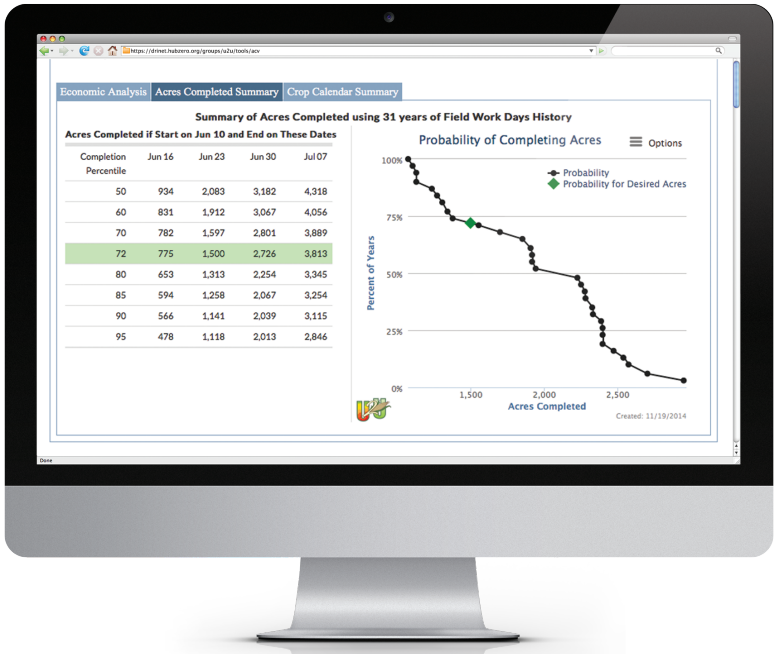
# Corn Split N DST

## Determine the feasibility and profitability of using post-planting nitrogen application for corn production.




SplitN.AgClimate4U.org

This product is designed to help farmers and farm advisors understand the risks and benefits of using post-planting nitrogen (N) application for corn production. The Corn Split N tool combines historical weather and fieldwork data with economic considerations to determine the feasibility and profitability of completing a second (split) N application within a user-specified time period.

### This tool may help you with decisions that:

- **Increase corn yields**
- **Reduce nitrogen costs**
- **Reduce nitrogen losses to the environment**
- **Affect the likelihood of completing fieldwork tasks**

With the Corn Split N tool you can quantify the costs and benefits of post-planting nitrogen applications for your farming operation to help your bottom line and the environment.

# Assumptions and Data Sources

The Corn Split N tool combines historical weather data, historical fieldwork data (observed and simulated), and economics to determine the riskiness associated with post-planting nitrogen applications for your location.

### Corn Growth Estimates

Corn height is an important factor in determining the probability of successful post-planting nitrogen application since your equipment must be able to travel through growing corn without damaging it. The Corn Split N tool provides estimates of corn development stages based on your location, your selected planting date, and the accumulated corn growing degree days (GDD) for the year.

This tool uses daily gridded* growing degree days (GDD), calculated using the 86/50 method, as a proxy for corn height. GDD are based on data from the Applied Climate Information System (ACIS). The relationship between accumulated GDD and plant growth comes from recommendations found in ISU publication PMR 1009 entitled “Corn Growth and Development.” Corn emergence in the Corn Split N tool is assumed to occur at 105 GDD post planting.

GDD accumulations and associated corn growth beyond the current day are estimated based on the 30-year (1981-2010) average GDD accumulation for your location.

### Historical Field Work Data

The Corn Split N tool uses historical observations (1981-last year) and model simulations of days suitable for field work (FWD) to estimate the probability of being able to fertilize corn during the user-defined application period. FWD are simply the estimated number of days per week that are suitable for conducting in-field activities.

Observed FWD data are reported weekly by the USDA National Agriculture Statistics Service (NASS) throughout the growing season (roughly Mar/Apr - Oct/Nov) for each Crop Reporting District (CRD) in the following Corn Belt states: IA, IL, IN, KS, MO.

In Michigan, Minnesota, Nebraska, North Dakota, Ohio, South Dakota and Wisconsin the FWD data reported by NASS are only available at the state-wide level (i.e. one weekly value represents conditions for the entire state). The Split N tool requires more localized FWD data. Therefore, the weekly FWD values for these seven states within the Split N tool are estimated weekly values, not historical observations. The estimates are derived from the statistical relationship between historic weather data and the area-weighted soil drainage class for each CRD in the states where weekly FWD data are available. The empirical equation used to generate these estimates is available at https://mygeohub.org/groups/u2u/aboutsplitn#Data.

