UNIVERSITY OF VERMONT EXTENSION
CULTIVATING HEALTHY COMMUNITIES

CHAMPLAIN VALLEY CROP, SOIL & PASTURE TEAM

WINTER 2016-2017

In This Issue

FOCUS ON AGRICULTURE IN THE CHAMPLAIN VALLEY AND BEYOND

By Jeff Carter, Agronomist and Champlain Valley Crop, Soil & Pasture Team Leader

We have all learned a lot about using no-till and cover crop farming practices on clay soils over the past few years, and feel good about it because improving soil health for the future really is important. If not, I don't think you would be farming.

But the fabric of agriculture is a bit tricky as one side pulls the covers off the other, then back, and over and over. Field practices to improve crop yields and water infiltration come back with reports of fear that this will increase the amount of dissolved phosphorus in the soil, which is exactly what you want for better crops, but not if it leaks out and pollutes Lake Champlain. Now the quilt comes off again, and it becomes apparent that the environmental damage may be increased by activities like improving soil health with tile drainage, no-till planting, even cover crop roots that go down into the soil to reduce compaction. All are field practices we promote with confidence that this will solve the "problem."

In a recent report from *Farm Journal*, Field Agronomist Ken Ferrie discusses how improving soil health increases concerns about nitrate and water-soluble phosphorus losses down through the soil. But let's not stop with that part of the equation. This is not a bad thing; it's just that now farmers need to be even more aware of how their field management practices impact their P losses. And how important the work we do at Extension comparing different cropping system components and helping farmers decide what balance of tillage and crop types is right for their farm. One response is to stop if we are afraid; the other is to carefully move ahead with calculated confidence that we are making a positive difference, measure the effect, recognize new problems, and move ahead.

The Required Agriculture Practices (RAPs) are now here, and we will have a lot of "quilt pulling" as changing one thing – like requiring buffers along ditches – may trigger responses that are counter-productive like installing tile in the whole field and burying those ditches. Which way is better? I'm not sure; but when the quilt gets pulled off me, I pull back. Switching to no-till corn is a proven way to help soil aggregate structure, greatly reduce soil erosion, and reduce fossil fuel use. Yet the reaction to this is that preferential flow paths through the soil form as a conduit to move manure and P too fast through the soil matrix.

The Vermont Tile Drainage Advisory Group report has been submitted to the Agencies of Agriculture and Natural Resources, and will inform the secretaries for their joint report to the legislature in January. I participated on that advisory group and the discussions highlighted that these issues are not simply good and bad. Every action, like improving soil drainage, forces a conflict between a current farm business, family sustainability, and the cost of water quality remediation for past indiscretions in our lake that we are faced with fixing.

"Wait a minute, I lost my pencil in this preferential flow pathway." As the season progresses, clay soils can develop cracks that swell open and then close when the soil gets saturated again in winter.

The only way that we will be able to keep a reasonable perspective is for everyone (both sides of the quilt) to continue to be vigilant, to maintain a good balance of using our land resources to make money, but keep the water clean. This will never end, as the challenges of farming in Vermont are made more difficult with awareness of how a little P makes such a big problem in the Lake.

I heard a great quote: "there are no wrong turns on the journey, just course corrections when we figure out where we want to go next." I think we should be focused on learning how to make the best next moves, together, for farming practices that will help us meet the P reduction goals of the Vermont Clean Water Act. I don't agree with the folks who want to curtail the dairy industry in Vermont with hopes that a different farming model or land use is better. Get active in your local farmer watershed group (there are three in Vt.), come to conferences and workshops we offer to get better at these decisions. Speak up so the general public and legislative policymakers hear your voice.

Have a question for Jeff?
Jeff Carter (802) 388-4969 ext. 332
jeff.carter@uvm.edu

BEGINNING FARMER & RANCHER BENEFITS

Jake Jacobs, University of Vermont RMA Risk Management Education

USDA has established certain benefits designed to help beginning farmers and ranchers start their operations. These benefits include:

- Exemption from paying the administrative fee for catastrophic and additional coverage policies;
- Additional 10 percentage points of premium subsidy for additional coverage policies that have premium subsidy;
- Use of the production history of farming operations that you were previously involved in the decisionmaking or physical activities; and
- An increase in the substitute Yield Adjustment, which allows you to replace a low yield due to an insured cause of loss, from 60 to 80 percent of the applicable transitional yield (T-Yield).

