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Corn and Dry Soils at Planting, Looking Ahead to 2013—Part I

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Abstract
Iowa 2012 corn yields ended at 137 bu/acre (see USDA-NASS data), dropping 22 percent below the 30-year trend line yield of 180 bu/acre. For comparison, in 1988 Iowa corn yields were 29 percent below trend line. Based on the U.S. Drought Monitor and modeled soil moisture data from Mesonet (Volumetric Soil Water Map), 2013 conditions so far appear worse than those of 2012. Optimism wanes for normal soil moisture profiles at planting. That concerns most of us connected to agriculture across Iowa, which really should be everyone! Remember, soil moisture conditions were a hot topic for us last winter as well. I addressed that situation beginning with a series of ICM articles in January 2012 (Part 1, Part 2, Part 3).

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Part I - Plant population changes?

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Iowa 2012 corn yields ended at 137 bu/acre (see USDA-NASS data), dropping 22 percent below the 30-year trend line yield of 180 bu/acre. For comparison, in 1988 Iowa corn yields were 29 percent below trend line. Based on the U.S. Drought Monitor and modeled soil moisture data from Mesonet (Volumetric Soil Water Map), 2013 conditions so far appear worse than those of 2012. Optimism wanes for normal soil moisture profiles at planting. That concerns most of us connected to agriculture across Iowa, which really should be everyone! Remember, soil moisture conditions were a hot topic for us last winter as well. I addressed that situation beginning with a series of ICM articles in January 2012 (Part 1, Part 2, Part 3).

It doesn't surprise any of us that in areas of the Corn Belt with poorer soils and/or reduced rainfall, farmers typically reduce plant populations to compensate for conditions. Is that something we should again consider in Iowa if conditions remain dry at planting? In part based on concerns at planting in 2012, Iowa farmers as well as those across most of the Corn Belt reduced plant populations relative to those used in 2011 for the first time since 2000. Iowa corn plant populations in 2012 dropped to 30,100 plants per acre (ppa) from 30,750 in 2011 (see Figure 8 linked in the endnotes). Albeit, that is not a huge decrease; but it does reflect pessimistic sentiments at planting in 2012. This change will slow the consistent trend of increased plants per acre of about 400 plants per acre per year since the turn of the 21st century. With that as history, what should we think about this spring?

Should you consider lower plant populations if it is dry at planting in 2013?

Modeling Methods

As in last year's versions of these articles, I used a corn simulation model (Hybrid-Maize) to answer this question. The model uses historic weather data from automated weather stations. In this case, I used data from seven of Iowa State University's research and demonstration farms, one in each of the four corners of Iowa and the others in northern and west central Iowa and one near Ames in central Iowa.

The model allows users to change soil moisture conditions at planting to simulate different possibilities. This year, I compared two scenarios:

- 'Normal:' 75 percent Field Capacity (FC) in the topsoil (0-12 inches) and 100 percent FC in the subsoil (12-40 inches), and
- 'Very Dry:' 25 percent FC in both topsoil and subsoil.

I realize that some Iowa soils are wetter than 25 percent FC; so the second possibility may be overly pessimistic for those areas. Other common inputs

for each site modeled are provided in Table 1. Factors that varied across locations such as soil textures are shown in Table 2.

Table 1. Hybrid-Maize model input factors that were the same across locations and years	
Factor	Factor Input Value/ Date
Emergence date	1 May
Plant population Comparisons	27,000, 32,000 and 37,000 plants per acre
Soil moisture	
Situation A (Normal)	
Top soil	75% Field capacity (FC)
Sub soil	100% Field capacity (FC)
Situation B(Very Dry)	
Top soil	25% Field capacity (FC)
Sub soil	25% Field capacity (FC)
Rooting depth	40 inches

Table 2. Hybrid-Maize model input factors that varied by location							
	ISU Research and Demonstration Farm (Location)						
Factor	NW	North	NE	WC	Central	SW	SE
Year†	1988	1997	1988	1988	1986	1997	1988
Top Soil	SiClLo‡	Lo	Lo	SiLo	ClLo	SiClLo	SiClLo
Sub Soil	SiClLo	Lo	Lo	SiLo	ClLo	SiClLo	SiClLo
Hybrid GDU§	2500	2500	2500	2600	2600	2600	2600

† Year when automated weather data collection began
‡ Si = Silt, Cl = Clay, Lo = Loam.
§ GDU = Growing Degree Units; 2500 = about 105 RM; 2600 = about 110 RM.

