



University of Vermont Research-Based Ideas at Work for Vermonters



Annual Report 2014



UVM Research-Based Ideas at Work for Vermonters

For the past 24 years, this annual report has been released to great fanfare (apple pie and ice cream) at the Vermont's Statehouse amid a crowd of stateswomen and men led by the Governor; and the University of Vermont President, researchers, program leaders, students and staff. This year is no exception.

Credits

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Vermont
AGRICULTURAL
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The University
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Three Questions On Why UVM Research Matters To Vermonters

Tom Vogelmann, Dean and Director of the Vermont Agricultural Experiment Station (VT-AES) and UVM Extension Dean and Director Doug Lantagne cooperate to translate VT-AES research into UVM Extension's science-based programs to benefit Vermonters. They oversee over \$19.1 million in state, federal and other grants and contracts and are accountable to the University, state and federal leaders and the people of Vermont. That's why they publish this annual report.

Q: How do Vermonters see the effects of scientific research conducted at UVM?

A: Science is an essential part of innovation and technology in Vermont's economy. VT-AES and UVM Extension faculty and staff work with farmers, communities and organizations throughout Vermont. UVM discoveries and knowledge help solve some of our most pressing issues surrounding 21st Century farming, planning for climate change, food systems that work and building Vermont communities. These pages highlight projects that will have real impact at home and in the world – just a few examples of UVM work across many disciplines. Find out more at the websites at the bottom of each page.

Q: Vermont is a small state. How can it have bragging rights against 50 states most much bigger in so many ways?

A: "Vermont's stature as a leader is intrinsically linked to having world-class researchers and world-class outreach programs," says Lantagne. "But just as



Cheryl Dorschner

Tom Vogelmann, Dean
Vt Agricultural Experiment Station

"UVM discoveries help solve our most pressing issues surrounding:

- 21st century farming,
- Planning for climate change,
- Food systems that work and
- Building Vermont communities."



Cheryl Dorschner

Douglas Lantagne, Dean
UVM Extension

important is Vermont's close working relationship among government, community, business and higher education leaders."

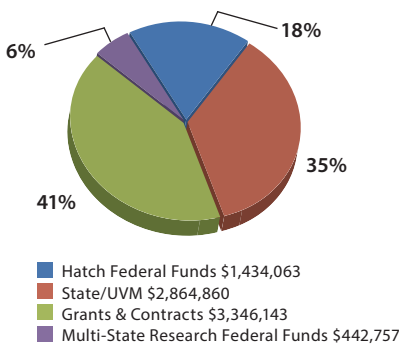
That's why, for example Vermont is synonymous with cheese, maple, hard cider, ice wine, artisan beers, ice cream, even kale. UVM scientists are developing the next generation of Vermont's signature products. Our hardworking state is also known for being among the first to take stands on many issues and for maintaining a beautiful working landscape. Likewise, UVM is renowned as one of the nation's pre-eminent small research universities. And Burlington is consistently top rated, including this year: #1 college town by "Travel & Leisure" magazine, "Outside" magazine ranked us one of 16 "best towns ever." And BTV is one of 15 hottest cities for 2015.

Q: With ever-stressed state and federal budgets, how do you aim to meet the research and program needs you just described?

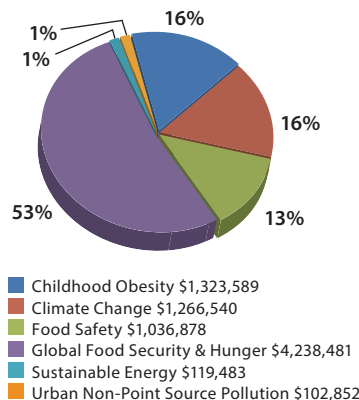
A: We don't ever aim to stay the course, because the research language is always changing. Witness Jill Preston's \$423,000 National Science foundation grant (page 3), Jeff Carter's \$500,000 National Institute of Food and Agriculture water quality grant, Heather Darby's \$150,000 UVM Dairy Center Excellence funding, and other pioneering ways of leveraging grant dollars through partnerships with farmers (page 2). "The key to our strong future is to increase the number partnerships at all levels," says Vogelmann.

