Flower colour should be stated as white, pink or purple. Although flower colour is not expected to be different across reps, clear colour notes allow for errors in data entry to be resolved after harvest or during data importing. In addition, flower notes are important in detecting segregation and contamination. In the event of mixed seed at planting, flower colour notes allow for planting errors to be detected.

3.3 Growth habit

Similar to flower colour, growth habit allows for data to be verified. Growth habit should denote plant type. Specifications for plant types can be found in Appendix B.

3.4 *Maturity*

Maturity should be assigned to plots when plants are at physiological maturity (indicated when 80% of pods have changed colour, and dry down has begun). At this point a grower would be considering a desiccant, and the yield is no longer increasing as the plant is no longer sending resources to the sink (beans). Maturity notes should be expressed as the Julian calendar date, from January 1. Maturity date after planting is calculated by subtracting the planting date (Julian date) from the maturity date.

3.5 Harvestability

Harvestability is measured on a scale based on lodging, pod height from soil and branching. The scale can be found in Appendix A. Harvestability should be expressed as a number from 1 (upright with high pods and tight branching) to 5 (lodged with low pods and considerable branching).

3.6 *Green stem*

Green stem notes are recorded as the percentage of plants within a plot that have green stems at harvest, should be taken just prior to harvest. All replications should have green stem notes taken, as field position can affect the amount of green stem present.

3.7 Plot quality notes (general plot observations)

Plot quality notes are subjective and may include a variety of observations. Some things to note could be disease presence, weed pressure, ozone damage, poor emergence, sparse plants, stunted plants, poor pod set, intense insect damage, plot damage from machinery, herbivore damage, etc. The plot quality notes are used to remove damaged plots from data analysis. Plot notes can also help explain outlier data points, and give a picture to the trial coordinators as to the overall state of the trial.

3.8 *Assessment procedure suggestions*

Quality of data is vital to the registration process, and steps should be taken to ensure data collected is thorough and complete. In addition to accurate scale assessment and instruments, there are habitual considerations to be made. Some suggestions to limit error include:

- In the event of repeated measures (repeated assessment of plots for the same trait), ensure the same person conducts each rating
- If possible, take repeated notes at the same time of day. This allows for field conditions to be as similar as possible.
- Consider external influences that may alter perception in the field such as hats with brims, sun glasses, and sunlight levels. If possible, take notes with the same sources of influence within the trial. For example, if sunglasses are worn ensure they are worn for all notes taken.

4.0 Yield Testing Procedures

Yield is expressed in kg/ha adjusted to 18% moisture. The calculation for moisture adjustment is the following:

Kg/ha@18% = ((((100-*moisture*)/82)***plot weight*)**x*)

X= the area adjustment from plot area to 1 ha

Moisture must be measured at the same time as the plot weight is taken.

In some cases, upon inspection of trial site or at the recommendation of the site coordinator yield may be recorded, but deemed an outlier and therefore not incorporated into the final report. Yield Coefficient of Variations (CV) greater than 15% for white bean trials and 18% for coloured bean trials at a single site will come under review.

Measurements of plots should be taken at time of plot trimming to ensure all plot yields are relative to each other. Plots should be no shorter than 4 m at harvest.

5.0 Quality Testing Procedures

5.1 Seed Drying and Storage Parameters

In order to maintain seed quality for canning, cooking and NIRS analysis, seed should be harvested and stored within the acceptable moisture range post harvest (12-18% moisture). If seed is harvested above this moisture level, spoilage can occur and plot seed should be dried slowly and gently to reach this range. It is strongly encouraged that seed drying is used sparingly. The rapid drop in moisture due to drying damages the seed coat, and can potentially influence quality parameters such as canning and cooking quality as it increase the percentage of cracked seed coats. At no point should seed moisture drop below 10% post harvest. Once seed is within the acceptable moisture range, it should be stored in a dry, cool and dark environment such that seed does not spoil.

5.2 Moisture

Yield data and 100 seed weight must be corrected to 18% based on measured moisture at time of weighing. Moisture content must be taken for each plot (4 replications). The moisture content of harvested seed may be measured using electronic moisture analyzers or combine-mounted moisture meters. For both options, the moisture reading must fall within the range of optimized moistures for the device being used (typically between 5% and 25%, but check equipment operation manuals). Seed falling out of the calibration range must be dried and re-tested.

In the event of combine mounted moisture meters being used, the determination of moisture content must be the same for all plots in a trial. If there is a significant risk of rainfall during the harvesting of a trial, backup samples should be taken to allow for moisture to be taken after harvest.

5.3 100 Seed Weight

The weight of 100 representative seeds at 18% moisture from a clean seed sample is recorded.

Procedure: Select a representative seed sample and clean removing split seed, damaged seed and debris. Count the sample (minimum of 100 seeds) and weigh. Adjust weight to account for 100 seeds [(Total weight/# of seeds)*100]. Record the weight for 100 seeds. 100 seed weight must be measured for each of the four replications. Use the following equation to adjust seed weight to 18% moisture:

100 seed weight @18%= (100-*moisture*)/82)**100 seed weight*

5.4 Canning and cooking quality

Entries being submitted for canning and cooking quality, along with the cooking check varieties, will be sent to Agriculture and Agri-Food Canada- Lethbridge for assessment. Before shipping to Lethbridge, samples will be organized and inspected at the University of Guelph. Shipping and packaging protocols can be found in Appendix C. Canning and cooking analysis protocols can be found in Appendix D. A list of entries requiring canning assessment will be sent out by trial coordinators by October 1.

5.5 NIRS analysis for protein and complex carbohydrate content

Each trial location is required to send a 200g sample of each entry to Agriculture and Agri-Food Canada- Harrow for NIRS analysis. Please adhere to the packaging and shipping requirements outlined in Appendix E.

Samples for analysis are ground with a Knifetec grinder and run through the FOSS DS2500 according to protocols established in the AAFC soy quality lab. Samples for each entry do not need to be in replicate (1 sample per entry) and do not need to be a composite.

6.0 Disease Test Procedures

6.1 Plot Disease Observations

Disease observations should be taken at all yield trial locations. If the disease pressure is present throughout the trial, severity notes should be taken in accordance to the scale given for the disease (see appendices). If disease pressure is not present through the entirety of the trial, plots with disease symptoms should be noted in the Agronomic Management Sheet under 'comments on general problems and biotic stress'.

