

Selecting Corn Hybrids for the Field

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Hybrid selection is one of the most important decisions a producer will make. Hybrid traits are introduced through breeding or genetic modification, and there are many available options. Certain physical traits fit some field environments better than others or are better suited to specific end uses, such as silage versus grain. The higher seed cost of specialty traits means growers must balance perceived benefits with the cost of using the newer technology. When selecting a hybrid to plant, in addition to yield, producers should consider days to maturity, disease and insect resistance, and sometimes herbicide tolerance.

Physical Traits

Information on important phenotypic traits is available from seed companies. Lodging scores and ear height data are available for hybrids grown at the University of Tennessee Institute of Agriculture’s (UTIA) AgResearch and Education Centers as part of the information provided by the statewide variety testing program (varietytrials.tennessee.edu).

A good hybrid should have an adequate shuck or husk covering the ear to minimize the introduction of disease organisms into kernels. Many newer hybrids have a more indeterminate or semiflex ear, which means the number of kernels per ear can increase from a fixed number as plant density is reduced or as growing conditions improve and will not decrease at higher populations as long as water and nutrients are adequate. Semiflex or fixed ear types may be better suited to planting at high populations. Full flex ear hybrids respond the best to lower plant populations and are more suited to fields where planting at lower populations is desired.

Good stress emergence is vital when no-till planting and planting corn early. Regardless of yield genetics, a good hybrid should stay green until near maturity. This usually indicates better stalk health and fewer problems with lodging. Above average drought



tolerance can help offset water deficiency that occurs in shallow soils where irrigation is not an option.

Relative Maturity

Corn hybrids are categorized by number of days to relative maturity (RM). RM is the number of days it takes a hybrid to reach physiological maturity or “black layer” after emergence (Table 1). Seeds that are physiologically mature have grain moisture contents greater than 30 percent and must dry down on the ear before grain can be harvested. When on-farm drying is not available, it is critical to plant hybrids with good dry-down ratings. Hybrids with good dry-down ratings can be harvested, stored or sold more quickly after reaching black layer. As a rule, early-season hybrids take less time to dry down than full-season hybrids when planted timely, but there are exceptions. Corn planted late in May or June or a crop that undergoes substantial stress during the season may stay wet longer than is typical.

Table 1. Relative Maturity of Hybrids Groups

Maturity	RM (days)
Early	≤113 days
Medium	114-116 days
Full	117-120+ days

Yield

Hybrid offerings often change every two to three years, making selection based on performance more challenging. Yield data are available from local university Extension offices and from seed companies. UTIA evaluates hybrid performance (varietytrials.tennessee.edu) in trials conducted at its AgResearch and Education Centers (replicated in small plots) and in county



strip trials (large plots replicated over several locations). The difference in yield potential of top-yielding hybrids versus bottom-yielding hybrids may be 20 bushels per acre or more, so it is important to choose a hybrid with care. Yield data from multiple locations or years give a much better indication of the consistency of a hybrid’s performance.

A good practice is to plant one-third each of early-, medium- and full-season hybrids to spread harvest time and minimize the effects of drought or heat stress during pollination. Under ideal conditions, a good full-season corn often out-yields early- or medium-season hybrids, since full-season hybrids produce more leaves and potentially larger ears. However, full-season hybrids take longer to mature and harvest slightly later. A recent trend is to forgo some potential yield and plant more early- and medium-season hybrids. Earlier harvest allows producers to establish a wheat or cover crop sooner and to harvest soybeans in a timely manner.

Disease Resistance

Stalk rots, gray leaf spot, common and southern rust, and other diseases affect many acres of corn each year. There are no hybrids with true resistance to gray leaf spot, but gray leaf spot and rust diseases can be managed by rotating ground, planting early, and choosing hybrids with some disease resistance. Stalk rots, gray leaf spot, as well as diplodia ear rot, are usually more problematic in fields that are continually planted to corn. Disease ratings for individual hybrids are available from seed companies and should be considered when selecting hybrids for fields in continuous corn or those with a known history of leaf or stalk diseases.

Significant yield losses from virus diseases were first observed in Tennessee in 1964. Research combining management practices and breeding for tolerance to these diseases has been highly successful in reducing, and in many cases eliminating, yield losses due to virus diseases. Rhizome Johnsongrass (*Sorghum halepense*) is the primary alternate and overwintering host for maize dwarf mosaic and maize chlorotic dwarf virus complexes. Virus diseases are transmitted to corn when leafhoppers and other leaf-feeding insects move from the grass to corn. Roundup Ready technology has almost eliminated Johnsongrass from many areas in the state, but hybrids with good virus resistance should be considered when planting corn in fields that still have significant Johnsongrass pressure.

