K-STATE Research and Extension

Wheat Variety Selection

Wheat Rx Series

Historically, about half of hard winter wheat yield increases have been due to improved varieties with the remaining half due to improved management. With unpredictable year-to-year environmental conditions, proper variety selection is the first step to ensure a successful wheat crop. Although it is not always straightforward, the primary objective is to pick varieties that give high per-acre yields and the highest possible net income.

A complicating factor in selecting wheat varieties in recent years is the growing number of choices. It takes time to sift through varieties' characteristics, comparative performance data, seed sources, and relative prices.

The Federal Plant Variety Protection Act accelerated private breeding and sales of variety seed by providing plant patent protection to originators. In addition, Great Plains public breeding programs release a number of new wheat varieties every year. Since it is not feasible for growers to individually test all varieties on their farms, they must rely on other sources for their information. Sources include their own experience, county agent demonstrations and tours, experiment station field days and test information, seed company demonstrations, advertising, and meetings. It takes considerable effort, careful study, and good judgment to make informed decisions. Use your own experience with the varieties you have grown as a base for comparisons.

Selecting a Wheat Variety

Yield potential

Varieties differ in yield potential, with yield gains in the Great Plains averaging about ¼ bushel per acre per year since the 1990s. Recently released varieties tend to have greater yield potential than older ones, justifying the need to choose new varieties on a regular basis. Most growers in Kansas usually realize grain yields well below the yield potential of their varieties due to management and environmental constraints; thus, many varieties might offer good performance if the goal is something other than reaching the variety's yield potential.

Area of adaptation

Beyond a variety's yield potential, growers need to consider its regional adaptation, especially in a state as diverse as Kansas. Some varieties are broadly adapted across the region, while some are known to perform best in niche regions. Varieties adapted for western Kansas will typically not perform as well in central or eastern Kansas, and vice-versa, while some varieties might perform well statewide. The best evaluation of a variety's area of adaptation is its yield record over multiple seasons. Consistent performance with excellent yield record in previous, replicated trials in the region of interest is crucial.

Within a given region, growers should consider the yield record in their own fields when selecting an adapted variety. Some varieties are better suited to higher yielding conditions, others are better adapted to lower yielding conditions, while some are adapted to a wide range of yielding conditions (Figure 1). For growers consistently yielding above the regional average, selecting a variety adapted to higher yielding conditions might be warranted. In the "Resources" portion of this publication, the *CSU Wheat Variety Database* allows for a rapid comparison of different varieties using this method. Knowing a given variety's adaptability in combination to each field's yield record can help place the variety in the environment in which it will be most likely to succeed.

Strengths and weaknesses

The key to maximize the chances of a successful variety selection is to try to match the varieties' strengths and minimize weaknesses so a variety has the opportunity to yield well. Variety strengths (e.g., yield potential, pest and disease resistance, drought tolerance, or straw strength) should be matched against expected field problems (e.g., soilborne mosaic virus, wheat streak mosaic virus, drought, or lodging). Since no perfect varieties have been developed, this usually results in compromise and assumption of risks to gain advantages in other areas.

Variety complementation

Depending on farm acreage, several varieties should be planted to hedge against some of the unpredictable weather and pest problems. Varieties should be adapted

Kansas Wheat Rx is a prescription for economical and sustainable production of high-quality winter wheat in Kansas.

Wheat Rx is partnership between Kansas Wheat and K-State Research and Extension to disseminate the latest research recommendations for high-yielding and high-quality wheat to Kansas wheat farmers.