If disease presence impacts the yield potential of the check varieties, plots should be noted and plot removal should be considered. Specifically if halo blight or anthracnose is noted in trial plots, an email must be sent to the trial coordinators and all other trial sites to allow for other locations to be scouted more intensely. If under 10% of plots are affected, plots must be removed to prevent the spread to the rest of the trial. If more than 10% of plots are infected, the trial integrity must be reviewed. The age of the plants, the status of the checks and if all replications are infected will be taken into consideration. If the trial is deemed valid, harvest methods must be reviewed to prevent the spread to seed that will be used in future years.

6.2 Common bacterial blight

Procedure: All entries are grown with four replications in the common bacterial blight (CBB) nursery at the Harrow Research and Development Centre (AAFC; Harrow, ON). Entries are grown in seven seed hill plots (75 cm space between plots within a row and 61 cm between

rows) that are inoculated via high pressure sprayer (200 psi) with a mixed bacterial solution approximately 4 weeks after planting. The plots are inoculated a second time 7 days later.

The mixed inoculum contains *Xanthomonas axonopodis* pv. *phaseoli* strains 18 and 98; and *Xanthomonas fuscans* subsp. f*uscans* strains 12 and 118. The four strains are grown on yeast salt media for 48 hours, prior to inoculum creation. Plates are generated from either frozen stock of bacterial isolations or from dried infected plant material. Leaves of infected plants (propagated to maintain bacterial lines) are soaked in phosphate buffer for one hour prior to plating the buffer onto yeast salt media. Inoculum is created by adjusting bacterial solutions of each strain to 10^6 CFU/mL. 1.5L of each bacterial strain (with concentration adjusted) is added to a 50 gallon sprayer tank, and diluted to 50 gallons with water. Plots are inoculated in the early morning to ensure inoculation occurs in a cool, humid environment. Plots are irrigated every other day after inoculation until the final rating is complete.

Plots are rated when the series of checks (shown below) are showing moderate symptoms across the nursery (approximately 3 weeks later). Ratings are repeated 7-10 days later to capture late infection. Ratings are expressed in a scale of 0-5 with 0 being disease free and 5 being severely infected. See Appendix F for rating scale.

CBB nursery checks:

Infection level	Check Variety
Resistant / moderately resistant	Mist
Indeterminate	Nautica
Moderately susceptible	Lightning
Susceptible	Dynasty

CBB testing is coordinated by:

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6.3 Anthracnose- field rating

Procedure: All entries are grown in hill plots with four replications at the Elora Research station (University of Guelph; Elora, ON). Hill plots, planted as seven seeds each, with 60cm between hills, and between rows. Plots are inoculated with a *Colletotrichum lindemuthianum* (Race 73) spore suspension of 10^5 spores/mL at flowering. To accommodate for various flowering times, inoculation occurs when 60% of plots are flowering. A backpack sprayer is used to inoculate the hills plots at an average rate of 5.6mL/plot. Once symptoms are observed on differential checks, disease severity is rated according to the scale in Appendix G. A rating is assigned for disease severity observed in the stems/pods and leaves.

Differential checks for anthracnose (race is determined by the addition of numerical differential name):

Binary code number	Name	Race 73 reaction
1	*Michelite*	*Susceptible*
2	MDRK	Resistant
4	Perry Marrow	Resistant
8	*Cornell 49242*	*Susceptible*
16	Widusa	Resistant
32	Kaboon	Resistant
64	*Mexico 222*	*Susceptible*
128	PI 207262	Resistant
256	TO	Resistant
512	TU	Resistant
1024	AB 136	Resistant
2048	G 2333	Resistant

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6.4 Anthracnose- indoor rating

Procedure: Entries are grown in triplicate within 38 celled trays. The same cultivars listed in section 6.3 are used as checks in this testing. Plants are inoculated with a *Colletotrichum lindemuthianum* spore suspension 10-12 days after planting (race depending on screening being done). Once the unifoliates are fully expanded, the spore solution is sprayed on the leaves in order to completely saturate the top surface of the leaf. Approximately 1.5mL of solution is used to saturate each plant.

In order to create the spore solution, plugs of infected Mathur media is transferred to bean pod media to initiate sporulation. Once the fungus has sporulated (1-2 weeks), the media is then washed (2 drops tween 20 to 100mL water) to suspend the spores in solution. The spore solution is adjusted to $1.5x10^6$ spores/mL. The spore solution is decanted into spray bottles (50mL of solution per 38 plants) and used for inoculation. Each race is kept separate, and

plants are inoculated with a single race. Tests are replicated in order to screen for multiple races. Plants are kept at 90% humidity after inoculation, until the plants are rated.

Plant ratings begin 7 days after inoculation. A total of 3 ratings are completed, each 2 days apart. Plants are rated on a scale of 0-9, with 0 given to plants with no disease, and 9 given to plants that are most severely diseased (dead). The scale used is found in Appendix G. The use of young plants results in only one to two sets of trifoliates being rated (no pod rating). The use of a highly concentrated inoculum results in severe symptoms, and plants that are rated a 9 are dead.

6.5 White Mold

Procedure: All entries are grown with two replications in the white mold nursery at either AAFC-London, ON or AAFC-Harrow, ON. Plots consist of 5m rows. Dried *Sclerotinia sclerotiorum* sclerotia obtained from elevator screenings, is spread with a fertilizer spreader prior to planting and then shallowly incorporated with mechanical field tillage equipment prior to planting. After plant emergence (first trifoliate), the plots remain under mist irrigation at an interval of every other day for the entire season to promote sclerotia germination, apothecia growth and the release of ascospores. The plots are rated after dry down for incidence (percent of plot bleached) and severity (scale of 1-10 based on average bleaching of plants within the plot). A white mold index is formed by multiplying incidence by severity and divided by 100. See Appendix H for rating scale.

