The mission of the UVM Extension Northwest Crops and Soils Program is to provide the best and most relevant cropping information, both research-based and experiential, delivered in the most practical and understandable ways to Vermont farmers.
WHEN I JOINED the University of Vermont Extension in 2003, it was also a return home. With my family, I am the seventh generation to continue our home farm in the Lake Champlain Islands. Having the perspectives of both farmer and Extension Specialist has helped create our unique projects at the Northwest Crops and Soils Program (NWCS).

Our goal at NWCS is to provide the best and most relevant cropping information, both research-based and experiential, delivered in the most practical and understandable ways to Vermont farmers. But our aspirations go much deeper than that. We want to help farmers stay on the land. We want to develop the best farming practices and management strategies to keep farms successful. We want to support Vermont’s economy by providing jobs on the farm, at the university, and across the food system. And we want to inspire the next generation of Vermonters to become farmers, researchers, Extension professionals, and educated consumers.

We know we can’t do this alone. Over these past 11 years, our NWCS team has grown to 17 committed field research assistants, outreach professionals, graduate and undergraduate students. But our team is bigger than just ourselves.

It simply would not be possible to conduct our work to its extent without full collaboration from the farmers, processors, and others who partner with us every day.

The strength of NWCS, I believe, is not just the work we do, but why we do it—striving to truly understand and address the needs of farmers and end-users of their products.

Today, we are conducting on-farm research and demonstration projects on a wide range of agronomic crops, from small grains and corn to hops and oilseeds. We are also working on soil health and nutrient management strategies to improve farm profits while protecting our natural resources. The information included herein provides some highlights of our work to date. We want to continue to provide this work well into the future, and we need your help to support and build a healthy and prosperous agriculture in Vermont.

“The strength of NWCS is not just the work we do, but why we do it...”
NWCS FAST FACTS

36 Vermont farm collaborators hosted more than 42 research and demonstration projects in 2014.

3,500 experimental plots were established and evaluated throughout Vermont in 2014.

4,800 farmers and others participated in our 68 conferences, field days, and workshops from 2010 to 2014.

84 instructional videos and conference recordings posted to YouTube have received more than 274,000 views by people from all 50 states and 192 countries across the globe.

859 farmers and others follow our work through social media channels like Facebook, Twitter, YouTube, and our blogs.
Cultivating a Safe and Bountiful Food System

Adding Value with Small Grains

The goal of our small grains work is to enhance the capacity of farmers to produce high quality and high yielding grains to meet the increasing demand from local millers, bakers, maltsters, distillers, and ultimately, consumers.

Early on in our program, we connected farmers and bakers to establish the Northern Grain Growers Association (NGGA). The mission of NGGA is to promote the culture and utilization of locally grown grains in the Northeast through research, education, and demonstration. Members of the NGGA have been critical partners in our research and education work—together we’ve advanced local grains production in Vermont and the Northeast region.

Since 2009, we’ve evaluated hundreds of grain varieties under the climatic conditions we experience here in Vermont. We’ve looked at commercially available wheat varieties as well as heirloom wheat, barley, and oats. We have also conducted numerous research trials to identify optimum weed control strategies, fertility management, and planting dates for these grain crops.

As a result of our work, we’ve been able to identify cultivars that perform best in our region under optimal management practices for organic grain production—and farmers are now adopting them. A 2013 survey of 30 New England grain growers revealed that 83% had adopted at least one and, on average, three new management practices based on our research results, including the following:

- 72% growers selected cultivars based on our variety trial reports
- 43% increased seeding rates
- 33% changed plant spacing to better suppress weeds
- 29% topdressed nitrogen on winter grains to improve grain quality
- 13% changed a marketing practice.

Through this work, farmers have increased grain yields, improved grain quality, connected with new buyers, increased or maintained employment, and increased wheat acreage. The economic value farmers placed on the benefits they gained was an average $7,000 each. For millers, this value was over $35,000 each.
Additionally, 71% of bakers and distributors with whom we’ve worked reported an increase in their use of locally grown grains; 36% have developed new products; and 86% made new contacts as a result of our work. They estimated an average of $5,000 and up to $20,000 in economic gain to their businesses from our project.

