QUALITY OBJECTIVES FOR WESTERN CANADIAN WHEAT CLASSES (REVISED March 2025)

Introduction: Wheat varieties registered for production in Western Canada are classified by the Canadian Grain Commission (CGC) into an appropriate market (Variety registration and classification for wheat and malting barley). This allows for orderly segregation of wheat into classes that meet customer expectations of end-use performance. The CGC uses the QET's assessment of candidate cultivars when determining classification of a newly registered variety.

These *Quality Objectives* are intended as guidelines for wheat breeders when determining the appropriate registration trial for submission and testing over the trial period. Candidate lines are tested and compared against approved check varieties for the trial and should aim to meet the established *Quality Objectives*.

When evaluating candidate lines from registration trials the QET uses objective assessments as much as possible. Many quality parameters are rated based on objective comparison to the mean values of the approved results of the check varieties, using defined variation from the mean. Check varieties are chosen to represent an acceptable performance range for the desired factors. If objective measures are difficult to incorporate then subjective assessments come from the combined expertise inherent in the QET membership.

For additional information on submission of registration trial material, quality factors to be tested for each registration trial category (class), laboratory testing methodology and reporting of data for quality evaluation please refer to the PRCWRT Operating Procedures - Appendix F (Wheat and Durum: Measurement of Quality Traits).

Detail on *Quality Objectives* for each class (listed below) are provided in this document:

- Canada Western Red Spring (CWRS) wheat
- Canada Western Amber Durum (CWAD) wheat
- Canada Western Red Winter (CWRW) wheat
- Canada Prairie Spring Red (CPSR) wheat
- Canada Western Hard White Spring (CWHWS) wheat
- Canada Western Soft White Spring (CWSWS) wheat
- Canada Northern Hard Red (CNHR) wheat

There are no ongoing registration trials for Canada Western Extra Strong (CWES) wheat and Canada Prairie Spring White (CPSW) wheat and therefore there are no *Quality Objectives* provided for either of these wheat classes. Additionally, the QET does not evaluate candidate cultivars within the Canada Western Special Purpose (CWSP) wheat class nor for Rye or Triticale.

Canada Western Red Spring (CWRS) wheat

CWRS has been a cornerstone of wheat production in Western Canada for many decades. The class is recognized worldwide as a high-quality milling wheat for many flour applications and has been appreciated for high, functional protein levels, good flour milling yield, low wheat-to-flour protein loss and superior water absorption. The last decade has seen a wider range of quality in CWRS production accompanied by particular concern for unacceptable dough strength properties. Dough strength and mixing tolerance are critical factors for producing high volume, yeast-raised baked products. Variable dough strength may be due to environmental factors as well as farm management practices and these impacts are being investigated.

Premium markets for CWRS are looking for wheat in the top grades (No. 1 and No. 2) and protein levels typically over 13.5% accompanied by traditional "mellow" gluten properties that provide adequate dough strength (resistance) and dough extensibility with superior mixing tolerance levels. High quality CWRS has relatively few competitive alternatives for discerning grain buyers. Lower CWRS grades and protein levels are traded into a wider spectrum of applications and must compete both domestically and in international markets with other Canadian wheat classes or with lower quality wheat available from many origins.

Candidate cultivars should express CWRS quality expectations, as follows:

