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What is the best seeding rate for corn based on seed prices and yield level?

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What is the best seeding rate for corn based on seed prices and yield level?

Abstract

Corn yield trends continue to increase in Iowa and across the country. In Iowa, yield is increasing at about 2 bushels per acre per year since the early 1970s. Research conducted at Iowa State University by Don Duvick, adjunct professor of agronomy, focused on comparing "era hybrids" to modern-day hybrids. Analysis of these hybrids has shown that approximately half of the annual yield increase is due to plant breeding efforts and the other half is due to improved crop management practices.

Keywords

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Crop Production

What is the best seeding rate for corn based on seed prices and yield level?

by Roger Elmore and Lori Abendroth, Department of Agronomy

Corn yield trends continue to increase in Iowa and across the country. In Iowa, yield is increasing at about 2 bushels per acre per year since the early 1970s. Research conducted at Iowa State University by Don Duvick, adjunct professor of agronomy, focused on comparing “era hybrids” to modern-day hybrids. Analysis of these hybrids has shown that approximately half of the annual yield increase is due to plant breeding efforts and the other half is due to improved crop management practices.

So, why are we discussing seeding rates in relation to plant breeding efforts and crop management practices? It is because breeders have focused largely on increasing stress tolerance of individual corn plants, specifically by increasing their ability to withstand increased plant densities. A significant portion of the observed yield increase per year is directly correlated with increased plant populations. Years ago, corn was planted with the check or hill-drop system that used seeding rates around 12,000 seeds per acre. In the 1960s, we planted approximately 16,000 seeds per acre. Over these past 50 years though, seeding rates have increased annually. Duvick reports a seeding rate increase of approximately 400 seeds per acre per year. This trend has continued across the Midwest (Figure 1). Iowa plant populations have increased about 425 plants per acre per year since 2001.

Are these higher populations crucial for obtaining high yields? Some suggest that the higher seeding rate trends are due to the advancement of hybrids that primarily perform best under higher populations. Yet, others suggest that producers are planting hybrids at seeding rates higher than recommended, thus forcing corn breeders to produce hybrids that can tolerate higher seeding rates. No matter which is ultimately true, it is clear that yield increases over the past 50 to 60 years have come not from increased grain per plant but rather from increased plants per acre. Increasing seeding rates has been paramount to increasing yields.

Research conducted by Dale Farnham, former ISU Extension corn specialist, demonstrates the importance of high plant populations for Iowa (Figure 2). Yields were maximized with final plant populations near 32,000 plants per acre. Reducing population 1,000 plants per acre caused a greater yield loss than increasing it that much. Research conducted in 2005 at the

Armstrong Research and Demonstration Farm by Clarke McGrath, field crop specialist; Bernie Havlovic, superintendent; and Jeff Butler, ag specialist; included seeding rates of 28,000 to 40,000 seeds per acre. None of the seeding rates yielded differently from the others. The 28,000 seeds per acre rate yielded 220 bushels per acre, whereas the 40,000 seeds per acre rate yielded 225 bushels per acre. We intend to conduct seeding rate research across the state in 2006.

Corn seed prices are increasing on average \$1.30 per acre per year (Iowa Farm Business Association, 2005 [see Figure 1, p. 59, ICM, IC-496 (4), March 13, 2006]). As seed prices increase, the yield advantage of planting more seed may become economically counterproductive. To show this relationship, we’ve used the data from Figure 2 and removed seed costs (Figure 3). Corn grain market price was set to \$2.00 per bushel. An estimate of 10 percent stand loss was used to account for poor germination and emergence loss. Depending on the number of traits included, seed prices can vary significantly; thus, we used a price range from \$1.00 to \$2.50 per 1,000 seed. The stars mark the seeding rate that has the Maximum Return to Seed (MRTS) for each seed price and yield level. The vertical bars on either side of the MRTS indicate a \$5.00 range in Return to Seed.

We notice two things in Figure 3. First, as seed price increases, MRTS decreases. Second, the decrease in MRTS is more evident at the 180 bushel yield level than with the 220 bushel yield level. With the lowest seed price, a seeding rate of 33,000 resulted in the highest MRTS for both yield levels. Yet, as seed price increases, seeding 3 to 6 percent fewer seed (1,000 to 2,000 fewer seeds per acre) results in the highest MRTS.

