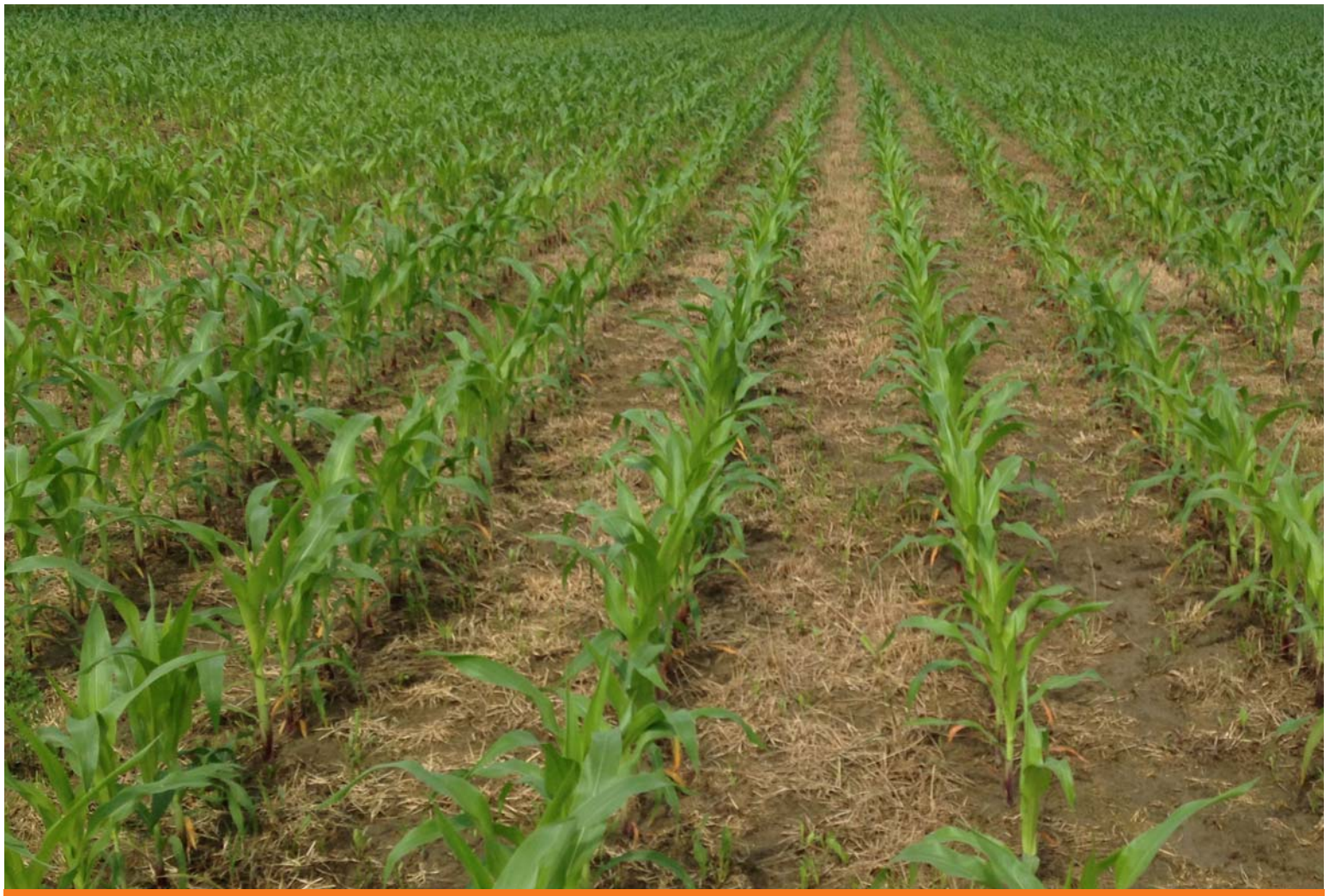
UNIVERSITY OF VERMONT EXTENSION

CULTIVATING HEALTHY COMMUNITIES

2014 No-Till & Cover Crop Symposium

February 19 and 20, 2014

Sheraton Hotel and Conference Center | Burlington, Vermont



CONFERENCE PROCEEDINGS

WELCOME

Good healthy soil to grow food and fiber is so important to us all. Why else would we be here? With so much emphasis on feeding the world, keeping our water supply clean, and paying our bills, what better place to focus than on collecting free solar energy with plants that build soil. The right plants and good agricultural practices protect the soil and water we depend on, while degraded soils tend to support plants we don't really want and are costly to farm.

When you pick up a handful of good rich soil you just know it. It smells good, it looks good and crumbles nicely in your hand. The way we want all our fields to be. There are so many ways to protect and improve soil that we could all write a book about our favorite methods. Today we'll start with just a few.

I hope this conversation about soil health, cover crops, planting and tillage are seen as a complete system that benefits everyone's goals. Higher yields, greater gains, protecting our drinking water, passing a great agriculture industry to our children.

We hope the 2014 No-till and Cover Crops Symposium is a place where you can talk about these issues, meet some new people and get some new ideas to make your farm business excel.

Jeffrey E Carter

ENJOY THE SYMPOSIUM!!

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MANSFIELD HELIFLIGHT

CHAMPLAIN VALLEY EQUIPMENT

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9:45—11:00	Jeff Sanders Rico Balzano	No-Till Nuts and Bolts Reduced Tillage Success
11:00—11:20		**BREAK:** **Snacks, Sponsor/Exhibitor Fair**
11:20—12:15	James Harbach Gerard Troisi	No-Till and Cover Crops: A Pennsylvania Dairy Farmer Shares the systems He's Developed for Success.
12:15—1:00		**LUNCH**
1:00—1:55	Frank Gibbs	Keeping Your Phosphorus Where it Belongs in No-Till Fields
1:55—2:50	Guy Palardy	Precision Agriculture for Reduced Tillage Success in Vermont
2:50—3:10		**BREAK:** **Snacks, Sponsor/Exhibitor Fair**
3:10—4:30	Jim Harbach Scott Magnan Tony Pouliot Shawn Gingue Mike Chaput	**FARMER PANEL:** Getting Started in No-Till National No-Till Conference Recap *Moderators: Rico Balzano & Jeff Sanders*

Thursday, February 20th

TIME	SPEAKER	TOPIC
9:30—9:45	Heather Darby	Welcome
9:45—11:00	Jeff Carter Heather Darby Kirsten Workman	Cover Crops, No-Till and Diversity Cover Crops: Integral to a 12 Month Cropping System Aerial Cover Crop Seeding in Vermont
11:00—11:20		**BREAK:** **Snacks, Sponsor/Exhibitor Fair**
11:20—12:15	Frank Gibbs	Earthworms and Quality No-Till Soils
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1:00—1:55	Sjoerd Duiker	Cover Crop Mixes after Corn Silage: No Carrots or Sticks
1:55—2:50	Andre Quintin Jim Harbach	Using Cover Crops to Your Advantage: Cover Crops as Management Tools
2:50—3:10		**BREAK:** **Snacks, Sponsor/Exhibitor Fair**
3:10—4:30	Ray Brands Jim Harbach Andre Quintin Gerard Troisi	**FARMER PANEL:** Cover Crops in Dairy Systems *Moderators: Jeff Carter & Heather Darby*

Our Speakers

FRANK GIBBS | *Wetland and Soil Consulting Services, LLC*

Email: fegibbs21@gmail.com | Phone: 419-963-2542

Mr. Gibbs is an Honors Graduate of the Ohio State University with a Major in Agronomy and Soils.He recently formed Wetland and Soil Consulting Services, LLC (WSCS) after retiring on August 1st from working 36 years for USDA in Ohio and teaching for The National Training Center across the Country.

Frank has an extensive background in Hydric Soils, Wetlands, Water Tables in the Soil, Soil Compaction, Soil Quality, Cover Crops, Manure Disposal, Preferential Flow, Septic Systems and Drainage Problems. He has conducted numerous soil training sessions for farmers, environmentalists, crop advisors, sanitarians, contractors, soil scientists and agency personnel.

Frank is a Certified Professional Soil Scientist, Professional Wetland Scientist, Certified Professional Soil Classifier, Certified Crop Consultant, a Certified Interagency Wetland Delineator, a National Interagency Hydric Soil and Wetland Delineation Instructor, Past President of the Association of Ohio Pedologists and Past Chair of the Ohio Soil Scientist Certification Board for the Soil Science Society of America. He has received so many Awards that he couldn't fit them all on the walls of his little cubical! Frank is the 5th generation to reside on and operate the family farm near Rawson, Ohio.

SJOERD DUIKER, Ph.D
Associate Professor of Soil Management and Applied Soil Physics, Penn State

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Sjoerd is soil management specialist in the Penn State Extension service, and works from the State College campus in PA. He studies and promotes methods to conserve and improve soil on farmland. A big focus of his work is the no-tillage system – continuous no-tillage, high mulch cover, diverse crop rotations, and cover crops.

By working as a team with agronomy educators, conservation districts, USDA NRCS, Pennsylvania Government agencies, the Pennsylvania No-Till Alliance, agricultural industry and others, no-tillage has increased from 23% of planted acres in 2004 to more than 50% today in PA. The next challenge Sjoerd and his team is working on is to encourage farmers to use cover crops more extensively.

JAMES HARBACH | *Partner, Schrack Farms*

Jim is a partner in Schrack Farms Resources LP. Schrack Farms dairy is located in the mountain region of central Pennsylvania with a elevation of 1200 to1500 ft. On a homestead tract of land dating back ten generations to 1773 ,they are currently milking 950 cows and operating a methane digester. Farmed acres have expanded to 2200 acres, many of which have been no tilled for forty years ,with the addition of cover crops in the last five years. He is active on many boards including Clinton Co. Conservation District, Clinton Co. Ag Preservation, Sugar Valley Watershed Association, Farm Bureau, State Dairy Committee, State Nutrient Management Advisory Committee and many other no till and church related activities. Sugar Valley is the home of Fishing Creek (a high quality cold water fishery), a tributary of the Chesapeake Bay.