**SUPPORTING LOCALLY GROWN HOPS**

Our team has also been addressing the interest in expanding the local food movement into beverage markets. Hops have not been grown in Vermont on a large scale since the 19th century when this crop was a large part of the state’s agricultural economy; during its peak in 1860, commercial hop production in Vermont out-produced all other New England states combined. The demand for locally produced hops today has spurred a renaissance of region-specific experience and research-based production knowledge on small scale hop production.

Working closely with local brewers and hop growers, we have identified critical factors needed to support a durable hop industry for our region: varieties suited to our growing conditions, robust insect and disease management strategies, scalable equipment to harvest and process the crop, and strong local markets.

Together, we are creating a new knowledge base of hop production from start to finish. In 2010, we initiated an organic hop variety trial to assess 21 publicly available hop varieties. We are determining the varieties that not only demonstrate disease and pest resistance, and grow well in the Northeast, but also present the most desirable characteristics for local brewers.

We collaborated with UVM Extension agricultural engineer, Chris Callahan, to develop working models of drying and storage equipment, as well as those for a mechanical hop harvester, drier, and a mechanical baler; all plans are available publicly for on-farm use.

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“One of the most exciting aspects of developing a locally-based grain growing and processing system is the opportunity that it offers for farmers and bakers to come together and discuss what can be done from the field to the hearth to produce the best bread possible.”

–Randy George, Red Hen Baking Company, Middlesex

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**Value of Our Grains Work**

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**Did you know?**

12 Vermont breweries are now using locally-produced hops.
Through our annual conferences and field days, we have trained more than 2,100 farmers and service providers about hop production considerations, proper harvest timing, and drying techniques. At our 2014 hops conference, 100% of 173 attendees said that our research and outreach has helped them improve yields and quality; 60% said the project has helped them find markets for their hops.

As a result of our work, 12 Vermont breweries are now using locally produced hops in their brewing process, with many more showing interest.

**TESTING TO ENSURE QUALITY & FOOD SAFETY**

A strong local food system not only relies on enough quantity of product to satisfy consumer demands, it needs assurance of quality and food safety; local grains and hops will not be successful if processors (bakers, maltsters, brewers, and distillers) and consumers find them inferior to those available elsewhere. Further, grains need to be evaluated for safety as certain fungal species can infect grains and produce toxins that are harmful to humans and animals at high concentrations.

Providing growers with access to quick and easy lab assessments to monitor the quality and safety of their products before it is distributed to the marketplace is critical to the successful expansion of the grain and hop industry here in Vermont.

Therefore, in 2010, we created the UVM Cereal Grain Quality Testing Laboratory—the first of its kind on the East coast—to conduct quality and safety testing services for growers and processors, as well as to perform analyses on our own research samples. Since opening, we have tested more than 5,630 samples received from over 12 states and Canada.

In 2013, we expanded our lab services by offering hops quality analyses to commercial growers and brewers. We’ve tested more than 200 samples to determine alpha and beta acid concentrations, characteristics used by brewers to determine the bittering and aromatic qualities hops contribute to their beers. In the future, we hope to offer beer analysis to brewers to determine a variety of quality characteristics of final brews, enhancing their product marketability.

Our lab services became particularly important following Tropical Storm Irene which devastated many farm fields throughout Vermont in 2011. Through our testing laboratory, we analyzed corn samples from flooded fields to detect the presence of five different mycotoxins—these are toxins produced by certain molds and fungi—ensuring that any contaminated feeds were not sold or used for livestock consumption.

“The grain quality testing lab at UVM helps me during the harvest season to determine quickly if my grain can pass the quality test for human consumption. The speed at which I get results can mean a prompt harvest when the grain is at its peak quality.”

—Ben Gleason, Gleason Grains, Bridport
ENHANCING SOIL HEALTH

Our most critical ingredient to supporting healthy and bountiful crop production is the soil. Since the start of NWCS, we have worked in partnership with groups like the Farmers’ Watershed Alliance to create management practices that enhance healthy farm soils to support crop viability while protecting the environment.

