CULTIVATING HEALTHY COMMUNITIES

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CULTIVATING HEALTHY COMMUNITIES

MULTI-SPECIES COVER CROP MIXTURES

Kirsten Workman, Agronomy Outreach Specialist, UVM Extension

No Till and Cover Crop Symposium (Burlington, Vt.)

February 2016

CHAMPLAIN VALLEY CROP, SOIL & PASTURE TEAM

- Field & Forage Crop Production
- Grazing & Pasture Management
- Nutrient Management
- No-Till
- Cover Crops
- Soil Health
- Water Quality
- Agronomic Technical Assistance

We are proud to work with farmers throughout the Champlain Basin to investigate and share techniques to grow the highest quality crops in the most efficient way, while protecting soil health and water quality.

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If it aint broke…why fix it?
picture taken November 16, 2013

Why Mixtures?

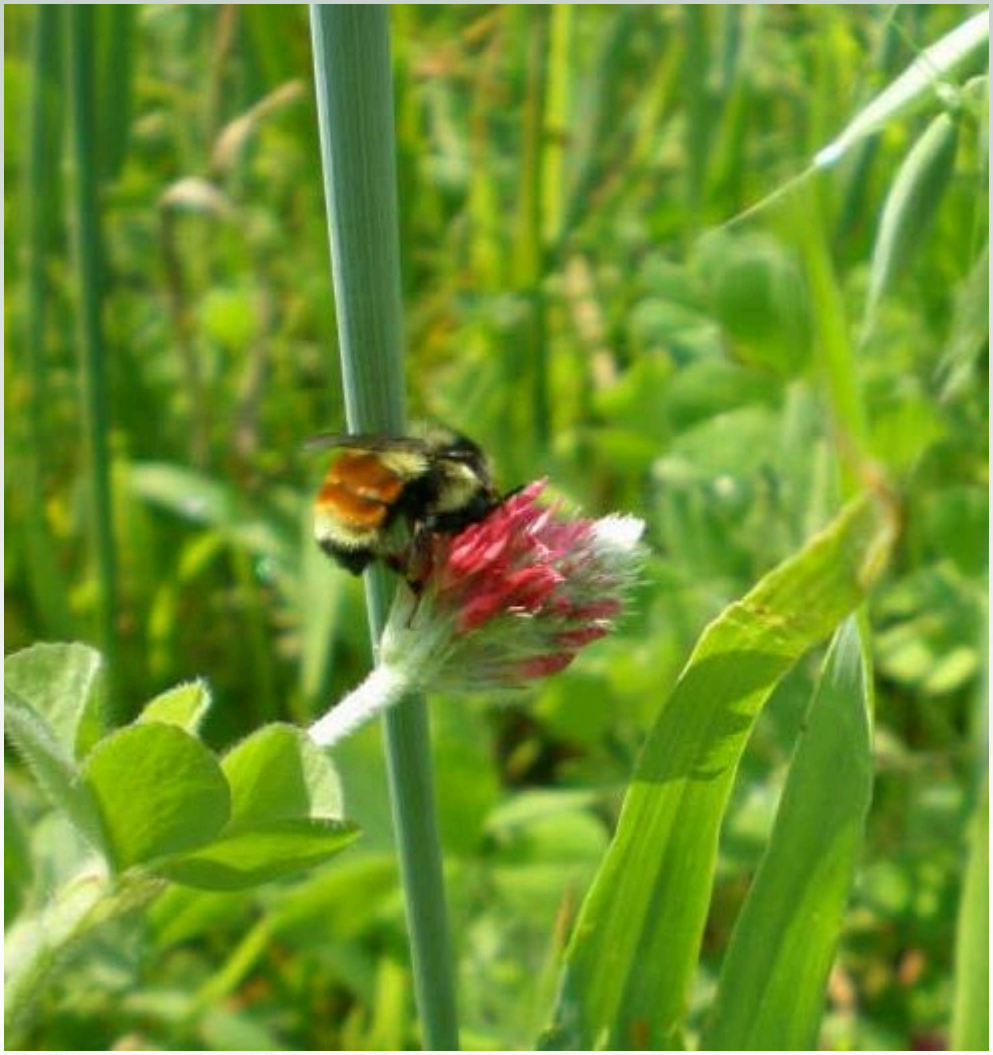

Photo: L. Ruhl

- Soil Health
- Transition to No-Till
- Maximize diversity & rotations
- C:N Ratio…*stop tying up N*
- Management Objective
  - Nutrient (N,P,K)
  - Weed Control
  - Pollinators
  - Compaction
  - Forage Quality
  - Disease
- Better cost share $$

Management Challenges in New England

Agronomic

Challenge	Solutions
Sourcing seed	Grow your own, Better suppliers already
Different seed sizes can be difficult to mix together	Coated seed, narrower pattern Different boxes in the drill
Often cover crops/mixes require different equipment	Custom Service Providers, new technology You wanted a new drill anyway, didn't you?
How to fit it in the rotation (timing)	Add a small grain to your rotation, Interseeding into cash crops, Be aware in vegetable rotations
Herbicides: Carryover impacts on emergence Good termination	Keeping residuals in check…work with your suppliers Glyphosate may not be enough