~ Cheryl Dorschner

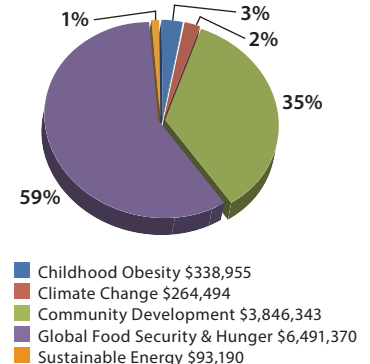
VT Agricultural Experiment Station Budgeted Dollars FY 2013



VT Agricultural Experiment Station Budgeted Dollars by National Program Area FY 2013



UVM Extension Budgeted Dollars by National Goal Area FY 2013



21ST CENTURY FARMING: DAVID KERR

UVM Dairy Center of Excellence New Paradigm: On-Farm Research



Jane O'Neil

UVM Dairy Center of Excellence Interim Director David Kerr examines skin cells of cows exposed to mastitis-causing bacteria. Students, from left, Benjamin Green, Amanda Ochoa and Aimee Benjamin discuss how animals' ability to respond to pathogens is related to how their cells respond in the lab.

TOP 10 THINGS YOU NEED TO KNOW

- 1 In 2009, UVM realized that the increasing operating costs of running an on-campus research farm far outspent income from research funding – to the tune of \$1.2 million a year.
- 2 Necessity is the Mother Cow of Invention.
- 3 By keeping the student-run dairy herd and selling UVM's research herd, the debt was eliminated, and \$150,000 in operating costs plus \$50,000 seed money was channeled to research.
- 4 Attracting matching investors, industry and grant funding, the UVM Dairy Center of Excellence (DCE) was launched with the idea that much research could be done on Vermont farms, with UVM's farm dedicated to specialized, intensive research on small groups of animals.
- 5 The number of partner farms has grown from 4 to 19 farms.
- 6 And the start-up \$200,000 investment has yielded more than \$1 million in research benefiting Vermont farmers.
- 7 Scientists can conduct larger and broader samples and tap into a greater gene pool than if they were restricted to UVM's herd.
- 8 Among the projects are identifying traits for milk production and mastitis and comparing forage crops in hopes of improving cattle health and lowering feed costs.
- 9 "Our new model of research is a much more efficient use of scarce research dollars," says David Kerr, DCE interim director.
- 10 Funding for two new proposals totaling \$300,000 was announced in February 2015.

UVM PARTNERS WITH FARMS
Expands Reach and Depth of Research

- Andersonville Dairy LLC, West Glover
- Audel's Blue Spruce Farm, Bridport
- Chaput Family Farms, North Troy
- Clifford Farm, Starksboro
- Fairmont Farm, Inc., East Montpelier
- Fitzgerald Dairy Farm, Colchester
- Foster Brothers Farm, Middlebury
- Four-Hills Farm, Bristol
- Green Mountain Dairy, Sheldon
- Island Acres Farm, South Hero
- Jasper Hill Dairy Farm, Greensboro
- Kane's Scenic River Farms, Enosburg Falls
- Knoxland Farm, Bradford
- Monument Farms Dairy, Weybridge
- Newmont Farm, LLC, Bradford
- Nordic Farms, Charlotte
- Rainville Farm, Highgate Center
- Shelburne Farms, Shelburne
- Terryland Farms, Inc., St. Eugene, Ontario



Debra Heleba, UVM Extension

UVM Agronomist Sid Bosworth studies cool-season grasses and forage crops at Borderview Farm in Alburgh in hopes of understanding the characteristics that could be altered to improve cattle health and lower feed costs.

PLANNING FOR CLIMATE CHANGE: JILL PRESTON

Chill Factor – How Will Plants Deal With What May Be Inevitable?



Cheryl Dorschner

Grasses include some of the grains that feed the world – wheat, oats, rice, corn and pasture crops, so how they withstand dramatic temperature change is important research that UVM’s Jill Preston is undertaking.

In the lab, Jill Preston, left, supervises Ph.D. student Meghan McKeown as they extract DNA from ‘poid’ grasses in order to identify genes responsible for cold hardiness and compare them across several species to find indicators of a common ancestor.



Cheryl Dorschner

Plants such as wheat require a chilling period called “Vernalization” to initiate flowering. They also respond to day length.



