

## Chapter 6: Selecting Spring and Winter Wheat Cultivars For Optimum Profitability



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The selection of a wheat cultivar or variety may be one of the most important management decisions a wheat grower can make, and choosing one or more wheat varieties to plant can be crucial to your operation. By selecting varieties with different genetic backgrounds, you can increase the resistance traits of certain pests and increase the genetic yield potential for a specific area.

Picking the right variety for your area takes more than choosing last year's local top yielder. Given the high amount of climatic variability across South Dakota, it is important to select a variety that will yield well across many environments (Chapter 34). Choose a variety that is consistent in yield even if the environments vary from location to location.

When comparing yields over years, always compare like yield averages; that is, one-year with one-year, two-year with two-year, and three-year with three-year averages. Always determine if the data is valid. The coefficient of variation (CV) value is a measure of experimental error. The CV is the standard deviation divided by the mean. [http://en.wikipedia.org/wiki/Coefficient\\_of\\_variation](http://en.wikipedia.org/wiki/Coefficient_of_variation). Both of these values can be calculated in Excel. For additional information and examples, consult the publication, Mathematics and Calculations for Agronomists and Soil Scientists, Clay et al. (2010).

Ideally, yield trials should have CV values of 15% or less; if not, the trial contains too much experimental error for accurate recommendations. The yields for the different varieties should be compared using an appropriate statistical analysis. One of the easiest tests to use is a t test (Clay et al. 2010). If an experiment contains more than two treatments, then a least significant difference (LSD) can be used to compare the averages. Consider, the varieties will differ if the difference between two varieties is greater than the LSD value, but if the difference is equal to or less than the LSD value, the varieties do not differ significantly. If you have questions, you should contact an Extension specialist.

Yield is only one parameter to consider when choosing a variety. Insect and disease resistance, tolerance to frost and winterkill in the case of winter wheat, hardiness, crop maturity, straw strength, milling characteristics, and other traits are important considerations as well.

South Dakota produces an annual report that compares the results from last year's variety yield trials. For example, the report from 2011 is located at [extension.sdstate.edu](http://extension.sdstate.edu) (Hall et al. 2011). This report provides the characteristics and performance of spring wheat varieties tested in South Dakota in 2011,

and recommendations for 2012. It is an excellent guide to select one or more varieties with the agronomic characteristics suitable for a grower's area and production system.

When considering yield, look for varieties that have performed well at locations near your farm over the past three years. This publication also contains a "Recommended" and "Acceptable/Promising" list of varieties, with notations as to the Crop Adaptation Area(s) they are suitable to be grown in, and a map of Crop Adaptation Areas for South Dakota. The following series of graphs (Fig. 6.1 and Fig. 6.2) offer a visual comparison of the spring and winter wheat varieties tested in 2011, based directly on the information in the 2011 Annual Report. Traits and characteristics are rated:

- P = poor
- F = fair
- G = good
- VG = very good
- E = excellent for lodging resistance

VS, S, MS, MR, R and VR for disease reactions are given a numerical value to allow charts to be generated.

Variety selection is an important step in reducing production risks and maximizing wheat yields and economic returns. By considering varieties that have specific resistance or tolerance traits to certain diseases and insects, growers can reduce impact costs such as fungicides and insecticides. This is one of the basic concepts of integrated pest management (IPM). Selecting cultivars that are best for your local growing conditions and maintaining healthy crops is an excellent preventative cultural practice against pests.

Resistant cultivars have a built-in tolerance or resistance to attack by certain pests. The degree of resistance will vary from slight to almost complete. However, no plant variety is resistant to all wheat pests (diseases and varieties), so you must carefully evaluate varieties from local testing programs.

The resistance mechanism basically works in the three main ways. Chemicals in the plant repel the pest, or prevent it from completing its life cycle. The plant is more vigorous and suffers less damage from pest attack, or is not susceptible to the disease. And the plant has physical characteristics making it more difficult for pest attack.

