IOWA STATE UNIVERSITY
Extension and Outreach

Integrated Crop Management

Potential Nitrogen Loss - 2018

June 22, 2018

High rainfall in some areas the past couple of weeks has produced another wet spring in Iowa. This leads to questions about nitrogen (N) loss and need for supplemental N application to corn. Unfortunately, this question has become almost the norm - I have written approximately 20 articles on the subject since 2007.

The discussion of N loss should include losses from both the soil N supply and residual nitrate-N. There is usually tile drainage every spring and occasionally in the late fall, leading to N losses. Also, losses can be rapid if soils become saturated, soils are warm, and nitrate is present; these conditions lead to denitrification (biological conversion of nitrate to N gas). Some N loss from soils is typical, the magnitude depends on many factors. Prediction of the effect of these losses on N supply to corn, additional N fertilization need, etc. in wet periods is difficult. There are several approaches in making estimates of N status or loss.

Remember that guidelines for N application rates for corn in Iowa take into account "normal" N losses as N rate research trials are conducted in the field. This is especially important as those N rate trials incorporate supply and loss of soil derived-N, not just applied N. This means that the accumulation of N rate research trials, like used in the Corn Nitrogen Rate Calculator, builds in some variation of soil N supply and climatic conditions.

Approaches to estimating N loss

Use the Late Spring Soil Nitrate Test (LSNT)

Use of the LSNT test in Iowa corn production in described in an Iowa State University Extension and Outreach publication (CROP 3140). At this time in most fields, we are past the calendar time and growth stage calibrated for that test and it should no longer be used.

Modeling

Use of computer models is relatively new for production agriculture. There are several models currently in the market place, including the ISU Extension and Outreach FACTS website that does supply information on nitrate-N in the soil profile (the site was recently updated). You can pick a research site near you and look at the increase and decrease in soil nitrate-N concentration between soil depths. Remember that corn is rapidly taking up N at this time, so there is expectation of decreasing overall nitrate in the profile due to uptake. However, very rapid changes would indicate leaching movement or denitrification, besides crop uptake.

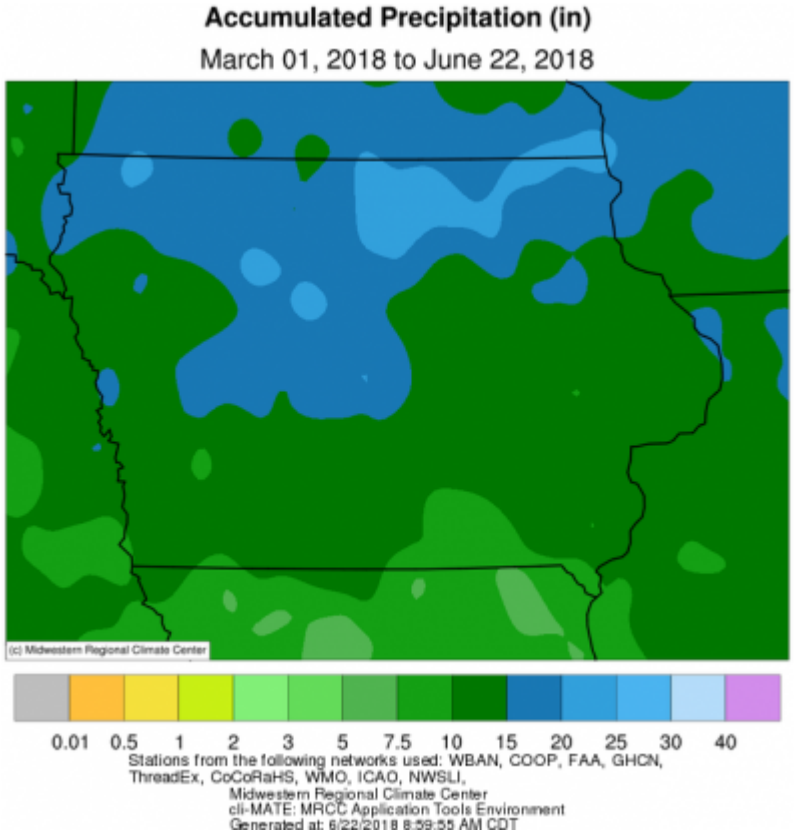
Estimates of nitrate-N production and loss