Cheryl Dorschner

TOP 10 THINGS YOU NEED TO KNOW

- 1 70% of all food crops are grasses including rice, cereals and corn.
- 2 Other grasses are grown as fodder for livestock – indirectly are still human food.
- 3 Grasses developed from tropical plants to cold hardy – but how?
- 4 Maybe plants that landed in cold climates developed novel ways of surviving.
- 5 Or an ancestral gene may have expressed itself when life depended upon it.
- 6 That’s what UVM plant biologist Jill Preston wants to find out.
- 7 This could be important to predict how plants will react to climate change.
- 8 If she identifies key gene(s), they could be modified for better crop yields.
- 9 In 2014 Preston received more than \$1.4 million to study the genetic origins of how cereal grasses adapted to cold temperatures.
- 10 Already she’s finding evidence of a common ancestor.

CROP GRASSES (POOIDS), SUSTAINED LIFE THROUGH MILLENIA



FOOD SYSTEMS THAT WORK: *TERENCE BRADSHAW*

Cider House Rules: Huge Demand for Vermont's Latest Food Star



Cheryl Dorschner

How much does an apple tree produce? At UVM's Horticultural Research and Education Center, Terence Bradshaw picks a whole tree of 'Liberty' apples at peak and weighs the harvest. He also measures tree size and later the cider yield per tree to understand what he calls "yield efficiency."

TOP 10 THINGS YOU NEED TO KNOW

- 1 Apples have long vied for second place among Vermont specialty crops (after maple).
- 2 2,800 acres of Vermont orchards produce mostly wholesale commodity apple crops.
- 3 But hard cider has become wildly popular – increasing annually 50 percent in sales.
- 4 Cideries' demand for apples is huge; growers scramble to plant or renovate orchards and adapt production to supply this new market.
- 5 If every Vermont apple were pressed into juice, it would barely fill a third of the fermentation tanks at Vermont Hard Cider Company in Middlebury – #2 producer in the U.S.
- 6 UVM's Terence Bradshaw is among the first in the nation to provide science-based research to help growers and cidemakers respond to overwhelming demand.
- 7 Bradshaw studies all angles: from fruit to bottle to understand costs, opportunities for efficiencies, management strategies and economic impact of cider production.
- 8 And he wants to know: what apple varieties grow best in Vermont, which produce highest yields, what the flavor profiles are of various ciders.
- 9 Research happens in UVM and Vermont orchards, in the UVM campus Jeffords Hall "juice lab" and in cider press rooms across the state.
- 10 Federal-state grants, cash and in-kind matching funds and donations from cider companies pave the way for Vermont to perhaps lead the nation in cidemaking and apple research.

The Unquenchable Thirst for Vermont Hard Cider

VERMONT APPLES

One bushel of Apples Equals Three Gallons of Cider

How UVM Research Helps Meet the Demand

Growing	Sales
60 Active Orchards	\$8 to \$12 Million In Direct Farmgate Sales
264 Farms Grow Apples	\$20 Million Annual Income In Apple Products
2nd Largest Specialty Crop (after maple)	

Vermont Hard Ciders

Sales tripled Nationwide 2007-2012

In 2013, Cideries employed 200+ Vermonters

VERMONT HARD CIDER POPULARITY

2014 Ranking Nationwide

#2 - Vermont Hard Cider Company

#22 - Citizen Cider

#44 - Boyden Valley

#57 - Pruners Pride (Champlain Valley Orchard)



Becky Gollin

At Middlebury's Happy Valley Orchard last November, Terence Bradshaw bottles fresh-pressed cider, from different apple cultivars. This spring, cidemakers will compare the likes of 'Jonagold,' 'Liberty' and 'Macoun' to help identify best flavored Vermont varieties for hard cider.

Love It or Hate It: Sugary Drink Tax Provides Arena for Key Research



Cheryl Dorschner

Sarah Heiss, right, and Jane Kolodinsky are among the UVM researchers who collect data and study how Vermonters and the media frame their positions on the proposed excise tax on sugary drinks.