How to Apply for Benefits

You must apply for Beginning Farmer and Rancher benefits by your Federal crop insurance policy's sales closing date. You are required to identify any previous farming or ranching experience and any exclusionary time periods you were under the age of 18, in post-secondary education, or active duty military. Talk to your crop insurance agent for more information.

Cover Crop Guidelines

Recently the Farm Service Agency (FSA), Natural Resource Conservation Service (NRCS) and Risk Management Agency (RMA) worked together to develop consistent, simple and a flexible policy for cover crop practices.

Search for "Cover Crops and Soil Health" at *www.nrcs.usda.gov* or contact your local agency for more information.

Being a young farmer is challenging enough, but learning about the best options for the business like Sayer Palmer is (below), can be even more difficult. Contact your crop insurance agent for Beginning Farmer and Rancher benefit information. Photo: Jenn Colby.

NEWS AND EVENTS

New Required Agricultural Practices (RAPs) Are Here.
Contact our office or go online for more information:
agriculture.vermont.gov/water-quality/regulations/rap

Vermont Farm Show. Come visit with us or submit your crops to our exhibit at the 2017 Vermont Farm Show, January 31 – February 2, 2017. Contact our office or go online for more information: *vtfarmshow.com*.

Annual No-Till and Cover Crop Symposium. Champlain Valley Crop, Soil and Pasture Team and Northwest Crops and Soils Team invite you to register for the 2017 Symposium, February 16, 2017 at the Sheraton Hotel in Burlington, Vt. Contact our office or go online for more information: *go.uvm.edu/ntcc*.

Bon Voyage, Dan Infurna! We are sad to see Dan leaving us for warmer climates. He has enrolled in the Peace Corps and will be sharing his agronomy skills with folks in Madagascar. He hopes to find a mango tree to sit under and a fishing hole to hang out at. We will miss his dedication moving drills, taking soil samples and generally helping us on all of our various projects. All the best Dan!

HOW DO WE DECIDE WHEN TO NO-TILL ALFALFA?

CONSIDER THE DENSITY AND VIGOR OF YOUR COVER CROP

Nate Severy, Agronomy Outreach Professional

Over the past year there has been growing interest in the farming community in trying to no-till alfalfa hay seedings into winter cover crops as a way of reducing erosion, and saving time and fuel. Come spring, there will be a number of farmers who want to plant then or in early summer and who will look at their fields wondering "should I plant now, or wait until later?" While we have not yet done any formal research looking at alfalfa establishment under different management systems and the associated economics, there are some clues that may be able to guide us until we have more data.

One clue we can look at when deciding whether to plant in early spring or early summer is cover crop stand density. (Late-summer seeding is a consideration that we won't discuss in this article.) We know from helping farmers no-till-renovate pastures/hay fields that a productive and competitive hay field will outcompete your no-till seedlings for light and nutrients. We should expect this same thing to happen when we have cover crops.

A field was planted in early September to winter rye after corn silage harvest; by December it completely covered the soil surface and was between 4 and 6 inches high (*below*). This success was due in part to early planting, full seeding rate, and timely rain. In spring, we expect that this crop will take off and, with proper management, be very high yielding. If alfalfa mix were planted into this stand in April without any control methods, would the seedlings be able to compete? Maybe, but we wouldn't count on it. We are not suggesting that a productive stand is bad as it provides many environmental and economics benefits, but it must be managed correctly. So, in this situation, we would recommend that before seeding an alfalfa mix, a farmer either terminate the cover crop, or wait until mid-May and harvest for livestock feed before seeding. If the field is terminated in April, the alfalfa should be planted with a nurse crop like barley or oats. If properly killed, the winter rye will be barely noticeable after about a month. If there is no nurse crop, there will be a substantial amount of bare ground which will be susceptible to erosion and weed pressure.

