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Corn Plant Population: The second most important management decision for moving off the yield curve

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The Kernels

- Farmers are increasing plant densities (PD) in commercial fields
- The economic optimum plant density (EOPD) is lower than the plant density required to maximize grain or forage yield (MYPD).
- The economic optimum plant density is likely different between farms and fields within farms.
- To move off current yield levels, begin by planting a field to what you think is the optimum plant density and at two or three places (rounds) in the field, increase plant population by 10%.

Farmers are increasing plant densities (PD) in commercial fields (Figure 1). In research plots, the plant density that maximizes corn grain and silage yield has been increasing through time. The economic optimum plant density (EOPD) is a function of corn yield and quality responses, seed cost, and grain or silage price. The economic plant density is lower than the plant density that maximizes yield (MYPD).

Farmers have many questions including: What is the maximum yield PD (MYPD)? What is the economic optimum PD (EOPD)? Is the MYPD and EOPD the same for silage and grain? Do hybrids differ for MYPD and EOPD? Do fields differ for MYPD and EOPD? How does yield risk change with increasing plant density? How does drought affect MYPD and EOPD? Is lodging and barrenness affected by plant density? How should variable rate technology in precision farming systems be adjusted in-field?

Since 1997, plots have been that are 8 rows wide by 25 feet long. Four rows are harvested for silage and the remaining 4 rows are harvested later for grain. The target plant densities have varied by year and ranged from 14 000 to 56 000 plants/A. Adapted, high-performing hybrids were selected using results from the UW Corn Trials and varied for relative maturity (full- and shorter-season). Milk per Ton and Milk per Acre were estimated using Milk2006. The treatment (hybrid x plant density) mean that maximized the measure within a year was set to 100%. The results in Figure 2 were summarize the relationship between various measures and plant density across all experiments conducted between

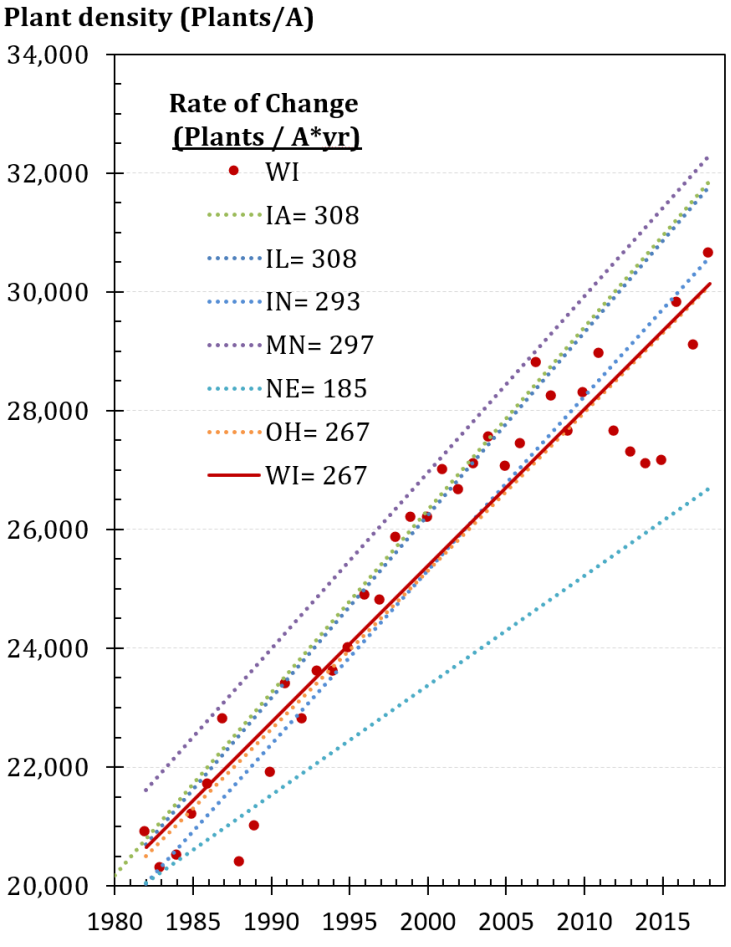

Figure 1. Corn plant density of farmer fields since 1982. Data source: USDA-NASS.

2008 to 2017.

Maximum grain yield was measured at 41 000 plants/A. The relationship increased to a maximum and then decreased as plant density changed. In agronomic research, it is very difficult to measure grain yield differences less than 5%. So, grain yields within 5% of the maximum grain yield were measured at plant density above 30 000 plants/A. The economic optimum plant density (EOPD) was 35 000 plants/A. The EOPD was within 95% of the maximum at 26 000 plants/A.