*Gridded data are derived from nearby weather observation stations, which allows data to be available for the entire region at about a 2.5 mile resolution.

## Assumptions and Data Sources cont.

**Yield Penalties and Benefits**

Corn plants require adequate nitrogen for optimal growth. In the event that plant-available nitrogen is limited, there could be an associated yield reduction. Conversely, a "rescue" application of nitrogen could result in a yield increase. The Corn Split N tool allows you to customize yield (bu/acre) penalties and benefits to account for these situations since they will vary by location and time of year.

The default values used for Yield Benefit and Reduced N are based on data reported in the literature. They do not take into account the range of values that could be used. You are encouraged to seek information from university extension or crop consultants on what values should be used for your particular soil and climatic conditions.

A variety of factors contribute to yield penalties associated with inadequate nitrogen availability, and nitrogen rate trials and data availability varies by location. The Corn Split N tool uses a number of data sources, including Extension publications and direct consultation with local Extension specialists, to provide the best available default yield penalty information.

Yield penalties for Illinois, Indiana, Iowa, Michigan, Minnesota, Ohio, and Wisconsin are based on the "Percent of Maximum Yield" information contained in the online Corn N Rate Calculator (http://extension.agron.iastate.edu/soilfertility/nrate.aspx) that was jointly developed by agronomy and fertility extension specialists from across the Corn Belt region (J. Camberato, S. Culman, D. Kaiser, C. Laboski, E. Nafziger, J. Sawyer and K. Steiner. Corn Nitrogen Rate Calculator, 2013)

Kansas, Missouri, Nebraska, North Dakota and South Dakota are not included in the Corn N Rate Calculator. Expert recommendations from local Extension specialists were used to develop default yield penalties for these locations. Full details are available online in the About Split N page (https://mygeohub.org/groups/u2u/aboutsplitn).

**Nitrogen Price, Corn Price, and Sidedress Cost Inputs**

Corn and nitrogen prices and sidedressing costs will have a direct impact on the profitability of split nitrogen applications. Default values for price and cost are provided in the Corn Split N tool, but these should be adjusted based on local conditions. Any change in corn yield is best priced using your local market price. Reduction in fertilizer use would need to take into account both the type of fertilizer used and the local price of that fertilizer. The default values in this tool were appropriate for a particular time and assumed a particular type of N fertilizer. Corn Split N users are encouraged to adjust this information to make it realistic of their situation.

For simplicity, we have assumed that the cost of sidedressing N is a custom rate, or a flat rate per acre. This is appropriate since most sidedressing will be done by a custom operator such as your input supplier. The default value is appropriate for illustrative purposes, but the user is encouraged to call potential sidedress application businesses to discern their price and availability for applying post-planting N on your fields.

# User Guide

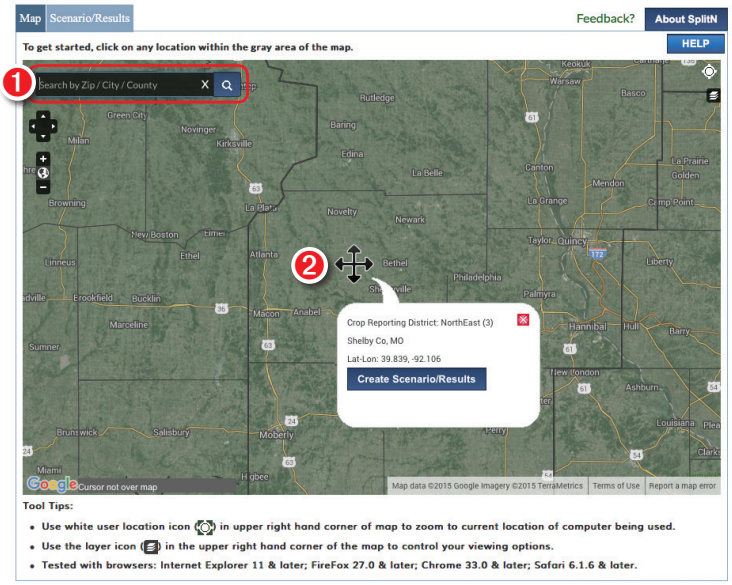
Follow these simple instructions to get started with the Corn Split N tool. Click the blue ? button on any page for step-by-step instructions on using the tool. For additional background information on this product, click on the blue **About SplitN** button on the upper corner of the tool.

## Location Selection Overview

To start, select your location of interest.
This can be done in several ways:

1. Type in a ZIP code, city name, or county name into the search bar and the map will zoom to the center of that location.
2. Zoom in and manually drag the map to your area of interest, and then click on the map.

