University of New Hampshire

UNH TODAY

Droughts Are a New Reality for New England. Diverse Crop Rotations Can Help.

NHAES research shows that complex crop rotations encourage nitrogen build-up in soil and improve drought resistance

Wednesday, October 19, 2022

Your browser can't play this video.
Learn more

What is crop rotation?

Crop rotation refers to the practice of planting different crops in the same plot over different time periods. For example, planting broccoli one season, winter wheat the next season and sweet corn the next. Using a variety of

UNH Scientists Receive $1M to Support Critical Soil Sustainability Research

University of New Hampshire scientists have received three grants totaling $1 million that will support research addressing urgent questions in soil sustainability and, ultimately, resilient food production in New Hampshire and beyond. The projects range from

crops can provide different advantages, such as adding nitrogen to the soil and reducing the need for fertilizer, offering natural weed suppression and disease prevention, improving water quality or reducing erosion, and boosting the organic matter in the soil.

> A simple crop rotation might involve planting just two or three crops successively...More complex crop rotations often involve more than three and can include as many as 10-12 crops, with each having different benefits.

A simple crop rotation might involve planting just two or three crops successively, such as a corn crop followed by a soybean crop, which is the most common rotation in the Midwest. More complex crop rotations often involve more than three and can include as many as 10-12 crops, with each crop offering different benefits.

When it comes to crop rotations, complexity is key to boosting levels of nitrogen—a soil nutrient that is critical to crop production. However, new research from an international group of scientists—among them NH Agricultural Experiment Station scientist Stuart Grandy, a professor in the natural resources and the environment department at UNH—shows that complex crop rotations can benefit levels of nitrogen even during droughts, when application of nitrogen fertilizers can be less effective.

“When soils become really dry, nutrient uptake shuts down in plants, limiting plant growth and causing those nutrients–following a subsequent heavy rainfall–to eventually leach out of the soil,” said Grandy. “We were interested in whether complex rotations

using state-of-the-art instrumentation to determine components that help build soil organic matter, to increasing soil microbes' ability to increase the efficiency of nitrogen fertilizer, to understanding how plants extracts beneficial nutrients from soil organic matter.

READ ARTICLE

Rotating Crops Over Time Boosts Corn Yields, Even in Droughts

Rotating crops over time increases the yield of corn, even during unfavorable weather conditions such as droughts, according to new research findings from the NH Agricultural Experiment Station at the University of New Hampshire and the University of California, Berkeley. The findings demonstrate that diversifying crops may be an effective, long-term strategy for strengthening food production systems globally in the face of a

would be able to handle drought conditions better than simple rotations, and if we'd see more continual uptake of nitrogen during a drought."

Research-informed management practices, aimed at helping food producers remain resilient to adverse growing conditions, are critical as the Granite State is experiencing more and more drought conditions. Since 2016, parts of New Hampshire have experienced "extreme" droughts—resulting in major crop and pasture losses and widespread water shortages or restrictions—for at least 34 weeks. Several of those weeks occurred consecutively, and all of those weeks fell within the years of 2016, 2020 and 2022, according to the U.S. Drought monitoring system maintained by the USDA, NOAA, and the National Drought Mitigation Center at the University of Nebraska.

Grandy, along with researchers from the University of California Berkeley, Oklahoma State University, the University of Hawaii, and the University of Vienna, published their research in *Soil Biology and Biochemistry*. Their study had both fundamental and applied components, said Grandy. On the fundamental side, they were looking at the areas that soils accumulated – or "pooled" – nitrogen within for use by plants, and which of those areas (for example, in the soil microbes, in decomposing organic matter, or in organic nitrogen pools associated with the mineral particles themselves) did plants tap into for nutrient uptake. Nutrient uptake refers to the ability of plants to pull in nutrients from the soil. On the applied side, they wanted to know which crop rotation patterns most impacted nitrogen pools and how did drought and non-drought conditions affect the ability of plants to access that nitrogen from different soil pools.

changing climate and environmental degradation.

READ ARTICLE

New Guidelines Provide Farmers in Nation's Breadbasket a Roadmap in Changing World

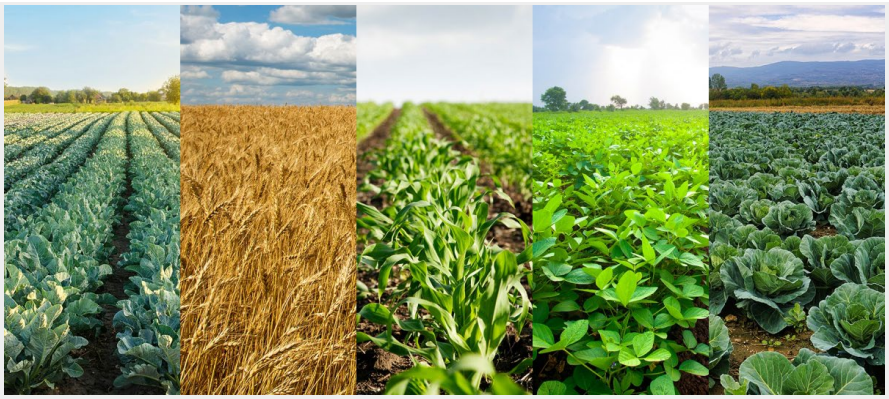
Midwest farmers experiencing more erratic rainfall and prolonged dry periods that have devastated crops now have new guidelines to help them manage the effects of climate variability.

READ ARTICLE

RELATED LINKS

A. Stuart Grandy profile

Crop rotational complexity affects plant-soil nitrogen cycling during water deficit



According to new research from Station scientists, the greater the crop diversity, the higher the potential to increase soil nitrogen and nutrient richness, and the greater the ability of those plants surviving during drought conditions.