Another field was planted in late September 2015 to winter rye after corn silage harvest. By early April 2016 (*inset*), although the cover crop did protect against erosion, there was still a lot of bare soil. A crop like this can produce high quality livestock feed, but will be very low yielding. In this type of situation, the farmer can plant alfalfa mix. S/he can terminate the cover crop beforehand, but there should be enough open canopy that the cover crop should not be a problem. This winter rye can later be mowed for livestock feed, or possibly even left and combined for seed for next fall's cover crop.

Dense cover crops like this winter rye (below) can be good for soil conservation, but challenging for no-till planting. In contrast, a winter rye crop that was lower yielding (above) will be less competition for a no-till crop like alfalfa (top).

GULLIES - A SIGNIFICANT SOURCE OF SOIL LOSS

By Kirsten Workman, Agronomy Outreach Professional

As farmers, nutrient management planners and soil conservationists, many of us deal with the estimated loss of soil from fields. We often use a very important tool called the Revised Universal Soil Loss Equation (commonly referred to as RUSLE2). If you have a nutrient management plan, you know about RUSLE2. This tool, however, only estimates soil loss in the form of sheet and/or rill erosion. This is the gradual and sometimes unnoticeable erosion that sheets off fields or that forms small, uniformly spaced and sized channels (less than 4 inches deep). With proper crop rotations, reduced tillage, good cover cropping, good organic matter and even proper manure applications, we can manage for this erosion fairly simply and inexpensively.

Gullies, on the other hand, are the "unaccounted for" erosion that can have a major impact on soil loss, soil health, water quality and crop yields. Gullies are water formations with increased intensity to sheet and rill erosion, and can also exacerbate sheet/rill erosion. While we have all seen photos of giant gullies big enough to consume a tractor, those tend to be rare. However, the gullies in Vermont farm fields are no less impactful on our landscape. According to an older, but interesting analysis from USDA-NRCS in 1997, they estimated that (19 years ago), roughly 6.1 tons/acre of soil loss per year was attributed to gully erosion, making up roughly 58% of the total sediment lost through water erosion annually (the remaining 4.5 tons/acre/year was from sheet and rill erosion).

Types of Gullies

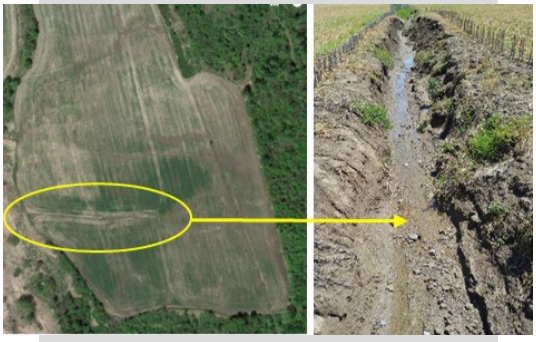
Ephemeral gullies recur in the same area each time they form, can be partially or totally erased or filled in with tillage, and frequently form in well-defined depressions or natural drainage in a field. As described by the USDA –NRCS (1997), "most ephemeral gullies occur on fields with highly erodible soils, little or no crop residue cover or where crop harvest disturbs the soil." They are associated with water flow in areas where runoff is great, including snowmelt runoff like that experienced in the Northeast.

True or "classic" gullies are "channels too deep for normal tillage operations to erase." (NRCS, 2015). They may get bigger in subsequent years, but can also stabilize and become more permanent drainage channels. They tend to start as ephemeral gullies that were left untreated. They can also start as a result of tillage, for example adjacent to a dead furrow. Or they may start at the edges of established grassed waterways or buffers that were inadequately sized or not maintained.

(above) Ephemeral gully erosion on a moderately sloped Vergennes clay corn field in southern Chittenden County. The example pictured here equates to an estimated 9.9 tons of soil loss per year.+

*(below) Classic gully erosion on a field on a Covington and Vergennes clay soil corn field. This gully has since been fixed with assistance from NRCS. This gully started upland as an ephemeral gully but progressed into a classic gully. Cover crop and no-till weren't enough to stop the gully erosion once it began. In two years, it was responsible for an estimated 234 tons of soil loss (or roughly 117 tons per year).**

**Estimations based on both field calculations and NRCS erosion calculations based on dimensions, frequency and soil type.*



Management Implications

This type of significant erosion has many costs associated with it: water quality degradation, decreased yields, and the sometimes significant costs to repair (potentially tens of thousands of dollars). The cost of fixing and maintaining an area where a classic gully has formed can be drastically more expensive and time intensive than preventing them from forming. Once a gully begins forming, additional measures will need to be implemented. Continuing to till and level out an ephemeral gully every year only introduces more soil into the drainage area for erosion.