GERARD TROISI | *Production Consultant, Upper Susquehanna Crop Management*

Gerard Troisi started his own business as a crop advisor and production consultant in 1991. He annually consults on 16,000 acres in central Pennsylvania, does soil tests on about 10,000 acres and works exclusively with no-tillers or those transitioning to no-till. His strong suit is increasing production on marginal or poor soils while reducing input costs and adjusting production practices to fully utilize beneficial environmental services to the crops

Our Speakers

Vermont Farmer Presenters

RAY BRANDS, Deer Valley Farm (Ferrisburgh)

Ray and his family own and operate Deer Valley Farm. They milk 500 cows and raise 500 young stock, while growing crops on around 1200 acres in Addison County—550 acres of corn and 650 acres of hay. Ray has been experimenting with cover crops on his farm for the last three years, including harvesting winter rye in a double crop system and working with UVM Extension to do on-farm research with cover crop mixes. Ray is also a founding member of the Champlain Valley Farmer Coalition, an organization looking to help farmers work together to protect water quality and thriving, resilient farms.

MIKE CHAPUT, Chaput Family Farms (North Troy)

Mike and his brother, Reg own and operate Chaput Family Farms where they care for 1800 cows (milking and young stock). Mike is in charge of growing the crops on almost 2000 acres in northern Vermont. The farm has a methane digester that produces power from the cows' manure, they truck their own milk, and are the largest employer in North Troy. Chaput Family Farms was awarded the distinguished honor of being named the 2012 Vermont Dairy Farmer of the Year.

SHAWN GINGUE, Gingue Brothers Dairy LLC (Fairfax/Waterford)

Shawn and his brothers Dan, James and Jeff along with their father, Paul own and operate Gingue Brothers Dairy LLC in Fairfax and Waterford. Since joining the two farms in 2010, they milk 400 cows at their Fairfax farm and raise their young stock and transition cows in Waterford. Their farm is a DFA Highest Award Top Quality Milk Producer. Shawn manages the crop production on 1200 acres and has been starting to implement no-till and cover crop practices on some of those acres. Over the last three years, he has increased their no-till acres to 350 and cover crop acres to 150. He looks forward to perfecting those systems on his farm, and building on the progress they have made thus far.

SCOTT MAGNAN, Custom Service (St. Albans)

Scott is the owner of Scott Magnan's Custom Service, a professional crop service located out of St. Albans. He has worked in connection with UVM Extension over the past three seasons, running a no-till corn planter for interested farmers in the region. This past season his company ran a Jamesway manure injector owned by UVM Extension, on one of their tanks on area farms. In addition to the custom hire part of his business, he farms 200 acres, also in St. Albans. He keeps about half the acres in hay, annually grows winter rye as a seed and straw crop, and grows and sells soybeans. He currently has fields going into a fourth season in no-till, and is experimenting will all methods of tillage and planting.

GUY PALARDY, Palardy Farm (Alburgh)

Guy has been farming in Grand Isle County for thirty years of which twenty-three were with dairy. In 2007 he transitioned to growing only crops, mainly corn and soybeans for grain. Last year as an exception, most of his corn went for silage due to high demand. He started no-tilling about ten years ago and three years ago with strip-till. Last year they planted all 600+ acres with strip-till, injecting most of the fertilizer with one pass**.** His use of precision farming has increased over the last 8-10 years from the use of GPS for spraying, spreading, recording drainage tile, installing tile, to strip-tilling and planting. His farm currently use two Trimble displays unlocked to RTK.

TONY POULIOT, Pouliot Dairy Farm (Westford)

Tony is part of the Pouliot Dairy Farm. They milk 395 cows and raise all their own replacements. The Pouliots crop around 600 acres of haylage, 450 acres of corn silage and snaplage. They are currently trying to convert to no-till.

ANDRE QUINTIN, North Island Dairy (North Hero)

Andre Quintin and his family own and operate their dairy farm on North Hero Island. They milk 330 cows and crop 900 acres. They have been growing cover crops for 10 years, and recently have taken it to the next level to use them as management tools on their fields. Andre has also been no-tilling for about 10 years, and now plants 350 acres of his 500 acre annual corn crop no-till.

Reduced Tillage: How to Plan for Success

Jeff Sanders, Agronomy Specialist | UVM Extension, Northwest Crops & Soils Program
(802) 524-6501 | Jeffrey.sanders@uvm.edu

To make reduced tillage strategies succeed on farms in the northeast, farmers and crop consultants need to focus on three main areas; **field planning, equipment preparation, and practicing techniques.**

If a farmer is considering implementing a reduced tillage cropping strategy on some acreage specific considerations must be made. **The goal of reduced tillage is to meet or exceed conventional tillage yields with less tillage not less effort.** The benefits of reduced tillage for building soil health, reducing erosion, and reducing nutrient levels in surface waters are well documented. Achieving comparable yield goals to conventional tillage practices year in and year out are to be expected when properly implemented. This presentation will provide some examples of what one should consider when deciding to implement reduced tillage practices.

Field Planning is essential to success. Do not try to implement reduced tillage on a field which is marginal cropland at best. For long term reduced tillage strategies to be successful the farmer must make sure that the fields being targeted are suitable candidates for reduced tillage. The farmer should take the following into consideration: field soil conditions, drainage conditions, crop history, and seed variety traits.

Machinery preparation is the second part of a successful reduced tillage program. There are many different options today which make reduced tillage more successful but the key with all equipment is attention to detail. Equipment must be in 100% working order to establish excellent stands. Special attention must be paid to the vee openers, seed tubes, and closing disks. Remember you are asking your planter to do what your plows, finishers and planter used to do. Technological advances have made it possible to grow highly successful stands if planters and drills are equipped and maintained properly.

Reduced tillage should not be a one and done procedure. The farmer looking to implement reduced tillage practices has got to be convinced that it can be done successfully. It takes practice and experience to learn what works and doesn't work on their farm. Recording adjustments and results is an important part of the process. Less than satisfactory stands doesn't mean reduced tillage doesn't work it means that somewhere in the process something was missed and revisions and new strategies need to be tried.

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Reduced tillage is not a practice for the farmer who wants to do less, it is for the farmer who wants to get more but till less.

Keeping Your Phosphorus Where it Belongs in No-Till Fields

Frank Gibbs, Certified Professional Soil Scientist with Wetland and Soil Consulting Services, L.L.C.
Email: fegibbs21@gmail.com Phone: 419-963-2542 Address: P. O. Box 346, Rawson, Ohio, 45881

The Ohio Agricultural Experience:
Challenges, Achievements, Politics and The Way Forward on Our Land

Challenges:

Ohio is blessed with some of the most productive agricultural soils to feed our nation and the world. The vast majority of these soils require drainage to be productive. Wet heavy clay Lake Bed soils and Dense Glacial Till Soils are very susceptible to soil compaction during planting and harvest operations. In Northern Ohio, Lake Erie has had a long history of water quality problems from a variety of sources climaxing in the 1960's. Climate Change is causing extreme, violent rain events interspersed with droughts. Besides, the crop damage these wild weather swings are causing, Farmers are paying record prices for their nutrient inputs and violent rain storms are flushing nutrients out into the Lake. Dissolved Reactive Phosphorus has become the new driver of algal blooms in Lakes and Agriculture is receiving the lion's share of public blame, regardless of the lack of research, as to why this is occurring.

Achievements:

Our ancestors took on the daunting task to make this land productive, by installing one of the most extensive infrastructures of drainage in the world. Agricultural Phosphorus loading in Lake Erie was addressed in the 1980's by the adoption of Conservation Tillage Methods of farming. This practice alone, dramatically reduced sheet erosion and the Particulate Phosphorus that was attached to the clay particles. Again, drainage was key to the success of this Conservation Practice. Farmers are testing their soil for accurate application of nutrients in record numbers never seen before. Technology is opening new doors to Precision Nutrient Management options and Conservation Practices not possible in the past. Progressive Farmers, Certified Crop Advisors (CCA's), Soil Scientists, Commodity Groups and Fertilizer Dealers are organizing to get the word out to implement the 4-R's and Conservation Systems with Cover Crops. They are also, funding basic research thru Universities to solve the Dissolved Reactive Phosphorus Problem.

Politics:

Algae Blooms have become a hot topic in the news. Whenever someone's vacation, fishing trip or boat outing is ruined; the public is hopping mad and want the "Government" to do something, immediately. Intelligent conversations of the complexity of the problem and research needs are few and far between. Politicians need to shift the blame and look like they are doing something. Agriculture has become the default, "Fall Guy" for the Algae Blooms because of the amount of the watersheds in Agriculture. Legislation has been introduced in Ohio to require licensing and certification to apply nutrients (manure or fertilizer), much the same as Registered Pesticide Applicators. This legislation has been amended several times and has taken on a political element that threatens to divorce it from good science or reality. Hopefully, cooler heads will prevail, so that legislation will not be passed that restricts a farmers ability to solve the problem before the mechanism's that are detaching the Phosphorus are even known. Agriculture (All of Us) need to keep letting the public know we are doing our part to proactively solve this problem.

The Way Forward on Our Land:

There is no one "Magic Bullet" to solve this problem. Rather a "Systems Approach" with cooperation of all Partners in Agriculture is the "Way Forward". Growers need a "Tool Box" of tools (Conservation Practices) at their disposal to choose from and assemble the right System for their Soils and Production needs. At the Base in Ohio is the 4-R's: Right Source, Right Rate, Right Time and Right Place. Soil Testing, Nutrient Management Plans, Surface Drainage, Subsurface Drainage, Conservation Tillage, Controlled Traffic, Crop Rotations, Crop Residue Management, Various Cover Crop Strategies, Controlled Drainage, Yield Monitors, Crop Management Zones, Variable Rate Application of Nutrients and Seed, Soil Health Assessments, Filter Strips and Wetlands are all Conservation Practices being ramped up in Ohio. The Dissolved Reactive Phosphorus Problem will never be solved by the Government or by Legislation requiring a Crescent Wrench and a pair of Vice Grips. It will be solved by Progressive Farmers working with CCA's, Soil Scientists and Fertilizer Dealers using a whole Tool Box of Conservation Practices while producing food for the whole world.