KANSAS WHEAT® Rx

kswheat.com/kansas-wheat-rx

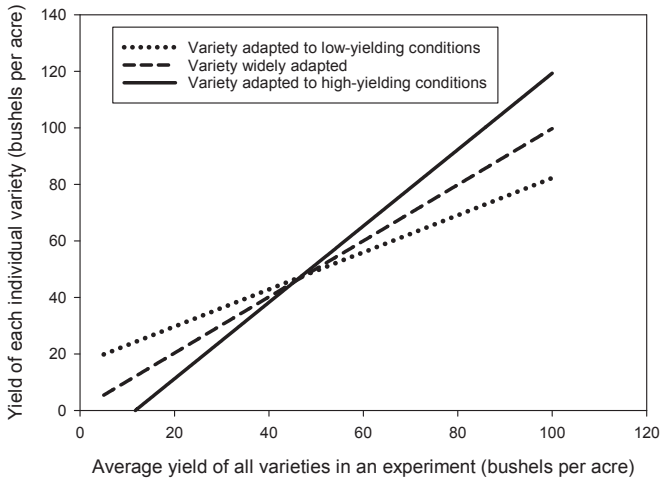

Figure 1. *Example of variety adaptability analysis that can benefit growers when selecting a wheat variety. Each line represents one variety whose yield is shown on the left axis. The bottom axis represents the average yield of several varieties within an experiment, with mean experiment yield ranging from about 5 to 100 bushels per acre. The dashed line represents a variety with broad adaptability, which had a yield similar to the average yield of all varieties at all experiments. A variety adapted to low-yielding conditions (dotted line) will outperform the other varieties in low-yielding environments but, in this example, does not have the same yield potential as the other two varieties have as environmental conditions improve. A variety adapted to high-yielding conditions (solid line) might not perform as well under low-yielding conditions (e.g., drought) but has a greater yield potential at improved environmental conditions.*

and have a good yield record, but should also have contrasting characteristics (e.g. different maturities or disease resistance) because pest problems change and the growing environments are unpredictable. Choose varieties that have different pedigrees and different growing patterns. This will help buffer the risk of a single event (e.g., freeze, drought, disease) compromising the production of the whole operation, while spreading out harvest dates.

Other Important Considerations

Production system

For producers who graze cattle on wheat before taking it for grain (dual-purpose producers), selecting a variety with good forage yield; medium to late first hollow stem; Hessian fly, barley yellow dwarf, and wheat streak mosaic resistance; and good recovery from grazing is important.

Another consideration is whether the crop will be irrigated or dryland. Wheat varieties differ in their straw strength, and varieties with below average straw strength should be restricted to dryland use.

A field with history of feral rye or other difficult-to-control grassy weeds might require wheat varieties with tolerance to grass-controlling herbicides such as Clearfield or Co-AXium technologies.

Double-cropping wheat following soybeans or grain sorghum in central Kansas, or following corn in western Kansas, may require varieties with excellent tillering potential to compensate for the delayed development due to late planting. Wheat fields planted after a corn crop might require varieties with above-average resistance to Fusarium head blight. No-till producers in western Kansas might be looking for tall varieties with good straw production potential to help improve water retention in the soil.

Tolerance to abiotic factors

Depending on the region of the state, the wheat crop will be subjected to different abiotic stresses. For example, acidic soils are a major concern in the central corridor of Kansas. These conditions increase the availability of soluble aluminum, which burns root tips. Varieties differ in their ability to tolerate low soil pH, many times through root exudates that interact with the soil's aluminum. Selecting varieties with a good low soil pH tolerance is warranted in these conditions. Drought is a dominant factor in western Kansas, and varieties with better drought tolerance either through root or leaf mechanisms should be favored there. Varieties differ in their tolerance to abiotic stresses, and selecting a variety with better tolerance to the major limiting factor in each operation allows the variety's potential to be more easily achieved.

Disease and insect resistance

When available, genetic resistance to insects and diseases is an excellent and sustainable control method. Selecting varieties with good stripe rust, leaf rust, and tan spot resistance levels can reduce the risk of severe disease problems and the need for foliar fungicide in the spring; however, few varieties are available with resistance to each of these diseases. It is critical to know the disease vulnerabilities of a variety and to plan for a fungicide application if environmental conditions are favorable for disease development.

Some pests and diseases require a more systems-management approach. For example, Fusarium head blight is a fungal disease that cannot be managed with variety resistance or fungicides alone and requires the integration of each of these tools in favorable years. Viral diseases such as wheat streak mosaic, barley yellow dwarf, and soilborne mosaic, as well as pests such as Hessian fly also require a systems management approach. When these diseases are a concern, the use of genetic resistance should be coupled with complementary cultural management strategies, such as sowing date and volunteer wheat management, to minimize losses.

For more information on disease and insect management see the publications *Wheat Variety Disease and Insect Ratings* and *Evaluating the Need for Wheat Foliar Fungicides* in the resources section.

Maturity

Selecting several varieties with differing maturities spreads risk and optimizes harvest timing. Early maturing varieties are more likely to escape damage from hot winds, drought, and rust. They are more subject to late-spring freezes, however. Medium-late maturing varieties are more likely to benefit from growing seasons with an extended grain-filling period. Producers with a large number of acres can spread harvest by using varieties of differing maturity.

Other agronomic characteristics of interest

Other considerations when selecting a wheat variety include straw strength and its potential for lodging, its shattering tendencies, coleoptile length, and winter hardiness. Many breeding programs are also releasing "Certified Seed Only" varieties, that require growers to purchase seed every year and can be an important consideration when selecting a wheat variety.