White Mold nursery checks:

Infection level	Check utilized
Resistant	G122
Moderately resistant	FR 266
Indeterminate	Mist
Moderately susceptible	Dresden
Susceptible	Bolt

White mold testing is coordinated by:

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6.6 Marsh spot

Procedure: Cranberry beans are prone to a manganese deficiency disorder known as marsh spot, which discolours the interior of the cotyledon and can create marketing issues. Seed samples are collected from the Ontario Kidney and Cranberry Dry Bean Registration and

Performance Trials to determine if the cranberry varieties entered in the trial are susceptible to Marsh Spot. These varieties are compared to the variety Messina, a highly susceptible variety of cranberry beans, which is seeded at each trial location.

Samples of seed harvested from each plot within the cranberry market class are to be sent to the Huron Research Station (University of Guelph), and scored for marsh spot incidence and severity. Each trial location is to send 100g from each cranberry bean plot, as well as 100g of Messina from each location. Marsh spot is calculated on an incidence by severity index. Incidence is calculated by splitting 50 seeds, and determining what percentage of seed has marsh spot present. Seed with marsh spot is rated based on the scale found in Appendix I. The IxS index is then calculated. See appendix I for more details.

Marsh spot testing is coordinated by:

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6.7 Bacterial brown spot

Procedure: All entries are grown with two replications in the bacterial brown spot nursery at the London Research and Development Centre (AAFC; London, ON). Entries are grown in seven seed hill plots (75 cm space between plots within a row and 61 cm between rows) that are inoculated via high pressure sprayer (200 psi) with a mixed *Pseudomonas syringae* pv. *syringae* bacterial solution four weeks after planting. The plots are inoculated a second time 7 days later.

The mixed inoculum contains strains 39 and 40 (obtained from Dr. O. Wally AAFC-Harrow). The two strains are grown on yeast salt media for 48 hours, prior to inoculum creation. Plates are generated from frozen stock of bacterial isolations. Inoculum is created by adjusting bacterial solutions of each strain to 10^6 CFU/mL. 1.5L of each bacterial strain (with concentration adjusted) is added to a 50 gallon sprayer tank, and diluted to 50 gallons with water. Plots are inoculated in the early morning to ensure inoculation occurs in a cool, humid environment. Plots are irrigated every other day after inoculation.

Plots are rated when susceptible checks are showing moderate symptoms across the nursery (approximately 3 weeks later). Ratings are repeated 7-10 days later to capture late infection. Ratings are expressed in a scale of 0-5 with 0 being disease free and 5 being severely infected. See Appendix J for rating scale.

BBS nursery checks:

Infection level	Check Variety
Resistant / moderately resistant	Rexeter
Indeterminate	Argosy
Moderately susceptible	Viper
Susceptible	Dynasty

BBS testing is coordinated by:

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519-325-8279

6.8 Root rot

Procedure: All entries are grown with two replications in the root rot nursery established at the Harrow Research and Development Centre (AAFC; Harrow, ON). Entries are seeded in late-May in seven seed hill plots (75 cm space between plots within a row and 61 cm between rows) within a field that was inoculated with *Rhizoctonia solani*, *Fusarium solani* f. sp. *phaseoli*, and *Pythium ultimum* Trow and has been seeded to dry beans for 40 years. Plots are irrigated for the duration of the season to encourage high soil moisture levels. Once known highly susceptible cultivars show symptoms (~six weeks after planting), plots are extracted from the soil with a tree digger. Roots are washed in water and rated (scale of 0-7). The ratings are then used to make a disease index using the incidence of disease in the hill and the severity of each root. See Appendix K for rating scale.

Root rot nursery checks:

Infection level	Check Variety
Resistant / moderately resistant	Apex
Indeterminate	OAC Thunder
Moderately susceptible	Vax1
Susceptible	Yeti

Root rot testing is coordinated by:

Emily Morneau and Dr. Jamie Larsen
Agriculture and Agri-Food Canada
2585 County Road 20
Harrow, ON N0R 1G0
emily.morneau@agr.gc.ca
519-325-8279

6.9 Bean common mosaic virus

Procedure: All entries are grown with three replications in a indoor plant growth facility and will be completed on cultivars entered in the OPCC Registration and Performance Trials. Once the seedlings are 10 days old, the fully expanded unifoliate is abraded with an inoculum consisting of ground up leaves from an infected plant, 10mL of 0.1M phosphate buffer and 1 tsp carborundum powder. Inoculum for race 1 is obtained from the susceptible cultivar Refugee and the inoculum for race 15 is from the susceptible cultivar Sanilac. Plants grown from infected seed act as the source of inoculum for screening. Clean seed (seed from uninfected plants) of these cultivars serve as the susceptible checks for the experiment. Mist is the resistant check, and is added to each screening.

Inoculated plants are left to grow under normal greenhouse conditions (fertilizers and watering as normal) for 2-3 weeks. Race 1 is rated at 12-14 days after infection and race 15 is rated 18-21 days after infection. Plants are rated as resistant or susceptible. All entries with contradicting replications are repeated in a second screening to ensure confidence in results. All screening is to be completed by February 1st of the following year (eg. For 2020 entries the results are available February 2021). See Appendix L for rating scale.

BCMV testing is coordinated by:

Emily Morneau and Dr. Jamie Larsen
Agriculture and Agri-Food Canada
2585 County Road 20
Harrow, ON N0R 1G0
emily.morneau@agr.gc.ca

Appendix A
Harvestability Scale

The following scale can be used to guide harvestability ratings for each harvested plot. To rate harvestability start with a score of 1, and add "points" for each characteristic listed below, to a maximum of 5.

Score	Criteria
1	Plants are upright, pods are high, branching is tight
2	One point is given for each characteristic: prostrate, lodged plants, loose branching, low pods (touching ground), stems broken at ground level
3	
4	
5	Plants are all semi-prostrate with low pods, loose branching and increased vining. Plot has all of the characteristics that make for poor direct harvesting.

Notes:

Upright: plants are standing erect, with very little leaning onto other plants out of the seeded row

High pods: If a combine head were to go through the plot, very few pods are resting on the ground and therefore would not be clipped in half or lost during harvest.

Tight branching: Plants with loose branching will have a high amount of branches resting on the ground. Generally, a cultivar that has a bush determinate (Type I) growth habit has loose branching and will have a higher (poor) harvestability rating opposed to a indeterminate (Type IIa and IIb). Highly indeterminate (Type III) varieties will typically be more prostrate and viney growth habit that grows along the ground. See Appendix B for further details.

