7-31-2015

# In-season forecast of soil water-nitrogen and corn-soybean yields for central and northwest Iowa; an update

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# In-season forecast of soil water-nitrogen and corn-soybean yields for central and northwest Iowa; an update

**Abstract**
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**Keywords**
Agronomy

**Disciplines**
Agricultural Science | Agriculture | Agronomy and Crop Sciences

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# In-season forecast of soil water-nitrogen and corn-soybean yields for central and northwest Iowa; an update

*July 31, 2015*

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This article is an update of the status of the soil water-nitrogen and the expected corn-soybean yields at the end of the season for eight cropping systems in Iowa. The data provided here and the analysis are part of the pilot Yield Forecast project that is coordinated by the ISU. Briefly, this project combines the use of the Agricultural Production Systems sIMulator (APSIM) cropping systems model, the Weather Research

and Forecast Model (WRF), and parallel in-field data collection to provide in-season systems-level forecasts. This pilot project focuses on two locations (central and northwest IA), two crops (corn and soybean), and two planting dates (early and late planting). Additional information can be found in a June 17, 2015 ICM News article.

Results from the July 28 forecast show that soil water reserves have substantially benefited from the rainfall events (~3 inches of water) on July 27 and 28 (Table 1). The soil nitrogen status for central Iowa is low but reasonably low given that the crops have taken up significant amounts of N to date. The model analysis currently shows no N stress. In contrast, there is a risk of water stress at the Northwest Iowa location.

Table 1. Current status of crop stage, crop water and nitrogen use, and soil water and nitrogen as of the July 28, 2015 forecast date.

| Cropping System[1] | Crop Staging[2] | Available water in soil profile (5 ft) | Plant available water to roots | Crop water use | Available N[3] soil profile (5ft) | Plant available N to roots | Crop N use |
|---|---|---|---|---|---|---|---|
| | | inches | | | lbs N / acre | | |
| ACE | R3 | 7.4 | 5.2 | 9.1 | 13 | 11 | 220 |
| ACL | R1.5 | 6.8 | 4.7 | 6.3 | 60 | 54 | 181 |
| SCE | R2 | 7.7 | 5.3 | 7.4 | 152 | 146 | 206 |
| SCL | R1.5 | 9.1 | 6.7 | 5.2 | 223 | 217 | 147 |
| ASE | R4 | 8.4 | 5.9 | 6.6 | 11 | 8 | 151 |
| ASL | R3 | 8.4 | 5.9 | 4.2 | 15 | 10 | 106 |
| SSE | R4 | 9 | 6.4 | 5.8 | 95 | 88 | 140 |
| SSL | R3 | 10.1 | 7.2 | 3.8 | 122 | 115 | 98 |

[1] Cropping systems are defined as first digit = Ames (A) or Sutherland (S); second digit = Corn (C) or Soybean (S); and third digit = Early (E) or Late (L) planting date.
[2] Crop staging is using standard vegetative (V) stages found in the Soybean Field Guide and Corn Field Guide available through the ISU Extension and Outreach Store
[3] it refers to the inorganic nitrogen (nitrate-nitrogen and ammonium-nitrogen)

Over the next 10 days, corn will accumulate dry mass at a rate of 330 lbs/acre/day and soybean at a rate of 180 lbs/acre/day (Table 2). The lower crop growth rate for soybean compared to corn is due to the C3 versus C4 photosynthetic pathway and the cost of energy-rich proteins and oils in soybean. Water and N needs by the crops are currently at peak usage rates because the crops have to build new biomass (mostly grain) and at the same time sustain existing biomass (mostly vegetative). Overall, soil water and nitrogen reserves together with N supply from organic matter mineralization will satisfy crop needs without major stress over the next 10 days.

Table 2. Predicted cumulative rainfall, water and nitrogen use, nitrogen mineralization and crop growth from July 28, 2015 to August 6, 2015 based on the forecasted weather.

| Location / cropping system | Forecasted cumulative rainfall | Cumulative soil water evaporation | Cumulative crop water use | Cumulative crop N use | Cumulative net soil N mineralization | Average crop growth rate [1] |
|---|---|---|---|---|---|---|
| | inches | inches | inches | lbs N/acre | lbs N/acre | lb DM/ac/d |
| ACE | 0.57 | 0.44 | 2.88 | 13.8 | 11.8 | 293 |
| ACL | 0.57 | 0.46 | 3.24 | 43.2 | 11.3 | 325 |
| SCE | 0.34 | 0.47 | 3.70 | 49.9 | 10.8 | 349 |
| SCL | 0.34 | 0.47 | 3.69 | 56.4 | 12.5 | 348 |
| ASE | 0.57 | 0.45 | 3.11 | 34.7 | 8.4 | 180 |
| ASL | 0.57 | 0.46 | 3.13 | 38.6 | 7.5 | 181 |
| SSE | 0.34 | 0.49 | 3.85 | 45.1 | 10.1 | 185 |
| SSL | 0.34 | 0.50 | 3.79 | 52.7 | 9.1 | 182 |

