Illinois Corn Management 2023

Corn is an important commodity crop in Illinois, with approximately 10.8 million acres planted in 2022. This publication is designed as a quick reference for information on corn management in Illinois, including hybrid selection, planting practices, and fertilizer and pest management. This guide offers advice to assist corn producers and crop consultants and should be tailored to best fit the conditions in their cropping system.

Variety Selection

When tested under uniform conditions, the range in yields among commercial hybrids is often between 30 to 50 bushels per acre (or more). Therefore it pays to spend some time choosing the best hybrid for your field. The most important factors to consider are maturity, yield for that maturity, standability, and disease and pest resistance.

Because the environment changes from year to year, look for hybrids that perform well across multiple locations and years in your area. The University of IIllinois Variety Testing Program conducts corn crop performance tests annually, including yields, grain moisture, and average yield from the previous 2 to 3 years. Results are published soon after harvest and available at go.illinois.edu/CornCropTests. Other sources of information include tests conducted by youself, seed companies, and neighboring producers.

Corn hybrids grown in Illinois have planting-to-harvest growing degree day (GDD) requirements ranging from 2,200 to 2,400 for early hybrids grown in the northern part of the state to 2,800 to 2,900 for late hybrids grown in the southernmost part of Illinois. Generally, hybrids that use most of the growing season to mature should produce higher yields than those that mature much earlier. For this, consider hybrids that would reach maturity at least two weeks before the average date of the first killing freeze (32°F) in your region – shown in Figure 1.

Resistance to insects and diseases is also important when selecting a corn hybrid. For instance, corn

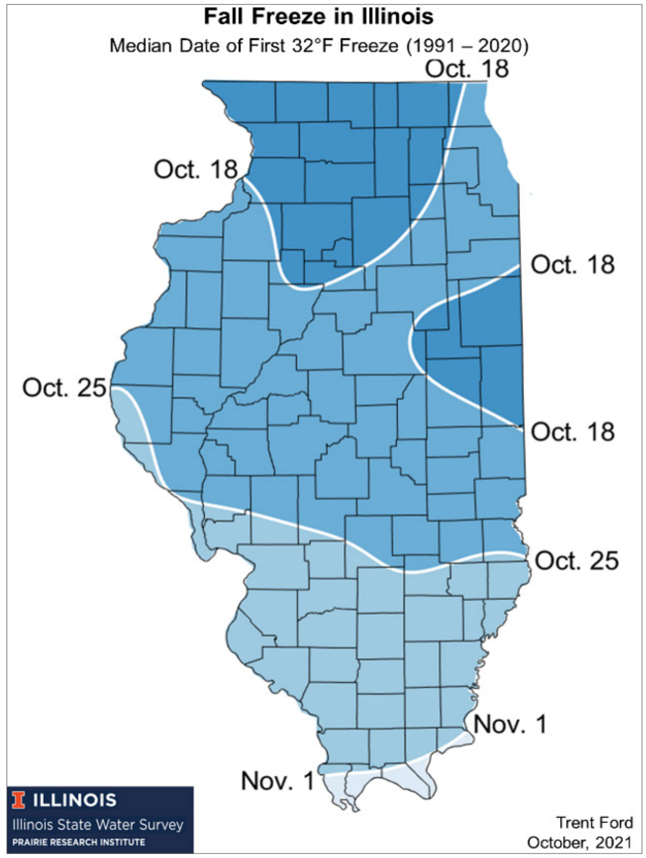

Fig. 1. Median date of first fall freeze in Illinois (1991 to 2020 normal). Map generated by Trent Ford, Illinois State Water Survey.

rootworms – including the western and northern corn rootworm species – are the most economically important corn insect pests in Illinois. Further, refine your selection by considering the high-yielding hybrids with resistance or tolerance to major diseases in your area.