- **Protein Content, Protein Quality:**
  - CWRS is a high protein milling wheat with typical wheat protein content ranging from 12.0-14.5% (measured as N x 5.7 at 13.5% moisture basis).
  - Protein content is easily measured at early stages of breeding and candidate cultivars should express equal or higher protein levels when compared to check varieties. Protein content is an objective measure and levels for candidate cultivars will be assessed against the results of the check varieties.
  - A unique property of CWRS varieties is a low protein loss from wheat to flour, typically about 0.7-0.8% loss from wheat (13.5% moisture basis) to flour (14.0% moisture basis). Excess protein loss will be flagged.
  - Gluten strength should be adequate for high volume pan-bread production. Gluten strength is a more subjective assessment and is determined through interpretation of various testing methods such as Farinograph, Extensograph or functional bake tests.
  - CWRS is used for a wide range of flour products when used as a single component of a mill grist or when blended with wheat of other classes or origins. The high protein and adequate gluten strength of CWRS is a key expectation when used for blending.
- **Milling Quality:**
  - CWRS is a hard wheat that requires suitable tempering (conditioning) prior to milling to allow for optimum flour extraction. Excessive wheat hardness is not desirable as it can impact milling yield and result in increased flour ash content, starch damage and flour water absorption levels. Kernel hardness is a selectable genetic trait that can be influenced by the environment, such as when hard, flinty kernels develop due to excessive heat stress.
  - At optimized commercial mill settings, CWRS achieves a high extraction of bright, clean flour with low flour ash levels. This high extraction potential should still be apparent in small scale test milling where restriction in mill settings may not allow full optimization.
  - Flour yield is expressed as a percentage of cleaned wheat on a constant moisture basis. Milling quality measures (starch damage, flour milling yield, flour ash) are objective and levels for candidate cultivars will be assessed against the results of check varieties.

- **Flour Water Absorption:**
  - A unique property of milled CWRS flour is high water absorption allowing full gluten hydration to achieve desirable dough mixing properties. This is partly due to grain hardness but excessive hardness is not desirable. Balanced, high water absorption potential is both a functional and commercial benefit desired by bakers.
  - High flour water absorption in CWRS is a key expectation when used in blended grists.
  - Flour water absorption is an objective measure and levels for candidate cultivars will be assessed against the results of check varieties.
- **End-Product Applications:**
  - High quality CWRS flour will meet many processing requirements with a primary application being yeast-fermented, high volume pan-breads whether used alone or in blends. Many dough additives are available to assist bakers to achieve dough strength and tolerance parameters but these cannot fully replace fundamental gluten quality.
  - Flour milled from CWRS wheat is used for various Asian products including noodles with an important factor being colour retention and appearance of noodle sheets. Noodle quality measures (water dough colour) are objective and levels for candidate cultivars will be assessed against the results of check varieties.
  - CWRS flour may also be used outside of yeast-raised dough applications such as extruded dough products (pasta, snacks), crackers and biscuits but there are no specific quality requirements that have been identified for CWRS to meet in these applications.
- **Grade factors:**
  - Wheat quality can be affected by environmental factors such as weather, disease or insect damage. Their influence is controlled through wheat grading standards established and monitored by the CGC. Grading factors that impact end use performance include:
    - **Sprout Damage** – excess sprouting of grain will result in low Amylograph peak viscosities and low Falling Number levels and can severely impact end-product quality. CWRS candidate cultivars should express adequate resistance to sprout damage.
    - **Fusarium** – excessive levels of fusarium damaged kernels (FDK) will impact dough strength. As well most fusarium species produce toxins, e.g. deoxynivalenol (DON or vomitoxin), that are a health and safety concern. CWRS candidate cultivars should express adequate resistance to fusarium damage.
    - **Midge Damage** – high levels of midge damage can severely affect bread baking properties. CWRS candidate cultivars should express adequate resistance to midge damage.

Canada Western Amber Durum (CWAD) wheat

CWAD is the second largest wheat class grown in Western Canada and Canadian durum wheat has enjoyed a large market share in international durum trade for many decades. CWAD is widely used in various products, including long and short dried pasta, fresh pasta, sheeted pasta, couscous and baked bread. CWAD has superior milling quality producing a high yield of semolina with low ash content and speck count, and has high yellow pigment content necessary to produce end-products with a bright-yellow colour. The high protein content and strong gluten characteristics of CWAD ensures superior pasta cooking quality and good performance in certain products, such as durum bread. CWAD varieties must express low cadmium (Cd) uptake in order to meet international tolerance levels for cadmium.