Appendix B
Growth Habit Reference

Growth habit indicates the growth type and pattern of a variety. Notes can be taken by placing one of the following labels on each plot. Type 3 plants are not often seen in cultivated varieties.

Plant Type	Description
Type 1	Determinate bush Terminal growth ends in a flower
Type 2a	Indeterminate growth Short vine Terminal growth ends in vegetative growth
Type 2b	Indeterminate growth Long vine Terminal growth ends in vegetative growth
Type 3	Indeterminate growth Long vining type Prostrate

Appendix C
Canning and Cooking Sample Shipping Guidelines

The list of entries to be submitted for cooking quality analysis will be sent out by October 1st. For each entry requiring cooking and canning quality analysis the following criteria should be followed for sample submission:

- A 1 kg composite sample (250g sample from each replication)
- All samples must be cleaned and have no debris or soil. The seed composing the sample must not show any sign of disease, mold, dirt or severely compromised seed coat (fish face, cracking or split seed). The sample must be considered equivalent to packaged beans on a store shelf and fit for human consumption.
- The composite sample should be well mixed and then divided into two packages (bags or envelopes) of exactly 500g
- Seed moisture must be no higher than 18%
- Please package the samples in an appropriate sized bag or envelope, without over filling to avoid loss of sample in transit
- The package must be well labeled using stickers or tags.
    - For plastic bags (e.g. Ziploc), please place a label inside the bag as plastic labels do not stick properly. **Labelling plastic bags with marker is not sufficient** as the writing gets rubbed off through transit and handling
    - For paper envelopes, labels can be placed on the outside of the envelope
    - For cloth bags closed with stringed labels, a label should also be placed on the inside of the bag (two labels total)
- Labels should consist of the following information: year, location, test (Kid/Cran, Minor Class, or Navy), entry number and entry name
- Shipment boxes should not exceed 10 kg

We ask you to follow these guidelines as it saves considerable time and effort when preparing samples for shipping to the bean quality lab in Lethbridge. These guidelines should also improve data quality and ensure that cooking and quality data is received in a timely manner.

Complete samples can be sent to:

Lyndsay Schram
University of Guelph- Crop Science Building
50 Stone Rd. E
Guelph, ON N1G 2W1
lschram@uoguelph.ca
519-824-4120 ext. 58339

Appendix D
Canning and Cooking Quality Procedures

Canning Protocols for Processing of Navy Bean in Tomato Sauce and Other Market Classes in Light Sauce (Brine)

(Revised September 1, 2022)

Preliminary assessment of all dry bean market classes prior to canning

Seed storage: Dry bean seeds received at AAFC-Lethbridge are stored in airtight containers in the Bean Pilot Plant (Room 1709) at 21 °C until processing.

Seed moisture: The moisture content of dry bean seed sample is determined using a Dickey-john 2500-UGMA Grain Analyser. This will help determine the amount of dry bean seeds (on a dry matter basis) that is required for canning.

Tomato sauce for navy bean canning

Approximate amount of sauce for each can: 220 ml per 14 fl. oz. can (398 ml can)

	Number of cans			
Ingredients	**15**	**20**	**30**	**40**
Tomato paste (g)	340	500	700	900
Sugar (g)	285	419	587	754
Salt (g)	70	103	144	185
Colflo 67 Starch (g)	67.5	99	139	179
Deionised water (L)	3.4	5	7	9

13 fl. oz. (369 ml) can of tomato is about 370 g.

For sauce preparation make extra sauce for at least **three cans** over the actual number of cans. Pour 2 L of deionised water, depending on the amount of sauce to be made, in an 11 L pot and start to heat. Weigh out the required amount of tomato paste and place in a 2 L metal beaker (with a handle). Add deionised water with stirring to make the sauce light. Pour the tomato paste slurry into the pot with stirring. Rinse the beaker with deionised water.

Weigh out the salt and sugar and place in a 2 L metal beaker. Add enough water to make a slurry. Pour this mixture into the pot with stirring. Again, rinse out the beaker with water. Weigh out the starch into a tall, glass jar (about ½ L). Slowly add a small amount of water with mixing to make a paste. Then add water (about 300 ml) with mixing to make a slurry. Place the lid on the jar and vigorously shake the jar to completely suspend the starch. Pour the starch slurry into the pot with stirring.

Heat the sauce to 93 °C and maintain at this temperature for canning.

Processing of navy bean in tomato sauce

1. Color measurement	Using a Chroma Meter CR-410 measure L*, a* and b* to determine dry seed colour.
2. Hydration	Based on the dry bean seed moisture content, weigh **90 g** of seeds (on dry weight basis) per genotype into a 1.2 L stainless steel beaker. Soak bean seed in 1 L deionised water at ambient (room) temperature (21 °C) for 14 to 16 hours. Calculate the hydration coefficient for this soaking period. Return the bean samples back to the beakers.
3. Blanching	Several large aluminum trays (8 beakers/tray) are placed in a blancher and filled with tap water. This ensures that when the beakers are placed in the trays, they are heated more evenly. The beakers are placed in the trays in the blancher. Add about 1 L of boiling water that has been heated in a steam kettle to each sample. Close the steam table and apply steam monitoring the temperature with a digital thermometer equipped with a thermocouple. When the temperature is reached, hold **at 93 °C for 3 min**.
4. Cooling	Open the steam table and allow the beans to cool to about 50 °C which takes about 30 min. Cool the beans as rapidly as possible after blanching. Immerse them in a sink of ambient water and spray them with water. Drain for two (2) minutes and record the weight for the determination of the hydration coefficient. Place the beans in 14 oz cans.
5. Filling	Add heated tomato sauce to each can allowing a **headspace** of about **10 mm**.
6. Seaming	Seam the cans using a can closing machine.
7. Processing	Steam process for 14 fl. oz (398 mL) cans: Come-up Vent Open: **99 °C (210 °F) for 7 min (4 rpm)** Come-up Vent Closed: **121 °C (250 °F) for 10 min (4 rpm)** Cook (sterilisation step): **121 °C (250 °F) for 40 min (4 rpm)**
8. Cooling	Pressure Cool Fill: **10.5 psi (4 rpm)** Pressure Cool: **38 °C (100 °F) for 15 min, 2.5 psi (4 rpm)** Atmospheric Cool: **29 °C (85ºF) for 5 min (4 rpm)**

9. Storage	Store the cans in room temperature (21 °C) for at least 2 weeks before assessing the processing quality.

Brine (1% brine solution) for all remaining market classes except navy bean

Approximate requirement: 250 ml per 14 fl. oz. can (398 ml can)

Number of cans	Salt (g)	Deionised water (L)
20	50.0	5.00
25	62.5	6.25
30	75.0	7.50
35	87.5	8.75

Mix the salt into the water and heat to boiling.