We conduct on-farm research and demonstrations on crop rotation, cover crops, soil amendments, reduced tillage, and soil aeration. We’ve worked closely with farmers in their adoption of these practices to address both real and perceived barriers. For example, while we know that cover crops can reduce nutrient and soil loss, increase soil organic matter and provide other benefits, timely planting of these crops can be tricky during fall corn harvest on dairy farms. To address this challenge, we conducted a pilot project, in collaboration with UVM Extension’s Champlain Valley Crops, Soils and Pasture Program, to aerially seed winter rye into standing corn before harvest. In 2012, 2,544 acres in Addison, Chittenden, Franklin, Lamoille and Orleans counties were planted to this cover crop; in 2013, that acreage more than doubled to 5,600 acres seeded to winter rye, providing year-round vegetative cover.

In addition to cover crops, reduced- and no-till practices also help protect soils through minimal disturbance. Our team evaluates reduced tillage systems that successfully incorporate annual and perennial crops, cover crops, and manure injection systems into forage production systems. Through the acquisition of no-till drills and helping farmers retrofit their own planters, we have seen an increase in no-till farming; more than 3,900 acres were no-till planted in 2014.
MITIGATING NUTRIENT RUNOFF AND EROSION

Our team works hand-in-hand with farmers to proactively address water and soil quality on their farms. We assist farmers in developing their own nutrient management plans to minimize nutrient and soil losses to protect our state’s water bodies.

In 2006, we developed “Digging In: A Nutrient Management Course for Farmers” and have been teaching the course to livestock farmers for the past 9 years. As a result, 180 farmers—representing 10% of all dairy farms in Vermont—have successfully written their own nutrient management plans that meet state and federal standards.

The course has been upgraded with a companion user-friendly web-based application called goCrop™. Accurate and complete record keeping is often the missing link for effectively implementing a plan. goCrop™ was developed to help farmers keep track of inputs of manure and fertilizer and yields on the go, through a mobile application for their iPhone or iPad.

In 2013, we made goCrop™ available to farmers throughout the U.S—more than 160 farmers and service providers from 33 states and Canada are now using goCrop™ for their nutrient management planning.

Through this work, farmers now better understand how their farming practices have an impact on water quality. Vermont farmers have reduced phosphorus additions on their farms by an average of 50% as a result of implementing nutrient management plans, based on a 2010 survey we conducted of Vermont dairy farms.

“We went from looking at our manure as a liability to an asset. We now spread the manure over more acres using a carefully tailored plan to meet the needs of the individual crops, which helps the environment and saves us money.”

—Tony Poulion, Poulion Farm, Westford
Building Resiliency within Our Working Landscape

PROTECTING THE DIVERSITY OF OUR SEED SUPPLY
Farmers with whom we work have asked for control of their own seed supply, especially seed adapted to our climatic conditions. Seed sovereignty for us has thus become a look to our past as well as a look to the future.

In the 1880s, Vermont was dubbed the “bread basket of New England” because of its high wheat production. However, at the turn of the century, Vermont lost its grain production and with it, its indigenous knowledge and infrastructure needed to produce these crops.

We are now creating our own history through the renaissance of a local grain industry in Vermont. With a focus on seeds, we have resurrected 50 heirloom wheat varieties, testing their potential in our climate especially their tolerance to today’s pest and disease pressures. We have determined that these cultivars may offer farmers new markets that meet the growing demand for heirloom grains.
At the same time, we are creating new wheat varieties. Based on the work of the 19th century UVM plant breeder Cyrus Pringle, our farmer-centered seed breeding project is using Pringle’s varieties to create 15 unique wheat crosses that have potential for our region. For the past 7 years, our farmer partners have selected plants based on favorable characteristics and we’ve tested them for quality and suitability for our region. Traditional plant breeding takes time but through this work, we hope to release a new commercial wheat variety adapted to our climatic conditions in 2015.

**HOME-GROWN FORAGES FOR GREATER SUSTAINABILITY**

The more livestock farmers can grow their own feed, the less they need to rely on costly off-farm feed sources. On average, purchased grains are responsible for 40% of total expenses on organic dairy farms. Off-farm feeds can also equate to the import of expensive nutrients that may otherwise end up in our waterways. One dairy farmer with whom we work reported a reduction in phosphorus imported to his farm by 235 pounds per year by growing his own high-quality feeds.

