

Assignment #2A: Crop Profile - Hard Red Spring Wheat

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INTRODUCTION:

The history of hard red spring wheat (HRSW) (*Triticum aestivum* L.) cultivation, production, and breeding in Canada has been recorded in detail by some researchers (DePauw et al. 1995; DePauw and Hunt 2001). In the early years of HRSW cultivation in Canada, several important wheat cultivars were grown (almost exclusively) in Canada and were utilized as the parents for the continuing development of more recent wheat cultivars (Lamari et al. 2005). The primary cultivar that was first produced on the Prairies was Red Fife (introduced in 1868 or 1869), which represented the basis of wheat production in Canada until it was replaced by Marquis wheat in 1909 (DePauw and Hunt 2001). This cultivar was succeeded by Thatcher, which was the dominant wheat cultivar in Canada until it was supplanted by Neepawa (registered in 1969) (DePauw and Hunt 2001). Other important Canadian wheat cultivars were Selkirk (1956-1968), Manitou (1968-1972), Katepwa (1986-1993) and AC Barrie (DePauw and Hunt 2001). These cultivars are the basis of the current derived cultivars that are existent in the modern wheat-producing world of today (Lamari et al. 2005). Overall wheat acreage in 2012 was 25.9 million acres in Canada, up 9.3% from the previous year. Spring wheat acreage was 19.1 million acres in 2012, and a sizeable increase in HRSW was seen during 2013 as well (Howard 2013). From this, it can be understood that HRSW has been (and will continue to be) a vital crop in Canada.

Hard red spring wheat is mainly known as a bread wheat, due to its high protein and gluten levels. It can be used to make pan and hearth breads and as a strong blending wheat. HRSW can also be used alone or in blends with other wheat for noodles, flat bread, and common wheat pasta (CGC 2012). However, HRSW also has many other organic uses. This relates to human consumption applications. These include milling into flour to make baked goods, eating the grain sprouts, flaking the grain for porridge or fruit crisp, or raw consumption after soaking the grain. It can also be added to soups. HRSW can also be consumed by livestock as a feed grain, if the quality is deemed inferior or if it is sold as such. HRSW has a desirable array of characteristics that make it a positive nutrition option for both humans and animals/livestock alike. HRSW has also been used as a fuel source in grain burning heating systems. The grain can contribute a significant amount of heat output when burned, and can be a cheaper, renewable alternative to propane, electricity, natural gas, and wood (depending on market price).

IDENTIFICATION:

Currently, the spring wheat cultivar Neepawa is the standard of quality of the Canada Western Red Spring (CWRS) class of wheat in Canada. The CWRS varieties are identified and segregated from other wheat varieties by three different milling grades, several guaranteed protein content levels, and carefully defined processing characteristics (Dexter et al. 2006). CWRS varieties have a high test weight, high protein content, resistance to sprouting (high falling number), good milling performance, and high water absorption (Dexter et al. 2006). The Kernel Visual Distinguishability (KVD) grading system that was used to grade CWRS by physical properties was discontinued in 2008 due to lack of objectivity. CWRS is usually

identified by a dark brown colour (or translucent red) and a high percentage of hard vitreous kernels (HVK). The kernel is small to midsize, oval to ovate in shape, and the germ is round/midsize to large (CGC 2012). When grown, hard red spring wheat generally appears as any other wheat plant. Its inflorescence is a spike and can have awns or be awnless. These characteristics are fairly common for all HRSW being grown worldwide. There are many varieties of HRSW being grown in Canada and the world.

ADAPTATION:

Wheat is believed to have originated in southwestern Asia (along with all other wheats). Some of the earliest remains of wheat have been found in Syria, Jordan, and Turkey (the Fertile Crescent). Wheat is grown in large amounts in China, India, United States, France, and Russia (Gibson and Benson 2002).

Specifically, HRSW is mainly grown in Canada and the United States. The type of climate present in these regions (semi-arid) is suited for growing HRSW (short growing season and suitable climactic factors for quality). The dominant HRSW producing states in the U.S. are North Dakota, South Dakota, Minnesota, and Montana (Gibson and Benson 2002). HRSW in Canada is primarily grown in the Prairie Provinces of Alberta, Saskatchewan, and Manitoba. It is also well-adapted for growing in the Northeast Spring Wheat Region of China. Varieties from India, Europe and the Ukraine were used in early HRSW breeding in Canada (AAFC 2013).

