Mississippi Corn Promotion Board
2013 Progress Report

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

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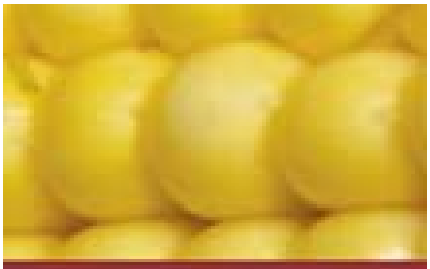

Project Summary (Issue/Response)

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 this year, 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.

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 in 2013. Moisture was plentiful throughout the season, and temperatures (especially night temperatures) during tasselling were 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 Verona, MS ranged from approximately 150 to 230 bu/A. At Brooksville, MS, yield ranged from 130 to 180 bu/A. Starkville, MS (MSU) (data not shown) yield samples have yet to be processed, but yields were lower than Verona and Brooksville because the study was grown on a poor field.

By planting earlier, we decreased the probability of corn plants having exposure to heat and drought stress during this critical window of tasselling and reproduction phases, and increased the likelihood of having weather like we experienced this season: wetter and cooler.

Our planting dates were not especially early this season because we, like a lot of producers, struggled to get into the field because of wet conditions. This next season, we hope will be different because we are preparing beds, applying residual herbicides, and anticipating getting these trials planted even earlier. Future 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.

Most of the hybrid varieties appeared to respond favorably to increased plant populations up to the 35K range. Populations up to 40K at the 1-May planting date at Verona continued to produce yields in the 160-170 bu/A range, even though ear size and cob length were reduced. 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 a wet growing 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. The first year of data is very promising, and we thank the MCPB for your 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. 2013 planting densities and corn yield at Verona, MS and Brooksville, MS

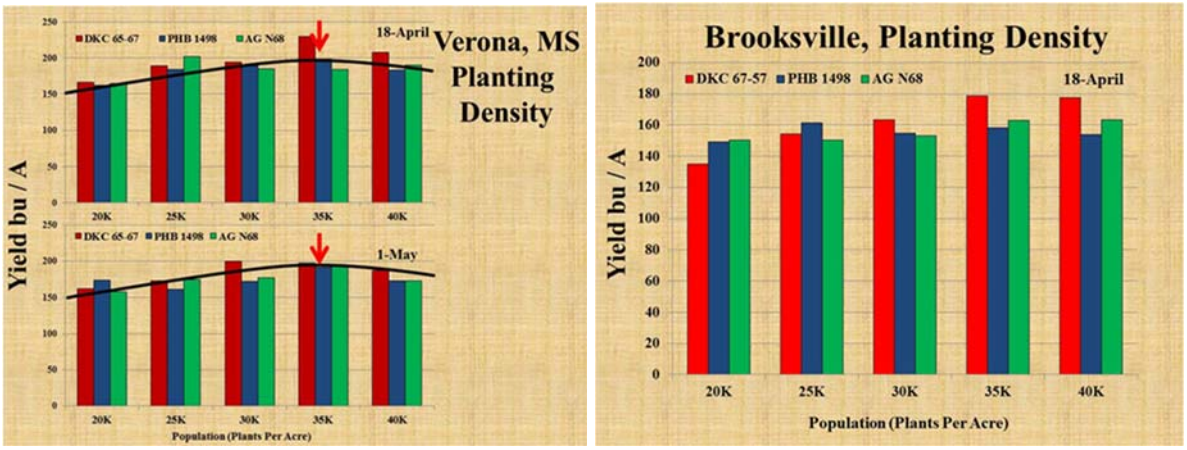

Figure 2. Monthly rainfall totals recorded in Stoneville, MS over the past 40 yrs.

These data represent rainfall totals for the past 40 yrs, 10 yrs and 5 yrs.