Processing of bean market classes (except navy bean) in light sauce

1. Using a Chroma Meter CR-410 measure L*, a* and b* for each bean seed sample.

2. An appropriate fill weight (please see below for fill weight by market class) on a dry weight basis is weighed. The beans are placed into 1.2 L stainless steel beakers and washed with deionised water if necessary.

Fill weights for 14 fluid ounce (398 ml) cans based on dry matter

Type	Amount of dry matter (g)
Navy (small white)	90
Black	90
Pinto	90
Great Northern	90
Red	90
Pink	90
Cranberry	90
Dark Red Kidney	90
Light Red Kidney	90
White Kidney	90
Yellow	90

3. To each sample is added about 600 ml of deionised water. Seed samples are soaked for 14 to 16 h at room temperature (21 °C).

4. After 16 h soaking, record the hydrated weights. Calculate the hydration coefficient after 16 h as hydrated weight / dry weight. Return the beans to the beakers.

5. Boil enough distilled water (600 ml/beaker) in a steam kettle. Several large aluminum trays (8 beakers/tray) are placed in a blancher and filled with tap water. This ensures that when the beakers are placed in the trays, they are heated more evenly. The beakers are placed in the trays in the blancher. Add about 1 L of boiling water that has been heated in a steam kettle to each sample. Close the steam table and apply steam monitoring the temperature with a digital thermometer equipped with a thermocouple. When the temperature is reached, hold at 93 °C for 3 min.

6. Open the steam table and allow the beans to cool to about 50 °C which takes about 30 min. Remove the beakers from the blancher and drain. Weigh the contents and record the weights to calculate hydration coefficient.

7. The hydrated beans are placed into cans. All cans are placed on an aluminum tray. Boiling brine is added to each can leaving a head space of about 10 mm.

8. The cans are closed.

9. The cans are placed in a retort for cooking and sterilisation
   Steam process (static) for 14 fl. oz (398 mL) cans:
   Come-up Vent Open: **99 °C (210 °F) for 7 min (4 rpm)**
   Come-up Vent Closed: **121 °C (250 °F) for 10 min (4 rpm)**
   Cook (sterilisation step): **121 °C (250 °F) for 20 min (4 rpm)**

10. Cooling
    Pressure Cool Fill: **10.5 psi (4 rpm)**
    Pressure Cool: **38 °C (100 °F) for 15 min, 2.5 psi (4 rpm)**
    Atmospheric Cool: **29 °C (85 °F) for 5 min (4 rpm)**

11. The cans are removed and stored for a minimum of two weeks before they are opened for assessment.

Cooking test of dry bean to determine hard seeds and partially hydrated seeds

1. Count 200 seeds per sample.
2. Place the seeds in 1.2 L stainless steel beakers and soak them in deionised water overnight (14 to 16 h) at room temperature (21 °C).
3. Drain the water and determine soaked seed weight.
4. Count the number of non-hydrated and partially-hydrated seeds to determine **Percentage hard-seed and Percentage partially-hydrated seed**, respectively.
5. Deionised water is heated in a blancher or steam cauldron to 93 °C.
6. Several large aluminum trays (8 beakers/tray) are placed in a blancher and filled with tap water. This ensures that when the beakers are placed in the trays, they are heated more evenly. The beakers are placed in the trays in the blancher. A digital thermometer is placed in one of the beakers to monitor the temperature. The hot deionised water (about 1L/beaker) is poured into the beaker with bean seeds. The steam table is covered and steam is applied to heat and maintain the temperature. The temperature is raised to and then held at 93 °C for 20 min.
7. After 20 min of cooking, remove the seed samples and allow the seeds to cool to about 50 °C.
8. Count the number of non-hydrated and partially-hydrated seeds to determine **Percentage hard-seed and Percentage partially-hydrated seed**, respectively.

Canning Quality Traits	
100-seed weight	Weight of 100-random seeds. Done on duplicate seed samples and presented as mean.
Hydration coefficient after soaking (HCS)	Seeds (90 g of seed solids on a moisture-free basis) were soaked for 16 h (overnight) in deionised water at room (21 °C) temperature. Hydration coefficient after soaking was determined as: seed weight after soaking / weight of dry seed. Hydration coefficient of 1.8 is considered acceptable, although bean seeds that double in weight (HCS = 2.0) after soaking are preferred.
Hydration coefficient after blanching (HCB)	Soaked seeds were blanched for 3 min at 93 °C. Hydration coefficient after blanching was determined as: seed weight after blanching / weight of dry weight. HCB of 2.0 or higher is preferred by the industry.
Drain weight (%)	Navy bean seeds were processed at 121 °C at 4 rpm for 40 min in tomato sauce. All remaining market classes of bean seeds were processed at 121 °C at 4 rpm for 20 min in brine. Can content was weighed and the weight of bean seed was determined after washing in tap water on a 8-mesh screen (Tyler series) positioned at a 15° angle. Percentage drain weight was determined as: (weight of bean seed / weight of can content) * 100. Drain weight of 60% or higher is acceptable as it indicates that 60% of the can content was bean seed.
Matting	Matting (clumping) of seeds was assessed on a 1 to 4 scale (1 = none, 2 = trace, 3 = slight, 4 = moderate).
Appearance	Appearance of seeds was assessed on a 1 to 4 scale (1 = excellent, 2 = good, 3 = acceptable, 4 = poor). Bean seeds were evaluated for their wholesomeness, splits and free seed coat.
Seed Colour	The L* (light-dark), a* (red-green) and b* (yellow-blue) attributes of colour were measured on dry seed and after canning seed using a CR-410 Chromameter (Konica Minolta Sensing Americas, Inc., Ramsey, NJ, USA). L* indicates “light-dark” with higher values for lightness; a* indicates “red-green” with positive values for redness and negative values for greenness; and b* indicates “yellow-blue” with positive values for yellowness and negative values for blueness. One-hundred g of processed bean seed was used to determine colour after canning.
Texture	Texture (Firmness) (kg force 100 g seed^{-1}) was determined by placing 100 g of washed drained bean in to a standard shear compression cell (CS-1) of Texture Measurement System-Touch (TMS-Touch, Food Technology Corp., Sterling, VA, USA), and shearing them using a load cell of 255 kg force at a rate of 0.83 cm sec^{-1}.
Cooking Quality Traits	
Hard seed and Partially hydrated seed (%)	Two hundred seeds per genotype were soaked in deionised water for 16 h (overnight) at 21 °C, and cooked for 20 min at 93 °C. Percentage hard seed and partially hydrated seed were determined after soaking, and after cooking.

