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# Crop weather outlook 2015

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The Midwest suffered the first drought since 1988 during 2012. Chances are that event opened a period of crop weather that will have greater variability (a mixture of very good and of very bad crop years) than we have seen since before 1996.

## Soil moisture

Rain events of late summer and fall of 2014 exceeded crop water use in much of Iowa, Illinois, Indiana, Missouri, and in eastern portions of Nebraska and Kansas. With the end of high water use by crops, the plant available water of the subsoil increased. Plant available soil water is likely to be near capacity in the spring of 2015. In the western portion of the Corn Belt (generally west of Interstate Highway 35) initial soil water enhances the outlook for crop success.

## Winter weather

The winter of 2013-2014 included more events of polar air incursion into the Midwest than usual. The press, with good reason, emphasized the events associated with "abnormalities" of the Polar Vortex. It is not historically uncommon to have periods of years when these events are commonplace. Winters when the outbreaks are common and strong enough to impact the state of Florida were the 1890s, 1917, 1934 (prompted the creation of the Florida Frost Warning Service), 1940, 1957, 1962, 1977 (initiation of the Satellite Freeze Warning/Analysis service), 1981, 1983, 1985, 1989. The winters were relatively mild from 1989-2009. Overall the harshness of winters and intervals of relatively mild winters seem to be associated with an apparent 60-year pattern of ocean current positions in the Atlantic (sometimes referred to as the long-term North Atlantic Oscillation). The next 20 years may be expected to have winters reminiscent of the 1950s to 1980s; that is, the winters of 2010 and 2014 may signal the beginning of the interval of more occurrences of bitterly cold winters. Note that sequentially bitter winters are rare even during the severe winter intervals.

## El Niño

The winter of 2013-2014 was the transition winter from a strong La Niña to an apparently weak El Niño. Transition seasons are commonly associated with extremes of heat or cold / wet or dry. When an El Niño event develops in the fall, it usually persists into spring. It is typical of an El Niño winter to be less extreme than the usual winter and much less extreme than La Niña seasons. The El Niño winter often results in favorable production conditions for corn and soy in South America and, if the event persists into summer, a favorable crop year for the US Corn Belt.

During years dominated by El Niño, the probability of the US corn yield per acre exceeding the trend is 70%. Drought has been observed during El Niño years (8% chance), but record high yields are more likely (32% chance). The persistence or fading of an El Niño event is commonly evident by the 15th of April. The average persistence of an El Niño event is 14-18 months. However, a persistence of 2 years is not uncommon and 3+ years occurred in the 1990s.