[1] DM, above ground dry matter (lb DM/ac/d, pounds of above ground dry matter per acre per day)

Compared to the first forecast (June 12), the range of uncertainty (difference between 10% and 90% probability) has decreased. In this particular year, the 50% probability (median) is close to the 10% probability (best case scenario) for the corn in central Iowa (Fig. 1). This reflects excellent growing conditions to date. The 90% probability reflects the minimum yield that can be achieved (worst case scenario). The 90% probability for corn in Sutherland is lower because of the water stress conditions that occurred in the mid to late vegetative stages. Soybean yields are similar between locations and planting dates, with levels above 55 bu/acre.

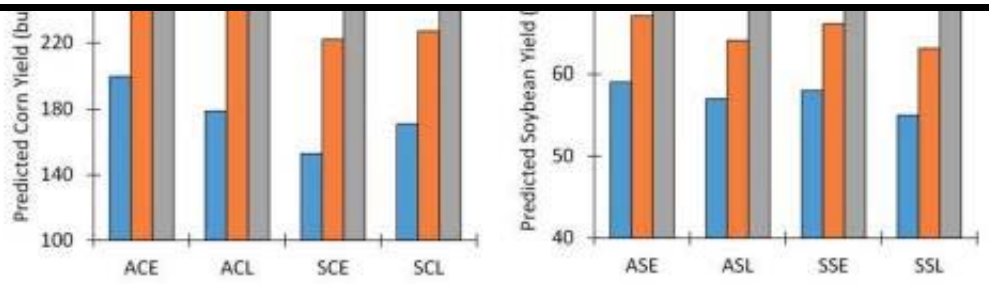


Fig. 1 Attainable yield predictions for eight cropping systems in Iowa based on information available until July 28, 2015. ACE = Ames Corn Early planted, ACL = Ames Corn Late planted, SCE = Sutherland Corn Early planted, SCL = Sutherland Corn Late planted, ASE = Ames Soybean Early planted, ASL = Ames Soybean Late planted, SSE = Sutherland Soybean Early planted, SSL = Sutherland Soybean Late planted.

The corn and soybean crops are in at a good status to date (July 28) and have the potential to reach high yield levels, about 4 to 17% higher compared to the historical yields (Fig. 2). Much of the yield increase can be attributed to recent rainfall events that occurred during critical periods of development for both crops. To highlight the importance of this particular precipitation event, a model analysis was conducted to predict yields without the rainfall on July 26-28 (Fig. 2). Corn yields in Sutherland benefited the most from nearly 3-inches of rainfall with a change in predicted yield from –28% to +4% compared to the historical average.

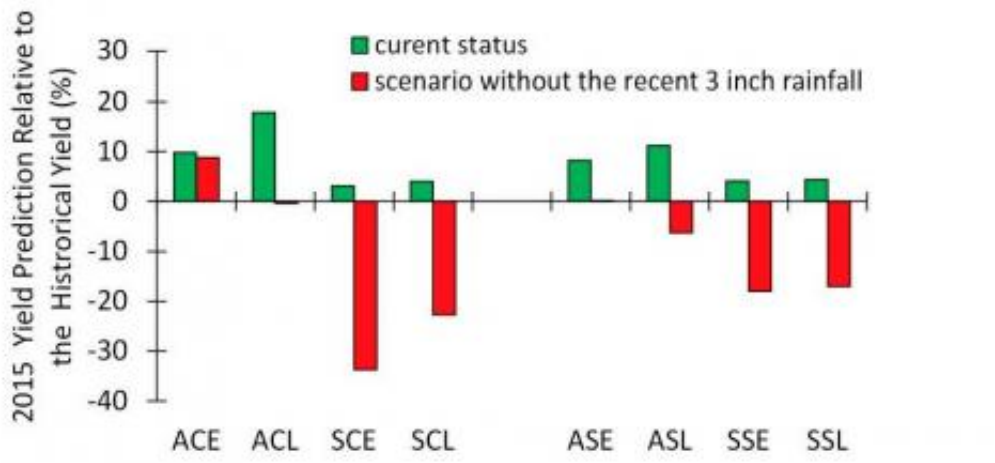


Fig. 2 Relative yield predictions for eight cropping systems in Iowa based on information available until July 28, 2015. For symbols explanation see above. To show the value of the last precipitation event on the crop yields, we ran the model without considering the last precipitation event (red bar).

The forecast provided by this pilot project is valid at the time the forecast was completed (July 28, 2015). Additional forecasts will be made throughout the growing season to update the information provided in this ICM Newsletter article.

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**Category:** Crop Production

**Crops:**
Corn
Soybean

**Tags:** Soybean | Corn | yield forecast | soil water-nitrogen | modeling

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