Appendix E
NIRS Sample Shipping Guidelines

All entries within the OPCC Registration and Performance Trials need to be sampled at three locations for NIRS analysis. Locations selected for cooking analysis (information sent out by October 1st) will submit a sample for NIRS analysis as well. Samples should be prepared as follows:

- A 200g sample for each entry (composite not required)
- Samples should be placed in envelopes or plastic bags and labeled
- Samples should be labelled with: year, location, test (Kid/Cran, Minor Class, or Navy), entry number and entry name
- All samples must be cleaned and have no debris or soil. The seed composing the sample must not show any sign of disease, mold, dirt or severely compromised seed coat (fish face, cracking or split seed). The sample must be considered equivalent to packaged beans on a store shelf and fit for human consumption.
- All samples must have a seed moisture less than 18%

Complete samples can be sent to:

Emily Morneau
Agriculture and Agri-Food Canada
2585 Country Road 20
Harrow, ON
N0R 1G0
519-325-8279
emily.morneau@agr.gc.ca.ca

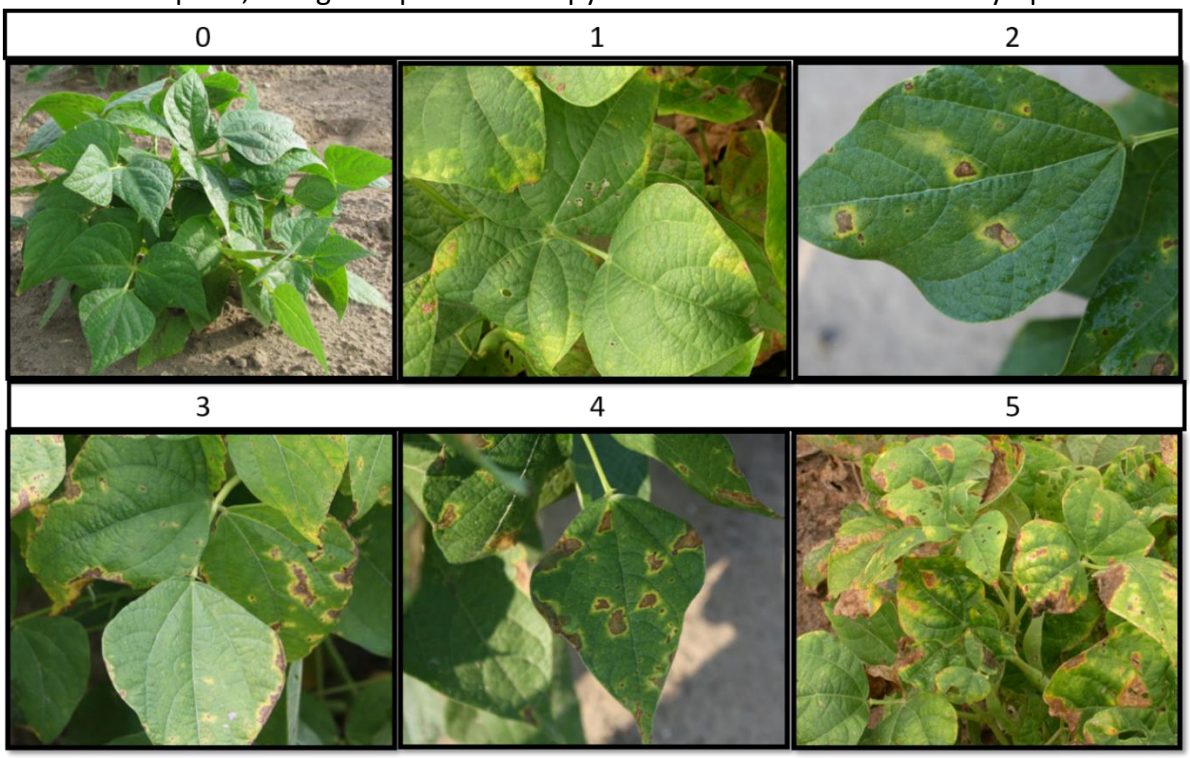
Appendix F
Common Bacterial Blight Scale

Common bacterial blight (CBB) is rated on a scale of 0-5. CBB will be rated within the CBB nursery, but the following scale can be used to assign highly infected yield plots a disease score in order to report disease pressure within trials.

Score	Criteria
0	No disease present. 0% of the plant leaf surfaces area covered in lesions.
1	1-20% of the plant leaf surfaces area is covered in lesions.
2	21-35% of the plant leaf surfaces area is covered in lesions.
3	36-50% of the plant leaf surfaces area is covered in lesions.
4	50-80% of the plant leaf surfaces area is covered in lesions.
5	Greater than 80% of the plant leafs surface area is covered in lesions.

Notes:

- Lesions include chlorotic and necrotic tissue expressing disease infection
- CBB has a necrotic centre with a large yellow halo of chlorotic tissue surrounding
- The total leaf surface area to be considered includes every plant in the plot (ie if only one plant in 100 is infected, but it is infected with 100% leaf surface area cover, the score is still a 1 for the plot)
- In susceptible cultivars, the CBB symptoms move from the point of initial infection, lower on the plant, to higher up in the canopy which increases leaf surface symptoms.



