# Mississippi Corn Promotion Board
# 2014 Progress Report

Project Title: Planting Density and the Effect on Dryland Yield Stability


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## Project Summary (Issue/Response)

Optimal plant population depends upon rainfall amount and timing, hybrid, soil type, and fertility. We investigated several of the most promising commercial hybrids at three locations with population densities ranging from 20- to 40-thousand plants per acre. We conducted this research at three locations, two of which we included a planting-date component. In summary, we think that by planting corn earlier we can stabilize and likely improve corn yields. Because for corn planted early, moisture during May (the reproductive phase) is more plentiful and temperatures cooler, raising plant populations might improve yields even further. This growing season was wet and cool, and raising the dryland populations up to 35K plants per acre produced favorable results worth further investigation. In fact, at Verona in 2013, yield for DKC67-57 at 35K ppa fertilized with 200 lbs N generated 230 bu/A in this replicated trial, the largest dryland corn yield ever produced at this research station. Starkville 2014 yield data was again exceptional with several of the treatments with high plant populations resulting in dryland corn yield of 250+ bu/A with relatively modest N input (200 lbs/A). We are excited about these data.

## Project Results/Outcomes

Corn yields are heavily influenced by moisture availability throughout the growing season. All cereal crops require water to produce grain, but corn is more sensitive than other crops about the time at which this moisture is received (Nielsen et al., 2010, Nielsen et al., 2009, Ma et al., 2012). These studies identified a critical period for corn production during which moisture must be present to ensure optimum yields. This critical period is a two to three week window around tasseling. Unlike producers in the Great Plains (Nielsen et al., 2009), Mississippi corn producers typically begin the year with a full soil profile leaving rainfall received during the critical period around tasseling to determine yields. Widespread drought has dramatically influenced corn production throughout the United States in 2012.

Assuming adequate fertility and weed control, water availability during the reproductive phase pretty well determines corn yield. It then becomes our challenge to match plant populations with water availability during this time in order to optimize corn yields. This study will target 15 March as the optimal planting date because this is the earliest recommended planting date according to MSUCares. Planting earlier in the Spring will ideally shift the reproductive phase of corn growth forward into May or early-June. Rainfall amounts in June and July decrease and become more sporadic (Figure 1). Although Figure 1 does not include data from 2011 and 2012, both of those years experienced significant droughts in mid- to late-June supporting the above statements about moisture availability in the mid-summer months.

# Project Impacts/Benefits

In practical terms, we would be evaluating if a producer could reduce plant populations to save seed costs without being penalized in years with above average rainfall and potential for high yields. Conversely, we would also be testing if a producer could increase plant populations and benefit with higher yield, so long as he were not penalized by a hot, dry year which would result in higher stress and low yield. Somewhere between these two alternative strategies lies the optimum plant population which we hope to determine through this research project. Because the overall stress tolerance of newly available commercial corn hybrids has steadily improved over the past 5 to 10 years (Lloyd pers. comm., 2012), we propose this research project to investigate various planting densities to help producers optimize economics and agronomics in a dryland setting.

Corn yield in Mississippi was strong once again in 2014 in fact, Mississippi's state average improved to 180 bushels per acre. The growing conditions were very favorable for corn production. Moisture was plentiful throughout the season, especially during June and July which is very unusual and cooler temperatures (especially night temperatures) during tasselling were also lower than usual. This allowed plants to avoid stress during this critical window which resulted in favorable yields. As shown in Figure 1, our dryland yields at Starkville, MS (MSU) ranged from approximately 184 to 259 bu/A. As shown in Figure 2, dry-land yields at Verona, MS ranged from 175 to 238 bu/A.

Our planting dates this year were 14-Mar and 21-Apr for the Starkville experiments and 21-Apr and 12-May for Verona. Unfortunately, we weren't able to plant at Brooksville, like a lot of producers; we struggled to get into the field because of wet conditions (poor drainage) and missed our planting window there. However, our foresight in preparing beds, applying residual herbicides, and anticipating wet spring growing conditions at Starkville allowed us to plant earlier than the previous year. We were able to expose hybrids to less optimal growing conditions and further observe their stress tolerance in these conditions. Additional studies and research proposals will deal with bed/soil preparation, cover crops, and trying to make early planting suitable for no-till/con-till farmers.