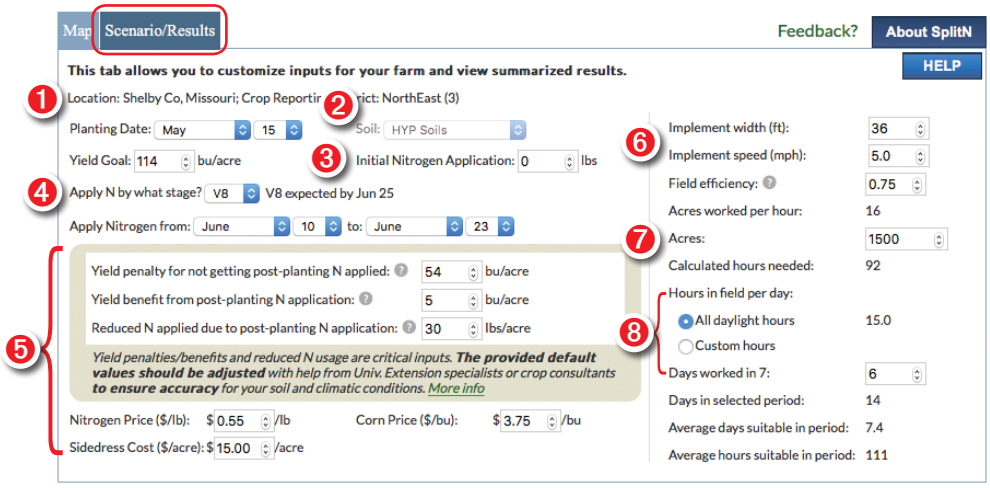
Once your area of interest has been located, click on the **Create Scenario/Results** button.




## Scenario Overview

The top half of the Scenario/Results tab allows you to customize inputs based on your farming operation. Although default values are provided, it is important to adjust the inputs for more accurate results.

1. Provide dates for when your corn was planted and when nitrogen applications are scheduled to start/end.
2. Yield penalty data for Wisconsin, Nebraska, and Indiana will require additional information about soil type.
3. Enter the amount of nitrogen that was applied to the field before planting.
4. Specify by what corn growth stage (V stage) nitrogen must be applied.
5. Provide estimates for yield penalties and benefits, anticipated reduction in nitrogen use, nitrogen and corn prices, and sidedress costs.
6. Specify machinery implement details.
7. Input the number of acres for which you are planning a post-planting nitrogen application.
8. Estimate how many days you will work per week and how many hours you will work per day.

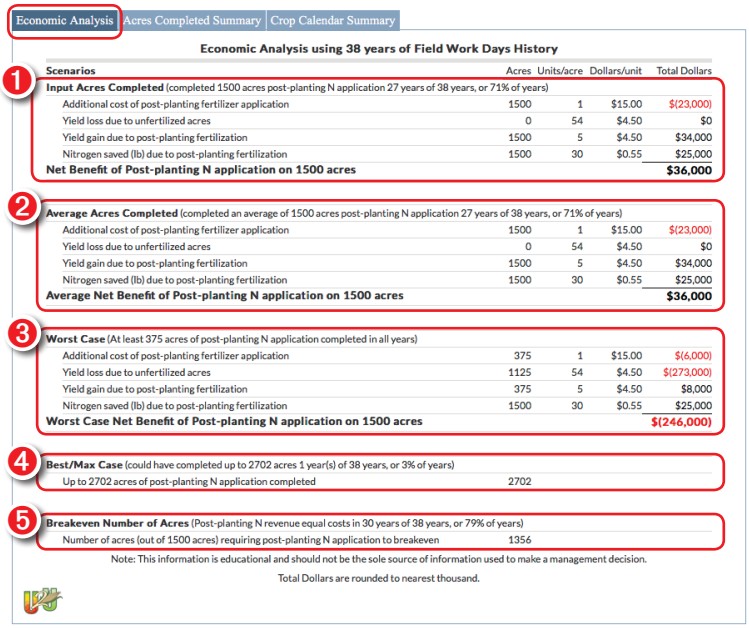


## Results Overview

The bottom half of the Scenario/Results tab lets you view results of the Corn Split N Economic Analysis, Acres Completed Summary, and the Crop Calendar Summary.