Planting Practices

Planting date

Long-term studies show that the optimum planting date for corn in Illinois is between mid-to-late April, with little yield losses (5 to 6%) when planting within the first week or so in May (Figure 2). Yield losses increased rapidly by the end of May and continue to accelerate as planting is delayed into June; expected yields reached 80% of early-planted yields by about June 10.

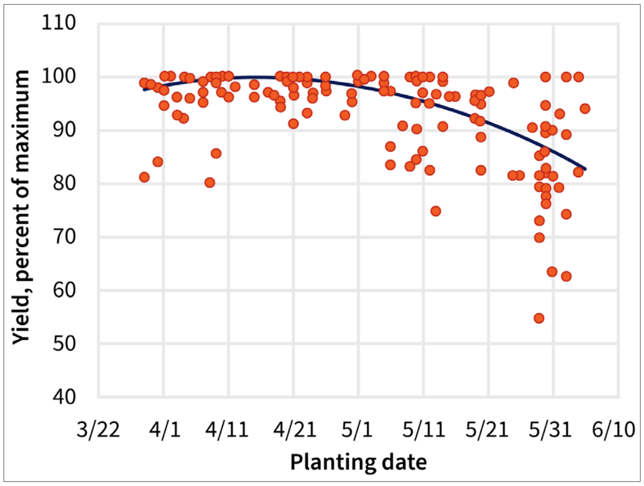

Fig. 2. Changes in corn yield by planting date in Illinois. Data are averaged over 39 field trials.

Another important consideration when deciding when to start planting is the condition of the soil. Planting into wet soils or "mudding in" can increase the risk of sidewall compaction and poor root development, especially if the weather turns hot and dry after planting. Reduced plant stand, delayed emergence, and restricted root growth will negatively impact yield.

Planting depth

Ideal planting depth varies with soil and weather conditions. For most situations, corn should be planted 1½ to 1¾ inches deep. Later in the season and under dry conditions, planting as much as 2½ inches into moisture may be advantageous. Deeper planting tends to result in reduced stand due to crusting or wet soils and an increased chance of uneven emergence, which can cause yield losses.

Seeding rate

Plant populations used by corn producers in Illinois have been rising steadily, with most fields now having 32,000 to 35,000 plants per acre at harvest. The optimum seeding rate depends on the weather, hybrid, and practices selected.

Fertilizer Requirements

Fertilizer application is an essential component of corn production, representing about 45% of the direct costs in Illinois. Here are a few considerations for profitable corn production.

Soil tests

Testing soil is the first step of a good nutrient management program since it provides information to guide accurate fertilizer decisions. It is recommended to take soil nutrient samples every 2 to 4 years to monitor soil testing levels in your field, especially in high-yielding environments where nutrient removal is expected to be high. When fertilizer prices are high, such information can help guide decisions on lime, phosphorus, and potassium applications, resulting in fertilizer savings and increased profitability.

Applications of phosphorus (P) and potassium (K) fertilizer should be based on soil testing. The Illinois Agronomy Handbook recommends maintaining Bray P1 soil test levels at 40 to 50 pounds per acre to ensure that soil P availability will not restrict crop yield. Similarly, soil test K levels should be slightly higher than the critical levels of 260 and 300 pounds of exchangeable K per acre for soils in the low CEC (<12 meq/100 grams) and high CEC regions (>12 meq/100 grams), respectively.

Yield responses to fertilizer P and K are generally consistent in low or low soil testing. However, there is little to no agronomic and economic advantage in applying P when Bray P1 values are higher than 60 to 70 pounds per acre. Similarly, no K additions are suggested if test levels are above 360 and 400 pounds per acre for the low and high CEC regions, respectively.

Crop removal rates

This process is best done when soil test P and K levels are within the desired range for optimum yield. Applying amounts removed by recent crops will keep soil test levels within the optimal range. Crop removal rates for Illinois were updated a few years ago based on several thousand corn and soybean samples collected over three years (2014 to 2016). The removal number for corn is 0.37 lb P_2O_5 and 0.24 lb K_2O per bushel.