Much like the 2013 field experiments, varieties appeared to respond favorably to increased plant populations trending upward with each increased plant population. Our highest populations of 40K at the 14-Mar planting date at Starkville produced yields of 242 bu/A, and the 21-Apr planting produced yields of 251 bu/A. Similar to the 2013 results the ear size and cob length were reduced as compared to lower populations, but yields were still very good throughout the experiment. Our highest populations of 40K at both the early and late planting dates at Verona produced yields of 235 bu/A.

Across populations as we increased from 20K ppa to 40K ppa yields trended up with each population increment. Individual hybrid response to increasing populations was different among hybrids, but also followed and upward trend in regard to yield. Across hybrids the rate at which the greatest yield boost was received from increasing plant populations was different for each planting date and location.

The summary of this trial is that these newer stress-tolerant varieties appeared to tolerate high populations quite well; however, **we must note that this was again a wet growing season**, especially late season. We need to conduct this study over additional locations (seeking an additional location at DREC, with J. Krutz) and site years to determine how well these early planting dates and elevated populations respond to a warm spring and periods of drought mid- to late-summer. We also need to incorporate the guidance of our economist to determine the profitability of the higher populations because higher yield doesn't always equal higher net profit. We also need to consider the risk associated with increasing the population, because we haven't seen a really dry year in the first two years of this study. The first two years of data are very promising, and we thank the MCPB for your continued support of this research.

# Project Deliverables

Field Day at MSU NE MS Verona Research Station, SAAS Poster/Presentation @ Southern Regional Agronomy Meeting + 2 graduate students attending with me with both of them presenting research funded by MCPB; thank you.

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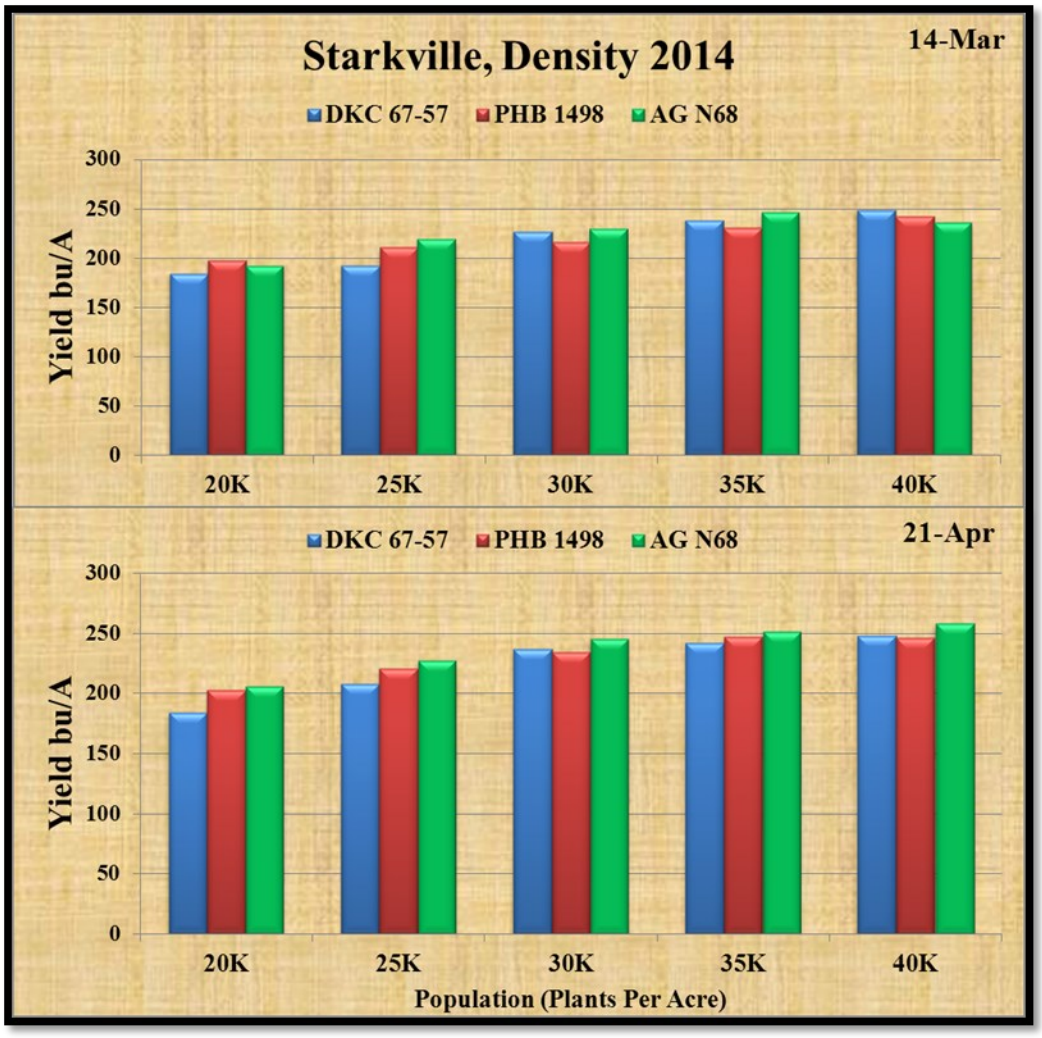
# Graphics