TOP 10 THINGS YOU NEED TO KNOW

- 1 Six states have proposed excise taxes on sugary drinks.
- 2 Berkeley, California and Mexico have instituted taxes.
- 3 After two previous tries, in January, a coalition proposed a Vermont sugary drinks tax of two cents per ounce.
- 4 UVM researchers Sarah Heiss and Richard Watts conducted a content analysis of media coverage of the proposed tax and how it influenced outcomes in 2011-2012.
- 5 Heiss previously studied how trade associations representing the sweetener industry reframed the risks and public debates associated with sweeteners.
- 6 UVM Center for Rural Studies director Jane Kolodinsky's data shows that opponents of the sugary drink tax switched the argument from one of public health to one of economics.
- 7 Surveys concluded: there's no evidence that a sugary drinks tax will hurt small retailers, cause job loss or an increase in border crossing to shop.
- 8 Findings also conclude, a tax would nudge consumers to choose lower-calorie beverages and lose weight.
- 9 Obesity expert Rachel Johnson's research links high intakes of sugary drinks with poor health outcomes. Now a spokesperson for the American Heart Association, she advocates for the tax. See chart.
- 10 USDA Hatch and UVM Food System Spire grants and the Robert Wood Johnson Foundation funded research.

VERMONT'S TAX DEBATE OVER SUGARY DRINKS



Sugary Drinks Affect Obesity Epidemic UVM Nutritionist Makes the Case

- ~ 2 out of 3 adults & 1 out of 3 children in Vermont are overweight or obese.
- ~ 46% of added sugars we eat come from sugary drinks.
- ~ On average, Americans drink 45 gallons of sugary drinks a year.
- ~ Sugary drinks are the #1 source of excess calories in teens' diets – even beating out pizza.
- ~ Sugary drinks are more strongly associated with weight gain than any other food or beverage.
- ~ The sugary drink-obesity connection makes it a public health issue.
- ~ Vermont spends an estimated \$202M a year treating obesity related health conditions.
- ~ A 2-cent-per-ounce tax is estimated to raise \$34M.

Rachel Johnson, UVM Bickford Green & Gold Professor of Nutrition, Spokesperson for the American Heart Association



Opponents Talk About Economics And Voice Financial Fears

- ~ A tax on sugary drinks won't reduce consumption
- ~ A sugary drinks tax would hurt low-income Vermonters
- ~ A sugary drinks tax would harm bottlers, distributors and stores.
- ~ A tax would make Vermont a less affordable place to live.
- ~ Vermonters will shop in New Hampshire
- ~ Others argue prices would be confusing.
- ~ Consumers not the government should make decisions about food choices.
- ~ If we start taxing sugary drinks, we'll tax other junk foods next.

Gleaned from Vermont media reports on January 20, 2015 press conference at Vermont Statehouse.





Tina Zuk

Nutrition scientist Rachel Johnson's research reveals the links between consumption of sugary drinks and poor health outcomes.

THE BUILDING BLOCKS FOR IMPROVING WATER QUALITY



UVM Extension has worked with hundreds of farmers, industry professionals and other partners documenting almost 700 implemented best practices - the building blocks of environmental protection - and thousands more acres are under one or more best practices this year.

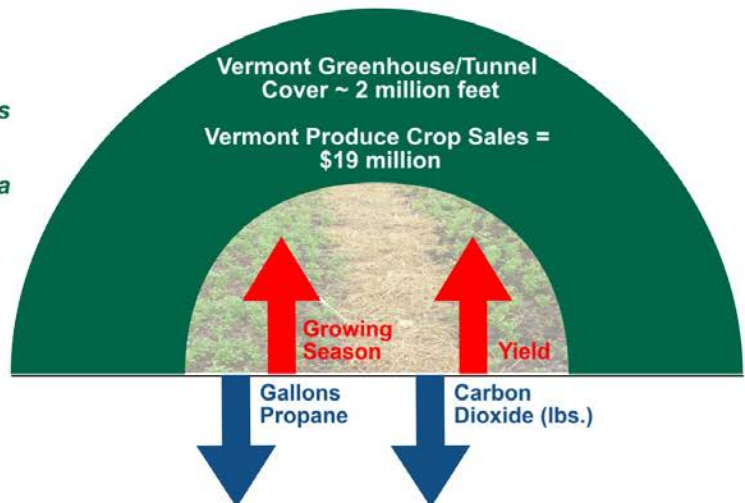
Soil Health + Agronomic Management Practices = Less Runoff

STRENGTHENING VERMONT'S ECONOMY AND REDUCING POLLUTANTS

UVM Extension assists growers with greenhouse growing and adoption of high tunnels and a biomass (wood pellet) heating option. A single system installation averages a savings of 600 gallons of propane which equals \$360,000 over 10 years - and a net reduction of 3.6 tons of carbon dioxide.