Conservation practices to address gullies include grassed waterways, cover crops, crop rotation and no-till. These practices relate to not retilling the gully area, maintaining residue on the soil surface, keeping soil covered and preventing erosion from starting in the first place.

Gully erosion is the not-so-hidden, but unaccounted for source of erosion in our watersheds. It is detrimental to our waterways, our cropland and pastures, and the sustainability of our farms. Take an afternoon and take a look around your fields. Do you see any gullies forming? Do you see where gullies could form? See a gully in need of repair? Visit your local NRCS office and get help, either stopping gullies before they start or fixing existing gully problems.

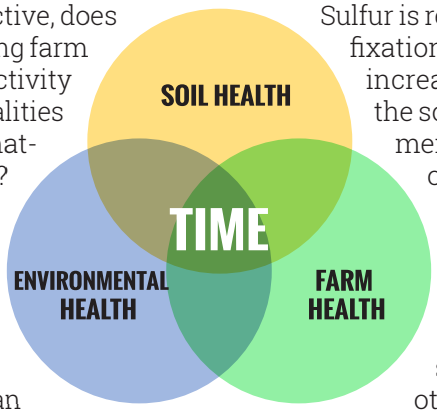
Sources and additional reading on our blog.

More Info Online:
blog.uvm.edu/cvcrops

THE SOIL HEALTH EQUATION

Kristin Williams, Agronomy Outreach Professional

While recently attending a Certified Crop Adviser Conference in N.Y. I started doodling Venn diagrams of the information I was digesting. In the world of soil health, the 'classic' Venn diagram is chemical-biological-physical properties all interacting and collectively leading to the ever elusive thing we call soil health. Thinking larger, we can ask the question, does soil health always lead to environmental health? Notably for us, does soil health always lead to a reduction in phosphorus loading to water bodies? And from the agricultural perspective, does soil health always lead to what I am terming farm health? What I mean is agricultural productivity and sustainability, including economic realities and crop yields. If we add more organic matter, will we always get greater crop yields? If we increase infiltration, will we always get reductions in phosphorus loss? We'd like to think so, but unfortunately for us reality is complex. Along with this Venn diagram is the overlap. Things take time and teasing out these realities to make sound management recommendations can be tricky and confusing. We continue to use a combination of research and demonstration trials in an attempt to approach that perfect union where farms are building their soil quality, increasing their farm profitability and having more positive environmental impacts.



The Possible Use of Gypsum Amendments to Reduce Soluble Phosphorus

Currently on the market are a number of products being sold both for increasing soil health and better utilization of phosphorus. One demonstration project we began this fall in McKenzie Brook watershed is looking at the use of gypsum amendments to increase soil health while also reducing soluble phosphorus loss. Gypsum (calcium sulfate dehydrate) actually has a long-standing history as an amendment, as a source of sulfur and calcium (without a pH change). The NRCS has a practice standard for gypsum application to improve physical and chemical properties of the soil, improve water infiltration, reduce dissolved P in surface runoff and subsurface drainage, ameliorate subsoil aluminum toxicity, and reduce potential transport of pathogens in cases of manure and biosolid application. Utilization of this practice is more common in other parts of the U.S. and applied in bioswales. Science research, thus far has primarily focused on flue gas gypsum (FGD) and results suggest there is some efficacy in improving soil health and reducing P loss, but the magnitude of effects may vary.

Sulfur is required for protein synthesis and nitrogen fixation, so in theory, additions of gypsum could increase yield potential if sulfur is limiting in the soil. Calcium is also needed in cell wall and membrane function, growth and fruit development. Perhaps even more importantly, calcium can help improve soil structure as a flocculating agent; that is, calcium can help with soil aggregation via its role as a positively charged ion (Ca^{2+}) held by soil's negatively charged exchange sites (CEC). It has a stronger bond than other lower charge particles like sodium (Na+), which is why gypsum amendments are used in reclaiming sodic and saline soils. This feature is also particularly relevant to our clay soils if soil aggregate stability and infiltration is poor. Gypsum can theoretically reduce phosphorus loss by two related means. The first is by increasing soil aggregation and therefore decreasing the loss of P with sediment. The second is that calcium-phosphorus complexes can form, keeping the P in a less soluble form. We have begun a demonstration project in McKenzie Brook utilizing multiple types of gypsum in contrast to a short paper fiber lime product, and hope to build upon it next year. We will have more on this topic as this project evolves.

