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CANADIAN WHEAT CLASSES

Wheat is not a single homogenous product, but instead is made up of many types and classes, each with different characteristics and end uses. Canadian Western Red Spring wheat is internationally renowned for its high quality in bread production and in blends to improve the baking performance of weaker wheats. Canadian farmers also produce other classes of wheat which have been specifically developed to meet the quality and /or pricing requirements of a wide variety of markets around the world. This issue of the *Bi-weekly Bulletin* examines the classes of wheat grown in Canada, providing a look at where these are grown, how much is produced, what the characteristics of each are and where the major markets are located.

INTRODUCTION

While there are a number of classes of wheat produced in Canada, commercial production is composed of only two species of plants. The common or bread wheats are all of the species *Triticum aestivum,* subspecies *aestivum*, while durum wheat is a separate species, *T. turgidum* ssp*. durum*. Other species of wheat exist, but are not commercially produced in significant volume in Canada. Common wheat has been bred over the years into many different types or classes, and it can be either fall or spring sown, have a hard or soft kernel, have varying protein quality and content, and a white or red seed coat. Canadian farmers produce hard red spring, hard red winter, soft red winter, soft white spring and soft white winter wheat. A sixth experimental class of spring wheat, hard white wheat, is just entering commercial production, although a lower protein white spring wheat, Canada Prairie Spring White (CPS-W), has been produced for a number of years. The hard red spring category is further subdivided into three classes; Canada Western Red Spring (CWRS), Canada Western Extra Strong (CWES) and Canada Prairie Spring Red (CPS-R). All Canadian durum wheats are considered to be of one class, although the extra strong variety Navigator is segregated, and all durum is spring sown in Canada.

All current registered wheat varieties have been developed through traditional breeding programs, without the use of genetic modification techniques.

Canada Western Red Spring Wheat

CWRS is the principal class of wheat produced in Canada. It is recognized as the highest quality wheat, in terms of its bread production and blending characteristics, grown in Canada. CWRS has a hard vitreous kernel, with a high protein content and strong gluten (the protein that gives bread dough its elastic nature), making it ideal for use alone in producing high quality bread flour, and as a blending wheat to improve the baking performance of weaker wheats. It is used alone for the production of high-volume pan breads. It can also be used for the production of a diverse range of products, such as hearth breads, noodles, flat breads and steam breads, either alone or in blends with weaker gluten wheat. The average protein content of No.1 CWRS wheat over the period 1991 to 2000 was 13.2% (on a 13.5% moisture basis), compared to 12% or less for the three other red wheats produced in western Canada {CWES, CPS-R, and Canada Western Red Winter Wheat (CWRW)}. The impact of the high protein levels and strong gluten on baking characteristics for pan breads is quite striking. For No.1 CWRS with 13.5% protein, the 10 year average loaf volume has been

WESTERN CANADIAN VARIETY REGISTRATION PROCESS [1]

The registration of varieties within each Canadian grain class is tightly controlled, in order to ensure that all wheat in each class is functionally uniform. Every new variety must be reviewed and accepted by the Prairie Registration Recommending Committee for Grains (PRRCG) before it can be registered for production. As a result, all varieties registered in a class will exhibit very similar end-use performance, not only between various cargoes, but also from year to year. Each wheat class has a reference standard variety, against which a new variety is compared concerning its quality characteristics, agronomic performance and disease resistance. A key component of the current varietal registration process is kernel visual distinguishability (KVD). Plant breeders are required to ensure that new varieties in each class have the same kernel shape and colour as other varieties in the class. Identification via KVD is a low cost efficient method of ensuring consistency. The identity of each of the various classes can be readily preserved throughout the handling system. The end user knows how any shipment of Canadian wheat will perform in his processing operation without the need for individual testing.

Before being considered for registration, a new variety must be grown for three years in a series of crop performance trials across western Canada. These trials allow the new variety to be compared to the reference variety for the class, over several growing seasons and in all parts of the growing region. Only if the new variety is visually distinguishable and its quality parameters are not unacceptably different from the reference variety will the PRRCG accept the new variety for registration.

Canada

1,105 cm^3 per 100 grams of flour, compared to an average of just 770 cm^3 for the other three red wheats. Average water absorption was 69%, compared to about 60% for the three other wheats.[2] This means that a smaller quantity of flour can be used to produce a given volume of bread, improving bakers' profit margins.