## Economic Analysis

1. The **Input Acres Completed** scenario provides estimates based on the assumption that all desired acres will successfully receive a post-planting nitrogen application. The results show the expected economic net benefit and the number of years in which this scenario would occur.
2. The **Average** scenario shows how many acres can typically be expected to successfully receive a post-planting nitrogen application and the associated economic returns.
3. The **Worst Case** scenario provides the economic returns for the year with the fewest acres receiving a post-planting nitrogen application. This scenario would represent the maximum losses that could be expected in a year where weather conditions limit your ability to fertilize.
4. **Best/Max Case** calculates the maximum number of acres that could theoretically receive a post-planting nitrogen application based on the provided inputs and historical weather data.
5. **Breakeven** shows the number of acres requiring successful post-planting nitrogen application in order for economic returns to equal the economic costs.



Economic Analysis | Acres Completed Summary | Crop Calendar Summary

**Economic Analysis using 38 years of Field Work Days History**

| Scenarios | Acres | Units/acre | Dollars/unit | Total Dollars |
|---|---|---|---|---|
| **Input Acres Completed** (completed 1500 acres post-planting N application 27 years of 38 years, or 71% of years) | | | | |
| Additional cost of post-planting fertilizer application | 1500 | 1 | $15.00 | $(23,000) |
| Yield loss due to unfertilized acres | 0 | 54 | $4.50 | $0 |
| Yield gain due to post-planting fertilization | 1500 | 5 | $4.50 | $34,000 |
| Nitrogen saved (lb) due to post-planting fertilization | 1500 | 30 | $0.55 | $25,000 |
| **Net Benefit of Post-planting N application on 1500 acres** | | | | **$36,000** |
| **Average Acres Completed** (completed an average of 1500 acres post-planting N application 27 years of 38 years, or 71% of years) | | | | |
| Additional cost of post-planting fertilizer application | 1500 | 1 | $15.00 | $(23,000) |
| Yield loss due to unfertilized acres | 0 | 54 | $4.50 | $0 |
| Yield gain due to post-planting fertilization | 1500 | 5 | $4.50 | $34,000 |
| Nitrogen saved (lb) due to post-planting fertilization | 1500 | 30 | $0.55 | $25,000 |
| **Average Net Benefit of Post-planting N application on 1500 acres** | | | | **$36,000** |
| **Worst Case** (At least 375 acres of post-planting N application completed in all years) | | | | |
| Additional cost of post-planting fertilizer application | 375 | 1 | $15.00 | $(6,000) |
| Yield loss due to unfertilized acres | 1125 | 54 | $4.50 | $(273,000) |
| Yield gain due to post-planting fertilization | 375 | 5 | $4.50 | $8,000 |
| Nitrogen saved (lb) due to post-planting fertilization | 1500 | 30 | $0.55 | $25,000 |
| **Worst Case Net Benefit of Post-planting N application on 1500 acres** | | | | **$(246,000)** |
| **Best/Max Case** (could have completed up to 2702 acres 1 year(s) of 38 years, or 3% of years) | | | | |
| Up to 2702 acres of post-planting N application completed | 2702 | | | |
| **Breakeven Number of Acres** (Post-planting N revenue equal costs in 30 years of 38 years, or 79% of years) | | | | |
| Number of acres (out of 1500 acres) requiring post-planting N application to breakeven | 1356 | | | |

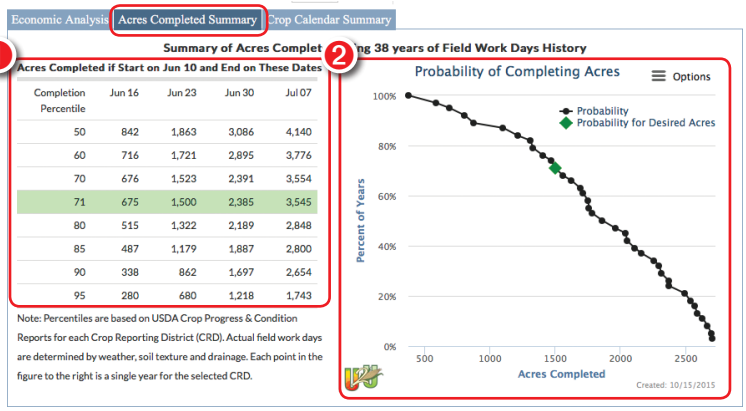
Note: This information is educational and should not be the sole source of information used to make a management decision.

Total Dollars are rounded to nearest thousand.

**USER TIP: The results will automatically update as inputs are adjusted.**

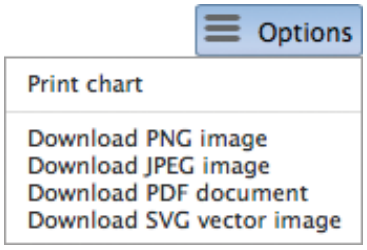
## Acres Completed Summary

The Acres Completed Summary shows the probability of completing post-planting nitrogen application on your desired number of acres within your specified application window.