**Figure 1.** 2014 planting densities and corn yield at Starkville, MS.



# Graphics (continued)

**Figure 2.** 2014 planting densities and corn yield at Verona, MS.

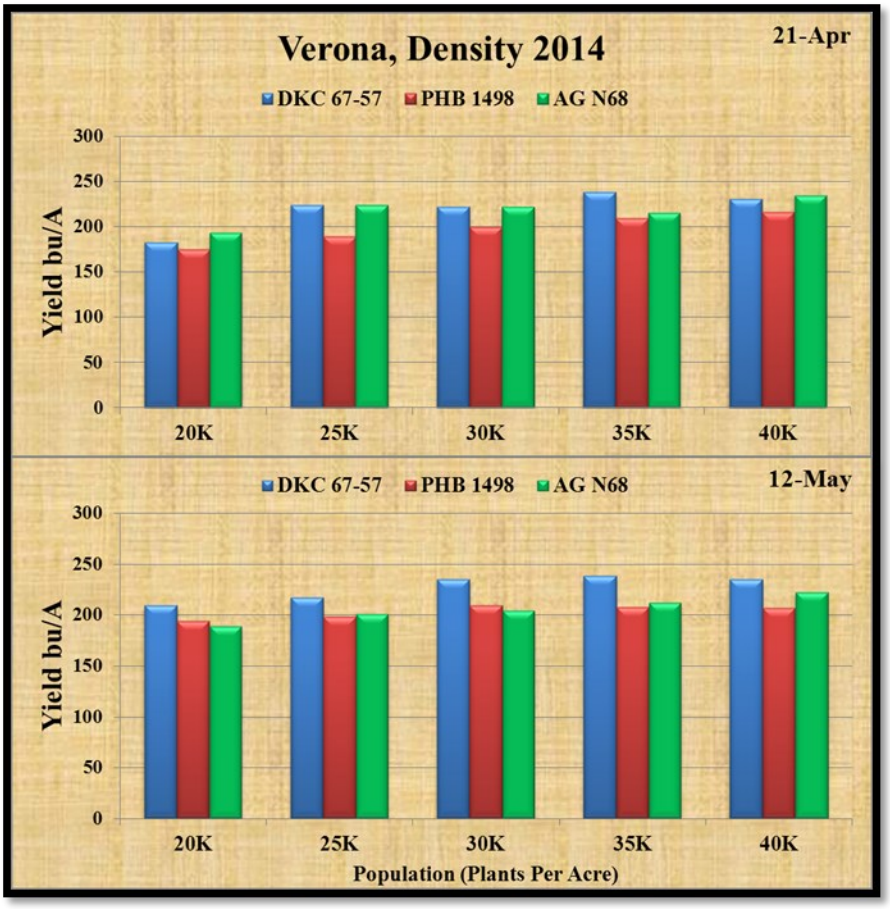



**Figure 3.** 2014 rainfall and temperatures at Starkville, MS