Nitrogen rates

Figure 3 shows an example of a typical corn yield response to N fertilizer. Generally, yield increases are higher at low N rates and diminish at high N rates. Yields level off at some point, with a flat line after that (i.e., yield does not increase despite additional N). The economic optimum N rate (EONR) is calculated based on mathematical equations that describe the yield response to N and the implementation of economic analysis using current N fertilizer and corn grain prices. This EONR is the N rate where the last pound of N added produces just enough extra yield to pay for itself – also called maximum return to N (MRTN).

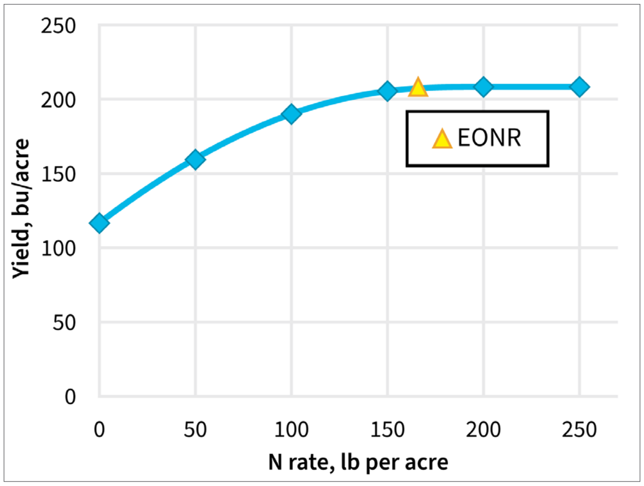

Fig. 3. Example of a typical corn yield response to applied N fertilizer. The line is fitted to the data points using computer software — courtesy of Dr. Emerson Nafziger.

The Corn N Rate Calculator website cornnratecalc.org calculates the EORN with different N and corn prices and profitable N rates from recent N rate research data on corn following corn and corn following soybean. The database is also grouped based on north, central, and south geographic locations in Illinois, allowing for more specific recommendations. As of 2022, there are 135 field trials in the Illinois database.

See the MRTN Guide publication for more details.

When it comes to N management, there is no one-size-fits-all solution, as there are many sources and ways that fertilizer N can be applied in Illinois. Corn crop typically takes up little N until growth stages V6 to V7. About half or more of its total N is taken up during the period of rapid growth, which is roughly between V8 and VT/R1. Corn plants had taken up 60 to 65% of their total seasonal N requirements by this point.

Therefore, consider an N management system that (1) supplies some N early in the season to support essential growth functions such as leaf growth and ear formation, and (2) ensures that enough soil N is available during the period of rapid N uptake.

See "Nitrogen Management for Corn" in the Illinois Agronomy Handbook for more information on N rate, source, placement, and time of application.

Sulfur applications

Most of the sulfur in soil is found in organic matter, which releases plant-available sulfur to crops as it mineralizes. Sulfur is also very mobile in the soil, and leaching is common. Therefore, sulfur deficiency is more likely to appear in sandy or coarse-texture soils with low organic matter. Heavier soils with high organic matter tend to be cooler and wetter in April – conditions that affect mineralization – and early-season S symptoms may disappear as S availability increases during the summer, and root systems develop to exploit greater soil volume. Sulfur deficiency in corn appears as interveinal striping chlorosis on the youngest leaves.

Weed Management

Eliminating or reducing the deleterious effects of weeds on agronomic crops is the ultimate goal of weed management. Integrated weed management includes all practices that enhance a crop's competitive ability and decrease weeds' ability to reduce yield. Successful weed management requires identifying relevant species and understanding their biological characteristics to tailor management to the weeds in individual fields.

Weed identification

Accurate identification is critical: identifying seedling weeds is necessary for selecting an appropriate postemergence herbicide, while identifying mature weeds often indicates which species will populate a particular field the following season. Most weed species in Illinois agronomic cropping systems are either broadleaves or grasses. Broadleaf species are generally easier to differentiate than grasses, especially at early growth stages.