Over the 5-year period from 1997 to 2001, CWRS production averaged 15.4 million tonnes (Mt), making up 62% of all wheat produced in Canada. CWRS production has declined since the early 1990's, with the 1992 to 1996 average production being 18.5 Mt, due to low wheat prices relative to those for alternative crops. Saskatchewan is the major producer of CWRS wheat, accounting for 50% of the total, with Alberta and Manitoba accounting for 29% and 20%, respectively.

The Canadian domestic milling and baking industry is the single largest market for CWRS wheat, accounting for over 2.5 Mt annually, as virtually all bread flour produced in Canada is from CWRS wheat. Mills in many other countries, particularly the United States (US), Italy, Great Britain, and Japan, also prize the quality of CWRS wheat, and are steady customers of the Canadian Wheat Board (CWB), ready to pay a premium price for CWRS wheat over wheat from other exporters. Of these "premium" markets, Japan is the largest, taking an average of 1.3 Mt over the past 5-years (1996-1997 to 2000-2001), followed by the US at about 1 Mt. Italy and Great Britain imported an average of 0.2 Mt and 0.3 Mt respectively over this period. The largest volume importer of CWRS wheat has been Iran, which imported an average of 1.9 Mt over the past 5 years, but this country is not as quality-conscious a market, and tends to take lower quality No.3 CWRS when it is available. Other major markets for CWRS wheat are Indonesia, China, Mexico, Colombia, and Venezuela.

Canada Western Extra Strong

CWES is also a hard red spring wheat, but its milling and baking characteristics are different from CWRS. Although its protein content is lower than that of CWRS, averaging just 12.2% over the past 10 years, its gluten strength is very high. This is illustrated by the high extensogram readings for CWES flour (a measure of the elasticity of the dough); an average maximum area of 210 cm^2 was recorded, compared to CWRS 13.5% flour, at just 160 cm^2.[2] Because the strong gluten results in a flour that requires a very long mixing time to properly develop the dough, CWES flour is not used alone in bread production. Instead, it has been found to be particularly useful as a blending wheat, to increase the flour strength of weaker wheats, particularly in the production of specialty products such as pizza dough, whole wheat and frozen dough products.[1]

CWES wheat production is relatively small, averaging 572,000 tonnes (t) over the past 5-years, just 2% of all Canadian wheat. Production is concentrated in Alberta and Saskatchewan, which produced 46% and 36% respectively, over the period from 1997 to 2001. Domestically, CWES has been used for blending with CWRS flour for specialty products, but very little is now used. It is also used for feed, particularly in the past few years, as prices have fallen well below those for CWRS wheat. CWES exports have averaged 290,000 t between 1996-1997 and 2000-2001, about 50% of production. The major export market for CWES wheat has been the US, which accounted for about 50% of all exports between 1996-1997 and 2000-2001. However, exports to the US have declined in recent years, due to an increase in American domestic production of wheats with similar baking characteristics. From 327,000 t in 1996-1997, exports to the US fell to under 50,000 t in 2000-2001. The other major export markets have been Italy and Indonesia, which have imported an average of 32,000 t and 36,000 t respectively over the past 5-years.

Canada Prairie Spring Red Wheat

Canada Prairie Spring Red Wheat (CPS-R) is the third class of hard red spring wheat produced in Canada. Many wheat customers around the world do not require the high protein and strong gluten of CWRS wheat for the products that they produce. These include hearth breads such as French bread, flat breads such as pita, and crackers. Canadian farmers needed a class of wheat which could compete with American hard red winter wheat in these markets, and in response to this requirement Canadian wheat breeders developed the CPS- R varieties of wheat. Compared to CWRS wheat, CPS-R has a slightly softer kernel, although still hard by world standards, and a lower protein content. The 5 year average protein content has been 11.5%.[2]