COVER CROP DIVERSITY IN NO-TILL SYSTEMS

A FIELD DAY TO SHARE PRELIMINARY RESULTS FROM A NE SARE PARTNERSHIP GRANT

NOVEMBER 8, 2013 * DEER VALLEY FARM * FERRISBURGH, VT

A special thank you to the farms who are participating in the project:

Ray Brands
Deer Valley Farm
No. Ferrisburg, VT
**cover crops in corn silage*

Ashley Farr
Farr Farms
Richmond, VT
**cover crops in corn silage*

Joseph Hescock
Elysian Fields Dairy
Shoreham, VT
** cover crops in org. wheat*

Roger Scholten
Scholten Family Farm
Weybridge, VT
**Tillage Radish in Pasture*

Project Summary:

Fall plowed fields on clay soils in Vermont are a leading contributor to phosphorus pollution in Lake Champlain. Increasing water quality pressures coupled with a tough dairy economy have made it difficult for dairy farms in our region to adopt new and innovative practices. This project aims to lower some of the 'risk' of adopting conservation practices by demonstrating how they might benefit water quality, soil quality, and crop production – a win-win for farmers and Lake Champlain.

The Champlain Valley Crop, Soil & Pasture Team will worked with four different farms to perform field trials to collect data and demonstrate practices to farmers across the Lake Champlain region, with a particular focus on managing challenging clay soils. Trials focused on the use of cover crop mixes, cover crops as pasture improvers, and reducing tillage. We utilized sound research methods to collect data that is usable and applicable to farmers in the Champlain basin. The CV Team has had great success with a no till project this summer and fall, and this project enabled us to capture that enthusiasm and momentum by offering yet another way to utilize those tools on their farms. This project will be expanded next year as we have received NRCS-CIG funding to trial 10 different cover crop mixes in corn, soybean & wheat systems

Site Statistics:

Location: Ferrisburgh,VT
Soil Type: Covington silty clay
Plot Size: 10'x 100'
Corn Planted: May 16, 2013
Cover Crop Mixes Broadcast*: August 15, 2013
Corn Harvested: September 24, 2013
Cover Crop Mixes Drilled**: September 26, 2013
**Broadcast plots seeded with hand seeders*
***Drilled plots seeded with Haybuster No-Till Grain Drill*

Funding for this project was provided by:
NORTHEAST SARE Sustainable Agriculture Research & Education
USDA NRCS United States Department of Agriculture Natural Resources Conservation Service
Strategic Watershed Action Team
UNIVERSITY OF VERMONT EXTENSION CULTIVATING HEALTHY COMMUNITIES

Cover Crop Mixes in Corn Silage

Mix 1 = Oat/Pea/Radish

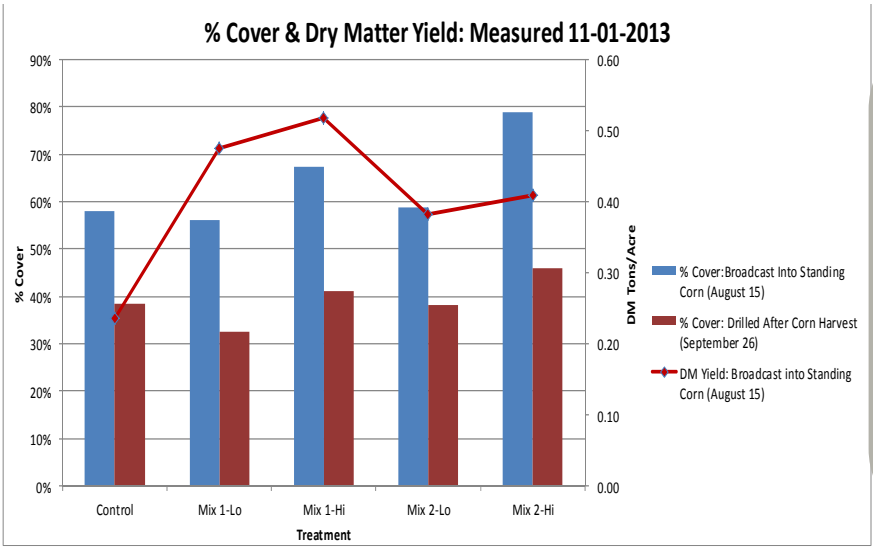
Mix 2 = Triticale/Winter Pea/Winter Rape

Low Rate = 50 lbs/acre

High Rate = 116 lbs/acre

N W E S

	Broadcast into standing corn: 8-15-13			Drilled after corn harvest: 9-26-13
	Mix 1 @ 116 lbs	15	15	Mix 1 @ 116 lbs
	Mix 2 @ 116 lbs	14	14	Mix 2 @ 116 lbs
R1	Mix 2 @ 50 lbs	13	13	Mix 2 @ 50 lbs
	Control *(Winter Rye @ 100 lbs)*	12	12	Control *(Winter Rye @ 100 lbs)*
	Mix 1 @ 50 lbs	11	11	Mix 1 @ 50 lbs
	Mix 2 @ 116 lbs	10	10	Mix 2 @ 116 lbs
	Mix 2@ 50 lbs	9	9	Mix 2@ 50 lbs
R2	Control *(Winter Rye @ 100 lbs)*	8	8	Control *(Winter Rye @ 100 lbs)*
	Mix 1 @ 50 lbs	7	7	Mix 1 @ 50 lbs
	Mix 1 @ 116 lbs	6	6	Mix 1 @ 116 lbs
	Mix 2 @ 116 lbs	5	5	Mix 2 @ 116 lbs
	Mix 1 @ 116 lbs	4	4	Mix 1 @ 116 lbs
R3	Mix 2 @ 50 lbs	3	3	Mix 2 @ 50 lbs
	Mix 1 @50 lbs	2	2	Mix 1 @50 lbs
	Control *(Winter Rye @ 100 lbs)*	1	1	Control *(Winter Rye @ 100 lbs)*



FOR MORE INFO:

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Brands…Fall 2013

Treatment	Planting Method	Site	AVG DM %	AVG DM Yield Ton/ Ac	AVG lbs N/acre	AVG lbs P/acre	AVG lbs K/acre	AVG % Cover
Control	BDCST	Brands	0.21	0.23	18	2	17	58%
Mix 1-Lo	BDCST	Brands	0.12	0.47	34	3	32	56%
Mix 1-Hi	BDCST	Brands	0.12	**0.52**	**36**	**4**	**39**	67%
Mix 2-Lo	BDCST	Brands	0.14	0.38	31	3	25	59%
Mix 2-Hi	BDCST	Brands	0.12	0.41	29	3	23	**79%**
Control	DRILL	Brands						38%
Mix 1-Lo	DRILL	Brands						33%
Mix 1-Hi	DRILL	Brands			N/A			41%
Mix 2-Lo	DRILL	Brands						38%
Mix 2-Hi	DRILL	Brands						**46%**

Our Team

Project Leader
Jeffrey Carter
Extension Agronomist

Agronomy Outreach
Rico Balzano
Kirsten Workman
Cheryl Cesario

Field Technicians
Daniel Infurna
Jonathan Kuehne
John Roberts

Aerial Seeding of Cover Crops in Vermont

Can seeding cover crops earlier in Vermont provide enhanced environmental benefit and farmer adoption? A pilot project in the Champlain Valley to aerially seed Winter Rye into standing corn before harvest.

2012— 2544 acres in Addison, Chittenden, Franklin, Lamoille & Orleans Counties

2013—5600 acres in Addison, Chittenden, Franklin, Grand Isle counties and in New York

Funding Partners:
VAAFM, USDA-NRCS (EQIP), LCBP

Contractor: Mansfield Heliflight (Milton, VT)

Contacts:
Heather Darby (heather.darby@uvm.edu)
Jeff Sanders (jeffrey.sanders@uvm.edu)
Kirsten Workman (kirsten.workman@uvm.edu)

Winter rye seeds on the soil surface (between corn plants) flown on by the helicopter

A good stand of cover crop before corn harvest

Helicopter seeding Winter Rye cover crops into corn

An aerial seeded cover crop after corn harvest in the fall.

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UVM Extension Fact Sheet: Champlain Valley Crop, Soil and Pasture Team June 2013

Cover Crops as Forage Crops…A Look at Winter Rye and Triticale

By Kirsten Workman, Agronomy Outreach Professional

'Double Cropping' or the practice of harvesting two crops from the same field in one year is not a new concept by any means. However, as more and more farmers in the Champlain Valley are starting to look at cover crops as part of their crop rotation, it becomes a very viable option to evaluate harvesting them for forage. The most popular cover crop planted here in Vermont after corn silage is Winter Rye. Recently, however, we have started to see more and more farmers plant Winter Triticale (a cross between winter rye and winter wheat) for its purported value as a forage crop. This spring, several producers harvested winter rye and triticale for forage.

Deer Valley Farm harvesting winter rye for round bale silage just before tilling it under and planting corn.

We were able to collect forage samples in an attempt to compare them to each other and get a better sense of the overall value of these crops as forage. We collected samples from three farms on five fields. The farms we collected samples from were located in Williston, North Ferrisburgh, and Wells, Vermont. The farms were harvesting these cover crops as baleage or grazing them. We calculated yields and sent the samples for analysis. Below is a table with our results, averaged by crop. The fields were all no-till drilled in late September at between 100 and 150 lbs/acre (after corn silage or into pasture) and harvested in mid-May. All of the crops were fertilized in the spring (with Urea or solid dairy manure). The majority of samples were taken at harvest during the split-boot stage (Feekes stage 10). The yield measurements represent one harvest, and do not account for multiple harvests. The pasture was grazed a second time in early June and that harvest would increase overall yields.