Candidate cultivars should express CWAD quality expectations, as follows:

- **Protein content**
  - High protein content is a primary quality factor in many markets using Canadian durum wheat. Registration of high protein lines is an effective way to maintain grain protein content at the highest possible level in a low-input production system characterized by low rates of nitrogen fertilizer application. Protein content is an objective measure and easily determined at early stages of breeding. Maintenance of protein relative to the current checks is sufficient.
  - Durum wheat with high protein and good physical condition will generally yield semolina of uniform particle size with a minimum number of starchy particles. Protein content in semolina facilitates hydration during mixing and provides the structure for pasta. High protein concentration is a prerequisite for superior pasta cooking quality.
- **Gluten strength**
  - The relationship between gluten strength and pasta cooking quality is complex and inconclusive. There is evidence that under high temperature drying conditions, gluten strength has less influence on pasta cooking quality than under low temperature drying conditions. High temperature drying is predominant in today's pasta industry. CWAD varieties registered since 1997 have significantly stronger gluten strength than earlier varieties. Feedback from the markets has been positive for this increase, although little information is available if this actually resulted in any significant improvement in the texture of cooked pasta. Research has shown improved pasta cooking quality for Canadian durum varieties could be partially attributed to the elimination of weak gluten types.
  - The continuity and strength of the protein matrix formed during extrusion is important in determining the textural characteristics of pasta. It is important to have strong resistance and extensible gluten for CWAD to be suitable for most products in major markets. This has resulted in lower interest in developing Extra Strong gluten strength durum wheat varieties that possesses strong but less extensible gluten. Cultivars with inextensible gluten have limited applications.
  - The current gluten strength characteristics (strong and extensible) have been well received by the markets and represent the target level. Strength should be in the range of the check varieties. In terms of upper levels for gluten strength, the key is to exclude lines with inextensible gluten properties. The Alveograph P/L value should be lower than that of Navigator. The market demand is limited for extra-strong CWAD.
- **Milling performance**
  - Milling performance is the most important factor that determines the industrial value of durum wheat. The key indicators of milling quality are yields (total and semolina), semolina ash content and semolina speck counts. Yield is a key indicator of profit for durum mills. There is a legal limit for semolina ash content in some EU countries. Speck count is a deciding factor of consumer acceptance for many durum products. CWAD is well appreciated by customers around the world for its good milling yields and low semolina ash content.

- Milling quality measures for durum (semolina and total milling yields, semolina ash) are objective and levels for candidate cultivars will be assessed against the results of check varieties. Candidate cultivars should maintain or further improve the current milling performance of the check varieties.