(left) Calibrating the spreading of short paper fiber lime from Casella Organics, LLC. The tractor/spreader drove over a known area – the tarp – and we weighed the material to determine the spreading rate.

(below) Granulated "natural" mined gypsum, "Nutrisoft DG" from Rock Dust Local, LLC.

REGENERATIVE AGRICULTURE AND THE CARBON CONVERSATION

By Cheryl Cesario, Grazing Specialist

(left and above) Good grazing practices can build soil carbon.

In March 2016 a concerning milestone was reached: global levels of atmospheric carbon dioxide passed 400 parts per million (ppm). For reference, 350 ppm is recognized as the level which is needed for a healthy functioning planet.

Carbon dioxide is a heat-trapping gas, which is released through human activities such as deforestation and burning fossil fuels, along with natural processes such as respiration and volcanic eruptions. Its increasing levels is one major driver of global climate change.

In November, Architect William McDonough, who specializes in sustainable development, published an article titled, "Carbon is Not the Enemy" in the journal *Nature*. In it he suggests we can work with carbon in all its forms, to keep it in the right place. Climate change, he says, is "the result of breakdowns in the carbon cycle caused by us, it is a design failure. Anthropogenic greenhouse gases in the atmosphere make airborne carbon a material in the wrong place, at the wrong dose and for the wrong duration."

A healthy carbon cycle supports life, rather than endangering it. McDonough writes that the way to work with the carbon cycle, to preserve and enhance the benefits it provides, starts with the soil. A healthy soil can sequester carbon, converting it to a stable form which improves its fertility and ability to hold water.

Dr. Christine Jones, an Australian soil ecologist who was highlighted in the book *Cows Save the Planet*, describes this process. Plants convert carbon dioxide into sugars or "liquid carbon" which is used for plant growth and is exuded by the roots to feed soil microbes. The plants obtain minerals and trace elements otherwise unavailable to them and in turn, the microbes use the sugars to create stable carbon, including humus. Dr. Jones states that much of the world's grazing land is losing carbon due to overgrazing practices. However, she writes about the potential to sequester carbon and reduce atmospheric CO_2 levels through management changes to improve soil health and activate the "liquid carbon" pathways. There is an enormous potential for the world's grasslands to capture and sequester carbon and perhaps lower atmospheric carbon dioxide levels.

In a 2014 paper titled "Regenerative Organic Agriculture and Climate Change," The Rodale Institute states that farming practices that maximize carbon fixation and minimize carbon loss have the potential to sequester more than 100% of current annual carbon dioxide emissions. However, to achieve this, a holistic systems approach to agriculture is needed worldwide that builds soil health by adopting cover crops, crop rotations, and conservation tillage practices.

Currently, The Savory Institute, co-founded by *Holistic Management* author and educator Allan Savory, is working to promote the importance of livestock in carbon sequestration and bring that message to the consumers. Well-managed pasture, acting as a giant solar panel, captures solar energy, grows dense stands of grasses, keeps soil protected, sequesters carbon and turns this solar energy into animal products. The institute will unveil a "Land to Market" program early in 2017 with a third party seal on qualifying products to indicate that sourcing is regenerative on the land on which it is produced.

Rodale describes regenerative agriculture as "beyond sustainable" - a system built on improving resources, through continual on-farm innovation for environmental, economic and social wellbeing. It is a model we will no doubt be hearing a lot more of as it may prove integral to climate stabilization solutions.

Sources and additional reading on our blog.

More Info Online:
blog.uvm.edu/cvcrops

MUSTARD COVER CROPS OFFER BENEFITS BEYOND SOIL HEALTH

By Rico Balzano, UVM Extension Agronomy Outreach Professional

There is growing consensus that cover crops have many environmental and agronomic benefits including reducing soil erosion, adding valuable organic matter, and improving overall soil health. But how do cover crops fit into a weed control program? And how may they affect other soil-borne pests and diseases?