Because of wheat variety testing programs, many wheat varieties have disease and insect resistance ratings. These ratings give you an idea of the rate of resistance or susceptibility to common insects and diseases for an area. For more information from yield studies conducted between 2010 and 2011, see Hall et al. (2011). For information on wheat diseases, see Chapter 23.

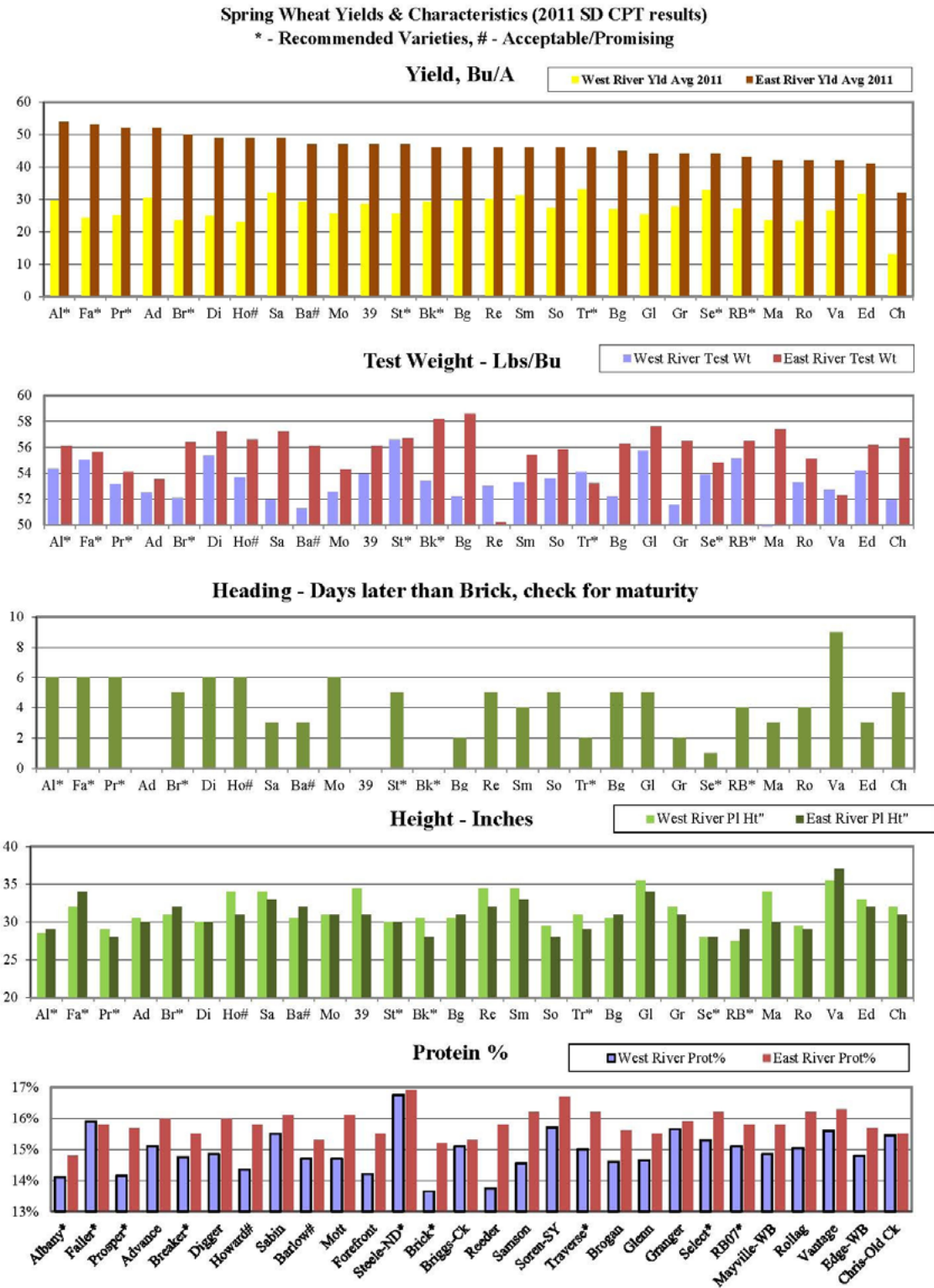
Diseases that should be considered include Fusarium head blight or scab, wheat streak mosaic virus, leaf rusts, bunts and smuts, barley yellow dwarf virus, wheat soil borne mosaic viruses, powdery mildew, stripe rust and stem rusts.