Maximum forage yield was measured at 48 000 plants/A and was within 5% of the maximum when plant densities were above 35 000 plants/A. Forage quality as measured by Milk per Ton decreased linearly from a maximum at 18 000 plants/A, but was within 5% of the maximum across the range of plant densities measured. Maximum Milk per Acre was measured at 45 000 plants/A and was within 5% of the maximum at 32 000 plants/A. These results are a good example of the trade-off that exists between forage yield and quality, i.e. the plant density that maximizes Milk per Acre is intermediate between plant densities that maximize forage yield and Milk per Ton.

Plant densities that maximize grain and forage yield are higher than currently recommended plant densities. These results indicate that the plant density that maximizes forage production is about 7000 plants/A higher than the plant density for maximizing grain yield. The economic optimum plant density is lower than the plant density required to maximize grain or forage yield. The economic optimum plant density is likely different between farms and fields within farms.

Adjusting plant density is probably one of the best ways to move off current yield levels. Begin by planting a field to what you think is the optimum plant density and at two or three places (rounds) in the field, increase your population by 10%. For example, if you currently plant at 30 000 plants/A, do so for the majority of your field, but in two or three rounds increase the population to 33 000 plants/A. Measure yield at the end of the season and during the season watch for "runt" plants, tillering, prolific versus ear bareness on plants, big versus small ears, ear tip "nose-back" and plant lodging. Adjust the field accordingly the following year.

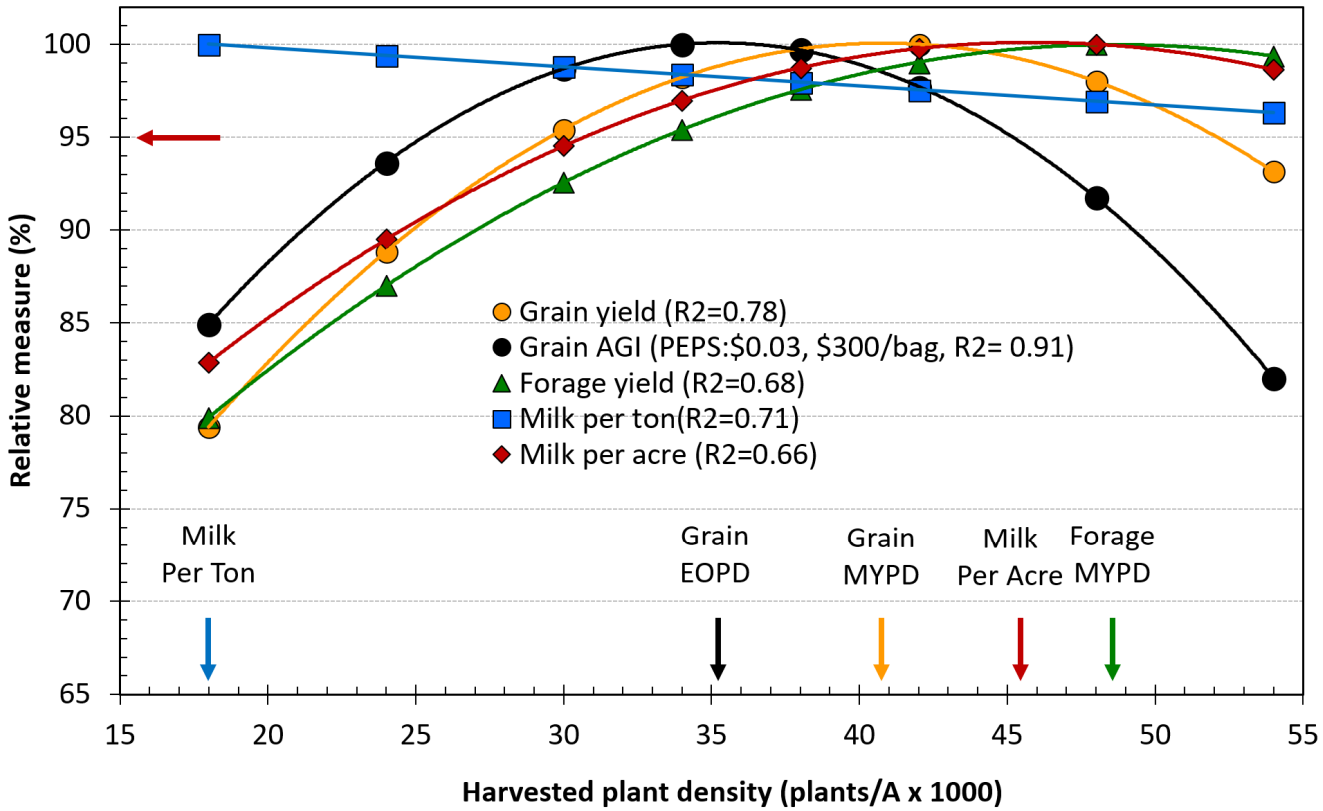

Figure 2. Relationship between corn plant density and grain yield, economic optimum (AGI), forage yield, Milk/Ton, and Milk/Acre. Data source: Lauer (Arlington 2008-2017).