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Agronomy ADVICE | Tips from the Channel® Field Check Up Series

What does it take to produce 300 bushel per acre corn?

Key Points

- Yields of 300 bushels per acre are possible with today's genetics, excellent management, and stress-free environments.
- By identifying the factors that influence yields on your farm, appropriate agronomic management strategies can help maximize yield potential.

The world's population is projected to grow from seven to nine billion people by 2050, and in order to feed this population, food experts are predicting a need for corn production to reach a target corn yield average of 300 bushels per acre.[1] Yields of 300 bushels per acre are certainly possible with today's genetics, excellent management, and stress-free environments. Some growers are already producing yields in this range. What can other growers do to push their yields over the 300 bushel per acre bar?

There are several factors that can limit corn yield including: weather related stresses, pest pressures, soil characteristics, and management decisions that impact agronomic practices. By identifying the specific yield-influencing factors that impact the fields on your farm, you can then implement the appropriate agronomic management strategies to alleviate factors that hold yields back and promote those that may help enhance yields. In order to optimize corn yield, a strong foundation, including water management (drainage, conservation, irrigation)[2]; sound weed, insect, and disease management; and soil pH in the optimum range with adequate soil levels of phosphorous (P) and potassium (K) should be in place.

Predicting the Weather

Weather is the factor that impacts crop yield the most and is also the one that we have no control over (Table 1). The difficulty in forecasting the weather in general, let alone advanced notice of the occurrence or severity of extreme weather events, increases the challenge of consistently obtaining higher corn yields. The effects of weather stress on crop growth are usually compounded by the presence of other yield limiting factors. Identifying and managing factors such as soil compaction, nutrient availability as affected by soil test level and soil pH, weed competition, insect and disease damage, poor soil drainage, and other factors that compound weather factors can help improve the tolerance of our crops to the effects of extreme weather events.[3] In addition, the use of reduced tillage, compaction management and residue conservation can help conserve soil moisture for potential use at pollination and during grain fill.

Climate Pro™, a decision support tool from Precision Planting and The Climate Corporation, can provide real-time decision-making support based on weather, soil, crop, and equipment performance, allowing a farmer to respond quickly to changing weather and field conditions, and anticipate yield-reducing agronomic issues. It can also integrate data across devices and equipment (*precisionacre.precisionplanting.com*).

Table 1. Top 7 Wonders of High Corn Yield Based on University of Illinois Research.

Factor	Value
Weather	27%
Nitrogen	26%
Corn Product Selection	19%
Crop Rotation	10%
Plant Population	8%
Tillage	6%
Growth Regulators	4%

Source: Adapted from Below, F.E.[7]

Fertility Management

Fertility sets the foundation for high crop yields. In a favorable season, weather and nitrogen (N) account for more than half of corn yield potential.[1] Minimizing nutrient stress requires matching nutrient supply with plant needs. Timely application and loss prevention of N fertilizer are primary components of high-yield corn systems. Most N loss occurs after fall applications or during spring rainfall events. Research has shown that an effective N delivery system includes sequential applications of N just prior to planting, with starter fertilizer, before the V8 growth stage, and near tasseling.[4] Adding N stabilizing products can help reduce volatility loss of N and may potentially increase N availability throughout the season.

Maintaining the proper nutrient balance between macro- and micro-nutrients in the soil and availability at critical phases of corn development is crucial to high-yield corn production. Research at Purdue University has shown that current corn products take up 27% more N from the soil after flowering than older products.

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It also shows that optimum N levels in the plant increase uptake and utilization of P, K, and sulfur (S) to support higher corn yields.[4] In addition, higher N rates and plant densities resulted in greater micro-nutrient uptake and utilization for grain production. Synchronizing fertilizer availability with periods of maximum nutrient uptake is critical to achieving the best efficiency of fertilizer use and helping to maximize corn yield potential.

Selection of Corn Products

Corn yield potential can vary widely between products. When trying to reach 300 bushels per acre corn yields, corn products should be selected that can produce top-end yield potential, have the characteristics conducive to yielding in the field they will be placed into, and can provide strong yield potential under stressed conditions. Consider selecting corn products that contain strong genetics and corn trait technologies with multiple site of action insect and weed protection to help maintain the yield potential of high yielding corn products.[5,8] Products with improved drought tolerance may be a benefit as well.

Crop Rotation

The benefits of rotating corn with soybean and other crops versus growing continuous corn are widely documented. yield penalty associated with continuous corn production can be substantial, especially in no-till corn, and is the result of accumulated corn residue, decreased soil mineralization of N, and poorer performance under hot/dry conditions.[6] Fields where corn follows soybean can have better soil tilth, fewer or less intense pest problems, more manageable residue, a cleaner seedbed, and promote better overall vigor.

Maximizing Plant Population

Corn response to population is continuously changing with seeding rates across the corn growing region increasing by about 280 plants per acre per year. Corn stress tolerance has increased over the past 50 years, allowing farmers to plant more seeds per acre and withstand more environmental stress. Corn seeding rate should be matched to soil characteristics, topography, and productivity factors. Variable rate planting, precision seed distribution, and depth control can help maximize stand establishment. Narrow or twin-row arrangements have been shown to be an effective way to accommodate higher plant populations and more equidistant plant spacing.

Seed treatments, starter fertilizer, and compaction management can help promote vigorous, uniform seedling and root development that supports optimum yield potential. Seed treatment products can provide protection against seedling and seed diseases as well as early-season insects and other pests. There are also seed treatment products that can provide early-season nematode protection.

Tillage Considerations

The primary role of tillage in high-yield management systems is to distribute residue and aerate and dry the soil to create a suitable seedbed while preserving soil moisture for use later in the season. Minimizing tillage traffic and avoiding soil compaction are key considerations for any tillage program.

Setting Your Sights on 300 Bushels per Acre

The genetics in current corn products have the potential for producing 300 bushels per acre, however, that potential can be compromised by weather stress and unsatisfactory crop management decisions.[7] High yields are the result of proactive management plans and proper seed selection. A recent research study demonstrated a 28% grain yield advantage for an intensive corn management system versus the standard system.[8] This research study confirmed that all of the factors discussed in this publication, not any single factor, were necessary for intensive high-yield corn management. Farmers can make decisions to optimize the seven factors summarized in this report to reach a high-yield goal for each field. Contact your local seed representative for recommendations on product, trait, and seed treatment selection.

Sources: [1] Below, F.E. 2014. Management factors that contribute to high corn yields. http://cropphysiology.cropsci.illinois.edu. University of Illinois. [2] Hofstrand, D. 2008. Economics of tile drainage. Special Report 13. Iowa State University. [3] Nielsen, R.L. Understanding factors that limit corn yield. Purdue University. [4] Ciampitti, I.A. and Vyn, T.J.. 2013. High nitrogen rates increase micronutrient uptake, storage in corn. Purdue University. [5] Gentry, L.F. and Below, F.E. 2011. Achieving 300 bushels-per-acre corn sustainably. [6] Gentry, L.F. Ruffo, M.L., and Below, F.E. 2013. Identifying factors controlling the continuous corn yield penalty. Agronomy Journal 105:295-303. [7] Below, F.E. The seven wonders of the corn yield world. http://cropphysiology.cropsci.illinois.edu. University of Illinois. [8] Ruffo, M.L., Gentry, L.F., Henninger, A.S., Seebauer, J.R., and Below, F.E., 2015. Evaluating management factor contributions to reduce corn yield gaps. Crop Economics, Production & Management Agronomy Journal Volume 107, Issue 2. All web sources verified 04/14/2015.