The high tunnel projects demonstrate options for growers who want to:

- > Increase business viability
- > Provide local produce for consumers
- > Reduce carbon emissions



PLANNING FOR CLIMATE CHANGE

PREPARING THE SCIENTISTS AND ENGINEERS OF TOMORROW



Reached > 8,700 Vermont youth
 > 3,500 Vermont youth increased STEM knowledge/skills

4-H STEM education shows how science and engineering issues affect youths' lives and prepare a future generation of scientists and engineers. Last year:

TEENS REACHING YOUTH (TRY), a STEM program, combines environmental education with service learning.

Almost 400 (grade K-3) youth solar and wind energy "engineers" learned energy concepts from Teen Renewable Energy Experts.



COMMUNITIES ACT TO DEAL WITH CLIMATE AND ENERGY ISSUES

Town Energy Committees - about 100 in 2013 - formed to provide community leadership on complex issues and opportunities dealing with increasing energy costs.

Committee members desired more knowledge and skills to be successful, and Extension responded with an educational conference.

The (now) Annual Community Energy and Climate Action Conference encourages increased understanding of local opportunities for addressing energy and climate change while increasing capacity for community leadership. Last year:

6th Annual UVM Extension Energy Conference had 259 attendees from 12 counties

45 communities, in 10 counties, started new projects addressing local energy issues



PROVIDING EDUCATION AND RESOURCES TO ADAPT TO A CHANGING CLIMATE

Climate change issues and challenges are addressed across Extension's programs and audiences in all 14 Vermont counties.

Last year, UVM Extension staff made ~47,000 direct educational connections with Vermonters addressing issues of importance to citizens, whether it be farmers dealing with extreme weather conditions, youth learning about sustainable energy, or other important topics.

Water Management & Protection	Food & Crop Production	Energy Usage & Efficiency
<ul style="list-style-type: none"> Agronomy workshops on field drainage Climate change adaptation & irrigation techniques Forest education Nutrient management planning 	<ul style="list-style-type: none"> High tunnel research Master Gardener Program Integrated Pest Management (IPM) Climate Hub & organic agriculture First Pest Detectors Maple production 	<ul style="list-style-type: none"> Sustainable Transportation Project Biomass heating options Energy Conference for municipalities 4-H Teens Reaching Youth (TRY)

**CULTIVATING HEALTHY FOOD,
ON THE FARM & AT THE TABLE**



Helping farmers meet year-round market demand for LOCAL, HEALTHY FOOD

through improved humidity and temperature monitoring and control to reduce spoilage

9-farm pilot project
CULL RATES
REDUCED 50%
= 423 tons of vegetables
estimated value of \$910,000

MINIMIZING RISK of food contamination is important to consumers and producers

Daylong workshops in 4 Vermont locations held for small-scale direct market growers to develop a Produce Safety Plan

Produce Safety Plans drafted by 87 farmers and agricultural service providers



EFNEP (Expanded Food and Nutrition Education Program) provides nutrition education to low-income, at-risk youth and families

1,113 Vermont youth participated in EFNEP and 400 more children reached through adult participants

87% of adult participants reported improved food access each month for their families

BUILDING VERMONT COMMUNITIES

**CULTIVATING HEALTHY COMMUNITIES IN VERMONT
YOUTH, FAMILIES AND BUSINESSES**

87% likely able to handle problems

42% answer **DEFINITELY** will do outdoor activities as a family

76% know one step to take towards goal

Pilot program has 10 teens purchase capital assets



Positive Youth Development Programs Making A Difference

Becoming An Outdoor Family >
Creating resilience through fun in the outdoors

PROSPER (PROmoting School Community University Partnerships to Enhance Resilience) >
Fighting substance abuse in youth

Youth Agriculture IDA Program (Individual Development Account) >
Removing barriers for young farmers to begin agricultural businesses

4-H >
Hands-on learning activities in science, citizenship and healthy living

Newport City Market Analysis >

Building local economy through local input for designing downtowns

36 businesses and 706 consumers surveyed for City Marketplace planning

Take Charge >

Teaching leadership skills creates local leaders able to accomplish goals in their community

Citizen committee raises \$300,000 and restores town municipal building

AgriTourism Forum >

Agribusiness and farm-based education options to keep farmland in production

143 farmers attend forum on farm-based education and agribusiness

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