Most weeds of agronomic cropping systems are herbaceous, but a few species that can become established in reduced-tillage fields are woody (such as maple trees). Weeds can be categorized according to their life cycle, or how long they live: annual, biennial, and perennial. Knowledge of life cycles is essential to reducing the potential for weeds to produce viable seed or vegetative structures that aid in weed dispersal.

Chemical controls

Currently, the most common method of managing weeds is through use of herbicides. Many options are available, each with distinct advantages and disadvantages. There are also several methods by which herbicides can be applied. Whatever the herbicide or method of application, the goal is to prevent weeds from contributing to crop yield loss by reducing the amount of competition exerted by the weeds. Other weed management practices in Illinois agronomic crops include cultural and mechanical approaches.

Cultural controls

Cultural weed management practices allow the crop to become established without experiencing any negative effects of weed interference. Proper crop variety selection and planting date, adequate soil fertility and pH, and crop row spacing are examples of factors that can be manipulated to improve the competitive ability of the crop.

Mechanical controls

Mechanical weed management involves physical disturbance of weeds, such as pulling weeds, tilling the soil before or after weeds emerge, and mowing.

See "Weed Management" in the Illinois Agronomy Handbook for more detailed information on chemical weed management.

Insect Management

Transgenic insect-resistant hybrids

Many commercial field corn hybrids grown in Illinois possess biotech traits for the control of one or more groups of insect pests. Packages of these traits are classified as "above-ground" if they target caterpillar species that feed on the foliage, stalk, silks, and/or kernels, or "below-ground" if they target corn rootworm. Usually, the traited hybrids express toxic proteins from the bacteria *Bacillus thuringiensis* (Bt), which target insects from the orders Lepidoptera (caterpillars such as European corn borer) or Coleoptera (beetles such as western corn rootworm). Recently, trait packages for corn rootworm control have been introduced that work via RNA-interference.

For more information on biotech traits, including which ones are present in which commercial trait packages, see the "Handy Bt Trait Table" provided by Extension entomologists at Michigan State University and Texas A&M University: texasinsects.org/bt-corn-trait-table.html

Seedling pests

Several insect pests attack corn seedlings, either by feeding on the germinating seeds and developing roots (e.g. wireworms, white grubs, grape colaspis, seedcorn maggot) or by feeding on the leaf and stem tissue of newly emerged plants (e.g. black cutworm, armyworm).

Rescue treatments are typically unavailable for those pests that feed below ground; control can be achieved using a seed- or soil-applied insecticide.

Understanding the risk factors that favor these pests can help to guide control decisions for these sporadic pests. For example, seedcorn maggot is often associated with decaying organic material (e.g. livestock manure or a terminated cover crop) incorporated by a tillage operation just before planting.

Black cutworm and armyworm injuries are usually associated with a stand of broadleaf (cutworm) or grass (armyworm) winter annuals that are dying (presumably due to a herbicide application) during the period from corn emergence to approximately V5. Cover crop termination during this time can also lead to injury from these pests; armyworm often injures corn where it borders winter wheat.

A broadcast insecticide as a rescue treatment can effectively control black cutworm or armyworm, but the larvae can be difficult to scout for due to their habits of hiding in residue or plant whorls during the day.

Corn borers

The widespread use of transgenic hybrids with corn borer resistance has dramatically reduced the incidence of both European and southwestern corn borer in Illinois. European corn borer injury still occurs in non-Bt corn occasionally, particularly where non-Bt corn has been grown repeatedly in one area with minimal destruction of residue.

Corn rootworm

Western and northern corn rootworms together make up the most economically important insect pest complex in Illinois corn. Several trends in rootworm management have emerged in recent years. The rotation-resistant "variant" population of western corn rootworm has declined in its impact, limiting most corn rootworm problems to areas of northern Illinois where corn-after-corn production is more common. Northern corn rootworm populations have increased in northern Illinois over the last 3 to 5 years.