AVERAGES-Champlain Valley*		
	Rye	Triticale
%DM	16.25	18.96
Yield (DM Ton/ac)	1.58	0.96
% Crude Protein	16.35	17.00
%ADF	32.90	31.16
%NDF	57.05	55.26
%TDN	67.00	66.40
NEL	0.63	0.63
Relative Feed Value	103	110
% N	2.62	2.72
% P	0.29	0.28
% K	2.53	2.23
% S	0.18	0.22
lbs N/acre	82.15	53.90
lbs P/acre	9.16	5.61
lbs K/acre	80.18	44.68

**all values are on a dry matter basis*

Overall, in our samples, triticale performed better than rye from a forage quality standpoint. Rye, however, outperforms in yields, sometimes by double. One of our triticale samples tested out at 22% protein when harvested at the split boot stage, but our samples averaged out at 17% CP. The rye was not far behind at 16% CP. We also found that planting at higher rates increased yields and quality.

For more information, please contact the UVM Extension Champlain Valley Crop, Soil & Pasture Team

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Considerations

In Alburgh, VT UVM Extension Agronomist, Dr. Heather Darby found similar results with her winter rye planting trials. She found similar dry matter yields over the 2011 and 2012 seasons. They did see lower crude protein levels at closer to 12% (our rye samples averaged 16% crude protein).

Aaron Gabriel, of Cornell Cooperative Extension's Capital Area Agriculture and Horticulture Program also collected samples on four fields this May that were each planted to rye and triticale. Although they did not collect yield data, the protein levels were also lower than ours. Rye averaged 12.7% CP while triticale averaged 14.6% CP. Their relative feed values were very close to what we found…both crops averaging well over 100.

Winter triticale that was drilled into a pasture in September being grazed the following May.

Like all crops, yield and quality all depend on management. Planting and harvesting in a timely manner, a good fertility program, and appropriate soils will have the most impact on growing a high quality, high yielding crop. In these situations, either crop would fit the bill. If you are hoping to get a crop off early in order to get your long season corn or soybeans established, winter rye might be a better fit.

Although dry matter yields are the best way to compare results, it is important to note that from a feed management standpoint, rye yielded up to 4 tons per acre of baleage (assuming 55% moisture) and closer to 5 tons/acre of chopped silage (assuming 65% moisture). Triticale yielded between around 2 tons/acre at 55% moisture and almost 3 tons/acre at 65% moisture.

This winter rye was drilled in late September and was harvested at 36 inches at the split boot stage in mid-May.

For a cost of $35 per acre to seed these cover crops, a farmer can see a return of between $80 and $200 in feed value (depending on your yields).

Conclusions

Overall, triticale matures later than rye and is shorter with less biomass. It did test out as higher quality feed in our sampling, but was inconclusive statistically. Rye does yield higher. In one field where rye was planted right next to triticale in the same field, the rye produced 1.49 DM tons per acre while the triticale yielded 0.91 DM tons per acre. In our observations, triticale seed is often more expensive and harder to get a hold of. Although, that may change as more producers purchase it over time. We found that seeding at higher rates closer to 150 pounds/acre gives higher yields and better quality (higher protein, lower NDF) than fields seeded at a lower rate of 100 pounds per acre.

An additional one or two dry matter tons per acre of quality feed is not a bad return on the investment of seed. Add to that the erosion prevention you accomplish over the winter and early spring, the nutrient recycling that occurs, and the soil health benefits of increased organic matter, better soil structure, and it seems like it makes sense in most cases. If you are unable to harvest these crops as forage and must plow or burn them down with herbicide, they can contribute significant amounts of nutrients back to your soil profile, enabling you to reduce fertilizer inputs. Rye provided 45 to 90 pounds of nitrogen, an average of 9 pounds of Phosphorus and 80 pounds of potassium; while triticale provided an between 45 and 65 pounds of nitrogen, 5.5 pounds of phosphorus, and 45 pounds of potassium (per acre). *All in all, a well-managed rye or triticale crop can improve soil health, water quality, and could become an important part of your feeding program. We will keep you posted as we continue to look at these cover crops in Vermont.*

More Reading:

http://blogs.cornell.edu/capitalareaagandhortprogram/files/2013/06/Ag-Report-June-6-2013-1qd72j3.pdf
http://www.uvm.edu/extension/cropsoil/wp-content/uploads/2012-Cover-crop-planting-date-and-seeding-rate-report.pdf
http://www.uvm.edu/extension/cropsoil/wp-content/uploads/2011-cover-crop-planting-date-final.pdf
http://www.uvm.edu/extension/cropsoil/wp-content/uploads/2011-cover-crop-planting-date-x-seeding-rate-final.pdf
http://nmsp.cals.cornell.edu/publications/factsheets/factsheet56.pdf

NORTHWEST CROPS & SOILS PROGRAM

Integrating Cover Crops into Corn Silage Systems

Dr. Heather Darby, UVM Extension Agronomist
Conner Burke, Hannah Harwood, and Jeff Sanders, Crop and Soil Technicians
UVM Extension Northwest Crops & Soils Program

Cover cropping has gained a lot of traction and interest in recent years. Growing cover crops between seasons of a cash crop like corn can provide a multitude of benefits to the soil, succeeding crops, and the environment. For example, cover crops can reduce nutrient and soil loss, increase soil organic matter, and serve as an extra source of forage. In general, cover cropping benefits far outweigh the costs of implementation, but there is some strategy and planning that goes into successful cover cropping systems. It is crucial that you not only know your goals, but also your constraints, as different cover crops will present different advantages and disadvantages.

BENEFITS OF COVER CROPPING

Nutrient recycling
Decreased soil erosion
Decreased N leaching
Improved soil tilth
Increased soil organic matter
Improved soil microbiology
Manure management
Grazing opportunities
Reduction in fertilizer costs
Moderated soil temperature
Weed suppression
Mitigation of disease
Increased crop yields

Integrating a cover crop into your corn silage cropping system will take planning so the benefits of cover cropping can be realized on your farm. Figure 1 outlines a yearly cropping system that incorporates cover crops. Timely planting and termination are important to the success of any cover crop.

 www.uvm.edu/extension/cropsoil

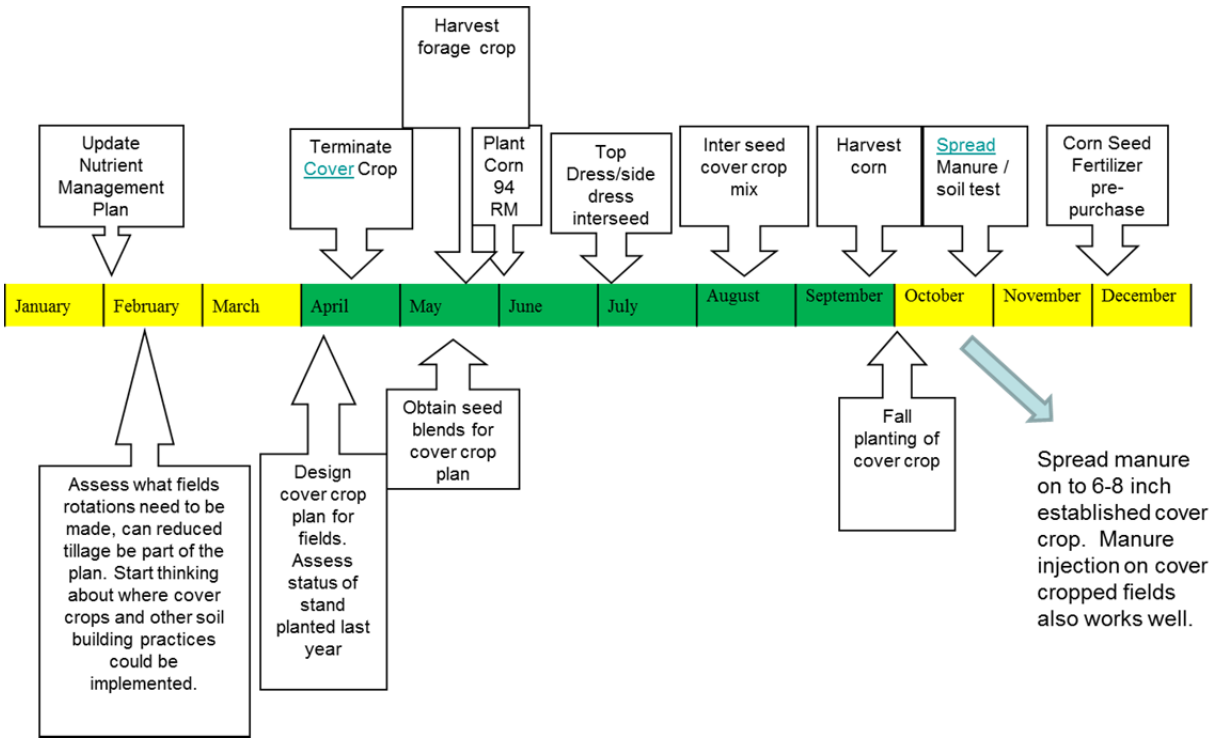


Figure 1. Twelve month cropping schedule integrating cover crops into a corn cropping system.

ESTABLISHMENT

Cover crops are commonly established at three time points during the corn growing season.

The first potential to plant a cover crop is just prior to canopy closure of the corn. This commonly occurs near the time of topdress or at the 6th leaf stage of crop development. The technique of establishing a cover crop into an already growing crop is termed "interseeding". At the 6th leaf stage cover crop seed can be broadcast using a tractor mounted seeder or mixed with nitrogen (N) fertilizer and applied at the time of topdress (Figure 2). New equipment has been developed to seed cover crops at the same time of N topdress and herbicide application (Figure 3). Applying cover crop seed at this time allows the plant to become established just prior to canopy closure (Figure 4). The cover crop will remain relatively small since little sunlight will penetrate through the corn leaf canopy. Once the corn begins to dry down the cover crop will begin to grow rapidly. The second potential to seed cover crops occurs in the late summer approximately one month prior to harvest. Planting the cover crop at this point gets the seed on the ground allowing ample time for germination prior to harvest of the crop. This type of interseeding requires equipment that can maneuver through a crop of mature corn. Aerial seeding has been gaining in popularity throughout the region. New technology is also becoming more popular to seed via a high-boy piece of equipment (Figure 5). Establishing by interseeding will likely allow farmers to have a broader selection of cover crop species. As an example in 2013 a trial conducted by UVM Extension evaluated interseeding of clover, tillage radish, and

annual ryegrass. Preliminary results suggest that planting cover crops with this strategy can provide adequate establishment of a diverse range of species (Figure 6).