Another consideration to keep in mind with disease resistance traits is many are developed for specific races or strains of the disease pathogen. Over time, these races can change, making the variety that was once resistant susceptible to the disease. This is the reason new varieties with specific disease-resistant traits are continually being developed.

Insect resistance or tolerance works much the same way, utilizing bred-in characteristics of the plant variety that may have a chemical in the plant that repels the specific insect. Additionally, the plant variety may have a specific physical characteristic that makes it more difficult for the insect to attack or cause significant damage. For additional information on insects, see Chapter 22.

Many wheat varieties have been developed that have specific resistance or tolerance to Hessian fly, greenbugs, Russian wheat aphid, wheat stem saw fly, and others. In many cases, even moderate resistance

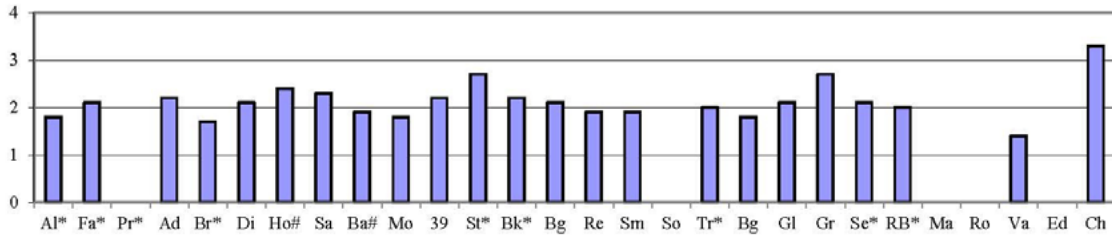
**Figure 6.1. Spring wheat cultivar impact on measured yields, protein, and pest resistance.**  
*(continues on next page)*



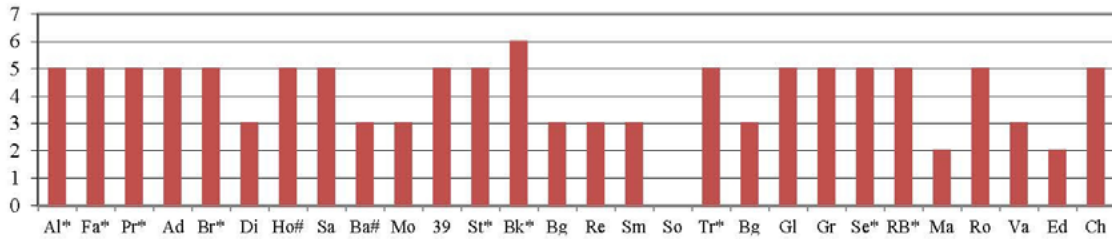
Spring Wheat Yields & Characteristics (2011 SD CPT results)