Insect Protection

Insect-protected or “Bt” corn was originally genetically engineered to produce a toxin in plant tissue that would control European and southwestern corn borers. Newer Bt traits provide some control of fall armyworm, corn earworm and black cutworm (e.g., Herculex I, YieldGard VT Pro, Viptera) or control of corn rootworm (e.g., YieldGard Rootworm, YieldGard Plus, Herculex RW) (see Table 2). Insect protection and herbicide tolerance traits are now stacked into single hybrids. Examples of products with multiple stacked traits are VT Triple Pro and Herculex Xtra, which provide glyphosate tolerance, corn borer and corn rootworm protection.

Table 2. A Description of Current Bt Corn Products

Product Name	Refuge Requirement	
Older Traits/Brands		
Agrisure GT/CB/LL, Agrisure 3000GT, Herculex 1, Herculex XTRA, YieldGard Corn Borer, YieldGard VT Triple (VT3)	50% in cotton counties	20% in corn counties
Recent Traits/Brands		
Agrisure Viptera 3110 and 3111, Genuity VT Triple Pro, Optimum Intrasect Xtra	20% in cotton counties	20% in corn counties
Genuity VT Double Pro, SmartStax, Optimum Intrasect, Optimum Leptra, Optimum Intrasect Xtreme	20% in cotton counties	5% in corn counties
Prebagged Refuge Products		
Agrisure Viptera 3220 or 3122, Genuity VT Double Pro RIB, Genuity SmartStax or SmartStax RIB, Optimum AcreMax, Optimum AcreMax Xtreme	20% in cotton counties	5% in corn counties

Growers are required to plant a non-Bt corn refuge to help reduce the development of resistance by maintaining a population of insects that are not exposed to the Bt toxin. In cotton-growing counties, growers can plant up to 80 percent of their corn acreage in Bt corn borer hybrids if they purchase stacked trait hybrids or prebagged refuge products. In non-cotton-growing counties, up to 95 percent of corn acreage can be Bt hybrids with newer product offerings. Bt rootworm hybrids have a different refuge requirement. When corn borer and rootworm stacked hybrids are planted, the most restrictive refuge requirement for percentage of refuge (corn borer) and distance to refuge (corn rootworm) should be followed.

Bt technology adds to the cost of seed, and seed cost increases as more traits are stacked into the hybrid. Rootworm-protected corn

does not have a strong fit in Tennessee and is not cost-effective in most areas of the state. It is not clear whether the cost of the corn borer technology gives a return each year, particularly when corn is planted early and in areas where corn borer is not a problem. However, it is strongly recommended that Bt corn borer protected hybrids with resistance to corn earworm and fall armyworm (such as the Viptera hybrids) be included when planting late corn, particularly late-planted, irrigated corn, which is more attractive to insects.

Herbicide Tolerance

Herbicide-tolerant hybrids have been available to producers since the 1990s. Hybrids with tolerance to selected postemergence herbicides (Table 3io) allow producers to use herbicides with different modes of action to manage weed resistance.

Table 3. Description of Herbicide-tolerant Technologies

Hybrid Type	Description	Other Information
Roundup Ready ®	Genetically modified (GMO) to have tolerance to glyphosate; NK603- Roundup Ready 2 and others.	
Liberty Link ®	Genetically modified (GMO) to have tolerance to glufosinate or Liberty herbicide; most Herculex insect-protected hybrids contain the Liberty Link gene.	Most hybrids cleared for export. Check with local seed dealer for information about specific stacked hybrids. Liberty is used in weed control programs to control glyphosate-resistant weeds.
Enlist ®	Enhanced tolerance to 2,4-D to allow application to corn > 8" in height.	Not all hybrids have been cleared for human or animal use outside the U.S. Check with seed company for export restrictions.

GMOs and Hybrid Selection

Some hybrids with multiple stacked traits that are considered genetically modified organisms are still not cleared for export to the European Union or other countries for human and animal use. This means that nonapproved harvested corn should be used or fed to livestock locally and not mixed with corn that is being shipped to river ports for delivery outside the U.S. Seed companies may require signed agreements prior to purchase. Check with your local grain handler to determine if specific types of corn will be accepted or a local seed dealer for current lists and restrictions on exports.

Hybrid Selection for the Field

In summary, corn hybrid selection should be tailored for the environment of a given field. There are many options to choose from, but a few basic rules apply:

- Choose proven performers based on multiyear data from multiple locations and plant a mixture of maturities to spread risk.
- Semiflex or fixed ear types tolerate high populations while flex ear types do best at more conservative planting rates.
- Plant early- and medium-season hybrids with good dry-down ratings when early harvest is the goal.
- Plant as early as practical to minimize damage from gray leaf spot, rusts and corn borers.
- Select Bt hybrids with gray leaf spot resistance when planting after mid-May and observe refuge requirements.
- With bottomland and irrigated fields, select top-yielding hybrids with good stalk strength and gray leaf spot resistance.
- For upland and drought-prone hills, select hybrids for drought stress tolerance and consider early-maturing hybrids that will develop faster while moisture is usually less limited.