- **Pigment content and pigment loss**
  - CWAD varieties produce semolina and pasta products with bright yellow colour, a desirable feature appreciated by customers. Semolina and pasta yellowness are affected by various factors: the yellow pigment content of grain; the oxidative degradation of pigments by lipoxygenase (LOX; enzyme) during pasta processing and the processing conditions such as drying temperature, extrusion die design and type.
  - High yellow pigment content is desirable and can be measured at early breeding stages. Elevated redness (a*) of pasta in some high pigment genotypes is undesirable but increased pasta yellowness (b*) will usually compensate for redness in the overall appearance of pasta. Many customers also use Canadian durum for blending with wheat that has low yellow pigment content to improve colour of semolina and pasta products.
  - Some of the pigments in semolina will be degraded and lose yellow colour during pasta processing through oxidation induced by LOX. Progress in the genetics of LOX has facilitated improvement in developing cultivars with low LOX activity. While high yellow pigment content is the primary factor for superior colour of semolina and pasta, reduction in LOX activity will further improve the colour of pasta products. Candidate lines with low pigment loss will be noted as having a positive trait.
- **Cadmium (Cd) level**
  - High levels of Cd in cereal grains are a health concern and limits are imposed for international grain trade. Low Cd concentration in durum wheat is mainly controlled by a single dominant gene that is highly heritable. Incorporation of the low Cd allele into cultivars typically reduces the grain Cd by about 50%. Low Cd is mandatory for registration of durum wheat cultivars in Canada.
  - In anticipation of potential tightening of Cd level especially in the EU, further reduction of Cd concentration will better position CWAD in key markets. The development of durum varieties with very low Cd is encouraged.
  - Candidate cultivars must have Cd levels lower than 121 ppb. This value is established in consideration of import tolerances in the major markets.
- **Grade Factors:**
  - Durum quality can be affected by environmental factors such as weather, disease or insect damage. Their influence is controlled through grading standards established and monitored by the CGC. Grading factors that impact end use performance include:
    - **Surface Discolouration** – bright, speck-free semolina is required to give the clean, aesthetic appearance of premium semolina and pasta products. Ergot, smudge, black point, mildew, and midge are the main physical defects associated with surface discolouration and are tolerated in very low amounts in top grades of CWAD. Resistance to disease and insect damage not only prevents loss of yield but also protects grade and quality of durum wheat because of the major impact on speck count. In a fixed and controlled milling environment, semolina speck count depends more on weather and disease impacts to the kernel rather than on intrinsic quality.
    - **Hard Vitreous Kernels (HVK)** – CWAD varieties demonstrate high levels of HVK, an important commercial measure for semolina yield potential. Late season weathering can result in lower HVK levels and drop grade potential for the crop. CWAD candidate cultivars should express high potential for HVK levels when compared to check varieties.
    - **Sprout Damage:** Excess sprouting of CWAD will impact FN levels and can impact end-product quality. CWAD candidate cultivars should express adequate resistance to sprout damage.

- **Fusarium:** Excessive levels of fusarium damaged kernels can impact durum wheat processing quality as well most fusarium species produce toxins, for ex. DON, that are a health and safety concern. CWAD candidate cultivars should express adequate resistance to fusarium.
- **Midge Damage:** Midge damage, especially severe midge damage, can significantly increase the speck count in CWAD semolina. CWAD candidate cultivars should express adequate resistance to midge damage.

Canada Western Red Winter (CWRW) wheat

CWRW wheat has excellent milling properties with high milling yield of bright flour with low ash content. Protein levels in CWRW wheat are mid-range, typically averaging 11.5%. Water absorption in winter wheat is typically lower than CWRS.

Product applications for CWRW are for lower volume breads (hearth and flat breads), crackers and in blends with stronger wheats for high volume pan bread. CWRW is also ideal for steamed breads and some noodles.

Candidate cultivars should express CWRW quality expectations, as follows:

- **Protein Content, Protein Quality**:
  - CWRW is a medium protein milling wheat with a minimum wheat protein content requirement of 11.0% (measured as N x 5.7 at 13.5% moisture basis) to be eligible for grades No. 1 and 2. Protein content is easily measured at early stages of breeding and candidates should express high protein levels when compared to check varieties. Higher grain protein in this class is desirable.
  - Current gluten strength targets are acceptable however there has been discussion to increase strength to better compete with stronger US HRW. New (stronger) check varieties will ensure strength is maintained and improved.
- **Milling Quality:**
  - CWRW is a semi-hard wheat that requires adequate tempering (conditioning) prior to milling to allow for optimum flour extraction. The same milling principles explained in CWRS are applicable to CWRW with the same goal of producing bright, clean flour with low flour ash levels. CWRW has the desirable reputation of producing flour with a very low ash content, good color and high brightness and these traits should be maintained. A small increase in the acceptable limits for “flag” and “poor” when evaluating ash content was passed in 2011.
  - Flour yield is expressed as a percentage of cleaned wheat on a constant moisture basis.
  - Milling quality measures (starch damage, flour milling yield, flour ash) are objective and levels for candidate cultivars will be assessed against check variety results.
- **Flour Water Absorption:**
  - Due to a combination of factors including lower wheat protein levels and a softer kernel contributing to lower starch damage, and lower arabinoxylan levels, CWRW has a lower water absorption than CWRS. It would be desirable to see an increase to levels approaching CWRS wheat but only at a gradual pace so that consistency is maintained within the class.
- **End-Product Applications:**
  - CWRW is suitable for hearth and flat breads as well as crackers. It also works well in a blend with CWRS for pan bread flour due to its good mixing and fermentation tolerance.
  - CWRW has been used in steamed breads and is highly regarded for smooth, bright white surfaces and symmetrical shape without the need for flour bleaching.
  - CWRW can also be used for various Asian products including noodles with an important factor being colour retention and appearance of noodle sheets. Noodle quality measures (water dough colour) are objective and levels for candidate cultivars will be assessed against check variety results.