In 2015, I received a Sustainable Agriculture Research and Education (SARE) farmer grant to explore the use of mustard cover crops to help control plant parasitic nematodes*, weeds, and soil-borne diseases. Varieties of two species of mustard (*Sinapis alba* and *Brassica juncea*) have been identified as producing chemical compounds known as glucosinolates that have been shown to reduce fungus and nematodes populations when mowed and incorporated into the soil. This process is known as biofumigation.

Six varieties of mustard were trialed to test glucosinolate production and overall biomass yield. The yields were measured by weighing samples in the field, and glucosinolates were measured by a lab at the University of Idaho. The varieties were: Kodiak (*Brassica juncea*), Pacific Gold (*Brassica juncea*), Ida Gold (*Sinapis alba*), Caliente 119 (*S.alba* and *B. juncea* blend), Caliente 199 (*S.alba* and *B. juncea* blend), and Nemat (*Eruca sativa* - also a *Brassica*, bred as a nematode trap crop). They were planted in the spring of 2015 and allowed to grow for 60 days before incorporation and measurements were taken. It was found that "Caliente 199" had the highest biomass yield and highest levels of the glucosinolate "sinigrin," a volatile compound that has been shown to have anti-fungal and anti-nematode properties. Interestingly, 'Ida Gold' contained another gluscosinolate, "sinalbin." This non-volatile compound has shown the ability to inhibit weed seed germination. Although measurements were not taken, it was observed there was less overall weed pressure in the "Ida Gold" plots. This is similar to observations in trials of "tillage radish," another *Brassica* species. It was not determined whether weed suppression was a result of biofumigation or a dense cover crop outcompeting weeds. Planting rate (density) in other cover crops such as winter rye and oats has been shown to effectively suppress weeds. Further study is needed to determine how planting rates of mustards and other *Brassica* species effect glucosinolate production, disease suppression, and weed control.

As with any biological control, results can be variable. In trials in Idaho, higher soil moisture improved fungus and nematode suppression, while increasing weed pressure. It is necessary to macerate and incorporate the mustard plants for the glucosinolates to be effective. This can be accomplished by mowing and disking in the plants. For fall planted mustards and *Brassicas*, freezing and thawing may effectively macerate and release the glucosinolate "sinalbin," potentially explaining weed suppression the following spring. Further study is needed to determine how these bio-chemicals and cover crops perform under different management.

**Not all nematodes are detrimental. Many play an important role in soil ecology.*

More Info Online:
blog.uvm.edu/cvcrops

UNIVERSITY OF VERMONT EXTENSION
CULTIVATING HEALTHY COMMUNITIES

23 Pond Lane, Suite 300
Middlebury, VT 05753

Champlain Valley Crop, Soil & Pasture Team

UNIVERSITY OF VERMONT EXTENSION
CULTIVATING HEALTHY COMMUNITIES

Middlebury, Vt.
(802) 388-4969 • (800) 956-1125
cvcrops@uvm.edu

Project Leader
Jeff Carter, Agronomy Specialist

Agronomy Outreach
Rico Balzano
Cheryl Cesario
Daniel Infurna
Nate Severy
Kristin Williams
Kirsten Workman

Administration
Karen Gallott

SUPPORT THIS PUBLICATION & OUR RESEARCH:
go.uvm.edu/donate-extension

More Info Online:
blog.uvm.edu/cvcrops

www.uvm.edu/extension/cvcrops

UVM Extension is grateful to our supporters and funders:

NRCS Natural Resources Conservation Service

NORTHEAST SARE Sustainable Agriculture Research & Education

VERMONT AGENCY OF NATURAL RESOURCES

VERMONT AGENCY OF AGRICULTURE, FOOD & MARKETS www.VermontAgriculture.com

USDA United States Department of Agriculture Risk Management Agency RMA

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

This material is based upon work that is supported by the National Institute of Food and Agriculture, U.S. Department of Agriculture, under award number 2014-68006-21864. Any opinions, findings, conclusions, or recommendations expressed in this publication are those of the author(s) and do not necessarily reflect the view of the U.S. Department of Agriculture.