Management Challenges in New England

Climatic

- Short growing season
- Cold winters
- Soil temperatures
- Unpredictable weather at establishment and termination

Solutions:

- Shorter RM Corn
- Interseed
- Pay attention to details
- Quality seed
- Seed treatments

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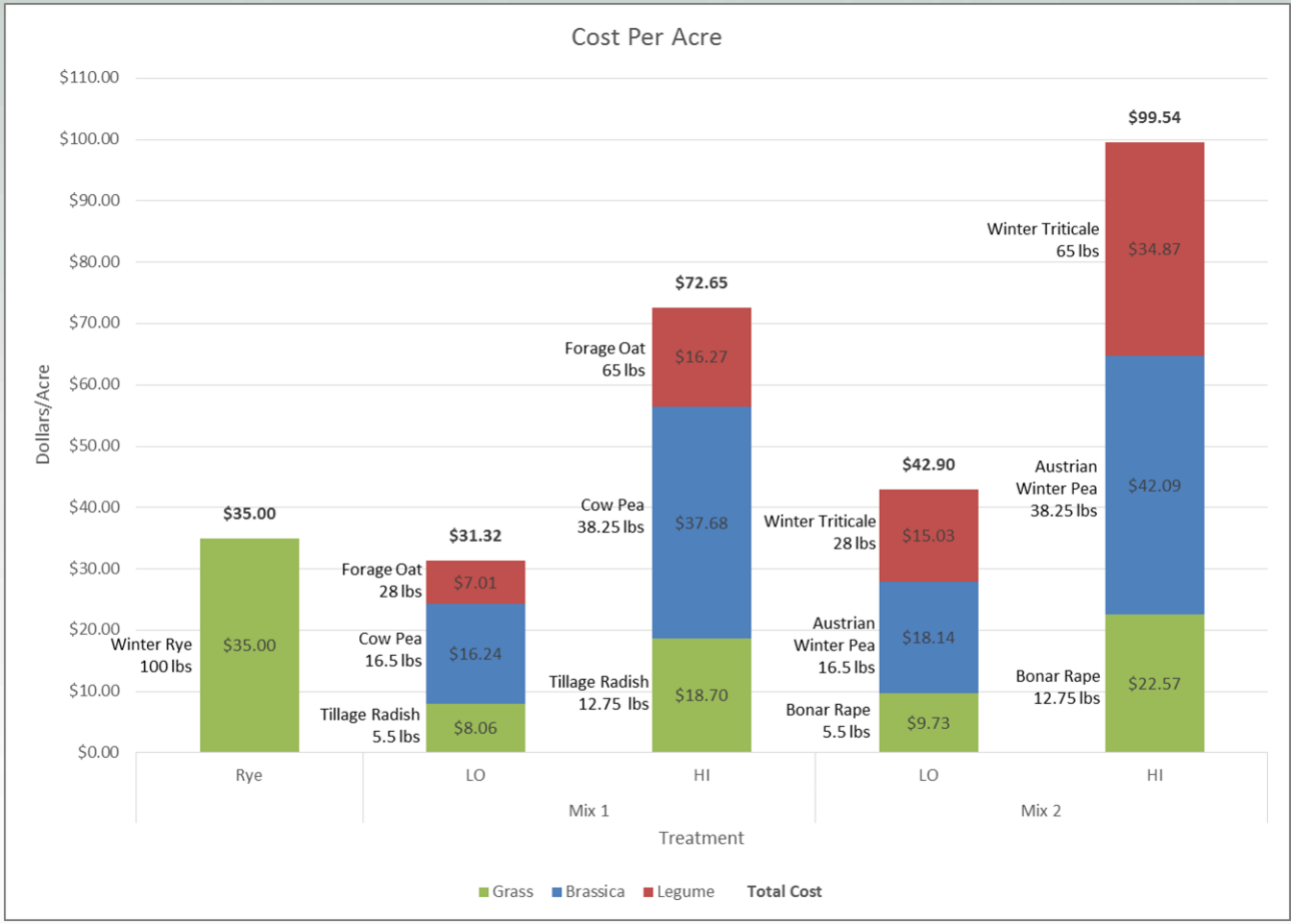
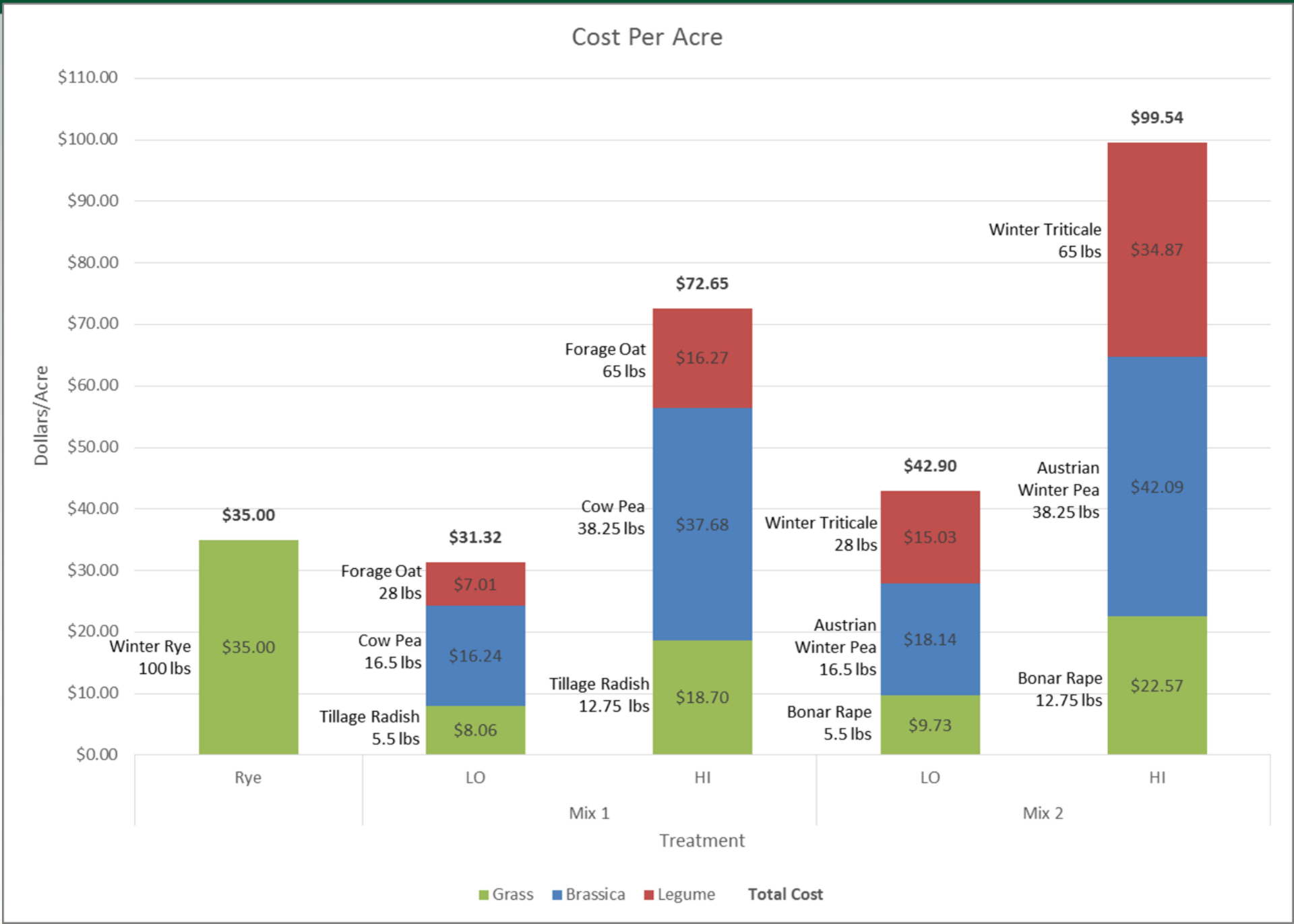
Management Challenges in New England

