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Corn and Dry Soils at Planting, Looking ahead to 2012—Part III: Plant population changes?

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Abstract
Dry conditions persist in many parts of Iowa as documented in Part I of this series. In areas of the Corn Belt with poorer soils and/or reduced rainfall, farmers typically reduce plant populations to compensate for the conditions. Is that something we should consider in Iowa if conditions remain dry at planting?

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Corn and Dry Soils at Planting, Looking ahead to 2012 – Part III

Part III: Plant population changes?

By Roger Elmore, Department of Agronomy

Dry conditions persist in many parts of Iowa as documented in Part I of this series. In areas of the Corn Belt with poorer soils and/or reduced rainfall, farmers typically reduce plant populations to compensate for the conditions. Is that something we should consider in Iowa if conditions remain dry at planting?

What if it is dry at planting in 2012, should you consider lower plant populations?

Methods
As in Part I and II of this series, I used a corn simulation model (Hybrid-Maize) to answer this question. As mentioned, the model uses historic weather data from automated weather stations. I used data from five of ISU's Research and Demonstration Farms, one in each of the four corners of Iowa and the other near Ames in central Iowa. The model allows users to change soil moisture conditions at planting to simulate different possibilities. I compared two scenarios: A. 75 percent field capacity (FC) in the topsoil (0-12 inches) and 100 percent FC in the subsoil (12-40 inches), and B. 50 percent FC in both topsoil and subsoil. I realize that many soils now are drier than 50 percent FC so the second possibility may be overly optimistic for those areas. Other common inputs for each site modeled are provided in Table 1 (with the exception of plant population). Factors that varied across locations such as soil textures are shown in Table 2. (See Part I for Tables 1 and 2).

Given the two soil moisture scenarios at planting, the model allows us to estimate the effects of changing plant populations on simulated yield. As mentioned in the other two parts of these articles, the model assumes a generic hybrid and models corn growth based on temperature, solar radiation and precipitation actually recorded in the weather database for each research farm.

For this comparison, I used a single hybrid at each location: Northwest (NW) and Northeast (NE) locations: 2500 GDD (about 105 days RM); Central, Southwest (SW) and Southeast (SE) locations, 2600 GDD (110 days). The major change in these simulations from that discussed in Part I of these articles is that I assumed final plant populations of 27,000, 32,000 and 37,000 plants per acre at each location with each of the two soil moisture scenarios at planting.

Simulation Results
Yield estimates were consistent across both scenarios for soil moisture at planting for the three plant populations. That is although estimated yields were often greater when planting occurred with moist soil versus dry soils (we talked about this in Part I), the population effects were relatively

consistent across both soil moisture scenarios (Table 5). In most cases, the number of years and the specific years where the higher plant populations were superior to the lower plant populations were the same in both soil moisture scenarios.

Table 5 displays the number and percentage of years where the lower of two plant populations increased simulated yields for the two soil moisture at planting scenarios. In all cases, with moist soils at planting, the lower plant population resulted in higher yields more often than if soils were dry at planting.

Locations varied in their responses. At the SE research farm near Crawfordsville, with dry soils at planting 32,000 ppa increased yields over those of 37,000 ppa one-third of the time. With wet soils at planting, in all but one year (1997) 37,000 ppa increased simulated yields over 32,000 ppa. Lower plant populations in NW and SE Iowa have a greater probability of resulting in greater yields that higher plant populations if soils at planting are dry than in other parts of the state.

The modeled yields show that higher plant populations improve the chances for higher yields in high-yielding years (see figures linked in the endnote). In lower yielding years, yields resulting from different plant populations are similar; thus, seed costs associated with higher populations may not be offset by yield increases in lower yielding years. But the probabilities of greater returns from higher seeding rates in better years would seem to counterbalance those concerns.

Summary
As mentioned in the other articles in this series, we all know that many things can happen between now and planting. If soil moisture conditions do not improve – that is soils are dry at planting – what I've tried to explain here is that planting to achieve high plant populations is a good approach, as it is every year (see information on typical plant population responses). Meanwhile, as before, let's hope for complete recharge of our soil before planting!

Endnote: This article and the two associated with it summarize portions of the 2012 Crop Advantage Series (CAS) talk entitled "Long silks, short pollen, …a long year" presented in January 2012. Figures presented at CAS provide more detail and are available here: CAS Part III slides.

Table 5. Years where simulated yields of lower plant population were greater than that of the higher plant population as affected by whether soils were dry or wet at planting.

ISU Research and Demonstration Farm (Years of weather data)	FC at planting‡	32,000 vs. 27,000 plant per acre		37,000 vs. 32,000 plant per acre	
		Number of years	Percent of years	Number of years	Percent of years
Northwest (24)	75/100	5	21%	5	21%
	50/50	8	33%	7	29%
Northeast (24)	75/100	3	12%	3	12%
	50/50	4	17%	3	12%
Central (26)	75/100	0	0%	0	0%
	50/50	4	15%	4	15%
Southwest (15)	75/100	1	7%	0	0%
	50/50	3	20%	2	13%
Southeast (24)	75/100	3	12.5%	1	4%
	50/50	10	42%	8	33%

† FC = Field Capacity. 75/100 (wet) = topsoil at 75% FC, subsoil 100% FC; 50:50 (dry) = topsoil at 50% FC, subsoil 50% FC.

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