Resistance to all four Bt proteins available for rootworm control has been confirmed in both species in parts of the U.S. Cornbelt, and this resistance is confirmed or suspected in much of Illinois. Resistance to the "Cry3" proteins (Cry3Bb1, mCry3A, and eCry3.1Ab) is apparently widespread in Illinois; resistance to Cry34/35Ab1 is present in the state, but the level of resistance varies from place to place. Resistance to these toxins has resulted in increasing reports of unexpected injury (greater than half of one root node pruned) to "pyramided" Bt hybrids (those that express multiple different Bt proteins targeting corn rootworm) in parts of northern Illinois. The best resistance mitigation tactic is to rotate problem fields away from corn for one or more years. Soil-applied insecticides are also available to control corn rootworm larvae.

Ear feeders

Several species of caterpillar pests injure corn ears by feeding directly on kernels. Corn earworm is the most widespread of these pests; this is a migratory insect that does not overwinter in Illinois, and damage is most common in the southern portion of the state and/or when corn planting is delayed. Because feeding in field corn is mainly limited to the ear tips, compensation by the remaining kernels typically results in little to no yield impact from this insect. However, the feeding sites can facilitate ear rots, leading to quality reductions and, in some cases, mycotoxin contamination. Control with insecticides is generally not recommended in corn grown for grain. Some Bt trait packages provide effective control, though resistance to all the Bt proteins available except Vip3Aa has been documented.

Fall armyworm can also feed on kernels, but its impact in Illinois field corn is usually minor. Western bean cutworm is present in parts of Illinois, particularly in areas south of Lake Michigan that have sandier soils. Unlike corn earworm, multiple western bean cutworm are often found in a single ear, and their feeding is not limited to the ear tip. Bt corn hybrids that contain the Vip3Aa protein provide effective control of western bean cutworm. In hybrids without Vip3Aa, this insect can be controlled with a broadcast insecticide application, though timing is critical – consider an application if 8% of plants have egg masses and/or small larvae.

See "Managing Insect Pests" in the Illinois Agronomy Handbook for more detailed information on identification, biology, and risk factors for these and other insect pests.

Disease Management

Disease pressure on corn in 2022 was not very high. Of course, all years are different, and producers should continue focusing on the basics of integrated plant disease management to protect yields. Important among disease management practices is to choose disease-resistant hybrids, continuing with crop rotations, balanced fertility, and seed treatments with a mixture of active ingredients.

Tar Spot

The most challenging disease in the last two years is the new kid on the block: Tar Spot. The severity of this disease varies widely with minor environmental changes. It is more of a problem in the northern parts of the state. Still, significant yield losses have been reported.

In addition to choosing hybrids that offer at least some resistance levels, it is probably a good idea to use foliar fungicides if the disease is present shortly before tasseling. The [Tarspotter smartphone app] developed by University of Wisconsin researchers forecasts Tar Spot disease based on weather predictions. Using the tool might help avoid unnecessary applications when the environment is not conducive for Tar Spot.

Other foliar diseases

Unfortunately, Tar Spot is not the only foliar disease of importance. **Grey leaf spot** has been consistently causing issues, and there is always a chance for **northern corn leaf blight** and **rust**. If those diseases are present in the field before flowering, foliar fungicides might be the best management option.

Stalk rot

Other diseases are always possible. For example, stalk rot caused some concerns in 2022. High-quality hybrids and balanced nutrition are our best tools against this disease.

Diagnosis

Remember that you can only achieve proper management with an accurate diagnosis. The University of Illinois [Plant Disease Clinic] can help with the appropriate identification. Upon receiving an accurate diagnosis, review the recently revised "[Managing Diseases]" section of the Illinois Agronomy Handbook for comprehensive and up-to-date Integrated Plant Disease management information for all corn diseases in Illinois.

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