Economic

- Some species can make your mix significantly more expensive.
- <u>The good news</u>: usually these are the species you can use very little of.
- LEGUME$
  invest in C:N ratio




Cost Per Acre
$110.00
$100.00
$90.00
$80.00
$70.00
$60.00
$50.00
$40.00
$30.00
$20.00
$10.00
$0.00
Dollars/Acre
$35.00
$31.32
$72.65
$42.90
$99.54
Winter Rye
100 lbs
$35.00
Forage Oat
28 lbs
$7.01
Cow Pea
16.5 lbs
$16.24
Tillage Radish
5.5 lbs
$8.06
Forage Oat
65 lbs
$16.27
Cow Pea
38.25 lbs
$37.68
Tillage Radish
12.75 lbs
$18.70
Winter Triticale
28 lbs
$15.03
Austrian
Winter Pea
16.5 lbs
$18.14
Bonar Rape
5.5 lbs
$9.73
Winter Triticale
65 lbs
$34.87
Austrian
Winter Pea
38.25 lbs
$42.09
Bonar Rape
12.75 lbs
$22.57
Rye
LO
HI
LO
HI
Mix 1
Mix 2
Treatment
Grass
Brassica
Legume
Total Cost

CHAMPLAIN VALLEY CROP, SOIL & PASTURE TEAM
2015-2016 SEASON

16 Demonstration & Research Projects on Cover Crop Mixes

- 7 CIG Cover Crop Mixes (5 Corn/2 Soy)
- 5 Prevented Planting Cover Crop
- 2 Winter Rye x Radish in Corn Silage w/ Manure *(research)*
- 2 Misc. Cover Cropping

Soil Health Field Day Site
Foster Bros. Farm—Middlebury VT

THANK YOU TO OUR FUNDERS

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Conservation Innovation Grants

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.

