Populations and Variable Rate Seeding for Corn

Corn seeding rates have steadily increased over the past 25 years with genetic improvements in plant stress tolerance and agronomic practices. The optimum seeding rate for a field is a balance between getting the most ears per acre without compromising the number of kernels per ear and kernel weight, and maintaining stalk health and integrity. Variable rate planters provide an opportunity to match optimum seeding rates to the productivity of each segment of a field.

Early planting, plant density, and uniform spacing between plants are essential to obtain optimal corn yield potential. Final plant populations between 32,000 and 38,000 plants/acre (ppa) are typically required for maximizing corn yield and profitability across the majority of northern corn producing states. Early maturing products usually require higher populations than later maturing products. Yield gains from higher plant densities is primarily a result of increased light interception by the corn canopy during the reproductive stages of development.

Seeding rates have been increasing steadily by 300 to 425 ppa per year during the last 25 years. Optimum corn plant population may need to be adjusted upward for higher-yield environments.1

Seeding rates should reflect the germination percentage on the seed tag, which is generally greater than 95% but can be as low as 85%. Generally, seeding rates should be at least 5% more than the desired final population to compensate not only for germination percentage but seasonal climate, soil type, soil condition, and moisture.

In a two-year research trial at the University of Minnesota from 2005 to 2008, optimum corn ppa were not affected by planting date and row spacing.1 Corn yields varied between planting dates but the optimum population was constant across the planting date comparisons. The results from this research showed that a plant population between 33,000 to 39,000 ppa was needed to maximize corn yield potential (Figure 1). Iowa State University evaluated a range of corn populations at 10 locations across Iowa and found that yield was maximized at seeding rates of 34,000 to 38,000 ppa.3 Research from the University of Illinois has shown that corn yield peaks about 37,000 ppa and levels off at higher populations.4 They also point out that “the economic risk of having populations too low for good conditions tend to be greater than the risk of having them too high, even when seed is expensive.”5 In lower yield environments, where moisture or soil productivity is less than optimum, corn yield can respond to an increase in population but will peak earlier and decline depending on resource limitations. Improvements in corn stress tolerance, production practices, and pest control will require on-farm, field-specific data to adjust corn plant populations to optimize corn yield and profitability.

Variable Rate Seeding

Adjusting seeding rates to variable soil conditions in a field can improve overall field productivity. Corn planters with the capability of varying seeding rates on-the-go are becoming more common. Variable rate seeding (VRS) has been shown to be most practical in fields with soil variability, particularly in areas with less than ideal growing conditions. Uniform soils are less likely to show a consistent benefit.6,7 Optimum corn seeding rates may vary from 5,000 to 12,000 ppa across a field due to variations in soil productivity.5,7

Hydraulic drives on newer planters and after-market drive systems make it possible to manage smaller sections of a planter or individual planter units to facilitate on-the-go prescription planting. Navigation and seed control devices can contribute to accurate adjustments to seeding rates.

Although equipment capabilities have improved...
rapidly, there has been a lag in research to support profitable use of the technology. Most research and on-farm experts working with VRS rely on subjective knowledge and spatial data to develop VRS zones, until enough data can be gathered to fine tune yield potential predictions and corn populations to support optimum corn production. Seed companies, consultants, and universities are engaged in researching VRS in the Dakotas, Iowa, and Illinois.3,4,5,6

To develop prescription maps for variable rate planting, agronomists recommend gathering as much information as possible on soil variability in fields, along with data measuring the corn yield response to those conditions. A variable rate prescription should be based management zones in each field. A management zone can be built using yield maps, soil map units, topography, landscape, slope, drainage, soil conductivity, and aerial imagery. That information can be used to get a complete estimate of yield potential in each management zone in a field. A farmer should not rely solely on soil survey maps as a basis for VRS zones. To help determine the potential effect of variable rate seeding, a farmer should conduct field scale testing of different corn populations. A good method is to split a planter and plant alternating strips of two seeding rates, above and below, a normal seeding rate for the area or operation. Harvest data from the yield monitor can be layered with aerial images, soil information, and topography to estimate yield potential of each zone. Management zones need to be continually evaluated and revised, primarily because high-yielding areas of a field may change with varying rainfall or other environmental conditions.

For VRS to be successful, getting the population right for each zone is important, but if seed spacing and placement are not precise, stand establishment may be compromised, limiting the potential yield benefit.

**FieldScripts℠**

The technology and supporting products for VRS are currently in the hands of many farmers but there’s a need for expert advice and the software tools to execute VRS properly. Monsanto has coupled its understanding of the performance of plant genetics in different environments with exclusive data analysis and a knowledge of precision planting equipment to help farmers maximize yield potential. FieldScripts℠ is the first product from Monsanto’s Integrated Farming Systems platform which uses exclusive seed-by-environment data to deliver a specific product match for each field with a VRS prescription by yield management zone. FieldScripts will be tested in the 2013 Ground Breakers® program in several Midwestern states. This will be the third year of field testing. Participating farmers will provide inputs like field boundaries, yield data, and fertility test results. In return, participants receive a prescription that will be executed by a Precision Planting® 20/20 SeedSense® monitor and planter control system. A FieldView® app for iPad® will provide a real-time image of population, singulation, down force and seed spacing for each row unit (Figure 2). This exclusive system will provide the means to execute VRS with precision seed placement. The Ground Breakers program will provide the testing framework to understand planting practices, stand establishment, in-season performance, and harvest data to assist farmers with the evaluation of VRS.

**Sources:**

*Individual results may vary, and performance may vary from location to location and from year to year. This result may not be an indicator of results you may obtain as local growing, soil and weather conditions may vary. Growers should evaluate data from multiple locations and years whenever possible.*

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