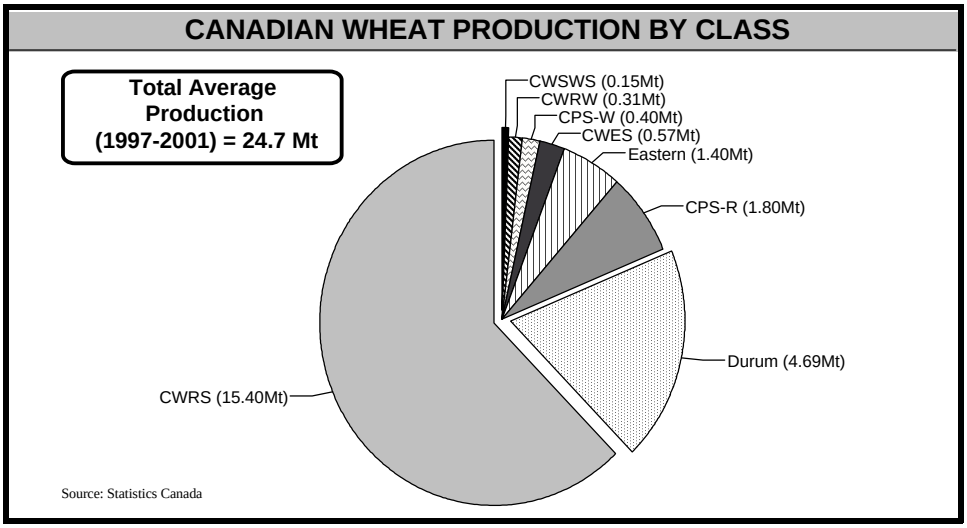
CPS-R production is estimated by Agriculture and Agri-food Canada (AAFC) to have averaged about 1.8 Mt between 1997 and 2001. Exports of CPS-R wheat have averaged 353,000 t over the past five years, about 20% of production, with the major markets being countries that tend to use wheat for the production of flat breads or noodles. The largest importers of CPS-R wheat between 1996-1997 and 2000-2001 were Mexico and Indonesia, which each imported about 75,000 t annually. Other major customers have been the United Arab Emirates, Bangladesh, Colombia, Venezuela, and Chile.

CPS-R wheat is priced lower than CWRS wheat, and it does not receive protein premiums. Over the past 5 years, on-farm CWB returns for No.1 CPS-R have averaged about 25% lower than for No.1 CWRS with 13.5% protein. It yields about 15-20% higher than CWRS, largely offsetting the lower price. The major domestic use of CPS-R wheat is for feeding livestock, largely hogs, in western Canada. The aim of current breeding is to increase the protein strength to a level similar to that of US hard red winter wheat[1]. New varieties of CPS-R wheat, such as AC Crystal, and 5700 PR, have improved protein strength, milling characteristics and bread making properties, which should improve the marketability of this class of wheat for human food uses. Almost two-thirds of the CPS-R production in 2001 was of AC Crystal.

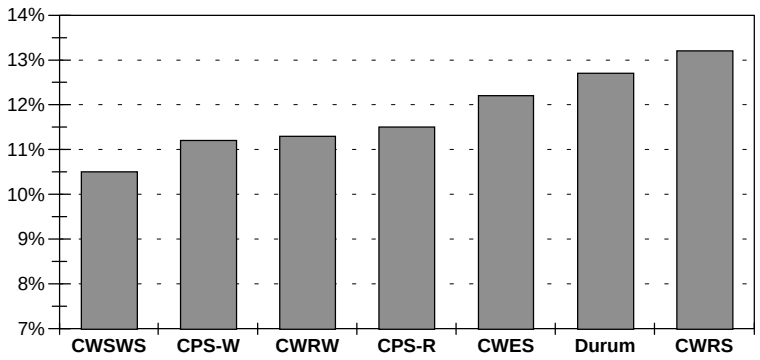
Canada Western Red Winter Wheat

Canada Western Red Winter Wheat (CWRW) is the only winter wheat grown on the Prairies. It is grown only on a small area, with production averaging just 311,000 t between 1997 and 2001. Production is rising, however, particularly on the eastern Prairies, and it reached 441,000 t in 2001,

CANADIAN WHEAT PRODUCTION BY CLASS



CANADA: PROTEIN CONTENT OF MAJOR WHEAT CLASSES



Source: Canadian Grain Commission

1996 to 2000 Average

with almost 50% grown in Manitoba. The popularity of CWRW is increasing, as it provides several important benefits. On average, winter wheat yield is 23% higher than spring wheat. It often escapes infection by serious pests such as Fusarium Head Blight and the orange wheat blossom midge. It offers work load displacement, and promotes conservation tillage practices.