NORTHEAST SARE
Sustainable Agriculture Research & Education

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THANK YOU TO OUR FARMERS!!

- Audy Farm *(New Haven)*
- Bourdeau Bros. of Middlebury
- Chimney Point Farm *(Addison)*
- Clifford Farm *(Starksboro)*
- Conant's Riverside Farm *(Richmond)*
- Deer Valley Farm *(Ferrisburgh)*
- Farr Farm *(Richmond)*
- Foster Bros. Farm *(Middlebury)*
- Jillian Holsteins *(Orwell)*
- Kennett Farm *(Addison)*
- LaBerge Bros. Dairy *(Charlotte)*
- Nichols Fodder Farm *(Charlotte)*
- No-Mon-Ne Farm *(Addison)*
- Rail View Dairy *(New Haven)*
- Senesac Farm *(Colchester)*
- Vorsteveld Family Farm *(Panton)*

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Cover Crop Diversity in No-Till Systems

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
R1	Mix 1 @ 116 lbs	15	Mix 1 @ 116 lbs
	Mix 2 @ 116 lbs	14	Mix 2 @ 116 lbs
	Mix 2 @ 50 lbs	13	Mix 2 @ 50 lbs
	Control *(Winter Rye @ 100 lbs)*	12	Control *(Winter Rye @ 100 lbs)*
	Mix 1 @ 50 lbs	11	Mix 1 @ 50 lbs
R2	Mix 2 @ 116 lbs	10	Mix 2 @ 116 lbs
	Mix 2@ 50 lbs	9	Mix 2@ 50 lbs
	Control *(Winter Rye @ 100 lbs)*	8	Control *(Winter Rye @ 100 lbs)*
	Mix 1 @ 50 lbs	7	Mix 1 @ 50 lbs
	Mix 1 @ 116 lbs	6	Mix 1 @ 116 lbs
R3	Mix 2 @ 116 lbs	5	Mix 2 @ 116 lbs
	Mix 1 @ 116 lbs	4	Mix 1 @ 116 lbs
	Mix 2 @ 50 lbs	3	Mix 2 @ 50 lbs
	Mix 1 @50 lbs	2	Mix 1 @50 lbs
	Control *(Winter Rye @ 100 lbs)*	1	Control *(Winter Rye @ 100 lbs)*

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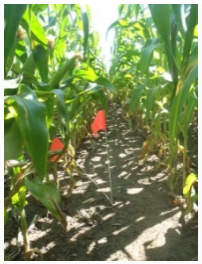
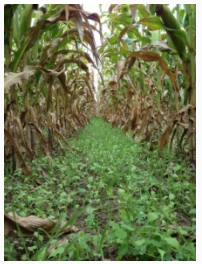
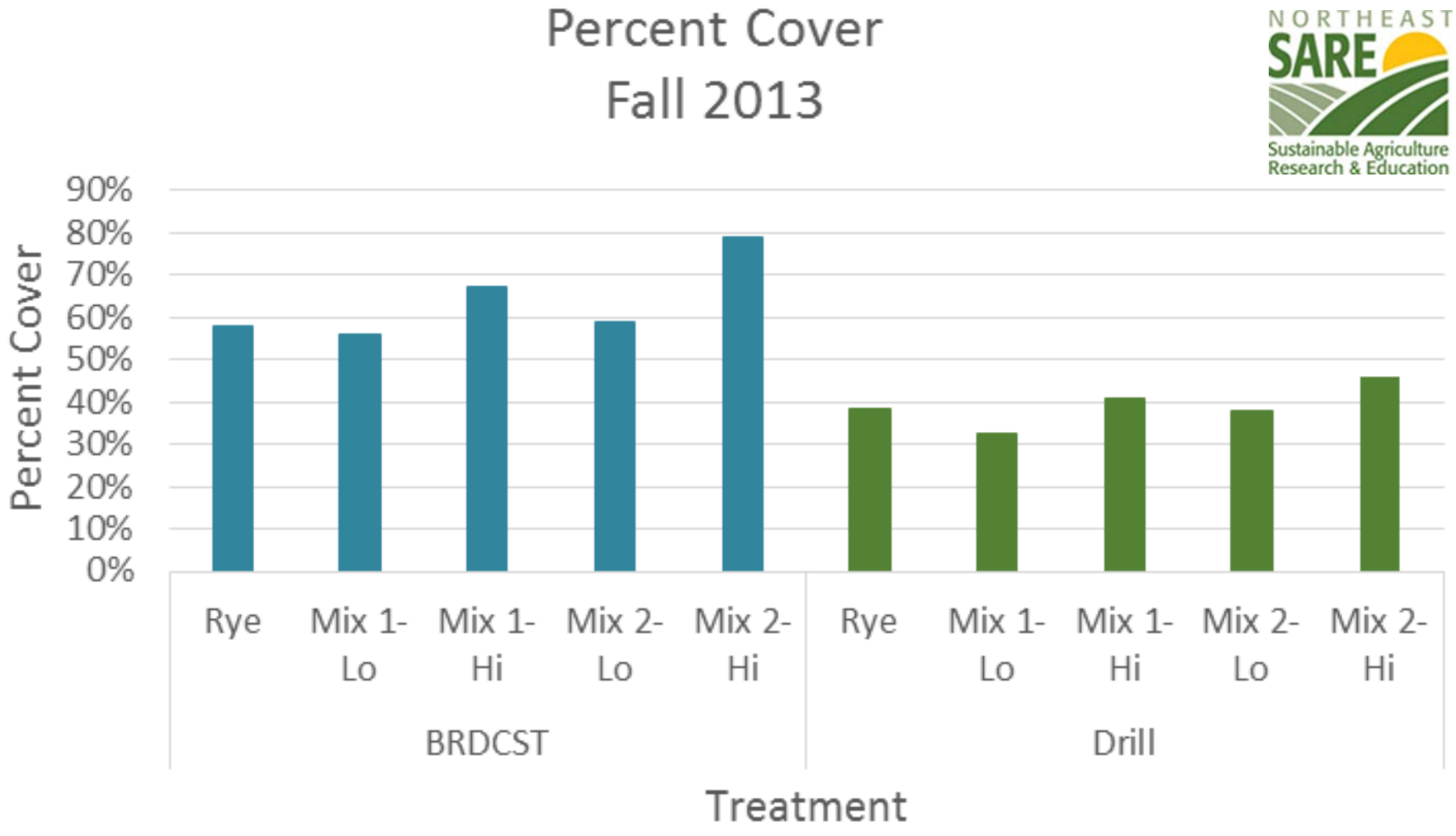