- **Grade Factors:**
  - Wheat quality can be affected by environmental factors such as weather, disease or insect damage. Their influence is controlled through grading standards established and monitored by the CGC. Grading factors that impact end use performance include:
    - **Sprout Damage** – excess sprouting of grain will result in poor (low) Amylograph peak viscosities and low Falling Number levels and can severely impact bread quality. Winter wheat is typically harvested earlier than spring cereals and may avoid late season sprout damage influence. CWRW candidate cultivars should express adequate resistance to sprout damage.
    - **Fusarium** – excess levels of fusarium damaged kernels (FDK) will impact dough strength due to the activity of protein degrading enzymes introduced by the fungus. As well most fusarium species produce toxins, e.g. deoxynivalenol (DON), that are a health and safety concern. CWRW candidate cultivars should express adequate resistance to fusarium damage. In 2014 the first variety rated resistant to fusarium (AC Emerson) became available commercially.
    - **Midge Damage** – high levels of midge damage can severely affect bread baking properties. CWRW candidate cultivars should express adequate resistance to midge damage.

Canada Prairie Spring Red (CPSR) wheat

The Quality Objectives for CPSR have evolved over the last three decades. Recent recommendations provide an opportunity for registration of good quality red spring wheat varieties that may not meet the more stringent attributes required for CWRS classification. Compared to CWRS, varieties of CPSR have lower wheat protein content. CPSR expresses good milling properties yielding a high percentage of bright flour. Flour water absorption tends to be lower than CWRS varieties. Flexibility in quality attributes allows for consideration of a wider range of grain properties such as kernel hardness which can impact flour milling features including flour ash content, milling yield and starch damage impact on water absorption.

Product applications for CPSR are for lower volume breads (hearth and flat breads), crackers and in blends with stronger wheats for high volume pan bread. CPSR may also be used in some markets, alone or in blends for the production of pasta products. Some CPSR varieties possess quality ideal for steamed breads and noodle applications. CPSR varieties registered since 2008 express stronger dough properties and provide good blending opportunity.

Candidate cultivars should express CPSR quality expectations, as follows:

- **Protein Content, Protein Quality**:
  - CPSR is a medium protein milling wheat. Protein content is easily measured at early stages of breeding and candidates should express equal protein levels when compared to check varieties.
  - CPSR varieties can have a greater loss of protein from wheat to flour when compared to CWRS but this should not be excessive or it will be flagged.
  - Current gluten strength targets are acceptable with a desire to maintain dough strength with improved extensibility to compete with stronger US HRW varieties. Check varieties will be chosen to ensure strength is maintained and improved.
- **Milling Quality:**
  - CPSR varieties are generally semi-hard but accommodation of harder varieties will require attention in maintaining good milling and baking attributes without resulting in excessive starch damage. Kernel hardness is a selectable genetic trait that can be influenced by the environment.
  - Similar milling principles as explained for CWRS are applicable to CPSR with the same goal of producing bright, clean flour with a wider accommodation in flour ash levels when compared to CWRS.
  - Flour yield is expressed as a percentage of cleaned wheat on a constant moisture basis.
  - Milling quality measures (starch damage, flour milling yield, flour ash) are objective and levels for candidate cultivars will be assessed against the results of the check varieties.
- **Flour Water Absorption:**
  - CPSR varieties tend to have lower flour water absorption. It is desirable to maintain water absorption levels compared to mean check variety values.
  - Flour water absorption is an objective measure and levels for candidate cultivars will be assessed against the results of the check varieties.
- **End-Product Applications:**
  - CPSR is suitable for hearth and flat breads as well as crackers. It also works well in a blend with CWRS for pan bread flour due to its good mixing and fermentation tolerance.
  - CPSR can also be used for various Asian products including noodles with an important factor being colour retention and appearance of noodle sheets. Noodle quality measures (water dough colour) are objective and levels for candidate cultivars will be assessed against check variety results.
  - CPSR is also used, alone or in blends, for the production of pasta products. However, there are no specific quality requirements that have been identified for these applications.

