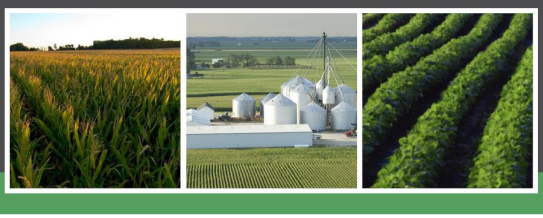

Agronomic Spotlight

High Yield Corn Management

- Current corn products have the potential to produce 300 bushels/acre if systematic integrated management practices are used.
- Omission plot research at the University of Illinois has shown that there are seven main factors that have the greatest impact on corn yield potential.
- A proactive, comprehensive management plan is required to consistently achieve high corn yields.

Several factors impact successful high-yield corn production systems.[1,5,7] Corn yield is limited by a number of direct, indirect, and interacting factors. The major categories of yield-limiting factors include weather stress, pest pressures, soil characteristics, and management decisions that impact agronomic practices. Developing a comprehensive, proactive management plan prior to planting is critical for consistently achieving high corn yield. Season-long crop monitoring to identify potential stressful conditions is necessary for precise deployment of management tactics to preserve yield potential. Managing a high-yield corn system requires an integrated approach to address interdependent factors that control corn physiology and yield.

Foundation Basics

Optimizing corn output is contingent upon building a solid foundation in each field. Before launching an intensive high-yield corn system, water management (drainage, conservation, irrigation); 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. Water management considers the seasonal distribution of rainfall, soil water holding capacity, and infiltration and runoff of rainfall. Subsurface drainage helps maintain the free water level in the soil at a depth that promotes root growth and healthy plant development, helps remove excess soil water, and permits air flow to facilitate important biological processes.[2] Subsurface drainage can help maintain consistent crop yields by providing a more mellow soil, deeper plant root zone, less compaction, earlier timely planting to maximize the growing season, earlier harvest, less soil erosion,; and less runoff of nutrients (P). Precision farming practices can help identify and correct drainage problems.[2] Sound pest management means integrated systems are in place to keep difficult-to-control weed, insect, and disease problems minimized to reduce plant stress.

Weather

The weather is consistently unpredictable in crop production and a big determinant of yield potential (Table 1). Farmers can help offset weather variability by managing plant stresses such as soil compaction, nutrient availability, weed competition, insect and disease damage, poor soil drainage, and other factors that compound weather problems.[3] Identifying the optimum planting window allows for early planting, full use of the growing season, and the potential for the crop to tolerate stressful conditions and pest pressure during pollination and grain fill. Reduced tillage, managing compaction, residue conservation, and proper nutrient placement can help conserve soil moisture for potential use at pollination and during the grain filling stage of corn growth. Decision support tools that integrate software and hardware for monitoring environmental conditions and equipment performance can provide real-time decision-making support based on weather, soil, crop, and equipment performance. This allows a farmer to respond quickly to changing weather and field conditions, and anticipate yield-reducing agronomic issues. These tools can integrate data across multiple devices and equipment (precisionacre.precisionplanting.com).

Fertility

Maintaining the proper nutrient balance between macro- and micro-nutrients in the soil at critical corn development stages is crucial to high-yield production. Purdue University research shows that current corn products take up 27% more nitrogen (N) from the soil after flowering than older products. 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. Protecting corn roots and leaf health can help the plant access and utilize more essential nutrients during reproductive growth stages. In a favorable season, weather and 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. To minimize preplant and in-season N loss, and provide N closer to the optimum uptake time (V10 growth stage through grain fill), multiple applications are recommended. Research has shown that sequential applications of N (just prior to planting, with starter fertilizer at a rate of 30 lb/acre N, before the V8 growth stage, and near tasseling) can be an effective N delivery system.

The addition of N stabilizing products can help reduce volatility, leaching, or denitrification loss of N and potentially increase seasonal availability. Deep banding (4 to 8 inches) P, K, and other nutrients under the row at planting, even on soils testing in the medium to high range for these nutrients, provided a significant benefit to yield production.[1]

Seed Selection

Corn yield potential can vary widely between products. Matching products with the highest yield potential to soil productivity levels throughout a field is essential for maximizing yield potential (Table 1). Corn products should have high-yield genetics with tolerance for higher plant densities and

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increased N rates. Corn trait technologies with multiple site of action insect and weed protection can help maintain the yield potential of these corn products.[5,8] Corn products with improved drought tolerance may be a benefit as well.

Crop Rotation

Research studies have shown that there is a benefit to annually rotating corn with soybean and other crops versus continuous corn. Modern corn products and management practices have similar responses to crop rotations as older products and practices.[7] The continuous corn yield penalty can be substantial. It 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 and a cleaner seedbed, and promote better overall vigor.

Plant Density

Corn products that respond to higher plant densities fit high-yield systems, but that response may be different from products that fit standard systems or in individual fields. The planting density 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. Soil and yield mapping can improve variable rate planting plans and help make planter adjustments to improve seed spacing, singulation, and depth control required at higher plant densities. 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 and Growth Regulators

Using a tillage system appropriate for field conditions may lead to increased yield, profit, and soil and water conservation. The primary role of tillage in high-yield management systems is to distribute residue, 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. However, tillage is not nearly as important as many farmers assume it is for realizing high yields, based on University of Illinois research.[1] Growth regulators can help promote healthy plant growth, preserve green leaf tissue, or ward off pest problems that can limit corn yield. Examples include the growth regulator effect of strobilurin-based fungicides on leaf greening and the overall improved plant health attributed to corn seed treatments that exhibit growth regulator effects.

Table 1. Top 7 Factors for 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: Below, F.E. 2014. Management factors that contribute to high corn yields. University of Illinois.[1]

Summary

Yield potential in current genetics may be substantially higher than in previous corn products but can be compromised by weather stress and unsatisfactory crop management decisions. 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

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] Lauer, J. 2010. The natural benefits of crop rotations and the costs of monoculture. 2010 University of Minnesota Crop Pest Management Shortcourse. [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. Web sources verified 04/14/2015. 140214060649

For additional agronomic information, please contact your local seed representative. Individual results may vary, and performance may vary from location to location and from year to year. Developed in partnership with Technology, Development, & Agronomy by Monsanto.