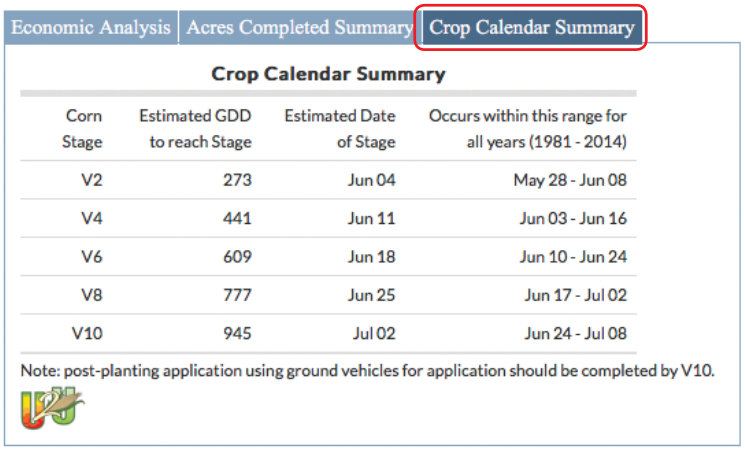

1. The table on the left shows the estimated number of acres receiving post-planting nitrogen for the period designated, plus one week prior and up to two weeks after the user-specified end date. The row shaded green represents, historically, the percentage of time that the desired number of acres received a post-planting nitrogen application by user-specified the end date.

2. The chart on the right is a graphical representation of the probability of completing post-planting nitrogen application for your desired number of acres in the user-specified time period. The Chart Options button can be used to download or print this chart.




## Crop Calendar Summary

The Crop Calendar Summary provides estimated dates for reaching various corn development stages based on the planting date and the accumulated corn growing degree days (GDD) for the year. GDD beyond the current day are estimated based on the 30 year average for that location.

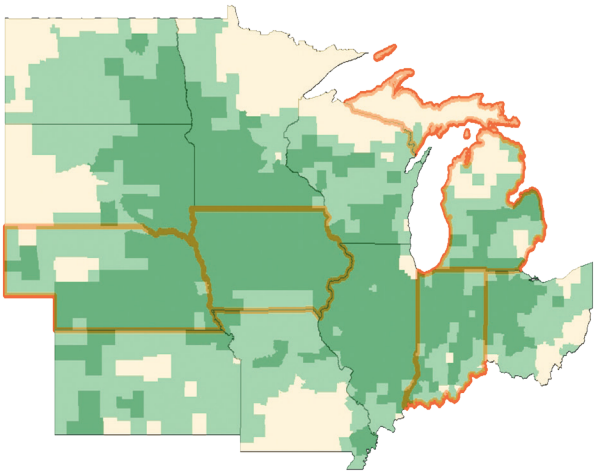


## About Useful to Usable (U2U)

U2U is an integrated research and extension project, funded by the USDA, to improve farm resilience and profitability in the North Central U.S. by transforming existing climate data into usable products for the agricultural community. Our goal is to help producers make better long-term plans for what, when and where to plant and how to manage crops for maximum yields and minimum environmental impact.

The U2U team includes climatologists, agronomists, social scientists and computer specialists who have come together to create tools to aid in farming decisions. Partners include Purdue University, Iowa State University, Michigan State University, South Dakota State University, University of Illinois, University of Michigan, University of Missouri, University of Nebraska, University of Wisconsin, the High Plains Regional Climate Center, the Midwestern Regional Climate Center, and the National Drought Mitigation Center.

## U2U Study Region



*Pilot States*
*Major Corn Growing Area*
*Minor Corn Growing Area*

Crop data from National Agricultural Statistics Service (NASS) U.S. 2007 Census of Agriculture

Major corn areas harvested over 60,000 acres of corn

Minor corn areas more than 5,000 acres of corn

Map created by Adam Reimer

**PROJECT CONTACTS:**

**Linda Prokopy,**
Associate Professor and Project Lead, U2U
Purdue University
765-496-2221
lprokopy@purdue.edu

**Melissa Widhalm,**
Project Manager, U2U
Purdue University
765-494-8191
mwidhalm@purdue.edu

For more information, please visit
AgClimate4U.org
@AgClimate4U

United States Department of Agriculture
National Institute of Food and Agriculture

This project is supported by Agriculture and Food Research Initiative Competitive Grant no. 2011-68002-30220 from the USDA National Institute of Food and Agriculture.

Graphic design/production by the University of Wisconsin-Extension Environmental Resources Center
October 2015