Figure 2. Tractor mounted broadcast spreader.

Figure 3. Penn State Cover Crop Interseeder.

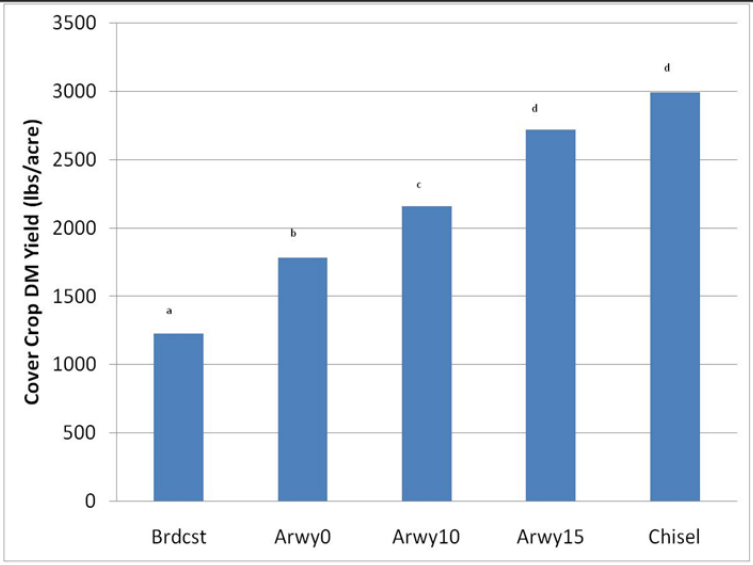
Figure 4. Late season cover crop interseeder.

Figure 5, Interseeded cover crop.

Figure 6. Interseeded tillage radish, 2013

In general most farms are establishing a cover crop after the corn has been harvested. This seeding generally happens between mid-September and late October. There are a multitude of avenues for planting a cover crop at this time of the year. A grain drill is best used to establish cover crops that will be harvested for forage or grain the following season. The advantage to seeding with a grain drill is more accurate seeding rates and more even establishment. However not everyone has a grain drill and drilling seed can be time consuming. Research through UVM Extension has shown that winter rye cover crops can also be effectively established by broadcasting and lightly incorporating with a variety of tillage implements (Figure 7). Simply broadcasting seed on the surface of the ground is a risky practice and often ends in poor cover crop establishment.

Figure 7. Efficacy of establishing a winter rye cover crop by broadcasting seed as compared to incorporating seed with Aerway and chisel plow



PLANTING DATE

Most of UVM Extension's cover cropping studies have been with winter rye (*Secale cereale*), a hearty cereal grain that does well in cool climates. This is the most popular cover crop in the region because of its reliability and relative success in becoming established and overwintering. Winter rye is considered a "workhorse," and although it is not the highest-quality forage crop, it is chosen often for its proven. When it comes to cover crops, timing is everything—planting dates seem to dictate how well a cover crop will overwinter and produce the intended results. Getting a corn crop harvested in time to establish a successful stand of rye is problematic, but in general, results show that the earlier cover crops are planted, the more successful its growth and development will be. Planting dates of winter rye evaluated by UVM Extension ranged from early September through early November (Table 2).

Table 2. Cover crop stand establishment and yield by planting date, Alburgh, VT, 2009-2012.

	Sep				Oct				Nov
	Week 1	*Week 2*	*Week 3*	*Week 4*	*Week 1*	*Week 2*	*Week 3*	*Week 4*	*Week 1*
Plant cover (%)	75.0	68.2	53.3	52.0	48.6	47.6	47.5	53.0	33.5
Plant height (in)	18.7	17.7	13.7	13.7	10.9	10.1	8.5	8.7	8.1
Biomass yield (lbs ac^{-1})	6001	2677	1968	2480	2410	2211	1588	1336	1238

Winter rye does best when planted early in the season (Figure 8). In all years of the study, yields were drastically higher for winter rye planted in early September than later planting dates, averaging three tons of dry matter per acre. Plants were taller (averaging 18.7 in) when planted in the first week of September, with an average of 75.0% plant cover. Winter rye planted in November yielded only 1238 lbs of dry matter per acre, with an average of 33.5% plant cover. This is not enough biomass accumulation for adequate soil coverage, animal grazing, or crop production, and would probably not justify the cost of rye seed. Later plantings generally do not have enough time to set tillers or side shoots resulting in lower yielding cover crops (Figure 9). Tillering is important as it can contribute to 60% of total yields.

If planted early enough the winter cover crop has ample time to scavenge nutrients and incorporate them into their biomass. Research has shown that winter rye cover crops scavenge 2 to 4% of their biomass in nitrogen (Figure 10). The more plant biomass produced in the fall and early spring the more nitrogen a plant consumes. Once the cover crop is terminated this nitrogen should become available to the following corn crop.

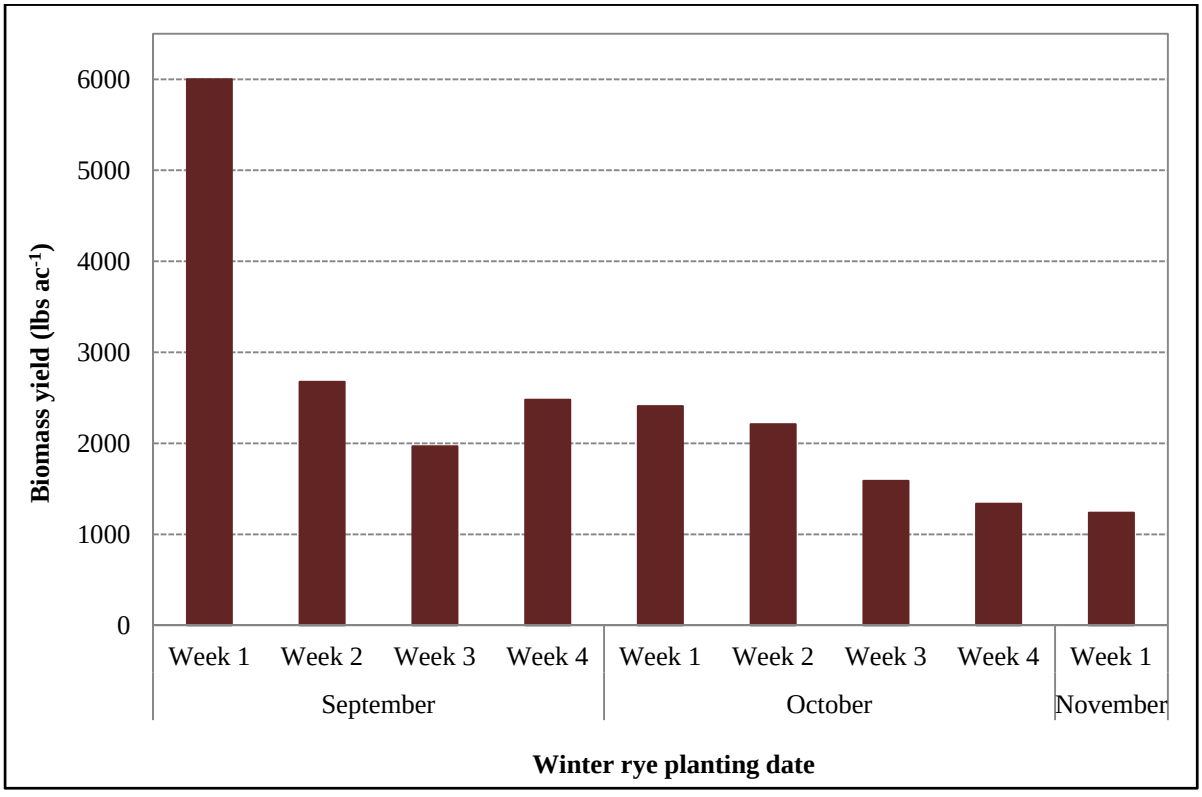


Figure 8. Effect of planting date on winter rye biomass accumulation, Alburgh, VT, 2009-2012.