Obtaining high yields is critical for staying ahead of persistently increasing input costs. Therefore, it is important to use the correct seeding rates. If producers have not changed seeding rates within the past 5 years, they most likely should. New hybrids are developed for higher seeding rates. On the other hand, as seed prices increase, we must strive to attain maximum return to seed rather than maximum yield.

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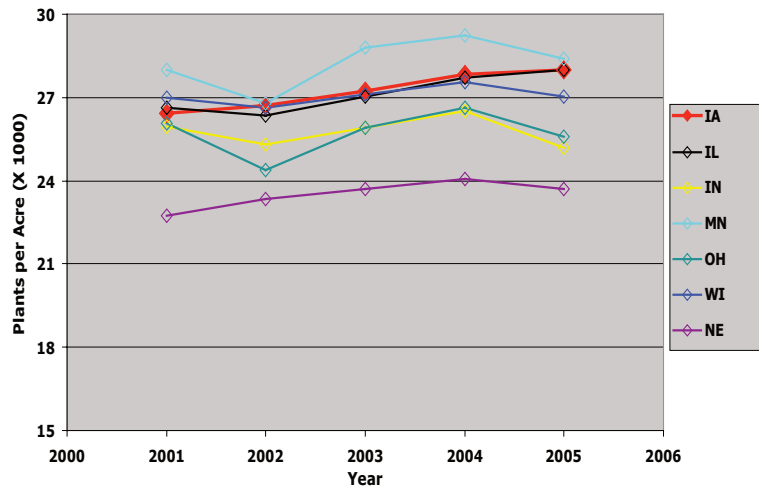


Figure 1. Plant populations at harvest, 2001–2005, Corn Belt states.

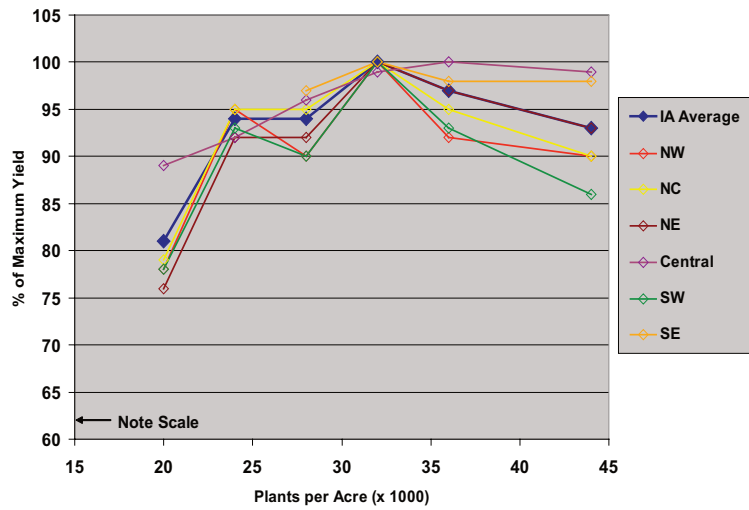


Figure 2. Corn yield response (%) to plant population in Iowa, 1997–2000. (D. Farnham, Iowa State University)

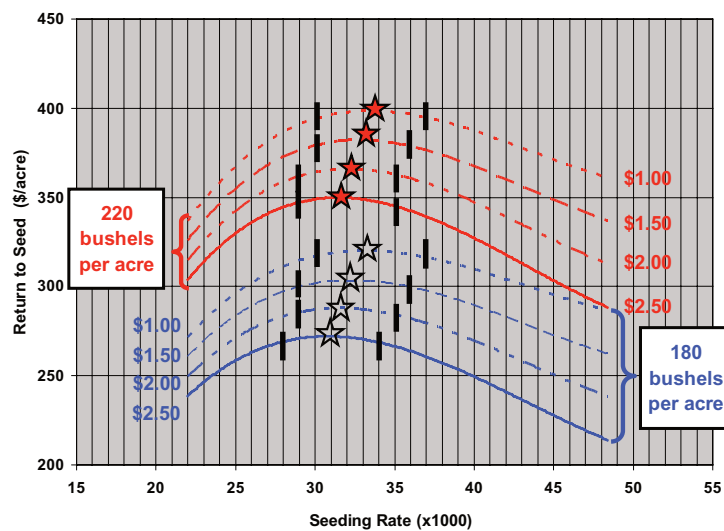


Figure 3. Net income for different seed prices (per 1,000 seed).