- **Grade Factors:**
  - Wheat quality can be affected by environmental factors such as weather, disease or insect damage. Their influence is controlled through grading standards established and monitored by the CGC. Grading factors that impact end use performance include:
    - **Sprout Damage** – excess sprouting of grain will result in low Amylograph peak viscosity and low Falling Number levels and can severely impact bread quality. CPSR candidate cultivars should express adequate resistance to sprout damage but there will be wider accommodation in Amylograph peak viscosity values when compared to CWRS.
    - **Fusarium** – excess levels of fusarium damaged kernel (FDK) will impact dough strength due to the activity of protein degrading enzymes introduced by the fungus. As well most fusarium species produce toxins, e.g. deoxynivalenol (DON), that are a health and safety concern. CPSR candidate cultivars should express adequate resistance to fusarium damage.
    - **Midge Damage** – excess levels of midge damage can severely affect bread baking properties. CPSR candidate cultivars should express adequate resistance to midge damage.

Canada Western Hard White Spring (CWHWS) wheat

The CWHWS class was developed and the first two varieties were registered in 2000. The target of the class is to provide similar functional properties as CWRS (red spring wheat) but as a hard white spring wheat. Benefits of hard white wheat include better flour milling yield with brighter flour. This provides improved potential for uses in noodle and other Asian product applications. Compared to red wheat with more bitter bran components, hard white wheat provides a sweeter, nuttier flavour in the growing demand for whole wheat flour products.

Protein targets are not as stringent as for CWRS but there is still a desire to provide adequate dough strength (resistance) and dough extensibility with superior mixing tolerance levels.

Candidate cultivars should express CWHWS quality expectations, as follows:

- **Protein Content, Protein Quality:**
  - CWHWS is a high protein milling wheat with typical wheat protein content ranging from 11.5-13.5% (measured as N x 5.7 at 13.5% moisture basis). Protein content is easily measured at early stages of breeding and candidates should express similar protein levels when compared to check varieties. Lower protein content will be considered if gluten strength parameters are maintained.
  - Gluten strength should be adequate for high volume pan-bread production, this is especially important when used in whole wheat and whole grain applications. Gluten strength is determined through interpretation of various objective testing methods such as Farinograph, Extensograph or functional bake tests.
  - CWHWS can be used for a wide range of flour products when used as a single component of a mill grist or when blended with wheat of other classes or origins. Adequate protein level and gluten strength in CWHWS is a key expectation when used for blending.
  - Similar to CWRS, varieties of CWHWS should express a low protein loss from wheat to flour, typically about 0.7-0.8% loss from wheat (13.5% moisture basis) to flour (14.0% moisture basis). Excess protein loss will be flagged.
- **Milling Quality:**
  - CWHWS is a hard wheat that requires adequate tempering (conditioning) prior to milling to allow for optimum flour extraction. Excessive wheat hardness is not desirable as it can result in roller mills producing elevated flour starch damage that can impact flour water absorption levels in commercial processing. Kernel hardness is a selectable genetic trait that can be influenced by the environment, such as when hard, flinty kernels develop due to excessive heat stress.
  - At optimized commercial mill settings CWHWS achieves a high extraction of bright, clean flour. The high extraction potential of hard white wheat should still be apparent in small scale test milling where restriction in mill settings may not allow full optimization.
  - Flour yield is expressed as a percentage of cleaned wheat on a constant moisture basis. For CWHWS wheat.
  - Milling quality measures (starch damage, flour milling yield, flour ash) are objective and levels for candidate cultivars will be assessed against the results of check varieties.
- **Flour Water Absorption:**
  - It is desirable to see improvement in flour water absorption levels for new CWHWS varieties. High flour water absorption in CWHWS is a key expectation when used in blended grists.
  - Flour water absorption is an objective measure and levels for candidate cultivars will be assessed against the results of check varieties.
- **End-Product Applications:**
  - High quality CWHWS will meet many processing requirements with a primary application being yeast-fermented, high volume pan-breads whether used alone or in blends. Many dough additives have been