Wheat is a very versatile crop, and thus can be rotated with many other crop species. Wheat (HRSW) is commonly used as a “stalk/residue” crop to add organic matter/crop residue to the soil. It is also used to control weed populations in rotation, because it is quite competitive. It could also be used in rotation after a non-competitive crop was grown (ex. flax, lentil) to help alleviate weed pressures.

CROPPING CONSIDERATIONS:

In some studies, it has been found that the various inputs associated with organic management (animal manure, crop residue, etc.) can greatly increase biological activity within the soil (Burger and Jackson 2003). Organic soils that receive inputs of composted manure and harvest residues have been found to have a higher ability to supply nitrogen than conventionally managed soils (with mineral fertilizers and harvest residues) (Burger and Jackson 2003). It was also found in research conducted by Mason et al. (2007) that grain yield, test weight, and gluten strength were higher on conventional land when compared to organic (of 27 different CWRS varieties). However, protein levels/content did not differ between the two systems (Mason et al. 2007). As well, many of these quality factors are largely determined and affected by environment, so there is potential for organic HRSW to achieve good breadmaking quality (Mason et al. 2007). It was also found that the use of older cultivars (such as Red Fife) may not be the best option for organic production (Mason et al. 2007).

Research conducted by Entz et al. (2001) found that under organic systems, wheat, oat, and barley yields were 23 to 27% less than in conventional systems. In another study conducted by Mason et al. (2007) on the competitive ability of HRSW cultivars grown under organic management, it was found that average conventional yields were 63% greater than organic yields (weed pressure/biomass was much higher). It was also suggested that an ideal spring wheat “ideotype” for organic production would be a taller cultivar with fast, early season growth, early maturity, and a greater number of fertile tillers (Mason et al. 2007).

Organic management in the previous studies did not involve any chemical fertilizer or herbicide applications (Mason et al. 2007). **Green manure** was utilized by mowing/plowing under fall rye along with an application of **composted dairy manure**. Cereal-legume plowdowns, followed by **cultivation and harrowing** (to kill weed seedlings), are common organic farming practices that can be applied to HRSW. Effective out-of-crop tillage and in-crop tillage (ex. rotary hoe or harrow) can be used to alleviate weed pressures. **Cover crops**, such as fall rye, can be utilized to reduce soil erosion, increase soil organic matter, and suppress weeds through allelopathy and light interception. **Intercropping**, such as pea-wheat or clover-wheat (small seed with large seed to facilitate separation), is also becoming a fairly common practice. Inherently, HRSW is a **competitive crop species**, which helps with weed management and allows it to be a good fit for crop rotations. **Wheat variety combinations** (the combination of two or more varieties in any given ratio) have been reported to produce yields equal or more than monocultures (Manthey and Fehrmann 1993). It has also been reported that spring wheat variety mixtures have the potential to provide greater stability with little or no reduction in yield. These mixtures can also provide greater crop competitive ability (Kaut et al. 2009). General **weed avoidance techniques** such as maintaining healthy soil conditions, implementing crop rotations, general sanitation, clean machinery, seedbed preparation, clean seed, chaff collection and other actions will generally aid in controlling weed populations. **Managing the growth environment** through allelopathy, early seeding date, increasing seeding rate, narrow row spacing, and shallow seeding depth may allow a HRSW crop to get a head start on weeds (MAFRI). **Classical or inundative biocontrol** may also be used to reduce weed thresholds (ex. leafy spurge control by black dot spurge beetle).

SUMMARY:

Hard red spring wheat is an important crop in Canada, the United States, and other parts of the world. Grown primarily for its breadmaking qualities, HRSW also has many other end-uses. Its unique identifying characteristics set it apart from other cereal grains/species. As a competitive crop, HRSW is useful as an organic crop species. Many different integrated weed management strategies can be implemented in HRSW to control weed populations.

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