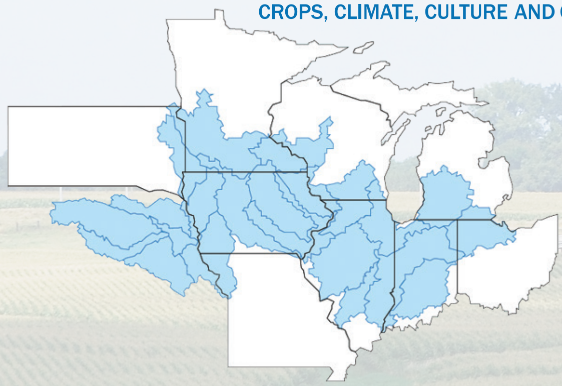
TOP TEN Y3

SUSTAINABLE CORN.ORG

CROPS, CLIMATE, CULTURE AND CHANGE



The United States is the largest producer of corn in the world. Corn is grown on over 400,000 U.S. farms. Corn grown for grain accounts for almost one quarter of all harvested crop acres in this country. Eighty-seven million acres of corn were harvested in 2012, valued at $79.8 billion. This highly versatile crop employs millions of Americans and produces affordable food for people and livestock, fuel ethanol, and thousands of other non-food products that Americans have come to rely on.

Stewardship of crops and cropland in the Corn Belt is extremely important to a steady, affordable food and fuel supply and the long-term protection of rich agricultural soils, biodiversity and water quality. As world population grows, demand for food and fuel rises, and climate instability continues, scientists and farmers in the Midwest are seeking ways to ensure crop productivity while also protecting the natural resources upon which agriculture, wildlife and people depend.

YEAR 3 TOP TEN ACCOMPLISHMENTS...

1. Rigorous field research data continues to be collected on 35 sites in 8 states, using Y1 standardized protocols measuring crop production, pests, and carbon, nitrogen, and water footprints. The data support team ensured quality control and assisted in interpretation of data sets.

2. First-of-its-kind regional data-analysis and interpretation of "Big Data" was undertaken. The centralized database equipped team members with multi-site data which they are utilizing for interdisciplinary team discussions and analysis in preparation for publication.

3. Biophysical (climate, yield, etc.) models were enhanced utilizing Y1 and Y2 research data in combination with data sets acquired through collaborations with external partners and enables model testing and fine-tuning many variables.

4. In-depth interviews with 165 project farmers in 9 Corn Belt states focused on challenges associated with management of agricultural systems under increasingly variable weather conditions. The interview data complement data from our 2012 survey of 4,778 Corn Belt farmers and are helping us to better understand the challenges farmers face and to develop engagement strategies that lead to adoption of more resilient agricultural systems.

5. The Extension team has built relationships with project scientists and project farmers, is assisting farmers in effectively using a suite of risk assessment and decision-support tools, and is providing feedback to project leadership.

6. Outreach to Corn Belt farmers was enhanced by redesigning our website, **sustainablecorn.org**, to more effectively engage Corn Belt farmers. This includes the addition of a farmer-focused blog, in partnership with the USDA Useful to Usable project.

7. This year team members shared preliminary findings beyond project personnel through 31 refereed articles, 189 presentations, 91 extension publications, 49 media/web pieces, and 28 white papers or book chapters.

8. Hands-on experiences and guidance were provided for the next generation of transdisciplinary scientists, including a professional development webinar series by CSCAP Advisory Board members. To date, 61 undergraduate and 51 graduate students (25% minority; 39% women), and 14 post-doctoral researchers (65% minority, 15% women), representing a diverse set of expertise and specialties, have worked alongside other project members, to develop disciplinary rigor and a transdisciplinary approach to addressing complex scientific issues. Ten graduate students have completed their degree and moved into their career paths.

9. Y3 leveraged support sums to over 1.3 million dollars, for a total of over 3 million dollars to date. These additional funds enhance project activities. Support comes from land grant universities, the United Soybean Board, Biological Agricultural Partners (in support of water use efficiency in organic corn-soybean rotations), NC SARE, NRCS and others.

10. Answers to CSCAP research questions began to emerge in this project year. See reverse side for a synopsis.

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USDA United States Department of Agriculture
National Institute of Food and Agriculture

Outlined below are some key preliminary findings emerging from analyses of Sustainable Corn data...

PROJECT GOALS

CARBON: Increase the retention of soil carbon to improve soil quality and sustainability within corn-based cropping systems.

NITROGEN: Limit the loss of nitrogen during seasonal peaks observed within Midwestern corn-based cropping systems that have naturally rich soils and fertilizer applied.

WATER: Stabilize soil and nutrients during periods of saturated and flooded conditions while improving water availability and efficiency for crop use during moisture stress conditions.

SYSTEMS: Build system resilience by integrating productivity and environmental goals through field, farm, watershed and landscape level management in the face of changing climate.

STAKEHOLDERS: Transfer knowledge and findings through science-driven, experiential learning opportunities to equip and educate farmers and teachers.

A cover crop of rye beginning to sprout between the corn rows. Photograph by Chad Ingels.

Carbon:
- Use of cover crops improves the soil structure, especially on hill tops and side slopes. This results in greater organic matter and carbon sequestration over the long term.
- Certain management practices, such as no-tillage and cover crops, can increase soil carbon, yet the amount of time to substantially increase carbon depends on factors such as soil type, temperature and other environmental factors.

Nitrogen:
- Cereal rye cover crops can reduce nitrate leaching.
- Applying nitrogen at a variable rate utilizing nitrogen sensing equipment results in a reduction in nitrogen fertilizer use, nitrous oxide emissions and soil nitrate leaching. This technology also appears to have the potential to reduce energy consumption and emissions based on a life cycle assessment.
- Nitrous oxide emissions can fluctuate positively or negatively from systems with cover crops based on the methods used to incorporate the cover crop or leave it on the surface, the date the cover crop is killed and whether the cover crop is a legume or non-legume.
- Nitrous oxide emissions from the soybean phase of a corn-soybean system are low overall with emissions similar to corn grown with no nitrogen fertilizer.
- Managing tile drainage systems can reduce nitrate losses from fields into surface waters.

Water:
- Managing tile drainage systems by controlling the volume flowing out of the system can keep some additional water in the soil profile during the growing season and available to the crop during times of moisture shortages.
- Rye cover crops in a corn-soybean system have a neutral or positive impact on soil water content and can help conserve moisture for later crop use.
- Rye cover crops and no-till can increase water infiltration into the soil profile and improve soil structure.

Systems:
- Midwest corn yields are likely to decrease under climate change, due to extreme temperature and precipitation events, if current management practices continue.
- Using models, such as SALUS (Systems Approach to Land Use Sustainability), to quantify on-farm effects of management practices and weather on soil and water can support management decisions and optimize profitability and efficient use of other resources.
- Beneficial and crop pest insect populations have been unchanged (to-date) by the addition of a cover crop.

Stakeholders:
- Corn belt farmers have highly heterogeneous beliefs about climate change which are associated with perceived risks to their farms.
- Farmers who believe that climate change is occurring and due at least in part to human activity (41%) are more concerned and have more positive attitudes toward both adaptation and mitigation activities. Farmers who believe that climate change is mostly natural (25%), are unsure (31%), or do not believe (4%) are less concerned and are less supportive of adaptation and (especially) mitigation.
- Seasonal precipitation from 2007-2011 varied across six subregions of the Upper Midwest and is significantly associated with variations in agricultural practices (drainage, no-till, cover crops, and planting on highly erodible lands). This suggests the need for more local climate information, as regional climate information is likely not to be representative of individual farmers' actual and perceived experiences.

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