Figure 9. Effect of planting date on tiller count in small grain

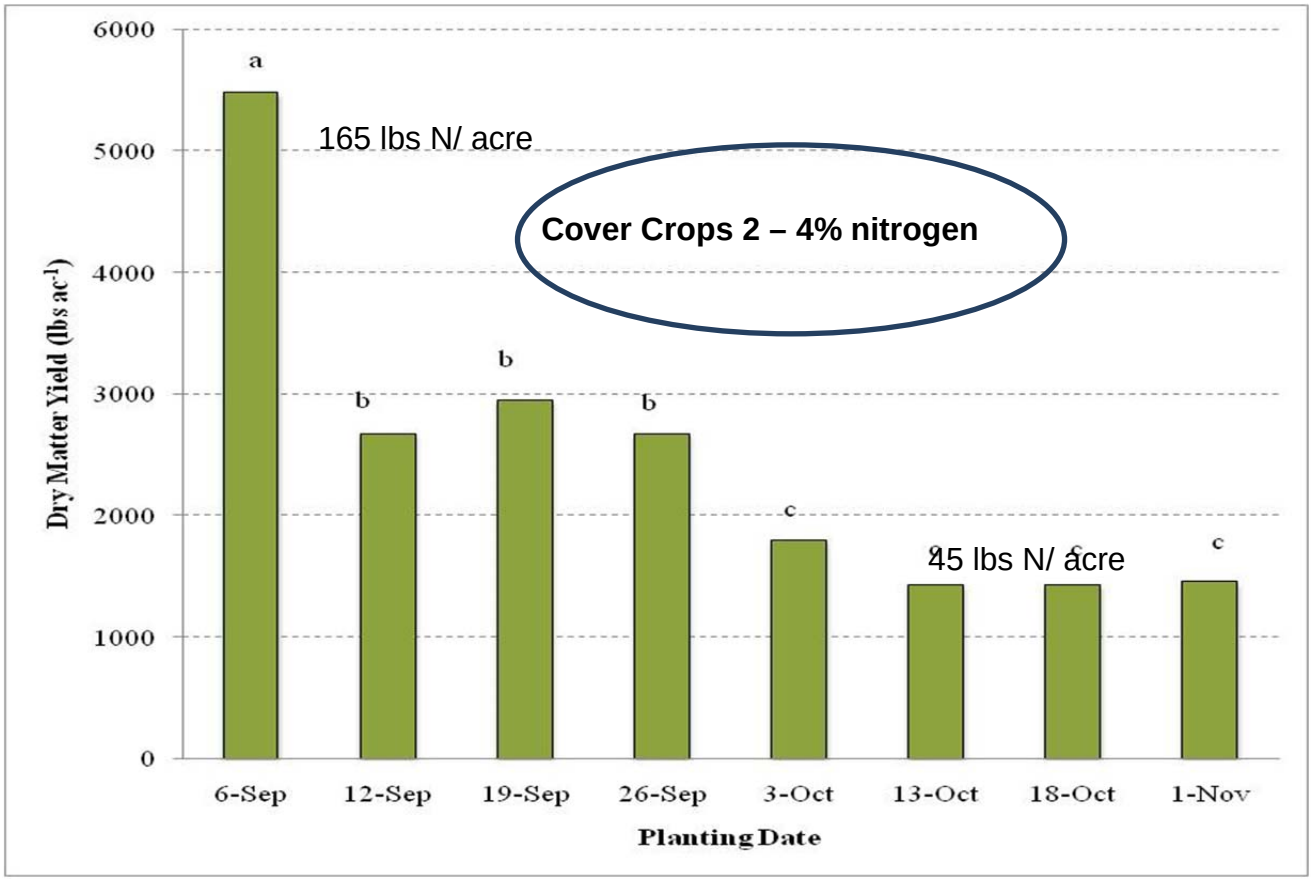


Figure 10. Impact of winter rye planting date on nitrogen scavenging.

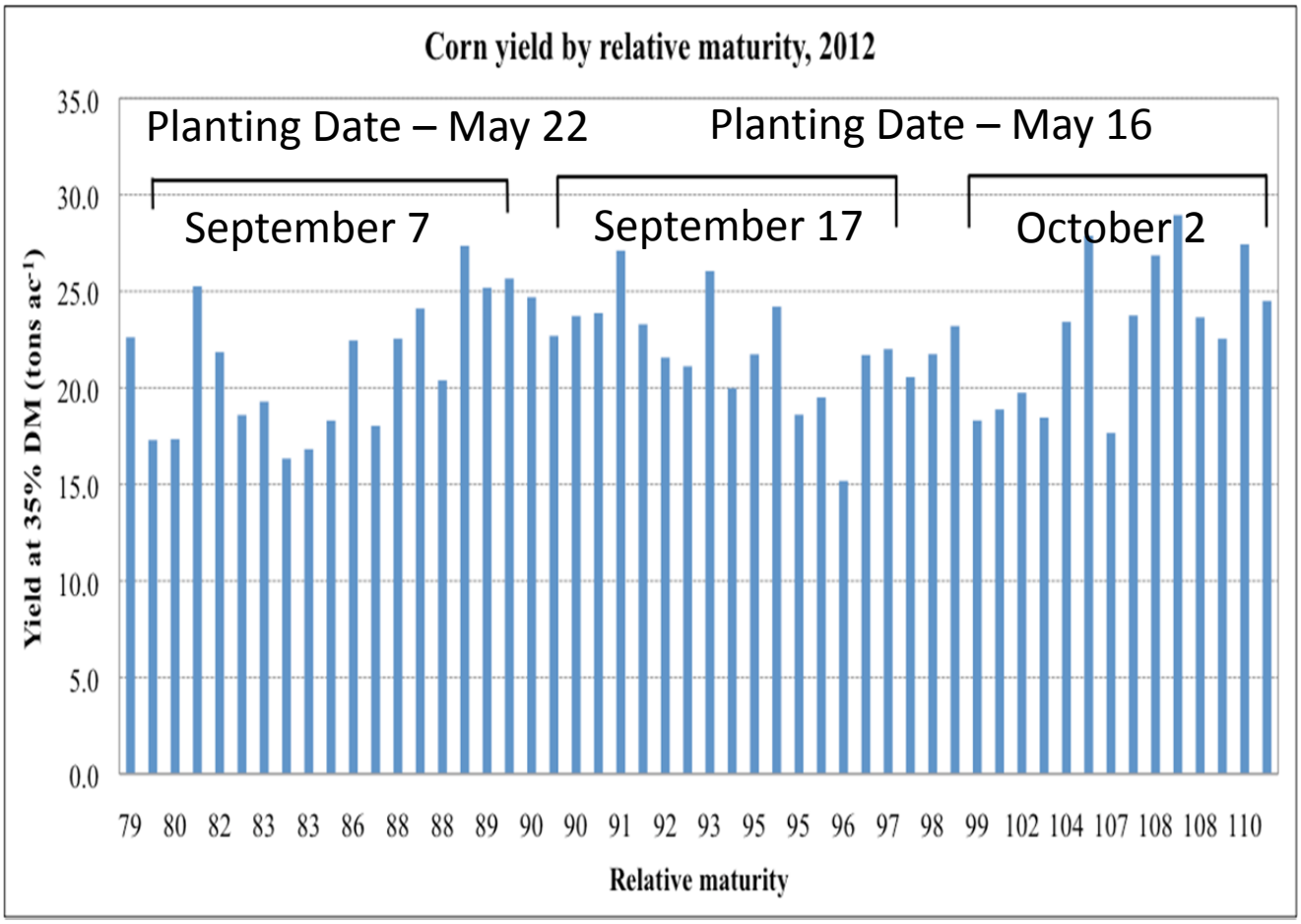


Figure 11. Effect of corn silage relative maturity on harvest date and yield.

While planting cover crops early can be difficult to manage with a corn crop, early planting dates are essential for cover crop success. Studies have shown that utilizing a shorter day corn with the addition of a cover crop can lead to higher yields than longer-season corn with bare soil through the winter months (Figure 11). Growing a shorter season corn can result in corn harvest almost one month earlier than longer season varieties.

SEEDING RATE

Seeding rates evaluated by UVM Extension's Northwest Crops & Soils Program ranged from 50-150 lbs per acre for winter rye (Table 3; Figure 12). Across three years of replicated trials, winter rye seeded at 125 lbs per acre had the highest average plant cover (83.3%) and biomass yield (2602 lbs of dry matter per acre). However adequate yields were obtained with seeding at a rate of 75 lbs per acre. Depending on the end use of a cover crop a higher seeding rate may be preferred such as in the case of those utilized for forage. Plant height varied, with taller plants at higher seeding rates (with the exception of the heaviest seeding rate of 150 lbs per acre).

Table 3. Cover crop stand establishment and yield by seeding rate, Alburgh, VT, 2009-2012.

	Seeding rate (lbs ac^{-1})				
	50	*75*	*100*	*125*	*150*
Plant cover (%)	58.4	61.3	48.7	83.3	71.8
Plant height (in)	23.6	31.0	29.4	30.6	22.5
Biomass yield (lbs ac^{-1})	1849	2112	2364	2602	2582

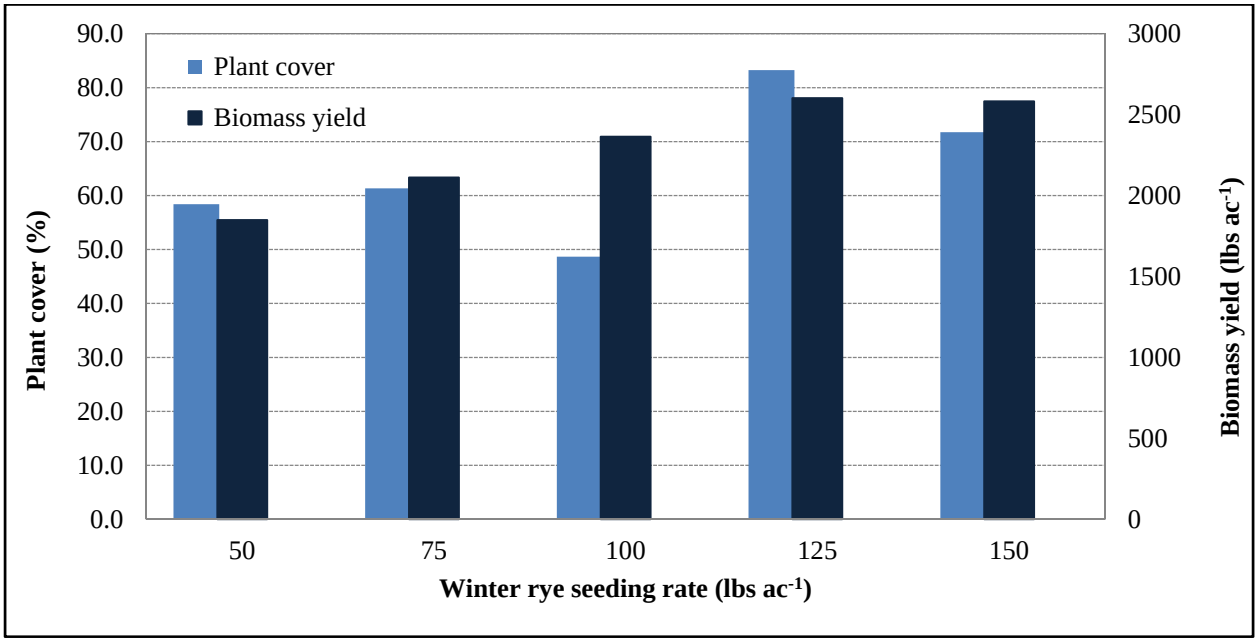


Figure 12. Effects of seeding rate on winter rye cover and biomass yield, Alburgh, VT, 2009-2012.