\* - Recommended Varieties, # - Acceptable/Promising

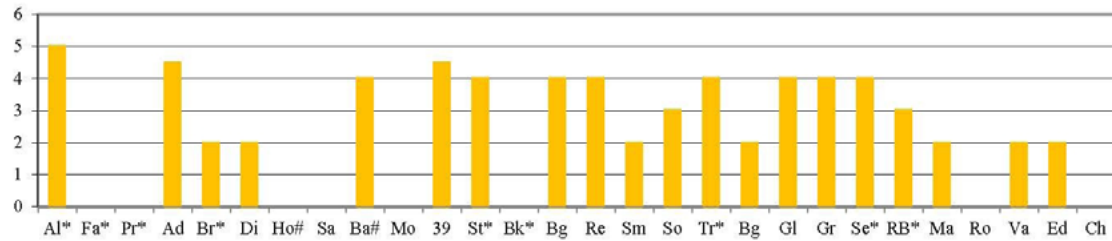
Lodging (1=Poor, 5=Excellent)



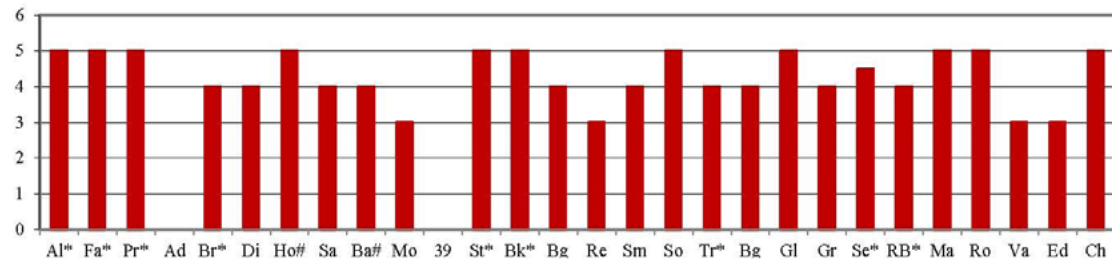
Scab - FHB (1=VS, 6=R)



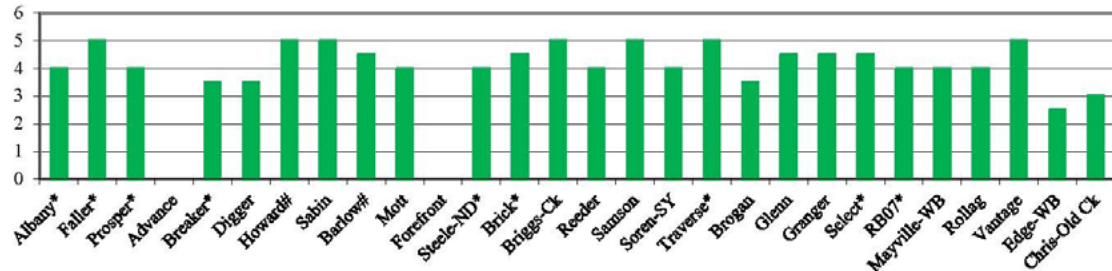
Stripe Rust (1=VS, 5=R)