CWRW has a hard kernel and medium gluten strength. Average protein content of CWRW is similar to CPS-R, averaging 11.3%. Baking performance remains inferior to US varieties of hard red winter wheat, and this, combined with the small volumes available, means that CWRW does not receive premiums generally available for most other Canadian wheat classes. Exports have averaged only 58,000 t over the past 5-years. Indonesia, Thailand and Malaysia have been the largest importers of CWRW, using it for noodle production. Domestically, the major use of CWRW is for feed. Starting in 2002, the CEB will segregate preferred quality varieties, such as AC Bellatrix and CDC Osprey, from poorer quality varieties, in an attempt to generate increased export demand and extract higher value from the world market place. The objective of breeding programs is to match and surpass the quality of US hard red winter wheat varieties.

Canada Prairie Spring White Wheat

Canada Prairie Spring White wheat (CPS-W) varieties were developed by Canadian wheat breeders largely in response to demand from the Asian noodle market, which traditionally imported Australian Standard White wheat for noodle production. In addition to noodles, CPS-W performs well in the production of hearth breads and flat breads. CPS-W has a low to medium protein content and a medium to strong gluten strength.[1] Average protein content is slightly lower than CPS-R wheat, with the 5-year average being 11.2%.[2] The white seed coat produces a flour with fewer visible bran specks, and with a whiter colour at high extraction rates, compared to a red wheat. The newest varieties of CPS-W, such as AC Vista and AC 2000, have a harder kernel, improved flour colour and stronger dough properties, which make this class better suited to Asian products such as noodles and steam breads. More than half of the CPS-W production in 2001 was of AC Vista.

Production of CPS-W is estimated by AAFC, to have averaged about 0.4 Mt over the past 5-years. Exports of CPS-W have averaged almost 300,000 t between 1996-1997 and 2000-2001, with the major markets being the United Arab Emirates and Pakistan, which use it for flat bread production. The major east Asian market has been Malaysia, where it is used largely for noodle production. Relatively little is milled domestically, and higher protein CPS-R wheat is preferred for livestock feeding.

Canada Western Soft White Spring Wheat

Canada Western Soft White Spring Wheat (CWSWS) is the only soft wheat grown on the Prairies. It has a soft kernel and low protein. Most is grown under irrigation, in southern Alberta, since dryland production can result in excessively high protein content if rainfall is not adequate. It can be used for flat breads, but it is largely used for the production of cookies, pastries, biscuits and crackers[1].

Due to low prices, production has been declining, as alternative crops could be more profitably grown on the irrigated land. The 1997 to 2001 average has been about 150,000 t, but this fell to only 72,600 t in 2001. As a result, most CWSWS is now used domestically in western Canada for the production of cake and pastry flour. Exports averaged 77,000 t over the past 5-years, but had fallen to only 2,000 t in 2000-2001, and they are forecast to remain low in 2001-2002. Major export markets were the Philippines and Chile. Production is forecast by AAFC to recover to about 140,000 t in 2002-2003, due to strong prices in 2001-2002. This should allow exports to resume to these traditional markets.

Hard White Wheat

Hard White Wheat (HWW) is a new class of spring wheat being developed for production in western Canada. The breeding objective has been to develop a hard white wheat with milling and baking characteristics similar to CWRS. The reduced visible bran specks at higher flour extraction rates, and milder flavour of the whole wheat flour, is expected to give HWW an advantage over CWRS in certain markets. It would also allow Canada to compete more directly with Australian Prime Hard, which is also a white wheat. There are currently two varieties available, with interim regional registration. The CWB offered a production contract for HWW wheat in 2001-2002, with the aim of producing enough wheat to commercially test market it, but the program has been hampered by problems with the seed supply. For this reason, the program is not being repeated for 2002-2003, but is expected to be renewed for 2003-2004.

Canada Western Amber Durum Wheat

Canada Western Amber Durum Wheat (CWAD) is quite different from other wheats, in both its milling and end-use characteristics. Good quality durum has a very hard vitreous (glassy) kernel. The durum endosperm (the inner part of the kernel which is milled into flour or semolina) is a pale yellow or amber colour, versus the white endosperm of common wheat. Both of these factors make durum wheat particularly suited to the production of pasta products. Durum pasta maintains a firm texture after cooking, and the amber kernel gives pasta the desired amber colour without the addition of artificial colouring. Traditional durum production and consumption is concentrated in the countries surrounding the Mediterranean, including North Africa, Spain, Italy, Greece and Turkey. Virtually all pasta consumed in these regions, as well as in North America and the remainder of Europe, is made from 100% durum semolina. Durum pasta production is also increasing in South America, a region where pasta has more traditionally been produced from common wheat. In Italy, North Africa and the Middle East, bread products are also made from durum. In North Africa, durum is also used to produce couscous, a staple food product in this region.