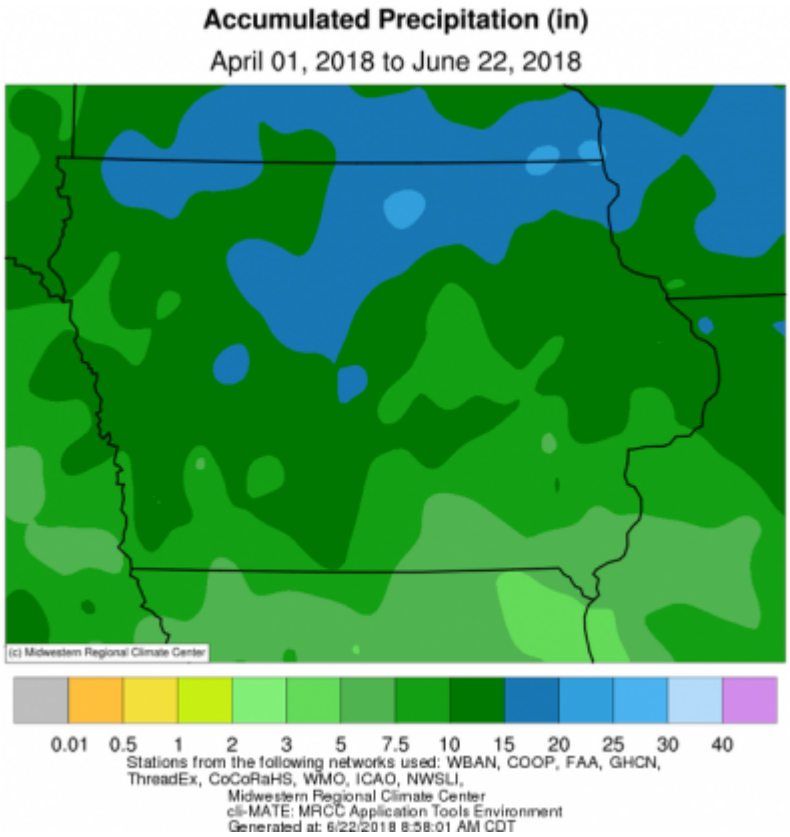
An example of this was discussed in a 2014 ICM News article (Estimating Nitrogen Loss in Wet Corn Fields). Important components are the estimation of how much nitrate-N has formed from applied N by the time of wet conditions, and the length of soil saturation (which can vary greatly across fields, ex. ponded vs. not ponded areas, and runoff vs. infiltration). When soils are warm, loss can be rapid and large, but slow when soils are cool or there is little nitrate. Recent sidedress fertilizer N applications would be fully or partially "protected" from loss if the application included ammonium which is retained on the soil cation exchange complex and not subject to leaching or denitrification (such as urea, ammonium, and anhydrous ammonia). Anhydrous ammonia is all ammonium, urea rapidly converts to ammonium, and urea-ammonium nitrate solution (UAN 28 or 32%) is one-quarter nitrate, one-quarter ammonium, and one-half urea. Early sidedress applications were likely converted to nitrate before the recent high rainfall events.

Spring rainfall

Details of this approach were discussed in a 2016 ICM News article (Precipitation and Nitrogen This Spring). The amount of spring rainfall to trigger the need for additional N application was updated with research data from 2016. Those rainfall totals are now 17.8 inches from March 1 to June 30 for Southeast Iowa, and 15.5 inches from April 1 to June 30 for the majority of Iowa. These rainfall totals have about a 76% chance for estimating correctly (adequate N or deficit N) if N loss is sufficient enough to consider additional N application. One does not need to wait until the end of June to calculate total rainfall. That can be done on an on-going basis and if the total begins to approach those values, then be thinking about plans for applying additional N. According to precipitation maps, we have exceeded those rainfall totals in the central to northern part of Iowa. Local rainfall measurements would provide more specific rainfall information. The more rainfall there is above those trigger totals, the more likely supplemental N would be needed. A caveat to use of the rainfall totals is if there are heavy, short duration, rainfall events. If water runs off the field, and does not get into the soil profile, then there should be a discounting off the total. Also, if the rainfall reaches those totals in the early spring, there should also be

some discounting off the total due to less nitrate buildup and less denitrification with cool soils. For example, total rainfall amounts in just an individual month, like April or May, do not provide the same level of success as when June rainfall is included. The rainfall triggers are related to use of suggested economical N rates (MRTN) from the Corn Nitrogen Rate Calculator. If higher or lower N rates were applied to fields, then the odds of needing additional N go up or down.