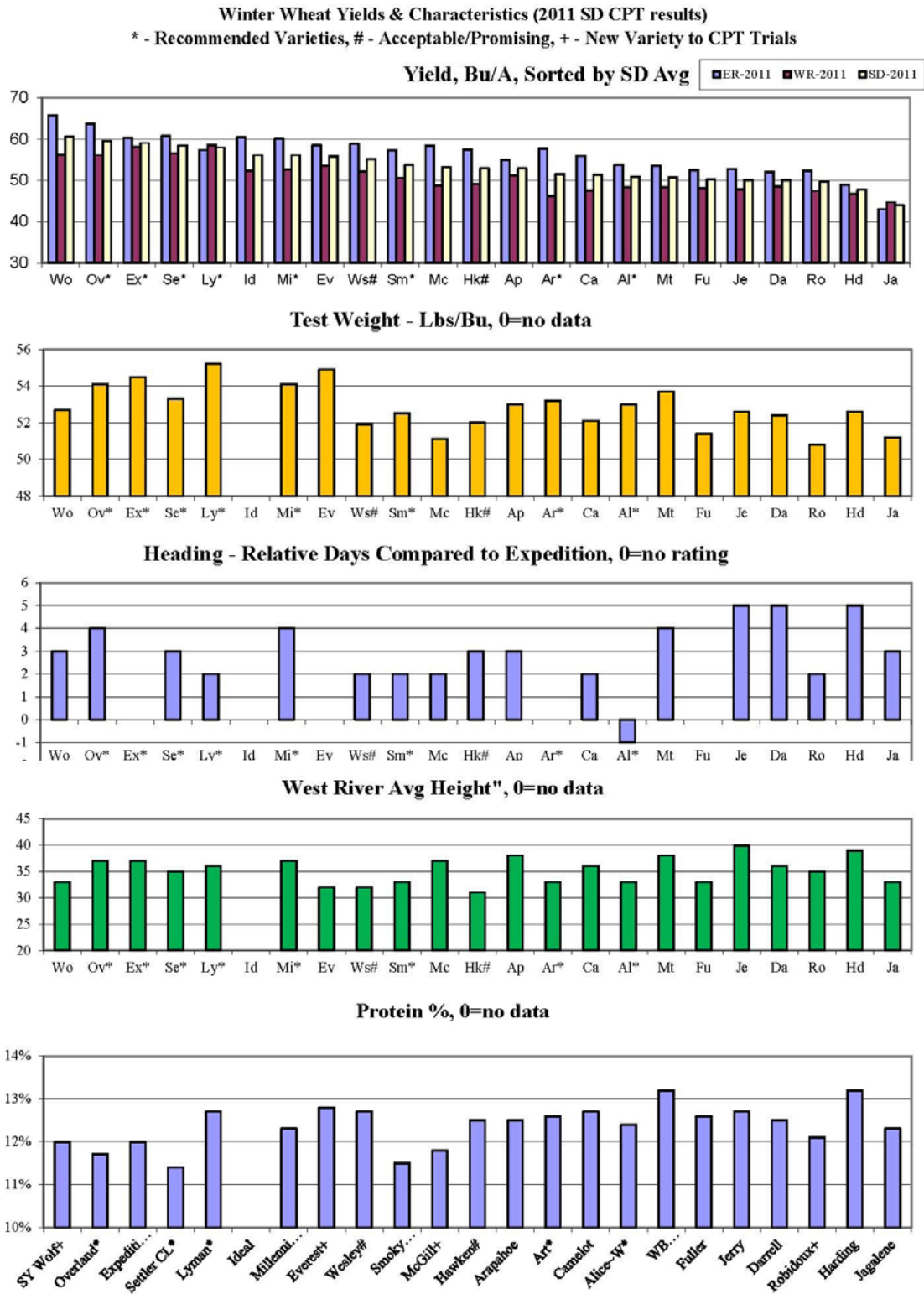
Stem Rust (1=VS, 5=R)



Leaf Rust (1=VS, 5=R)



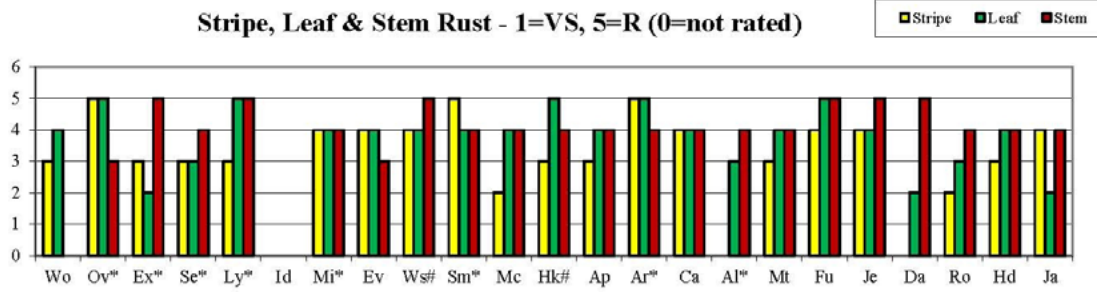
**Figure 6.2. Winter wheat cultivar impact on measured yields, protein, and pest resistance.**  
*(continues on next page)*