Grain quality

The major use of Kansas wheat is for human consumption as bread. Therefore, the grain must meet quality standards of millers and bakers to produce a quality end product. Quality is determined by variety as well as by management and the environmental growing conditions, thus, producers should consider a variety's quality profile when selecting varieties to grow. In recent years, milling and baking companies have developed "preferred varieties" lists based on desirably milling and baking attributed. These lists can help growers select good quality varieties according to industry standards and, in some cases, capitalize on price premiums for quality.

Resources and Tips

Varieties are not specifically recommended or endorsed by Kansas State University. Instead, varieties are compared in scientifically conducted performance tests at several sites across Kansas each year, and the results are distributed to the public soon after harvest. Many greenhouse and laboratory tests contribute information on pest tolerance, baking quality, and other factors.

Publications summarizing the above tests are available to growers at all county extension offices and include, among others:

Kansas Performance Tests with Winter Wheat Varieties

This publication includes detailed current-year data, summary yield data over 2, 3, and 4 years at all locations, public variety pedigrees, private company entries and addresses, ratings for agronomic traits, and disease and insect resistance. The results of these tests can be found at **www.agronomy.k-state.edu/services/crop-performance-tests/winter-wheat/index.html**. To navigate this page, start searching by year, narrow down your search by region and finally by site. Choose the sites nearest to you and look for varieties that are consistently toward the top. Repeat the procedure for different years to check the consistency of the variety performance.

Wheat Variety Disease and Insect Ratings (MF991).

This publication provides the most recent ratings for new and established varieties for resistance or susceptibility to common insects and diseases attacking wheat in Kansas.

Dual-purpose wheat variety performance (MF3312) and wheat fungicide guide (MF3057)

Publications MF3312 provides information about wheat variety performance under dual-purpose (grazing plus grain harvest) management, including forage production, date of first hollow stem, and grain yield following simulated grazing.

Publication MF3057 provides guidelines on when to spray foliar fungicides depending on environmental conditions and variety disease resistance ratings.

OSU Wheat Variety Trial Results

If you are in southern Kansas or in Oklahoma, this is also an excellent resource. Go to **wheat.okstate.edu/**, select "Variety Testing" and then "Grain Yield" to have access to similar information to the one offered by K-State, but for variety performance tests from Oklahoma.

CSU Wheat Variety Database

This comprehensive database (**ramwheatdb.com/database.php**) encompasses replicated trial results from Colorado, Kansas, Oklahoma, and several other public state trials, so producers throughout the High Plains can benefit. This resource allows producers to see data from a single location, multiple locations, multiple years, and head-to-head comparisons. The "Multiple Location Trial Data" option summarizes yields data spanning wide but still locally relevant geographies for 1, 2, 3, or 4 years combined. Depending on region and number of years selected, data might be combined from more than 15 replicated trials.

If a few varieties show good performance across all these replicated trials, their strengths and weaknesses should be further evaluated. After selecting a few potential candidates, the "Head-to-head comparisons" option tests whether those varieties performed statistically different over a wide range of environments, and allows for graphing yield performance similarly to Figure 1.

Steps to Ensure a Successful Variety Selection

Review yield data from regional trials located in the area of interest for a number of years to find varieties that consistently rise toward at least the top third or quarter in yield performance. Avoid relying on data from one location or only one year of testing, as this information can be misleading.

Once a list of consistent yielders for a region is developed, think about which systems these varieties are going to be established into each field (e.g., dual purpose, after corn, or late planted after soybeans).

For each system, think about which production problems have reduced the yield potential of the crop over the past 5 years. For instance, for wheat after corn it may be Fusarium head scab, while for wheat after soybeans it may be lack of fall growth; meanwhile, stripe rust or drought may be a problem in both systems.

Once these problems are recognized, go back to the list of high yielding varieties and try to identify varieties that have strong ratings for tolerance or resistance to them. Determine if the group of varieties has been tested for milling and baking quality and try to choose the varieties with above-average ratings. From this group, pick the top three or four varieties, depending on farm acreage, based on yield in performance and strengths and weaknesses that match the needs in each field.

Referenced Publications

- *Evaluating the Need for Wheat Foliar Fungicides*, MF3057
  bookstore.ksre.ksu.edu/pubs/MF3057.pdf
- *Wheat Variety Date of First Hollow Stem, Fall Forage Yield, and Grain Yield*, MF3312
  bookstore.ksre.ksu.edu/pubs/MF3312.pdf
- *Wheat Variety Disease and Insect Rating*, MF991
  bookstore.ksre.ksu.edu/pubs/MF991.pdf

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