Accumulated Precipitation (in)
April 01, 2018 to June 22, 2018
(c) Midwestern Regional Climate Center
0.01 0.5 1 2 3 5 7.5 10 15 20 25 30 40
Stations from the following networks used: WBAN, COOP, FAA, GHCN, ThreadEx, CoCoRaHS, WMO, ICAO, NWSLI,
Midwestern Regional Climate Center
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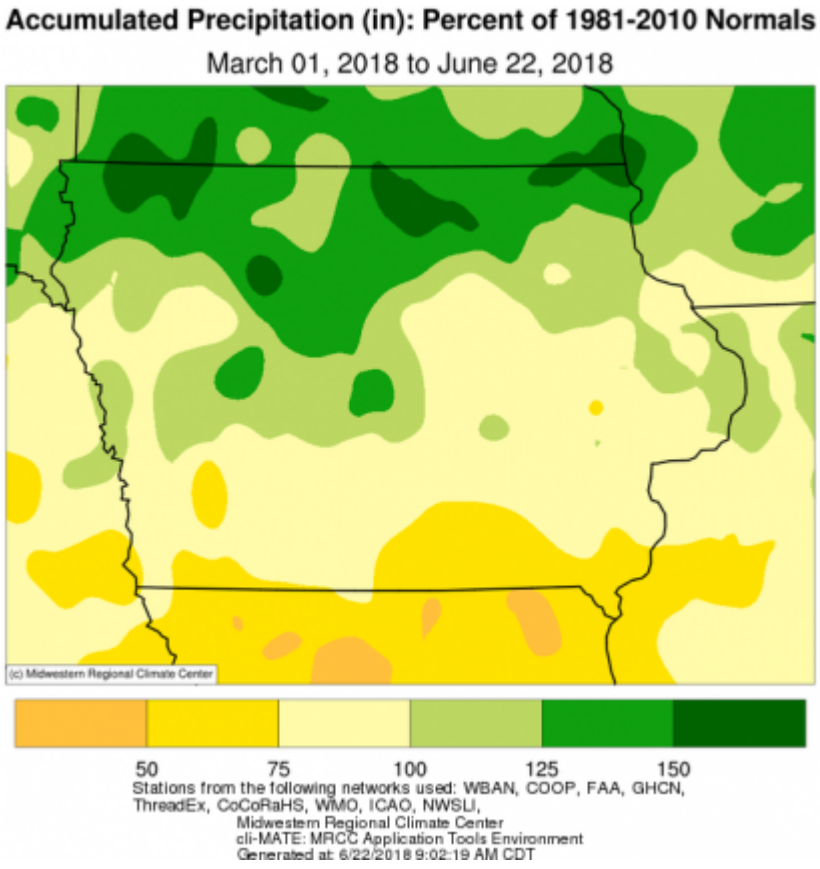
Accumulated Precipitation (in): Percent of 1981-2010 Normals
March 01, 2018 to June 22, 2018
(c) Midwestern Regional Climate Center
50 75 100 125 150
Stations from the following networks used: WBAN, COOP, FAA, GHCN, ThreadEx, CoCoRaHS, WMO, ICAO, NWSLI,
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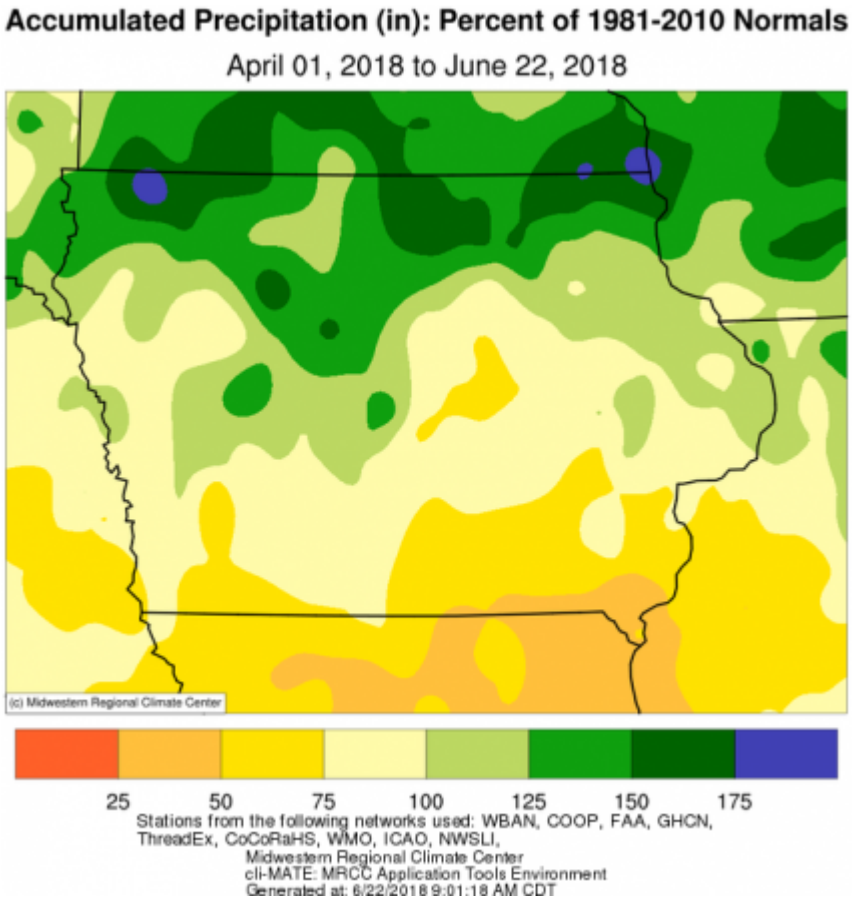

Resources for nitrogen rate decisions

Use of the Late-Spring Soil Nitrate Test in Iowa Corn Production (CROP 3140)
Corn Nitrogen Rate Calculator
ISU Extension and Outreach Soil Fertility Web Site
Nitrogen Use in Iowa Corn Production (CROP 3073)

Category: Soil Fertility

Crop:

Corn

Tags: estimating nitrogen loss supplemental N need

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