Cover Crop Diversity in No-Till Systems



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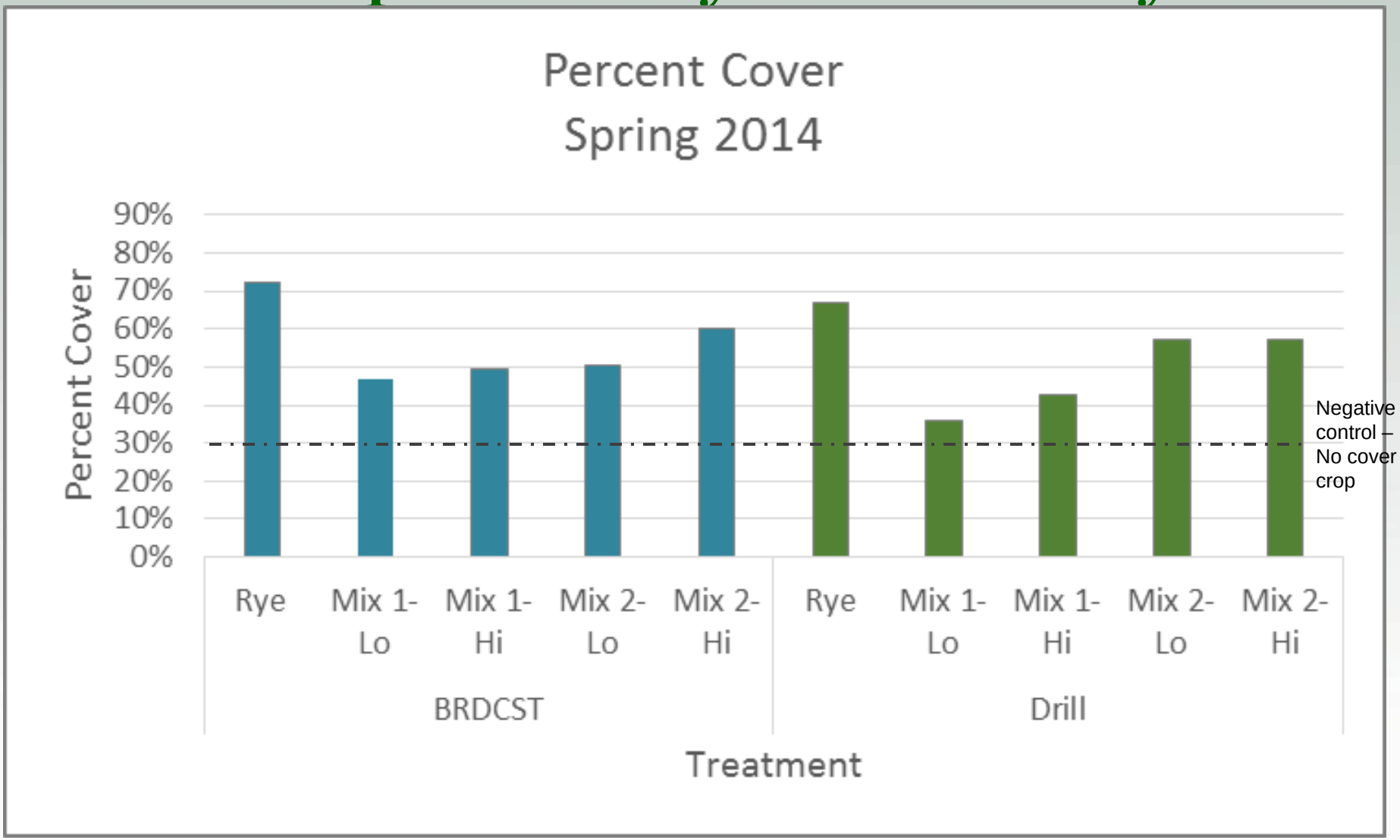
Cover Crop Diversity in No-Till Systems