What they found in the study was that nitrogen pooled in an area of soil previously believed to offer little nutrient value to plants – the mineral-associated organic matter (MAOM) comprised of small organic molecules, like amino acids, that stick to mineral or clay particles.

“We found that the MAOM does supply nutrients to plants. And we believe that under limited water, that that’s a specific nitrogen pool that plants tap into,” Grandy said. “Additionally, we learned that complex crop rotations are building up nitrogen specifically within that MAOM, making these complex rotations more resilient to water variability.”

> Ultimately, what we learned from this study is that the greater the crop diversity, the greater the potential to increase soil nitrogen, and the greater the ability of those plants surviving – or even thriving – during drought conditions.

“So ultimately, what we learned from this study is that the greater the crop diversity, the greater the potential to increase soil nitrogen, and the greater the ability of those plants surviving – or even thriving – during drought conditions.”

This material is based on work supported by the NH Agricultural Experiment Station through joint funding from the USDA National Institute of Food and Agriculture (under Hatch award number 1020144) and the state of New Hampshire. Support for this research was also provided by the National Science Foundation's Long-term Ecological Research Program (DEB 1832042) at the Kellogg Biological Station and by Michigan State University AgBioResearch.

You can read the published article, Crop rotational complexity affects plant-soil nitrogen cycling during water deficit, in Vol. 166 (March 2022) of *Soil Biology and Biochemistry*.

COLLEGE OF LIFE SCIENCES & AGRICULTURE

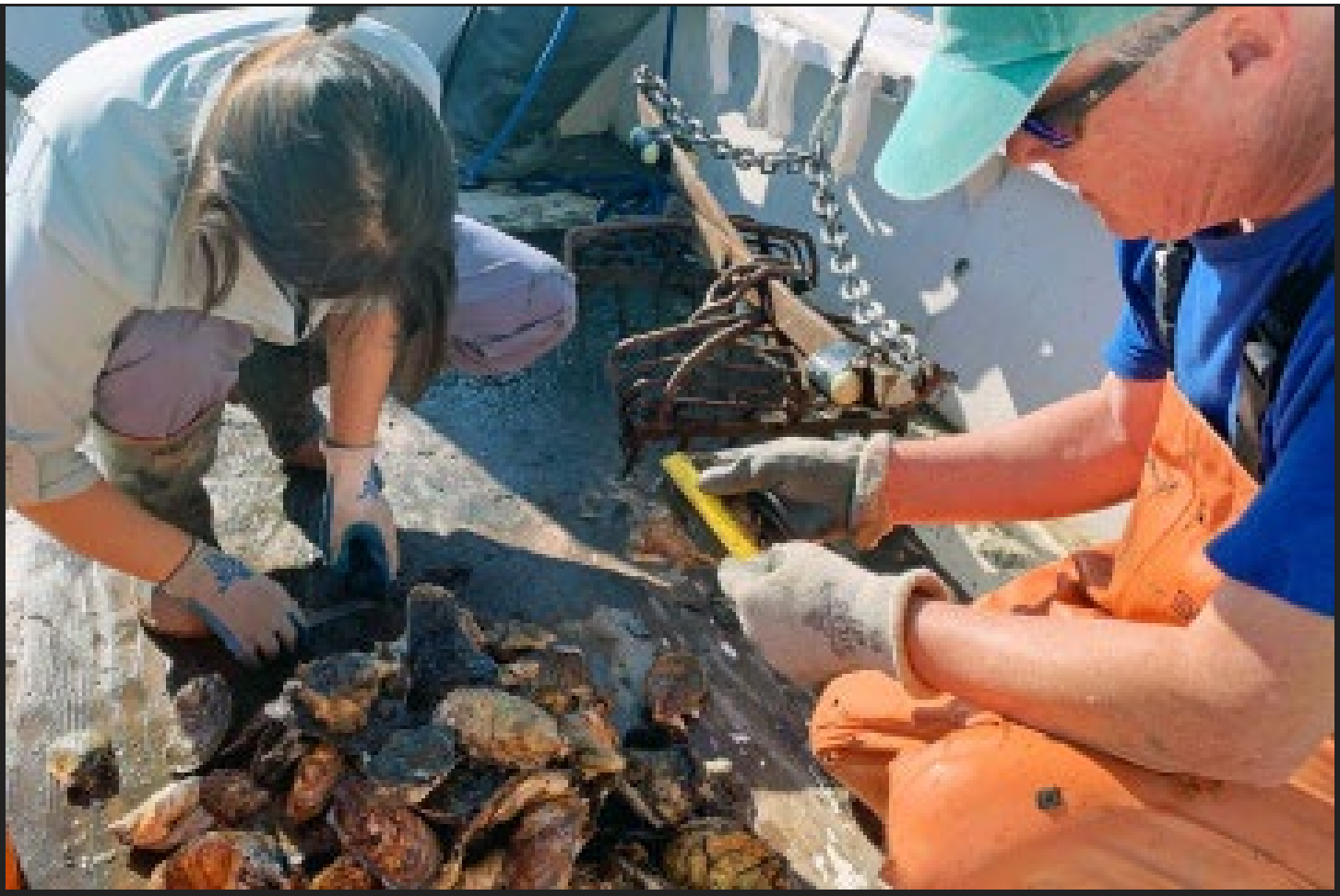
RELATED ARTICLES

July 18, 2022 | NH AGRICULTURAL EXPERIMENT STATION

Sizing Up Cover Crop Seeding Rates

July 27, 2022 | NH AGRICULTURAL EXPERIMENT STATION

Download the NHAES 2022 Inspired Horticultural Research Report today!



August 4, 2022 | NH AGRICULTURAL EXPERIMENT STATION

Oysters as Nitrogen Bioextractors