PHYSIOLOGICAL REPSONSES OF CORN TO VARIABLE SEEDING RATES IN LANDSCAPE-SCALE STRIP TRIALS

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Yield improvements over the past few decades have been attributed to increasing optimum plant population and not the increase of grain produced per plant. A goal in precision agriculture is to identify seeding rates that optimize yield, but that also minimize intra-specific competition. Intra-specific competition occurs when plants of the same species compete for vital resources needed for plant growth and fruit development. Intra-specific competition can cause stress for multiple resources crucial to plant growth and performance.

It is important to understand how seeding rate can govern stress and also understanding what rate is optimal for highest yield. Intra-specific competition in corn can cause a decline in kernel number per plant as well as an increase in the number of barren ears due to a decrease in light interception, and nutrient and water uptake (Maddonni and Otegui, 2004). Modern hybrids however have a greater tolerance to higher planting populations in part due to their improved ability to support and maintain photosynthesis. One mechanism for this increased tolerance is that per plant leaf areas remain relatively constant with increased seeding rate, but leaf area index is greater because of higher planting populations (Dwyer and Tollenaar, 1989; Tollenaar et al., 1992). The objective of this study is to examine corn development and physiological response of multiple hybrids across the growing season at a range of seeding rates.

Working with cooperators we have implemented a field scale strip-trial design at seven locations in the Central Claypan Areas of Northeast Missouri. The study includes four different hybrids at three different seeding rates: 74,100, 83,980, and 93,860 seeds ha^{-1}. Individual locations serve as replicates in a spatially distributed analysis of variance design. Treatments are laid out in field length strips, six or eight rows wide at 30-inch spacing. Measurements were tracked regularly throughout 2013 in small plot areas including: plant growth stage, plant height, normalized difference vegetation index and normalized difference red edge, leaf area index, plant biomass. Max vegetation measurements included the above plus ear height and stem diameter. At the end of the growing season yield was measured by hand sampling small plot areas and at field scale by yield monitor. Further we measured yield components of hand harvested sub-samples including barrenness, kernel rows, kernels per row, kernel mass, and kernel count.

Results show that as seeding rate increases over the growing season the leaf area index also increases over a series of growth stages (see figure 1.). However the leaf area per plant does not increase over the growing season, nor does a change in seeding rate result in an increase of leaf area per plant. Normalized difference vegetation index (NDVI) can give insight into such responses specifically canopy structure of corn. We correlated NDVI to canopy height, LAI, closure and color of vegetation to assist further study of spatially variable inter-specific competition effects in variable rate seeding trials.

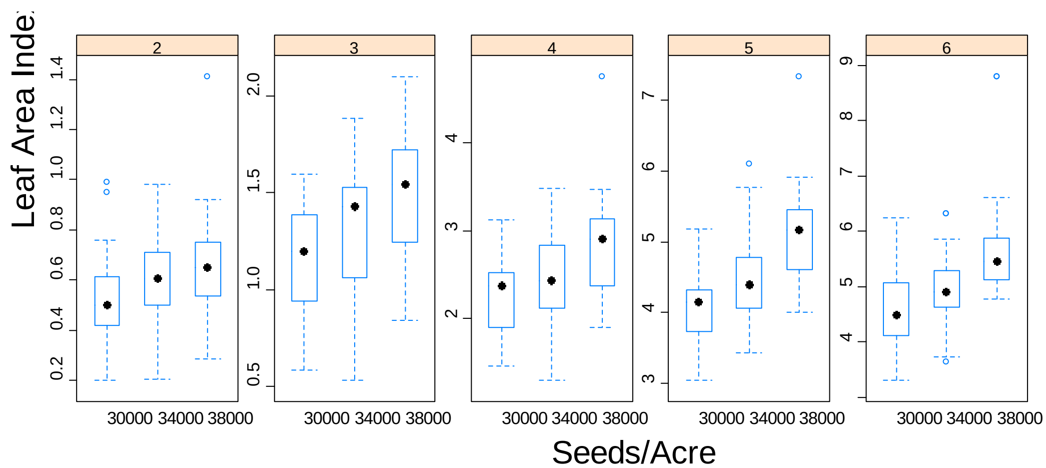

Figure 1. The growth stages in figure 1 are V7 for date 2, V8 for date 3, V10 for date 4, V13 for date 5, R2 for date 6.

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