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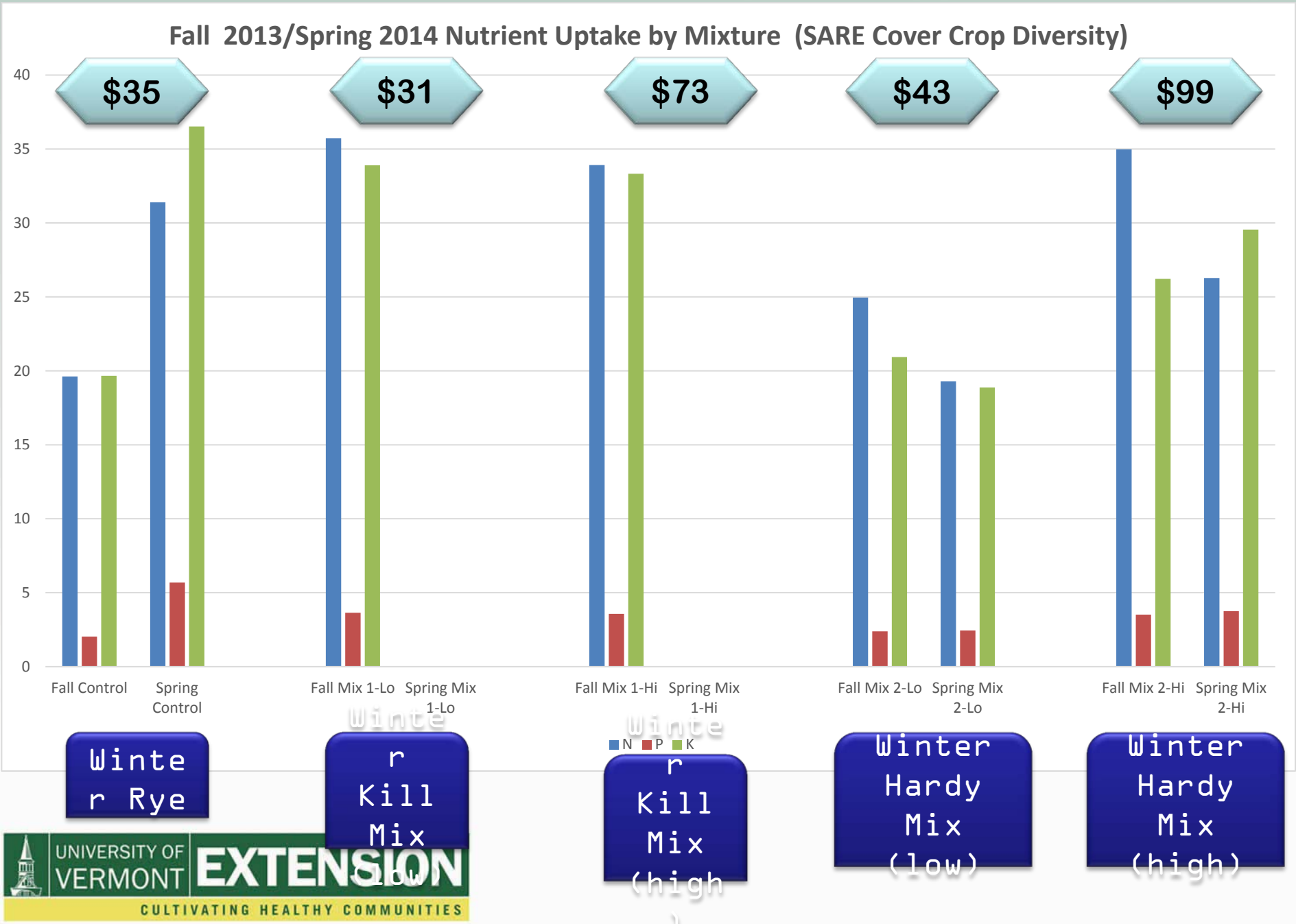