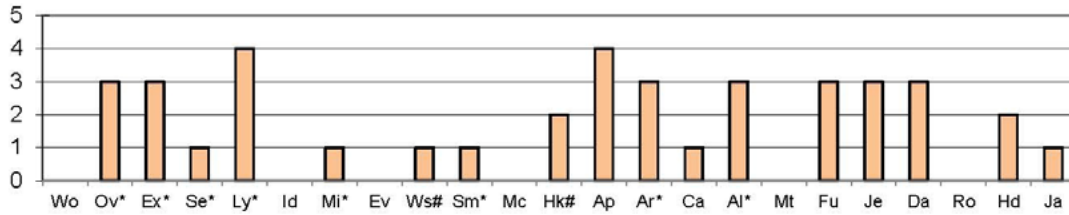
Winter Wheat Yields & Characteristics (2011 SD CPT results)

\* - Recommended Varieties, # - Acceptable/Promising, + - New Variety to CPT Trials

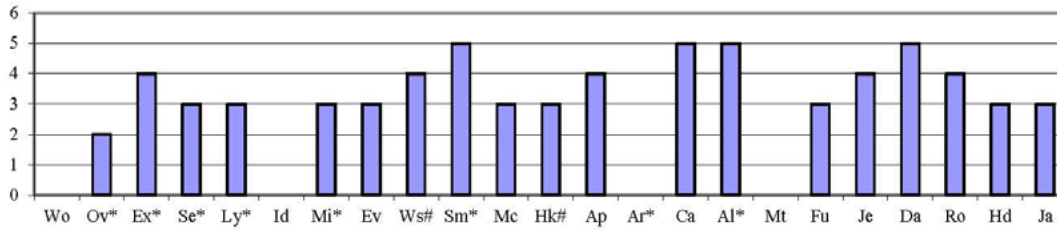
Stripe, Leaf & Stem Rust - 1=VS, 5=R (0=not rated)



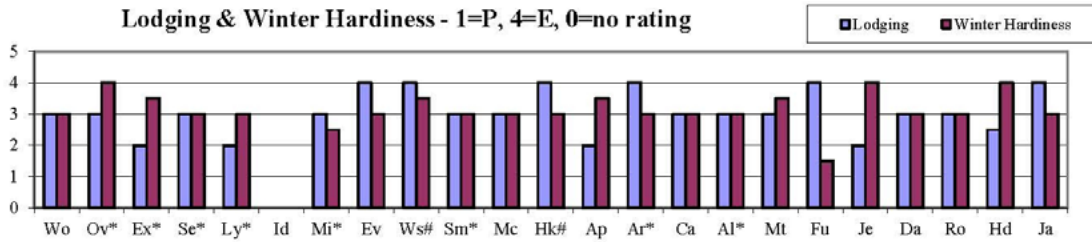
Scab (FHB), 5=tolerant, 1=susceptible (0=not rated)



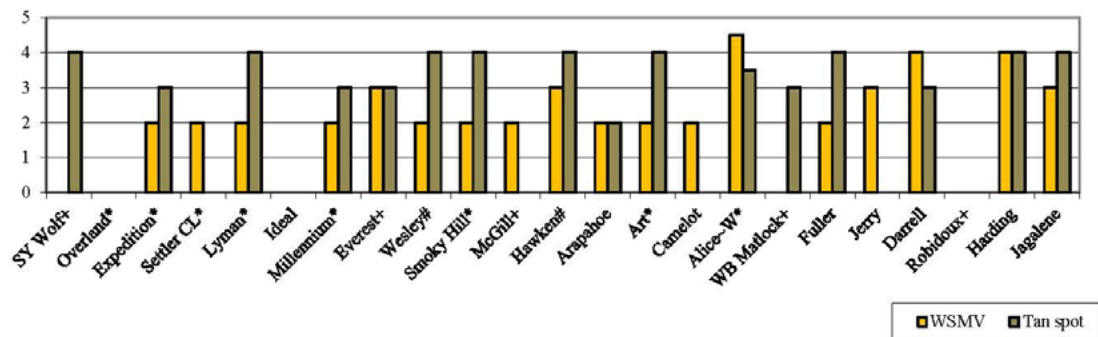
End use Quality - 1=P, 5=E (0=no rating)