developed that assist bakers to achieve dough strength and tolerance parameters but these cannot fully replace fundamental gluten quality.

- CWHWS can also be used for various Asian products including noodles with an important factor being colour retention and appearance of noodle sheets. Noodle quality measures (water dough colour) are objective and levels for candidate cultivars will be assessed against the results of check varieties.
- There is some use of CWHWS outside of yeast-raised dough applications such as extruded dough products (pasta, snacks), crackers and biscuits but there are no specific quality requirements that have been identified for these applications.

- **Grade factors:**
  - Wheat quality can be affected by environmental factors such as weather, disease or insect damage. Their influence is controlled through grading standards established and monitored by the CGC. Grading factors that impact end use performance include:
    - **Sprout Damage** – excess sprouting of grain will result in low Amylograph peak viscosities and low Falling Number levels and can severely affect bread quality. CWHWS candidate cultivars should express adequate resistance to sprout damage.
    - **Fusarium** – excess levels of fusarium damaged kernels (FDK) will impact dough strength due to the activity of protein-degrading enzymes introduced by the fungus. As well most fusarium species produce toxins, e.g. deoxynivalenol (DON), that are a health and safety concern. CWHWS candidate cultivars should express adequate resistance to fusarium damage.
    - **Midge Damage** – high levels of midge damage can severely affect bread baking properties. CWHWS candidate cultivars should express adequate resistance to midge damage.

Canada Western Soft White Spring (CWSWS) wheat

CWSWS is a low protein wheat suitable for the production of soft wheat products such as biscuits, cookies, cakes and thickeners. Production of good quality CWSWS is aimed primarily at the domestic market and this wheat can also be used alone or in blends for flat breads and for the production of various types of noodles and steamed bun flours. Growing the crop under irrigation aids in maintaining a low wheat protein content. Due to high agronomic yield and high starch content in CWSWS this wheat has value for industrial ethanol production.

Candidate cultivars should express CWSWS quality expectations, as follows:

- **Protein Content, Protein Quality:**
  - CWSWS for consumer product applications is characterized by low protein content, typically below 10.5% (measured as N x 5.7 at 13.5% moisture basis)
  - Protein content is easily measured at early stages of breeding and candidates should express similar low wheat protein content when compared to check varieties.
  - Gluten properties should be weak with low resistance accompanied by a reasonably extensible gluten.
  - Gluten strength is determined through interpretation of various objective testing methods. For CWSWS the most appropriate strength evaluation is gained through the Alveograph, Solvent Retention Capacity (SRC) and cookie spread test.
- **Milling Quality:**
  - CWSWS is a soft wheat that typically has lower flour extraction levels but should produce flour with a bright, clean appearance.
  - Soft wheat requires shorter tempering (conditioning) times prior to milling to achieve optimum flour extraction. Excessive wheat softness is not desirable as it can result in lower extraction levels due to increased stickiness and clogging in roller mill and sifter equipment. Kernel hardness is a selectable genetic trait that can be influenced by the environment, such as when hard, flinty kernels develop due to excessive heat stress.
  - Milling quality measures (starch damage, flour milling yield, flour ash; SRC: solvents – water and lactic acid) are objective and levels for candidate cultivars will be assessed against check variety results.
- **Grade factors:**
  - Wheat quality can be affected by environmental factors such as weather, disease or insect damage. Their influence is controlled through grading standards established and monitored by the CGC. Grading factors that impact end use performance include:
    - **Sprout Damage** – excess sprouting of grain will result in poor Amylograph peak viscosities and low Falling Number levels. For some applications it is desirable to have high thickening properties requiring superior Amylograph peak viscosity values. CWSWS candidate cultivars should express adequate resistance to sprout damage.

Canada Northern Hard Red (CNHR) wheat

CNHR became a wheat class on August 1 2018. Prior to this date this class was called Canada Western Interim Wheat (CWIW; established August 1 2016). CNHR was developed as a result of the Wheat Class Modernization undertaken by the Canadian Grain Commission (CGC). Varieties that are no longer eligible for CWRS and CPSR may be reclassified to CNHR.

Wheat varieties within this class will have medium-hard to hard kernels. Protein content of CNHR varieties will span a wide range and gluten strength will be lower than the gluten strength of varieties within the CWRS and CPSR classes. Varieties within this class are suitable for milling use and should have sound kernels.

Candidate cultivars should express CNHR quality expectations, as follows:

- **Protein Content, Protein Quality:**
  - Wheat protein content will span a wide range within 1.5% of the lowest check (measured as N x 5.7 on a 13.5% moisture basis).
  - Gluten strength will be weaker than the gluten strength of varieties in the CWRS and CPSR classes and assessed by comparison to the results of the check varieties.
  - Gluten strength is objectively assessed using the Farinograph and Extensograph.
- **Milling Quality:**
  - CNHR is a medium-hard to hard wheat that requires suitable tempering (conditioning) prior to milling to allow for optimum flour extraction. Excessive wheat hardness is not desirable as it can impact milling yield and result in increased flour ash content, starch damage and flour water absorption levels. Kernel hardness is a selectable genetic trait that can be influenced by the environment, such as when hard, flinty kernels develop due to excessive heat stress.
  - At optimized commercial mill settings, CNHR achieves a high extraction of bright, clean flour with low flour ash levels. This high extraction potential should still be apparent in small scale test millings where restrictions in mill settings may not allow for full optimization.
  - Flour yield is expressed as a percentage of cleaned wheat on a constant moisture basis.
  - Milling quality measures (starch damage, flour milling yield, flour ash) are objective and levels for candidate cultivars will be assessed against the results of the check varieties.
- **End-Product Applications:**
  - Depending on the protein content, flour milled from CNHR varieties can be used for the production of a variety of end-products including pan bread, hearth breads, flat breads and noodles.
- **Grade Factors:**
  - Wheat quality can be affected by environmental factors such as weather, disease or insect damage. Their influence is controlled through wheat grading standards established and monitored by the CGC. Grading factors that impact end-use performance include:
    - **Sprout Damage** – excessive sprouting of grain will result in low Amylograph peak viscosities and low Falling Number levels and can severely impact end-product quality. CNHR candidate cultivars should express adequate resistance to sprout damage.
    - **Fusarium Damage** – excessive levels of fusarium damaged kernels (FDK) will impact dough strength. As well, most fusarium species produce toxins, e.g. deoxynivalenol (DON or vomitoxin), that are a health and safety concern. CNHR candidate cultivars should express adequate resistance to fusarium damage.
    - **Midge Damage** – high levels of midge damage can severely affect bread baking properties. CNHR candidate cultivars should express adequate resistance to midge damage.