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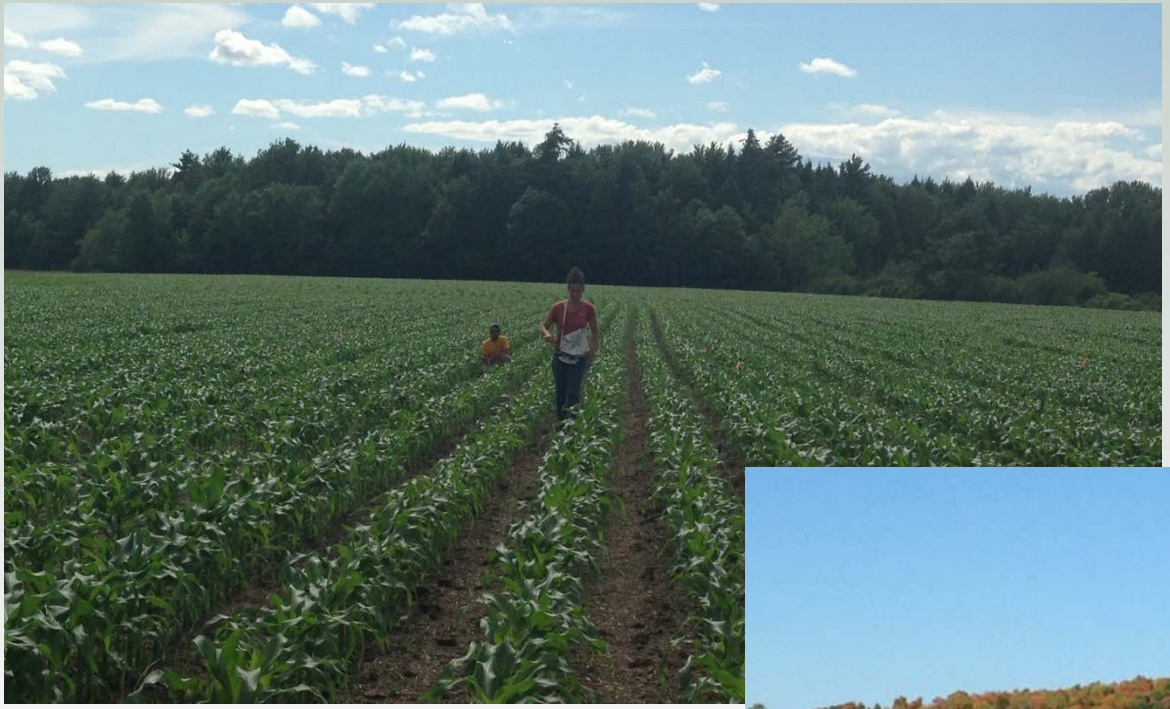
Cover Crop Diversity in No-Till Systems

**sampled on September 8, 2014...actual dry matters of corn silage averaged 26%, yields were adjusted to silage equivilants*

Treatment	Seeding Rate	Method of Planting Corn	tons/acre (adjusted to silage @ 32% DM)*	Dry Matter tons/acre	Population	% DM @ Sampling
Rye	112 lbs/acre winter rye	No-Till into green cover	17.62	5.64	29,333	26%
Mix 1-Hi	Oat/Pea/Radish @ 116 lbs/acre	No-Till into winter killed residue	19.98	6.39	35,000	26%
Mix 2-Hi	Triticale/W. Pea/W. Rape @ 116 lbs/ac	No-Till into green cover	17.63	5.64	34,000	28%
Conv.	no cover crop	Manure, Fall plowed, spring tillage	22.60	7.23	34,000	22%

Better Cover Crop Mixes for Vermont



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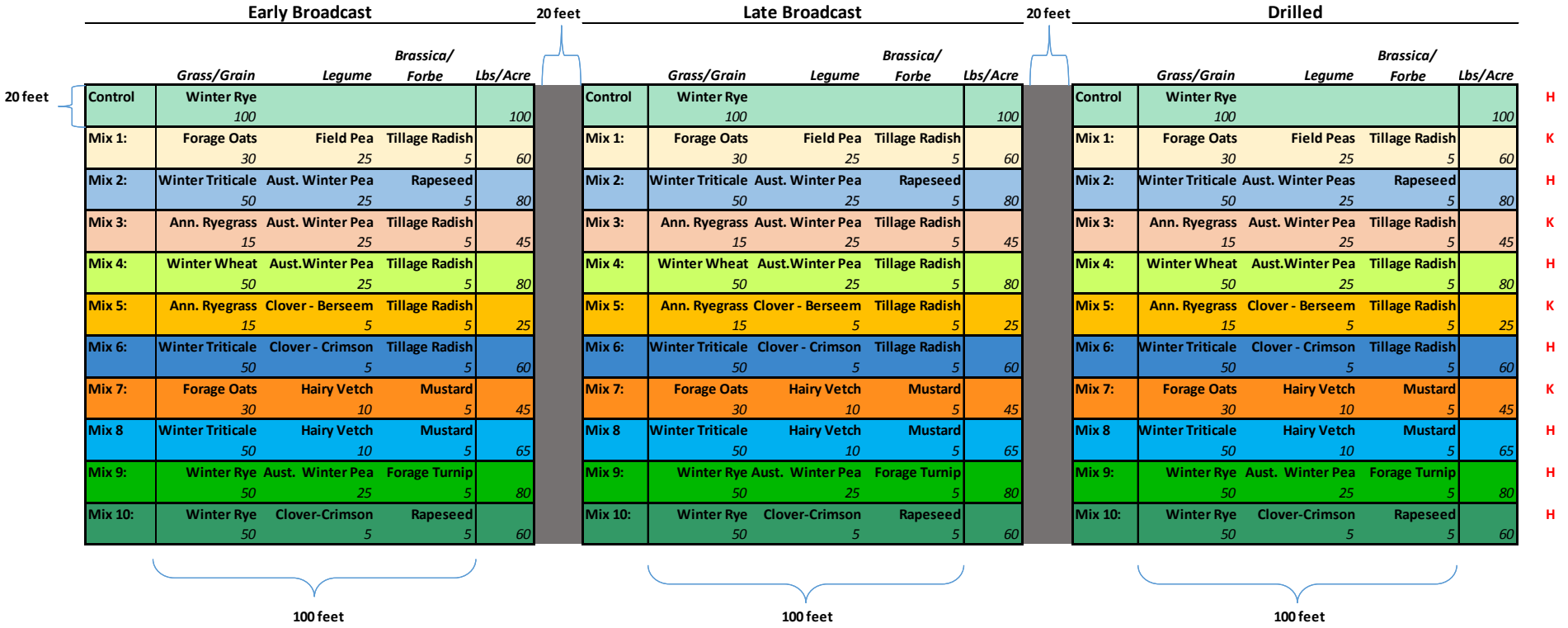
Better Cover Crop Mixes for Vermont