To help livestock farms—both conventional and organic—stay viable while protecting our natural resources, we are evaluating the best combinations of forage species to support annual and perennial on-farm cropping systems. We have studied new grass species to find those that are most palatable to and digestible by livestock. We have conducted a number of variety trials on long- and short-season silage corn, summer annuals, and forage brassicas to help farmers identify the highest-quality forages they can produce on their farms, particularly under today’s extreme weather conditions.

We also work with farmers to meet consumer demands for milk and meats produced on high forage diets by investigating management practices that can help increase the beneficial fats—like omega-3s and conjugated linoleic acids (CLAs)—in products we eat.

“There’s something about grazing brassicas that really supports milk nutrition. We noticed that production jumped 2 to 4 pounds per cow as soon as they started grazing them.”

—Brent Beidler, Beidler Family Farm, Randolph Center
Research results have helped dairy and other livestock farmers improve crop yields and extend the grazing season. For example, in 2013, 40 organic dairy farmers reported improving forage yields and quality and/or reduced grain use as a result of what they learned at our organic dairy producer conference offered in partnership with NOFA Vermont.

**ENERGY INDEPENDENCE**

Our farms are vulnerable to fluctuations in input costs, including fuel. Early in our program, farmers asked us if there were ways to grow their own ingredients for fuel to become more energy independent.

Through our oilseed research and outreach program, we are fostering a community of farmers who grow their own fuel right in Vermont, as well as conducting research with our UVM partners to enhance the efficiency and capacity of on-farm biofuel facilities.

Oilseed crops are relatively new to our region and little production information on these crops existed for our growing conditions. Therefore, on-farm research, conducted over the past six years, has included the evaluation of sunflower, soybean, and canola varieties, seeding rates, planting and harvest dates, as well as looking at how these crops fare in no-till and cover crop systems. Our evaluation of six oilseed press designs on three different crops has helped inform best operating practices for small-scale producers. This work has helped farmers learn how to successfully grow oilseed crops, extrude the oil, and produce biofuel on a scale suitable for Vermont farms. Despite some challenging weather conditions, reported sunflower seed yields have increased each year since 2011; in 3 years, the state saw an 85% increase in per acre sunflower yields, from 931 pounds per acre in 2011 to 1,725 pounds per acre in 2013.

There are more than 24 farms throughout Vermont that are now growing their own oilseed crops for feed, fuel, food, and fertilizers. Among them are farmers participating in the Farm Fresh Project. Started in 2012 in collaboration with the Vermont Bioenergy Initiative, the project sought to make Grand Isle County, Vermont, the first county in the nation to have each of its farmers use some form of on-farm alternative energy. During its pilot year, 69 acres of sunflowers were planted in the county, yielding 28 tons of seed and pressed into 2,750 gallons of oil for participating growers, enough to make 2,150 gallons of biofuel. By assisting these and other farmers, we are doing our part to help Vermont achieve its goal of producing 25% of its own energy needs by 2025.

During its pilot year, 69 acres of sunflowers were planted in the county, yielding 28.3 tons of seed pressed into 2,750 gallons of oil.

Vermont farmers save an average of $1.46 per gallon on fuel when they grow it themselves.
Expanding the Reach of Our Program

INSPIRING THE NEXT GENERATION
One of the greatest rewards of our work is sharing our excitement about agronomy and local food systems with Vermont’s young people. We’ve worked with more than two dozen high school, undergraduate, and graduate students interested in conducting on-farm research and outreach. We have presented soil health and small scale grain processing demonstrations to hundreds of elementary students at Conservation Field Days and high school girls at the annual Women Can Do! Conference. One of Heather’s shining moments was delivering the commencement address at her Alma mater, the Alburgh Community Education Center. Sharing what we do with today’s youth may inspire them to become Vermont’s next agronomists, but regardless of their ultimate career directions, they inspire us with their enthusiasm as our next generation of educated consumers.

BRINGING OUR INFORMATION TO THE NATIONAL STAGE
Though most of our work is conducted here in Vermont, our reach extends beyond our borders through our online education and collaborations with researchers and others throughout the U.S. For example, we lead eOrganic’s dairy team. eOrganic is the organic production Community of Practice for eXtension.org, a national initiative among U.S. land grant universities to develop peer-reviewed online information. eOrganic’s dairy team—one of more than 90 researchers, extension educators, farmers, and other professionals—has published more than 125 peer-review articles, 7 videos, and 27 webinars and conference broadcasts. All are posted at eXtension.org/organic_production. Our videos have received more than 72,200 views from people across the globe. More than 2,000 farmers and others have participated in our webinars and conference broadcasts—and 27,648 have viewed the recordings on YouTube.

