^ A 2009 central Missouri nitrogen experiment showed the cost of N loss in wet years. The row on the right received 180 lb N/acre at planting and yielded 96 bushels per acre. A great deal of the N applied at planting was lost before June and July when the corn really needed it. The row on the left received 153 lb N/acre when it was knee high and yielded 164 bushels per acre.

In-season N Applications Increasing in Response to More Frequent Wet Springs

Annual precipitation has increased overall in the Corn Belt over the last 100 years. In addition, many areas are experiencing more extreme rainfall events and higher total precipitation in the spring. In those areas, farmers report they are adapting by waiting to apply nitrogen (N) closer to crop N uptake.

Peter Scharf, professor of plant sciences at the University of Missouri and principal investigator on the Sustainable Corn Project team, says wet springs were widespread in the Corn Belt from 2008 through 2011, and so was nitrogen deficiency, based on aerial and windshield surveys of corn fields that he undertook in those years. Nitrogen deficiency is expressed by light green to yellow leaves. Scharf estimates that what he saw was two billion bushels of lost yield potential during those four years. He says applying N fertilizer during the growing season could have recovered much of the lost yield.

In 2013, much of the Corn Belt was blanketed with more than 16 inches of rain from April through June (Fig. 1). Scharf estimates the area represented 48 percent of all corn acres in the United States. Recently, Scharf undertook a study to see how 21st century spring rains compared to longer-term data in the Corn Belt. He obtained rainfall maps going back to 1900, from the Midwest Regional Climate Center. He discovered that the wet spring of 2013 covered more square miles than any other spring during the past 114 years.

More important than what happened in 2013 are the patterns over time that Scharf found in the data (Fig. 2). He analyzed the data using several different models and found that the best-fitting model showed two patterns: little to no change in the size of the wet area from 1900 through 1980, but from 1980 to 2013 the average size of the wet area has more than doubled.

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"…we actually increased our yields 17.5 bushel to the acre."

Scharf also found, through a series of three informal surveys, that corn producers applied in-season N in 2013 at rates far exceeding any previous year. Many of them had experienced wet springs, nitrogen loss, and the resulting yield limitation several times in the past six years.

Ray Gaesser, an Iowa corn and soybean producer and 2014 president of the American Soybean Association, started testing nitrogen rates in the early 2000s, looking for the right rate and timing for his fields. He says he "didn't see any difference in corn yields for spring-applied nitrogen versus fall, until I started seeing heavy spring rains." Now he uses "less upfront and more in-season applications" and is experiencing better yields overall. Gaesser also has incorporated cover crops in his rotations and has seen reduced erosion from heavy spring rains.

Garry Niemeyer, past president of the National Corn Growers Association, farms 2100 acres in central Illinois. "We put in 28 percent nitrogen as we plant the corn for a starter fertilizer, and then we come back and apply dry urea with a nitrogen stabilizer about the first week of June. And by doing that — this is the third year that we have experimented on our own — we actually increased our yields 17.5 bushel to the acre. So we did not use any more nitrogen; we just applied it at the appropriate time. And that to me is what we could do every year, no matter what the weather is going to do, because it makes the most sense. It keeps the nitrogen on the farm, in the crop, and not in the river. It's a win-win," says Niemeyer.

Wet springs affect not only soil and fertilizer nitrogen, but every field operation. Getting field operations completed becomes that much harder in a wet spring. Using USDA-NASS data, Ray Massey of the University of Missouri has shown that the time from Missouri's corn crop being 25 percent planted to 75 percent planted has increased by three days over the past 30 years.

"This is not because farmers are working shorter days, using smaller equipment, or losing logistical prowess. It's because weather has slowed them down," says Scharf.

Scharf suggests that producers should prepare to deal with more wet springs.

"Larger equipment, starting earlier when possible, hiring more custom work, and adapting operations to the year even if it increases cost are all reasonable strategies. Adding in-season nitrogen applications to that list seems daunting, but pays off in wet years," Scharf says.

In an experiment that he conducted from 2007 to 2013, in-season N out-yielded all-preplant N by a total of 265 bushels/acre, for the four year period, while using 120 lb/acre less N. The yield advantage all came in the wet years of 2008, 2009, 2010, and 2013.

FIGURE 1 | 2013 PRECIPITATION

Area outlined in red received 16 or more inches of precipitation from April 2013 through June 2013. Image courtesy of University of Missouri Division of Plant Sciences.

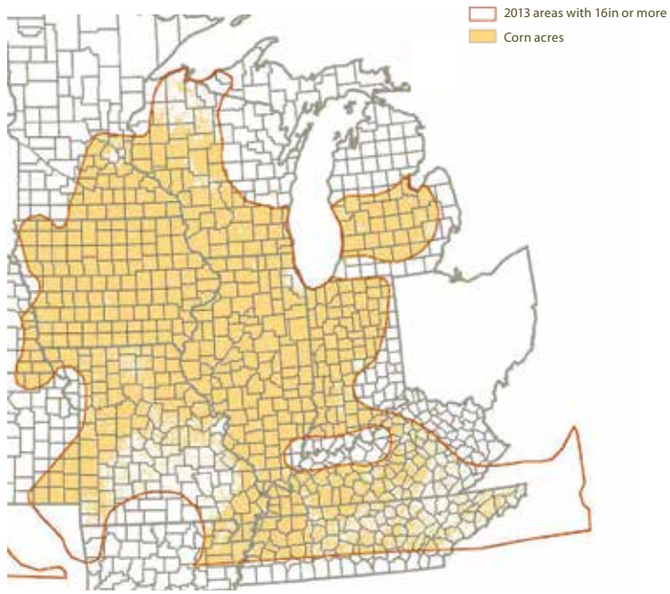
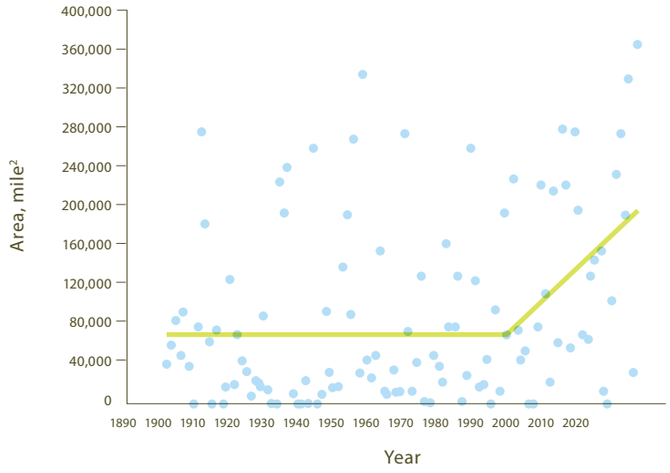


FIGURE 2 | AREA WITH ≥ 16 INCHES OF RAINFALL, APRIL–JUNE

Each dot on the graph represents the area for one year, and the higher the dot the greater the area that had over 16 inches from April through June. The dot at the top right is for 2013, higher than any other year.



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