COVER CROP TERMINATION METHOD

Many farmers are interested in terminating the cover crop through herbicide or incorporation in early May to prepare for corn harvest. Other farms are willing to wait and let the cover crop grow to obtain sufficient biomass for a forage harvest. Each termination strategy has its advantages and disadvantages. The strategy ultimately depends on the farmers overall cropping system goals. As an example all termination strategies will result in overall soil health improvement. Research has shown that even a single season of cover cropping can improve levels of soil aggregation, active organic matter, and potentially mineralizable nitrogen (Table 4). However removing the plant biomass for forage or even terminating a crop with herbicide will diminish the nitrogen value of a winter rye cover crop. Incorporating a winter rye cover crop in the vegetative stage will result in the quickest nitrogen release to the succeeding corn crop. Figure 13 illustrates the nitrogen release of cover crops terminated by plow down, herbicide, and rolling. Cover crop that was incorporated released the most nitrates to the succeeding corn crop.

Table 4. Quality of soil with and without cover crop production.

Treatment	Organic Matter	Water stable aggregation	Active carbon	Potentially mineralizable N
	%	%	mg kg^{-1}	ug N g^{-1} d soil
No cover crop	4.46a	61.4b	676b	11.1a
Cover crop	4.42a	63.2a	701a	12.3a

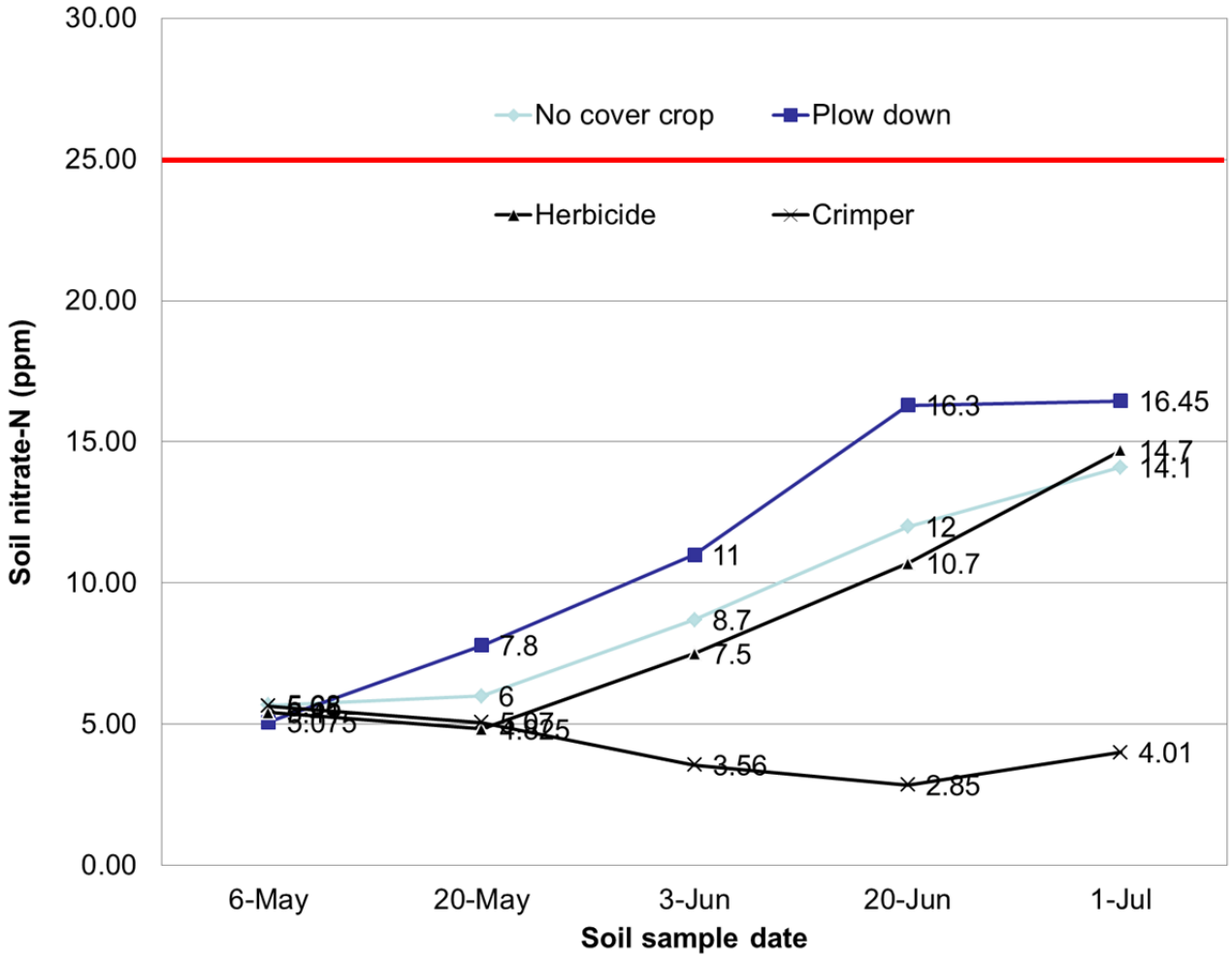
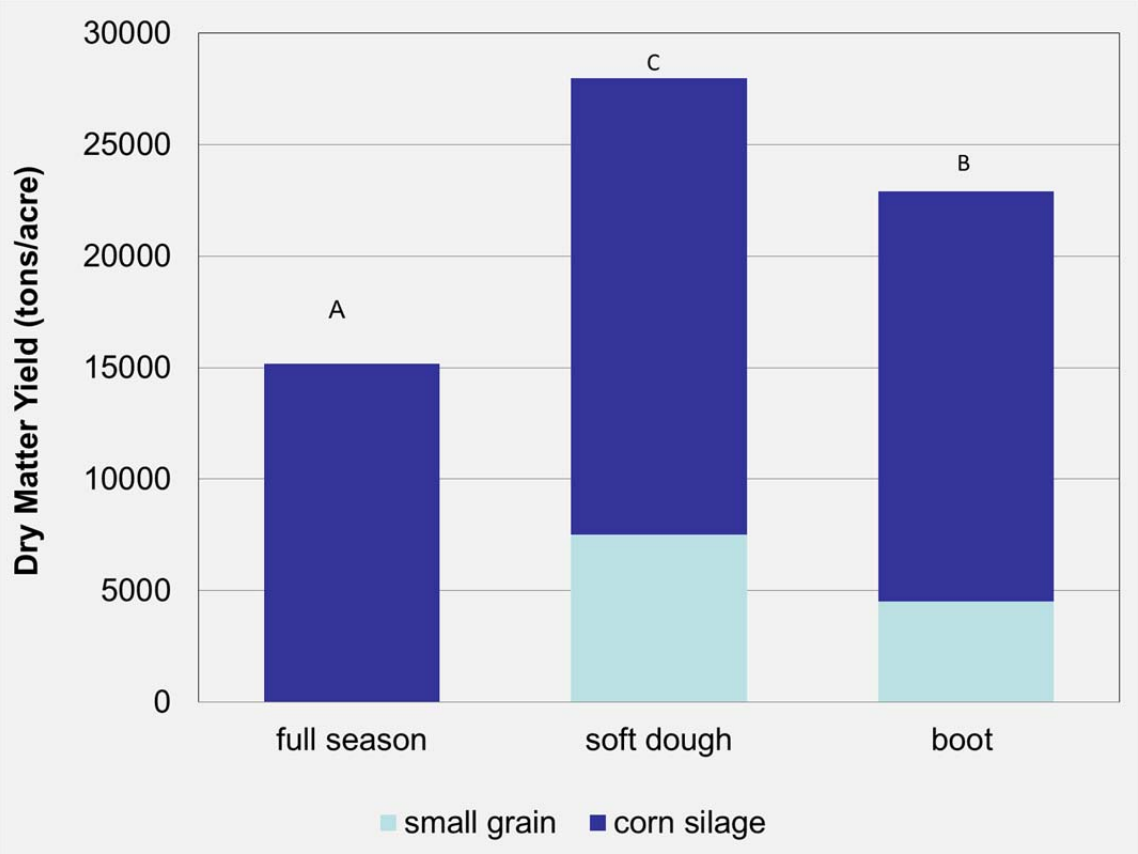


Figure 13. Nitrogen release from cover crops terminated by plow down, herbicide, and rolling as compared to no cover crop.

Harvesting cover crops as forage can help farmers gain more production per acre. This forage grows during months not commonly utilized for crop production so there is little competition with the main corn crop. Harvest of a winter cover crop can be made through grazing or mechanical harvest. Grazing a cover crop can allow for spring forage almost one to two weeks earlier as compared to perennial cool season pasture. If the winter forage is mechanically harvested it will likely be harvested in the boot stage to allow for a timely corn planting date.. Winter forage harvested in the boot stage generally occurs between the 3rd week of May and the first week of June. Fall planting date can influence spring heading dates of small grains. Hence an earlier planting date will result in cover crops ready to harvest for forage earlier in the spring. Yields of the forage will be highly dependent on the level of tillers initiated in the prior fall. Currently many farmers are recording approximately two tons of dry matter per acre from a harvested cover crop.

Figure 14. Cover crops harvested for winter forage and double cropped with corn silage.



