UT Extension
W076

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 vs. grain. The higher seed cost of specialty traits means growers must balance perceived benefits with the cost of using the newer technology. In addition to yield, producers should consider days to maturity, disease and insect resistance, and sometimes herbicide tolerance when selecting a hybrid to plant.

Physical Traits

Important phenotypic traits are rated and this information is available from seed companies. Regardless of genetics, a good hybrid should stay green until near maturity. This usually indicates better stalk health and fewer problems with lodging. A good hybrid should also have an adequate shuck or husk covering the ear to minimize introduction of disease organisms into kernels. Many newer hybrids have either a semi-flex or full-flex ear, which means the number of kernels per ear can "flex" or increase from a fixed number as plant density is reduced or as growing conditions improve.

Relative Maturity

Corn hybrids are categorized by number of days to relative maturity (RM). RM is the number of days a hybrid takes to reach physiological maturity or "black layer" after emergence (Table 1). Seed that are physiologically mature have grain moisture contents greater than 30 percent and must dry down on the ear before grain can be harvested. Hybrids with good dry-down ratings can be harvested more quickly after reaching black layer. Full-season hybrids typically take longer to dry down than early hybrids.

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. The University of Tennessee evaluates hybrid performance (varietytrials.tennessee.edu) in trials conducted on research and education centers (replicated in small plots) and in county strip trials (large plots with typically one replication per location). The difference in yield potential of top-yielding hybrids versus bottom-yielding hybrids may be 20 bushels per acre or more, which emphasizes the importance of choosing a hybrid with care. Yield data from multiple locations and 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 are slightly later to harvest.

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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 other crops in a timely manner. Producers who grow early maturity (Maturity Group 3 and 4) soybeans may wish to plant more early hybrids to complete corn harvest as quickly as possible.

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 and Gray Leaf Spot are usually more of a problem 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 is the primary alternate and over-wintering 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 between Johnsongrass and corn. Symptoms on corn often appear as grasses die following herbicide sprays. Hybrids with good virus resistance should be considered when planting corn into fields with significant Johnsongrass pressure.

Insect Protection

Insect-protected or "Bt" corn (e.g., YieldGard®) 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®) or control of corn rootworm (e.g., YieldGard® Rootworm, YieldGard® Plus, Herculex RW®) (Table 2). Insect protection and herbicide tolerance traits are sometimes 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.

Growers must plant a non-Bt 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 50 percent of their corn acreage in Bt corn borer hybrids. In non-cotton-growing counties, up to 80

Table 2. A Description of Current Bt Corn Products

Product Name	Refuge Requirement	
Traits for Control of Corn Borer		
Agrisure CB/LL	50% cotton counties	20% non-cotton counties
Herculex I	50% cotton counties	20% non-cotton counties
YieldGard Corn Borer	50% cotton counties	20% non-cotton counties
YieldGard VT Pro (VTP)	20% cotton counties*	5% non-cotton counties*
Traits for Control of Corn Rootworm		
Agrisure RW	20% all counties	
Herculex RW	20% all counties	
YieldGard Rootworm	20% all counties	
YieldGard VT Rootworm/RR2	20% all counties	
Stacked Traits for Corn Borer and Corn Rootworm		
Agrisure CB/LL/RW	50% cotton counties	20% non-cotton counties
Agrisure GT3000	50% cotton counties	20% non-cotton counties
Herculex XTRA	50% cotton counties	20% non-cotton counties
YieldGard Plus	50% cotton counties	20% non-cotton counties
YieldGard VT Triple	50% cotton counties	20% non-cotton counties
YieldGard VT Triple Pro (VT3P)	20% all counties*	

*Qualifies for reduced refuge.

percent of corn acreage can be Bt hybrids. New multi-event hybrids such as YieldGard VT Pro® and Triple Pro® contain two corn borer traits and qualify for a reduced corn borer refuge. The non-Bt corn borer refuge should be planted within ½ mile of each Bt cornfield (¼ mile or closer is preferred). There are several planting configurations that are acceptable, including splitting the planter to alternate a minimum of four rows (at least six rows is preferred) of non-Bt corn with a Bt hybrid. Bt rootworm hybrids have a 20 percent refuge requirement for the non-Bt rootworm refuge. The refuge area must be planted in the same field or in an adjacent field separated by a road or ditch. 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 cornborer protected hybrids be used 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 2) allow producers to use herbicides with different modes of action to manage weed resistance.

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 countries for human and animal use. This means that non-approved harvested corn should be used/fed locally and not mixed with corn that is being shipped to river ports and outside the U.S. 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 multi-year data from multiple locations.
- Select a mixture of maturities to spread risk.
- Plant early- and medium-season hybrids when early harvest is the goal.
- Plant as early as practical to minimize damage from Gray Leaf Spot, rusts and corn borers.
- Select Bt corn borer hybrids with Gray Leaf Spot resistance when planting after mid-May.
- 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 an early-maturing hybrid.

Table 3. Description of Herbicide-Tolerant Technologies

Hybrid Type	Description	Other Information
Roundup Ready® GAT®	Genetically modified (GMO) to have tolerance to glyphosate; NK603-Roundup Ready® 2. GAT® hybrids have tolerance to glyphosate and to ALS herbicides.	Not all multiple stacked hybrids have been cleared for human or animal use outside the U.S. Check with seed company for export restrictions.
Liberty Link®	Genetically modified (GMO) to have tolerance to glufosinate or Liberty® herbicide. 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.
Clearfield® or "IMI" corn	Developed by traditional plant breeding (non-GMO), these hybrids are tolerant to the imidazolinone herbicides Pursuit® or Lightning®.	Seed tag labeled 'IT' for imidazolinone-tolerant or 'IR' for imidazolinone-resistant. IR hybrids have the most built-in herbicide tolerance.

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