Last year, we published an online course, An Introduction to Organic Dairy Production. The course was piloted by 57 undergraduate students studying dairy sciences at the California State University—Chico and, to date, 17 farmers and agricultural service providers from across the U.S. have participated in the course online.

“This is a lot different from school. Heather trusted us to do our projects and experiments ourselves.”

—Katie Blair, 2011 NWCS Intern
GOING VIRTUAL: CONFERENCE BROADCASTS

We have taken the lessons learned from our national work and are using them back home by offering broadcasts of our conferences. For example, a farmer panel at our 2013 Vermont Organic Dairy Conference was broadcast to participants at the NOFA-NY Organic Dairy and Field Crops Conference, reaching a combined audience of 134 farmers and others. In 2014, we streamed presentations from both our annual Hops and Grains conferences to virtual audiences in Vermont, Massachusetts, New York, and Canada, extending our reach beyond Vermont’s borders.

“I just want to thank you for the webinars! ...I think back to not too long ago when farmers would ask us technical questions and there was no one to turn to for help. To have this great resource created by Extension is phenomenal.”

–Nancy Hirshberg, Stonyfield Farm, Londonderry, NH

COLLABORATION IS KEY

When we think of the word “team,” our Northwest Crops and Soils program extends far beyond our team of 17. We really couldn’t do the work we do without the following folks.

- More than 36 farm families who host on-farm research, workshops, and field days.
- Our baker, brewer, and maltster partners, as well as our non-profit organization collaborators, including:
  - Farmer’s Watershed Alliance
  - Friends of Northern Lake Champlain
  - Mid-West Organic & Sustainable Education Service
  - Northeast Hops Alliance
  - Northeast Organic Farming Association of Vermont
  - Northeast Organic Dairy Producers’ Alliance
  - Northern Grain Growers Association
  - Vermont Brewers Association
- The faculty and staff at other land grant universities who have collaborated with us on our research programs, including:
  - California State University-Chico
  - Cornell University
  - Oregon State University
  - Michigan State University
  - North Carolina State University
  - North Dakota State University
  - Pennsylvania State University
  - University of Illinois
  - University of New Hampshire
  - University of Maine
  - University of Massachusetts
  - University of Rhode Island
  - Washington State University
- Our funders. Without the support from grants and gifts from people like you, our team could not conduct our meaningful and high-quality research and education!
  - American Malting Barley Association
  - Ben and Jerry’s Caring Dairy Program
  - Castanea Foundation Inc.
  - Environmental Protection Agency
  - Lake Champlain Basin Program
  - Lattner Foundation
  - Massachusetts Department of Agricultural Resources
  - NE Interstate Water Pollution Control Commission
  - Nell Newman Foundation
  - Northeast Center for Risk Management Education
  - Organic Valley Farmers Advocating for Organics Program
  - USDA Agricultural Research Service
  - USDA Hatch
  - USDA Integrated Pest Management
  - USDA Natural Resources Conservation Service
  - USDA Organic Agriculture Research and Extension Initiative
  - USDA Risk Management Agency
  - USDA Specialty Crops Block Fund
  - USDA Sustainable Agriculture Research and Education Program
  - UVM Dairy Center of Excellence
  - Vermont Agency of Agriculture Food & Markets
  - Vermont Agency of Natural Resources
  - Vermont Brewers Association
  - Vermont Sustainable Jobs Fund
  - Vermont Vegetable and Berry Growers Association
  - Private funders
“For the last ten years, I have worked closely on farming and research projects with Heather Darby and have been able to perfect and improve my farming craft. I have changed the way I grow crops and produce forages for my cows. She is also interested in promoting grain farming and crops for human consumption—and has passion and unequaled focus. This is done for every farmer—and is why Vermont agriculture is so ahead of the curve.”

– Jack Lazor, Butterworks Farm, Westfield

Please consider an online donation to the Northwest Crops and Soils Program: go.uvm.edu/nwcsgift and choose “Northwest Crops and Soils Fund.”