Appendix G
Anthracnose Scale

Anthracnose rating is done on both the pods and leaves of the plant. The following is the rating scale for both.

Anthracnose rating scale for leaves

Score	**Criteria**
0	No disease
1-3	Very few veins on underside of a few leaves with lesions (dark colouration) under 2mm long
4-5	Lesions on veins increasing in length, density, and abundance
6-7	Many lesions on most leaves
8-9	Nearly all veins on leaves darkened

Anthracnose rating scale for pods

Score	**Criteria**
0	No disease
1-3	Very few small spots less than 2mm
4-5	Larger lesions
6-7	Some coalescing lesions
8-9	Most of the plant surface covered in lesions

Notes:

- In both scales, a score of 0-3 is resistant and >3 is considered susceptible

Appendix H
White Mold Scale

White mold scale is based on an index that combines incidence (number of plants infected per row) within a plot by the severity of the disease (on an average per plant basis). White mold is rated just before harvest by gauging how bleached white the stems have become in comparison to the beige colour that is typically observed at maturity.

White mold index = (IxS)/100

Incidence (I):
Rated as a percentage of plants within the plot that show bleaching on their stem.

Severity (S):
Rated as a value from 1 to 10, indicating the severity of the disease progression on infected plants in the plot according to the table below.

Score	Disease Progression
1	Up to 10% of the stems are bleached
2	11-20% of the stems are bleached
3	21-30% of the stems are bleached
4	31-40% of the stems are bleached
5	41-50% of the stems are bleached
6	51-60% of the stems are bleached
7	61-70% of the stems are bleached
8	71-80% of the stems are bleached
9	81-90% of the stems are bleached
10	91-100% of the stems are bleached

Index values are from 0-10, with 0 being plots without disease and an index score of 10 is given to plots that have high disease pressure on every plant in the plot.

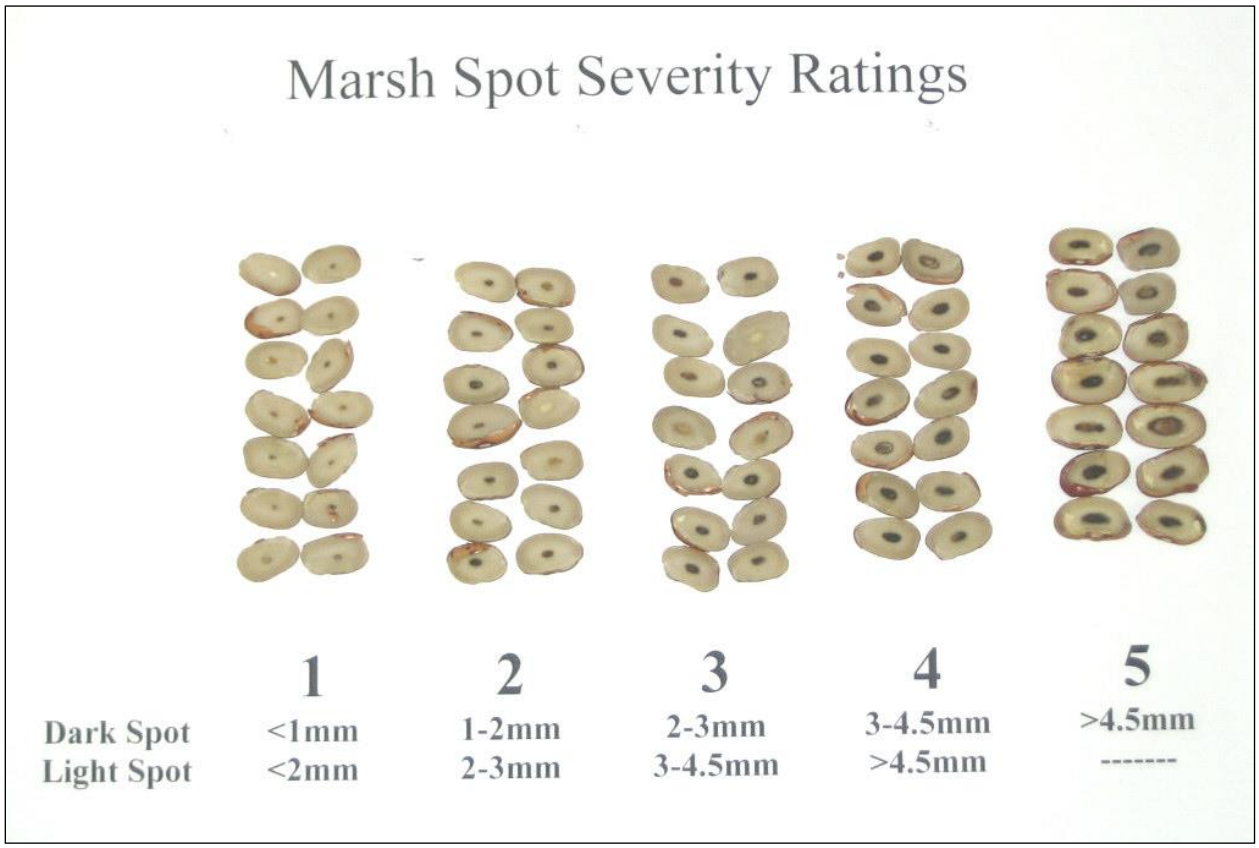
White Mold Index Score	White Mold Disease Reaction
0-2	Resistant (R)
3-4	Moderately resistant (MR)
5	Intermediate (I)
6-7	Moderately susceptible (MS)
8-10	Susceptible (S)

Appendix I
Marsh Spot Scale

Marsh spot is calculated based on an incidence by severity index. Incidence is calculated by splitting 50 seeds, and determining what percentage of seed has marsh spot present. Seed with marsh spot is rated for severity based on the scale below. The IxS index is calculated as:

Marsh Spot Index= (IxS)/100

Where I is incidence in % and S is severity based on figure below. All marsh spot index scores are given on a scale of 0>5, where 0 is resistant and 5 is very susceptible.