Lodging & Winter Hardiness - 1=P, 4=E, 0=no rating



Wheat Streak Mosaic Virus & Tan spot - 1=VS, 5=R, 0=no rating



is enough to avoid extensive insecticide treatments. However, like diseases, insect bio-types may develop, overcoming the plant resistance so considerable efforts in plant breeding are needed to maintain these traits.

Weed suppression can even be influenced by variety selection. Selecting wheat varieties or cultivars that can be more competitive than the weeds may be considered. Wheat traits that improve competitiveness with weeds would include rapid growth after seeding, greater seedling vigor, good tillering characteristics, and greater leaf area development to close the crop canopy quicker. In the case of winter wheat, wheat varieties with good winter and cold hardiness are important considerations.

Another tool available to winter wheat growers for improved weed control for specific weeds such as jointed goatgrass, feral rye, downy brome and some other hard to control grasses is the clear field wheat technology. Wheat cultivars that have been selected for this technology have a specific gene that has tolerance to imazamox herbicide, commercially known as Beyond®. This herbicide program has activity on specific grassy and broadleaf weeds, and can be used on the selected wheat cultivars that are sold commercially as clear field wheat.

The cultivars containing this specific gene may be treated with an imazamox herbicide with minimal risk of crop injury. However, winter wheat cultivars that do not contain this specific tolerance gene would be seriously injured or killed when treated with this particular kind of herbicide.

One concern to consider is the development of herbicide-resistant weeds so you need to continually observe your weed populations and utilize an herbicide rotation program. Additional information on weeds or weed control is available in Chapters 24, 25, and 26.

Growers should select varieties with good test weights, milling, and baking characteristics. Many wheat varieties have trait information on these characteristics.

Another trait to consider is the wheat varieties' coleoptile length. The coleoptile is the part of the seed that pushes upward through the soil after planting. Generally speaking, varieties with a longer coleoptile can be planted deeper to get to available moisture. This is important for more arid areas or if it looks like a year where adequate moisture may be a concern. Ratings for coleoptile length are commonly part of the variety testing information available to growers.

Variety or cultivar selection involves many considerations and there are tools available to help you make the most informed decisions. Every growing season will differ, so you need to consider variety-testing data that summarizes several years and locations. Choose those varieties that have performed the best at multiple locations near your operation and include information on those traits that are important to you. As stated in the beginning of this chapter, variety selection is one of the most important economic and management decisions that you as a grower can make.

## Additional information and references

Clay, D.E., S.A. Clay, C.G. Carlson, and S. Murrell. 2010. Mathematics and Calculations for Agronomists and Soil Scientists. International Plant Nutrition Institute. Available at <http://ppi-store.stores.yahoo.net/maandcaforag.html>

Hall, R., J. Rickertson, K. Kirby, S. Hawks, and B. Swan. 2011. Annual Report: Spring wheat test results for 2011 traits, yield averages, and variety recommendations for 2012.

## Acknowledgements

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Fanning, B., and D.L. Deneke. 2012. Selecting spring and winter wheat cultivars for optimum profitability. In Clay, D.E., C.G. Carlson, and K. Dalsted (eds). *iGrow Wheat: Best Management Practices for Wheat Production*. South Dakota State University, SDSU Extension, Brookings, SD.

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