ANCIENT WHEAT

Interest is being revived in growing "old" types of wheat, particularly under organic conditions, as these types have not been exposed to modern breeding techniques, making them a more "natural" product. These include einkorn and emmer wheats, which were the original wheats to be domesticated, and spelt, which later developed from emmer. Of the three, only spelt is currently produced in Canada, largely in Saskatchewan and Ontario. Spelt products are now available in health food stores. There are soft spelt lines that perform well in bread and cookie production, as well as hard spelt, that can be used to make pasta and cereal.

Recent research, however, indicates that einkorn and emmer may have a future as specialty food products as well. The nutritional profile of einkorn is said to be better than common wheat, with a higher protein content. It has poor bread-making performance, but could be used to make breakfast cereals, cakes and cookies. The baking characteristics of emmer wheat are reported to be better, and it can be used for bread production.

Another "ancient wheat" is known by the trademark name "Kamut". Kamut is similar to durum, except for the shape and larger size of the kernel. Small scale commercial production now takes place, and Kamut is used for the production of cereals, breads, cookies and baked goods. The flavour is said to be superior to that of common wheat or durum.

Durum wheat production averaged 4.7 Mt, or 19% of total Canadian wheat production, between 1997 and 2001, which was an increase from just 4.1 Mt or 15% of total production, in the 1992 to 1996 period. Production is concentrated in Saskatchewan, which accounted for more than 80% of the total over the past 5-years. Most of the remainder is produced in Alberta. Very little durum is produced outside the brown and dark brown soil zones in the southern part of these two provinces, because the relatively dry climate with hot summers in this region is suited to the production of good quality durum. Production of good quality durum cannot be achieved consistently in the moister black soil zone in the northern and eastern Prairies, because excess moisture, particularly late in the growing season, can result in a low vitreous kernel count, and can also downgrade the crop due to sprouting. Durum also has very little resistance to fusarium head blight, making production in eastern regions of the Prairies generally uneconomical.

Over the past 5-years, between 1996-1997 and 2000-2001, an average of about 0.28 Mt of durum was milled into semolina in Canada. This is an increase from about 0.25 Mt in the 1992-1993 to 1995-1996 period. This is relatively small compared to many export markets. The single largest market for Canadian durum has consistently been Algeria, which imported an average of 1.5 Mt over the past 5-years. Morocco has also been a large and consistent market, taking an average of 0.4 Mt annually. In the US, durum millers take advantage of their proximity to large supplies of good quality Canadian durum, and have imported an average of 0.4 Mt over the past 5-years. Italy and Belgium are the major markets in Europe for Canadian durum. South America is seen as a growth market for durum sales as changing consumer preferences are resulting in a shift from common wheat to durum for pasta production. Here, the major buyers of Canadian durum have been Chile, Peru and Venezuela, with smaller quantities going to Guatemala, Brazil, and Colombia. The only significant Asian durum market is Japan.

Eastern Canadian Wheat

Except for Ontario, very little wheat is produced in eastern Canada, and most is grown for feed use. Ontario, however, has a sizable wheat industry, producing an average of 1.2 Mt over the past 10 years. Most Ontario production is of soft wheat, with soft white winter wheat the traditional major class. This has been changing in recent years, with production of soft red winter wheat increasing due to its better agronomics, including more resistance to sprouting, and this has become the major class today. Most of the soft wheat is consumed domestically in the production of cake, cracker and pastry flour and breakfast cereal, or exported into the nearby US. Total domestic consumption of soft wheat averages 0.43 Mt, of which about 0.1 Mt is used by the breakfast cereal industry, which requires soft white wheat. Small quantities are also exported overseas in most years, usually as food aid. The major destinations have been Egypt, Bangladesh, Iran and Pakistan. Smaller areas of hard red winter and hard red spring wheat are also grown in Ontario, most of which are milled domestically in blends with CWRS wheat from western Canada.

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[1/] "Grains from Western Canada" , *Canadian Wheat Board,* p.
[2/] "Quality of Western Canadian Wheat", *Canadian Grain Commission,* p. 1.

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