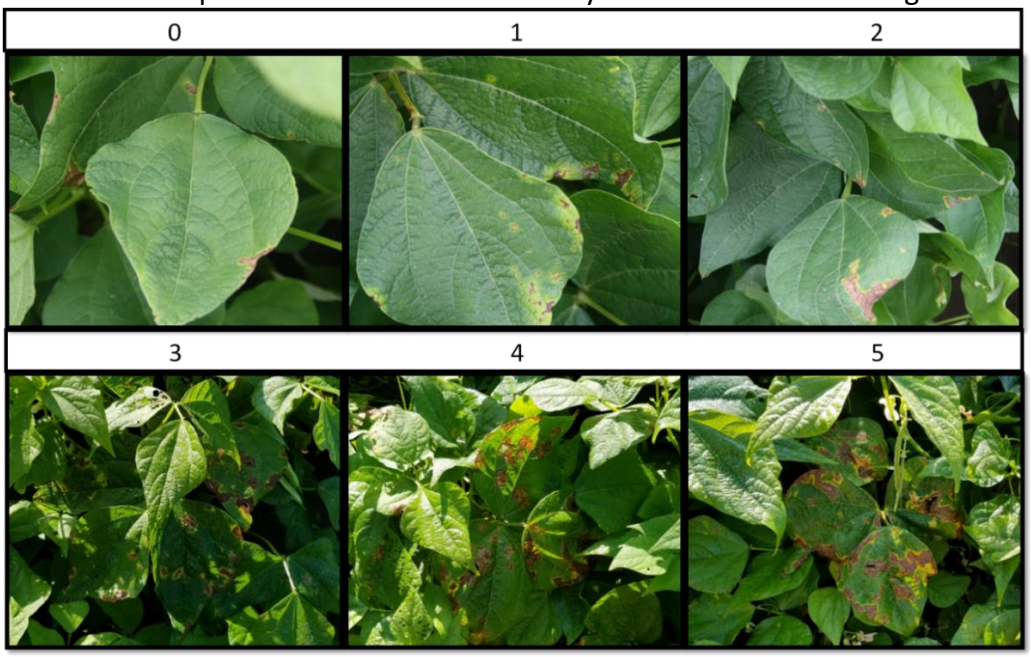
Appendix J
Bacterial Brown Spot Scale

Bacterial brown spot (BBS) is rated on a scale of 0-5 in the BBS nursery. The following scale can also be used to assign highly infected yield plots a disease score in order to report disease pressure within trials.

Score	Criteria
0	No disease present. 0% of the plant leaf surface area covered in lesions.
1	1-20% of the plant leaf surface area is covered in lesions.
2	21-35% of the plant leaf surface area is covered in lesions.
3	36-50% of the plant leaf surface area is covered in lesions.
4	50-80% of the plant leaf surface area is covered in lesions.
5	Greater than 80% of the plant leaf surface area is covered in lesions.

Notes:

- Lesions include chlorotic and necrotic tissue expressing disease infection
- BBS has a necrotic centre with a small yellow halo of chlorotic tissue surrounding
- The total leaf surface area to be considered includes every plant in the plot (ie if only one plant in 100 is infected, but it is infected with 100% leaf surface area cover, the score is still a 1 for the plot)
- In susceptible cultivars, the BBS symptoms move from the point of initial infection, lower on the plant, to higher up in the canopy which increases leaf surface symptoms.
- It is very difficult to differentiate CBB and BBS symptoms. If bacterial disease symptoms are observed in plots it should be listed as only “bacterial disease rating”



Appendix K
Root Rot Scale

The root rot nursery at AAFC-Harrow was established in 1979 through inoculation of sandy, flood prone soil with oat grain infected with Rhizoctonia solani Kuhn, Fusarium solani (Mart.) Appel. & Wr. f. sp. phaseoli (Burk.) Synd. & Hans, and Pythium ultimum Trow (Tan and Tu 1995). Dry beans have been seeded on this field each year since the trials inception. Trials are planted as seven seed hills (clumps) in a randomized complete block or alpha-lattice design with two replications. To maintain soil moisture, the field is heavily irrigated throughout growing season. The hill plots are dug using a 'tree-digger' implement attached to a tractor. All seven plants are rated on a scale of 0-7 as outlined below and a mean score is calculated to provide the rating for the plot., Plots with a score under 3 are considered resistant.

Rating 1	Rating 2	Rating 3
-White nodules - No lesions on main tap root - White-tan secondary roots	-White nodules - Small reddish/brown lesion starting usually around seed - Healthy secondary roots	-Some healthy nodules - Tap root lesion = 0.5-1cm - 10-20% root discolouration - No root mass reduction
		

Rating 4	Rating 5	Rating 6	Rating 7
-Lesion encircles tap root - Loss of nodules - Some root browning - 5-10% root mass reduction	-Large, encircling lesion on tap root - No nodules - 100% root discolouration - 20-50% root mass reduction	-Tap root lesion extending upwards to crown - 100% root discolouration - 50-80% root mass loss	-Tap root completely brown/black - Dead
			

Appendix L
Bean Common Mosaic Virus Scale

Bean common mosaic virus (BCMV) is rated for the presence of symptoms (S) or the absence of symptoms (R). Below are the symptoms for race 1 and 15 of BCMV.

Symptoms of race 1 (left) and race 15 (right) within the susceptible checks for each (Refugee and Sanilac respectively).

Appendix M
Trial Site Form

This form must be completed for each private trial site and for official OPCC Registration and Performance trial sites, in the first year the trial is carried out. Also, should any large changes to an existing site's protocol occur, a new form must be filled out and submitted to the OPCC chairperson, secretary and trial coordinators. The trial site forms are to act as a way to communicate intent, and allow for the review of procedures by the OPCC at the Annual Meeting in February each year where variety registration is discussed. This form must be submitted by January 31 of the year of the first trial. The form is copied here.

OPCC Trial Site Form

Date **Name**

Organization **Phone Number**

Site Information

Address **Street** **City/Town**

Co-operator's Information (if applicable)

GPS location **Harvest Method** **Row Width**

Site Dimensions (m) and Size (ha)

Site Design

Herbicides Intended and Timing (PPI, PRE, POST, etc)

Fungicides Intended

Insecticides Intended and Targets