Cover Crop Mixtures after Corn Silage

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Introduction

Cover crops can help improve soil erosion control, add surface mulch to the following crop to help conserve moisture, intensify nutrient cycling, alleviate soil compaction, provide weed control, and provide feed for ruminant livestock. Because environmental conservation is an important public good, federal, state and local governments are interested in promoting the use of cover crops. The two most widely used approaches to accomplish this are the 'stick' of environmental laws, and the 'carrot' of subsidies. Both have disadvantages. Environmental laws tend to polarize farmers and government, discourage inventiveness because of their inflexibility, and limit management freedoms of farmers. Besides, they are expensive to police. Subsidies, on the other hand, also tend to discourage inventiveness because they need to be simple, have ridged rules, are cumbersome to administer and are expensive for the public. Although these approaches may be useful for some environmental practices, we believe cover crops can be promoted better by building partnerships between cooperative extension, farmers, and agribusiness using a variety of outreach approaches. We therefore conducted a comprehensive outreach program in Pennsylvania employing on-farm research and demonstrations, field days, winter meeting presentations, farm journal articles and interviews, and advertisements to stimulate dairy farmers to use cover crops after corn silage. The focus on silage was because there is the greatest scenario for environmental gain and agronomic success because of the bare soil after harvest, the use of manure nutrients, and the larger window of establishment than after grain crops such as corn or soybean. This project was possible through support through a USDA-NRCS Conservation Innovation Grant.

Approach

We worked with approximately 10 small-to-medium scale dairy farms per year from 2010-2013. The farms varied from year to year to increase geographic impact. The farms were primarily located in the Chesapeake Bay watershed (Fig. 1).

Figure 1. Typical spread of on-farm research/demonstrations in our project

On each farm, we planted cover crop mixtures in replicated small plots using a small tractor and a 7 ft wide drill manufactured by Esch. Mixtures of cover crops are composed of species which are expected to complement each other. For example some species grow vigorously in the fall while others put on growth primarily in the spring; other species winterkill so would not provide living cover in the spring; or some species grow faster in the fall cf spring. We made sure to choose adapted varieties of the cover crops because in past research we found that varieties differ significantly in their winter-hardiness. We also asked the farmer to choose a new cover crop (mixture) of his/her choice to try it on a scale of up to 10 acres (the seed was provided by the project but the farmer was responsible for the establishment and management of this field). The large field was included in our project to get active farmer participation in the project and provide peers with management clues when using cover crops on a farm scale. We collected biomass data from the small research plots at dormancy in fall and again just before they would be terminated or harvested in the spring. The samples were cut at soil surface from a 0.5 square meter area and dried in the oven at 60 degrees Celsius. Samples were then ground and sent to a lab for nutrient analysis. We typically held field

days in the fall and spring to show the growth on the different cover crop mixtures and discuss results. The farmers were at these field days to talk about their use of cover crops and their opinion about integrating them in their farming system. We also employed remote sensing imagery from satellites and GIS systems to analyze the use of cover crops in four of the counties in which we worked from the year prior to the final year of our project (2009-2013).

Table 1. Cover crop species and variety mixes used in the three years of this project

2010/11	2011/12	2012/13
Crimson clover "Dixie" + Annual ryegrass "KB Royal"	Crimson clover "Dixie" + Annual ryegrass "402 KB"	Crimson clover "Dixie" + Annual ryegrass "402 KB"
Annual ryegrass "KB Royal" + Triticale "815"	Crimson clover "Dixie" + Triticale "815"	Crimson clover "Dixie" + Triticale "718"
Cereal rye "Aroostook" + Forage Oat "Jerry"	Crimson clover "Dixie" + Forage oat "Everleaf"	Crimson clover "Dixie" + Grain oat "Herculex"
Rape "Bonar" + Hairy vetch + Cereal rye "Aroostook"	Annual ryegrass "402 KB"+ Forage oat "Everleaf"	Grain oat "Herculex" + Annual ryegrass "402 KB"
"Tillage radish" + Hairy vetch + Cereal rye "Aroostook"	Forage oat "Everleaf" + Cereal rye "Aroostook"	Grain oat "Herculex" + Cereal rye "Aroostook"
"Tillage radish" + Cereal rye "Aroostook"	Grain oat "Herculex" + Cereal rye "Aroostook"	Grain oat "Herculex" + Cereal rye "Huron"
Cereal rye "Aroostook"	"Tillage radish" + Hairy vetch + Cereal rye "Aroostook"	"Tillage radish" + Hairy vetch + Cereal rye "Aroostook"

Results

On average, all mixtures performed well, the highest biomass being for cereal rye ('Aroostock' – 3914 lbs/A in 2012), and the lowest being 1300 lbs/A in the spring of 2013 for ryegrass/oats mixture (Table 2). However, there was a wide spread. For example, in 2011, maximum dry matter was 6517 lbs/A for crimson clover and annual ryegrass but the minimum was 1222 lbs/A. This variability in performance was due to climate and soil fertility. We noticed that in the northern regions of Pennsylvania temperatures tend to decrease rapidly after silage harvest, while the winter lingers on long, leaving little time for growth of the cover crop. Cover crops that are sensitive to cold can suffer from winterkill or just not grow well. On the other hand, we noticed that if a field had a history of regular manure applications the cover crops tended to produce more biomass than if the field had not received regular manure applications. Nitrogen seemed to be the major element that impacted cover crop growth. The performance of crimson clover and annual ryegrass can as a surprise because these species are not considered winter hardy in Pennsylvania. Although dry matter production may be lower than cereal rye the protein content and digestible fiber of these species is much better, making them interesting for our dairy producers. Hairy vetch did not perform very well and therefore we decreased the number of entries over the years. Triticale is a nice companion for crimson clover because it hugs the soil in the fall in contrast to cereal rye. The radish did not perform very well after corn silage harvest – it seems in

most cases it is too late for this species. Oats can do well if the silage harvest is early, but because it is very aggressive it sometimes chokes the companion crop and therefore we may find little biomass there in the spring.

Table 2. Spring biomass yield (dry matter) of cover crops showing average of all sites, minimum among sites, and maximum among sites per year.

		Average	Minimum (lbs/A)	Maximum
	Crimson + Ryegrass	2735	1222	6517
	Ryegrass +Triticale	3418	2150	6347
2011	Rye + F.Oat	3963	2462	5856
	Radish + Rye	4185	2477	6527
	Rape + HV + Rye	4334	2651	6588
	Radish + HV + rye	4547	2715	7137
	Rye	4634	2612	7468
	Ryegrass + F.Oat	2668	1719	3824
	Crimson + F. Oat	3313	2208	4787
	F.Oat + Rye	4170	2238	6047
2012	Radish + vetch + Rye	4489	2490	7470
	Crimson+ Ryegrass	4504	2194	6047
	Oats + Rye	4516	2520	6136
	Crimson + Triticale	4532	1971	6507
	Rye	4914	2653	7351
	Ryegrass + Oats	1341	121	2718
	Crimson + oat	1680	209	4609
	Crimson + ryegrass	2597	507	5262
2013	Huron rye + Oat	2771	738	5121
	Crimson + Triticale	3032	798	5633
	Rye + Oat	3385	782	5790
	Radish + Vetch + Rye	3487	699	5925
	Rye	4010	798	6864

We also measured the nitrogen contained in the above ground living biomass. Results are shown in Table 3. Large quantities of N were observed in the above ground biomass – up to 176 lbs/A. This represents nitrogen that could otherwise have leached from the soil profile into ground water, or nitrogen that was fixed from the atmosphere (in the case of legumes).

Table 3. Spring N-content of above-ground biomass (dry matter) of cover crops showing average of all sites, minimum among sites, and maximum among sites per year.

		Average	Minimum	Maximum
			lbs/A	
	Crimson + Ryegrass	70	21	104
	Ryegrass +Triticale	73	41	126
	Rye + F.Oat	76	44	139
2011	Radish + Rye	82	49	161
	Rape + HV + Rye	87	50	169
	Radish + HV + rye	89	52	164
	Rye	93	47	182
	Ryegrass + F.Oat	52	21	74
	F.Oat + Rye	69	26	107
	Oats + Rye	73	34	97
	Radish + vetch + Rye	82	39	120
2012	Rye	84	35	120
	Crimson + F. Oat	103	57	144
	Crimson+ Ryegrass	106	63	140
	Crimson + Triticale	112	65	147
	Ryegrass + Oats	31	5	72
	Crimson + oat	54	7	135
	Huron rye + Oat	66	16	125
2013	Rye + Oat	66	17	122
	Crimson + ryegrass	70	18	125
	Radish + Vetch + Rye	79	16	158
	Rye	82	16	176
	Crimson + Triticale	83	23	130

We measured a significant increase in the use of cover crops over the project period from 30-60% of corn acres being followed by green cover. Although not only the result of our project, we believe the approach taken is promising to advance cover crop adoption. Our research showed that there are promising new species that can be used such as crimson clover, annual ryegrass, and triticale.

NOTES:

NOTES:

University of Vermont Extension:
Helping farmers in Vermont put knowledge to work!

The University of Vermont Extension has a vast amount of resources available to farmers in Vermont and around the Northeast. Here are just a few that you mind find helpful.

The Champlain Valley Crop, Soil & Pasture Team is a group of UVM Extension professionals and their partners working to provide technical assistance to Vermont Farmers in the Lake Champlain Watershed. We strive to bring you research-based knowledge that has practical applications on your farm, and address many production related issues such as: Quality Forage & Crop Production; Soil Health; Grazing Management and Pasture Production; Nutrient Management; Water Quality and more.

23 Pond Lane, Suite 300, Middlebury, VT 05753 | (802) 388-4969 | www.uvm.edu/extension/cvcrops

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The mission of the UVM Extension Northwest Crops and Soils Team 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.

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MORE EXTENSION RESOURCES:

- **Sidney Bosworth,** Extension Associate Professor, University of Vermont
  Agronomy, Forages, Pasture Management | sid.bosworth@uvm.edu | 802-656-0478 | http://pss.uvm.edu/vtcrops
- **Daniel Hudson**, Assistant Professor: Agronomist & Nutrient Management Specialist
  St. Johnsbury Extension Office | daniel.hudson@uvm.edu | 802-751-8307 x356
- **University of Vermont Extension Agriculture Programs** | http://www.uvm.edu/extension/agriculture

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