Given the two soil moisture scenarios at planting, the model allows us to estimate the effects of changing plant populations, as well as other factors, on simulated yield. The model predicts corn growth based on temperature, solar radiation, and precipitation actually recorded in the automated weather database for each research and development farm. It does not account for factors like insect feeding, diseases, weed competition, nutrient deficiency, hail, wind damage, etc.

For this comparison, I used a single 'generic' hybrid at each location: NW, N, and NE locations: 2500 GDD (about 105 days RM); West Central, Central, SW, and SE locations, 2600 GDD (110 days). For the analysis in this article, I compared final plant populations of 27,000, 32,000 and 37,000 ppa at each location with each of the two soil moisture scenarios at planting.

Simulation Results

Wet soils at planting

Probabilities for different plant population responses with different soil moisture conditions at planting are shown in Table 3. At Kanawha and Ames for example, if we start the season with a wet soil profile, responses in all the

previous years (16 and 27 years of weather history in the database for Kanawha and Ames, respectively) would always favor planting 37,000 ppa over 32,000 ppa. Likewise, the lowest population, 27,000 ppa, always yielded less than the middle population, 32,000 ppa, when soils were wet at planting at both of these locations.

Table 3. Years where simulated yields of specified plant populations were greater than that of the other specified plant population as affected by whether soils were dry or wet at planting.

R & D Farm (Location, years of weather data)	Wet at Planting		Very Dry at Planting	
	37k > 32k	32K > 27k	37k > 32k	32k > 27k
	Probability of Plant Population Differences (%)			
NW (Sutherland, 25yr)	92	84*	60	60
N (Kanawha, 16yr)	100	100	63	56*
NE (Nashua, 25yr)	92	92	72	76*
WC (Castana, 25yr)	84	84	56	60*
Central (Ames, 27yr)	100	100	85	89*
SW (Lewis, 16yr)	94	94	81	81
SE (Crawfordsville, 25yr)	96	88	56	52

* Indicates situations where the 27,000 plant population resulted in greater yields than the 37,000 plant population in 2012. See figures linked in the endnote for more information.

For another example, at Sutherland in NW Iowa, 37,000 ppa out-yielded 32,000 ppa in 23 of the 25 years, 92 percent, when soils were wet at planting. The lowest population, 27,000 ppa, increased yields over 32,000 ppa in only four of the 25 years, 16 percent. However, in 2012, simulated yields with 27,000 ppa were greater than those of 37,000 ppa by an estimated 6 bu/acre (noted by the asterisks in Table 3). In most cases, if soils are wet at planting, staying with higher seeding rates would improve yields at all locations.

Very dry soils at planting

If we start the growing season with very dry soil profiles, optimism for high yields plummets along with probabilities of yield increases with high plant populations (Table 3). To illustrate this, look at the responses at Castana in WC Iowa. If we start with a very dry soil at planting, yields with 37,000 ppa are greater than those of 32,000 ppa just over half the time, 56 percent. Likewise, 32,000 ppa outperforms 27,000 ppa 60 percent of the time. In a year like 2012, 27,000 ppa would out-yield corn at 37,000 ppa by an estimated 9 bu/acre. That was true at Kanawha, Nashua and Ames as well. If soils are dry at planting, higher plant populations may reduce yields compared to lower plant populations.

Similar to modeled data in January 2012 ICM News, these 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 more similar; thus, seed costs associated with higher populations may not be offset by yield increases in lower yielding years when the soil is dry at planting. But the probabilities of greater returns from higher seeding rates in better years would seem to counterbalance those concerns.

Summary

We all know that many things can happen between now and planting. Normal seeding rate/ plant population recommendations are based on full soil profiles at planting (typical plant population responses). If 2013 soil moisture conditions do not improve, that is soils are dry at planting, be conservative on seeding rates changes. Although planting to achieve high plant populations is a good approach in most years, 2013 may be the year to not push seeding rates to higher levels especially in drought-prone soils. Meanwhile, as before, let's hope for complete recharge of our soil in the weeks remaining before planting!

Endnote

This article summarizes portions of a 2013 Crop Advantage Series talk presented in January 2013. Detailed summary graphics for each location modeled are available.

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