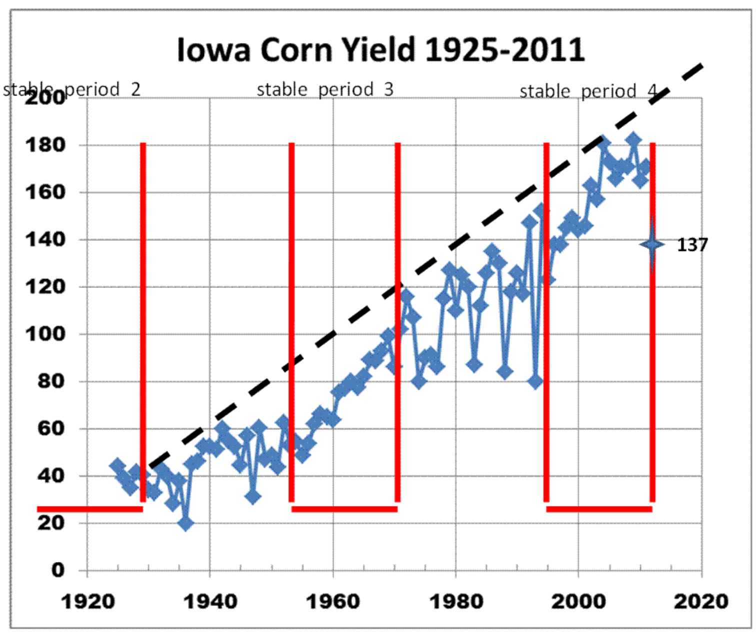
## Yield volatility

The US began keeping yield records in the mid-1860s. The year-to-year corn yield volatility was minimal during the so-called "Benign Weather Years" of 1956-1973. Corn yield tended to improve each year and no years were outstandingly high or unexpectedly low. The subsequent 25 years exhibited a fourfold increase of year to year yield volatility. Yields, reaching the trend of yields expected when weather conditions are as "good as they get" in the Midwest, were obtained as were intervening years when the yield was half of that potential. This volatility pattern of 18 benign years followed by 25 years of high yield volatility can be seen in the annual growth rings of Midwest trees over the past 300 years as well as in the recorded US Corn Yield to date. The US Corn Belt Drought of 2012 was the first wide-spread drought in the Corn Belt since 1988. The 1988 drought marked the end of a 25-year interval of yield volatility and was followed by an 18-year benign interval terminating with the 2012 drought that may very well be the beginning of a 25-year interval of high year-to-year yield volatility extending into the 2030s and that may very well include the best yields yet recorded and the relatively worst crop year of the century (the "worst" years tend to match the Gleissberg cycle of 88 or 89 years). The 89-year average period of extremes would suggest that during the current century the year most reminiscent of the peak of the Dust Bowl (1936) would be close to the year 2025.

## Management of risk

The weather is considered the greatest of the uncontrollable risks associated with agriculture. Although the weather is uncontrollable, the risk associated with the weather is controllable. The management of soil and the management of crop production options can to some extent reduce the risk associated with potential yield volatility and soil degradation. The management of crop marketing decisions in tandem with insurance tools available to the farmer can potentially make a condition of volatility more profitable than benign conditions and markets.

The risk management practices of the past 21 years should be instructive. However, the extremes of the previous interval of 25 years (1973-1997) may be more representative of the expected percent variability in crop yields from year to year. If you have farm records of the period from 1974 through 1996, look at the yields and the price of your production, management, and marketing from year to year to determine what could have been done better. In light of the farm and marketing management tools we have now, the coming years may very well be more profitable than was possible in the 1980s.




## Yield volatility

Corn yield (bushel/acre) in Iowa and the Midwest in general responds to the volatility of weather conditions. Stable intervals of about 18 years followed by more volatile seasons over about 25 years appear throughout the historical record of US corn yield. The dashed line represents the realized potential yield over time (the expected yield for seasons when the weather conditions are as optimal as have occurred in the region). The drought year of 2012 (137 bu/acre) may herald the beginning of a 25 year interval of greater yield volatility.

# Weather-based decision tools

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Useful to Usable (U2U): Transforming Climate Variability and Change Information for Cereal Crop Producers, is a USDA-funded research and extension project designed to improve the resilience and profitability of U.S. farms in the Corn Belt amid a changing climate. The team of over 50 faculty, staff, and students from nine Midwestern universities are experts in applied climatology, crop modeling, agronomy, cyber-technology, agricultural economics, and other social sciences. We are working together, and with members of the agricultural community, to develop decision support tools, resource materials, and training methods that lead to more effective decision making and the adoption of climate-resilient practices. The five tools listed below have been developed and are available for public use at https://mygeohub.org/groups/u2u/decision_resources.

## AgClimate view

A convenient way to access customized historical climate and crop yield data for the U.S. Corn Belt. View graphs of monthly temperature and precipitation, plot corn and soybean yield trends, and compare climate and yields over the past 30 years.

## CornGDD

Track real-time and historical GDD accumulations, assess spring and fall frost risk, and guide decisions related to planting, harvest, and seed selection. This innovative tool integrates corn development stages with weather and climate data for location-specific decision support tailored specifically to agricultural production.

## Climate patterns viewer

Discover how global climate patterns like the El Niño Southern Oscillation (ENSO) and Arctic Oscillation (AO) have historically affected local climate conditions and crop yields across the U.S. Corn Belt.

## Corn split N

Determine the feasibility and profitability of using post-planting nitrogen application for corn production. This product combines historical data on crop growth and fieldwork conditions with economic considerations to determine best/worst/average scenarios of successfully completing nitrogen applications within a user-specified time period. Currently available for Iowa, Illinois, Indiana, Kansas, and Missouri.

## Probable fieldwork days

This spreadsheet-based tool uses USDA data on Days Suitable for Fieldwork to determine the probability of completing in-field activities during a user-specified time period. This product is currently available for Illinois, Iowa, Kansas, and Missouri. (Hosted by the University of Missouri)