Plot Design



	Grass/Grain	Legume	Brassica/ Forbe	Lbs/Acre
Control	Winter Rye 100			100
Mix 1:	Forage Oats 30	Field Pea 25	Tillage Radish 5	60
Mix 2:	Winter Triticale 50	Aust. Winter Pea 25	Rapeseed 5	80
Mix 3:	Ann. Ryegrass 15	Aust. Winter Pea 25	Tillage Radish 5	45
Mix 4:	Winter Wheat 50	Aust.Winter Pea 25	Tillage Radish 5	80
Mix 5:	Ann. Ryegrass 15	Clover - Berseem 5	Tillage Radish 5	25
Mix 6:	Winter Triticale 50	Clover - Crimson 5	Tillage Radish 5	60
Mix 7:	Forage Oats 30	Hairy Vetch 10	Mustard 5	45
Mix 8	Winter Triticale 50	Hairy Vetch 10	Mustard 5	65
Mix 9:	Winter Rye 50	Aust. Winter Pea 25	Forage Turnip 5	80
Mix 10:	Winter Rye 50	Clover-Crimson 5	Rapeseed 5	60

	Grass/Grain	Legume	Brassica/ Forbe	Lbs/Acre
Control	Winter Rye 100			100
Mix 1:	Forage Oats 30	Field Pea 25	Tillage Radish 5	60
Mix 2:	Winter Triticale 50	Aust. Winter Pea 25	Rapeseed 5	80
Mix 3:	Ann. Ryegrass 15	Aust. Winter Pea 25	Tillage Radish 5	45
Mix 4:	Winter Wheat 50	Aust.Winter Pea 25	Tillage Radish 5	80
Mix 5:	Ann. Ryegrass 15	Clover - Berseem 5	Tillage Radish 5	25
Mix 6:	Winter Triticale 50	Clover - Crimson 5	Tillage Radish 5	60
Mix 7:	Forage Oats 30	Hairy Vetch 10	Mustard 5	45
Mix 8	Winter Triticale 50	Hairy Vetch 10	Mustard 5	65
Mix 9:	Winter Rye 50	Aust. Winter Pea 25	Forage Turnip 5	80
Mix 10:	Winter Rye 50	Clover-Crimson 5	Rapeseed 5	60

	Grass/Grain	Legume	Brassica/ Forbe	Lbs/Acre	
Control	Winter Rye 100			100	H
Mix 1:	Forage Oats 30	Field Peas 25	Tillage Radish 5	60	K
Mix 2:	Winter Triticale 50	Aust. Winter Peas 25	Rapeseed 5	80	H
Mix 3:	Ann. Ryegrass 15	Aust. Winter Pea 25	Tillage Radish 5	45	K
Mix 4:	Winter Wheat 50	Aust.Winter Pea 25	Tillage Radish 5	80	H
Mix 5:	Ann. Ryegrass 15	Clover - Berseem 5	Tillage Radish 5	25	K
Mix 6:	Winter Triticale 50	Clover - Crimson 5	Tillage Radish 5	60	H
Mix 7:	Forage Oats 30	Hairy Vetch 10	Mustard 5	45	K
Mix 8	Winter Triticale 50	Hairy Vetch 10	Mustard 5	65	H
Mix 9:	Winter Rye 50	Aust. Winter Pea 25	Forage Turnip 5	80	H
Mix 10:	Winter Rye 50	Clover-Crimson 5	Rapeseed 5	60	H

Winter Hardy Mixes

Those in blue and green shades with winter rye, winter triticale, or winter wheat

Austrian winter pea is theoretically winter hardy but produced minimal to no growth in the spring (it was a very hard winter)
Hairy vetch can overwinter, but we did not see substantial spring growth before termination

Winter Kill Mixes

Those in orange and tan shades with annual ryegrass or forage oats

All brassicas are winter killed
Crimson and Berseem clovers do not over winter in VT

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Better Cover Crop Mixes for Vermont

2014-2015 Mixes

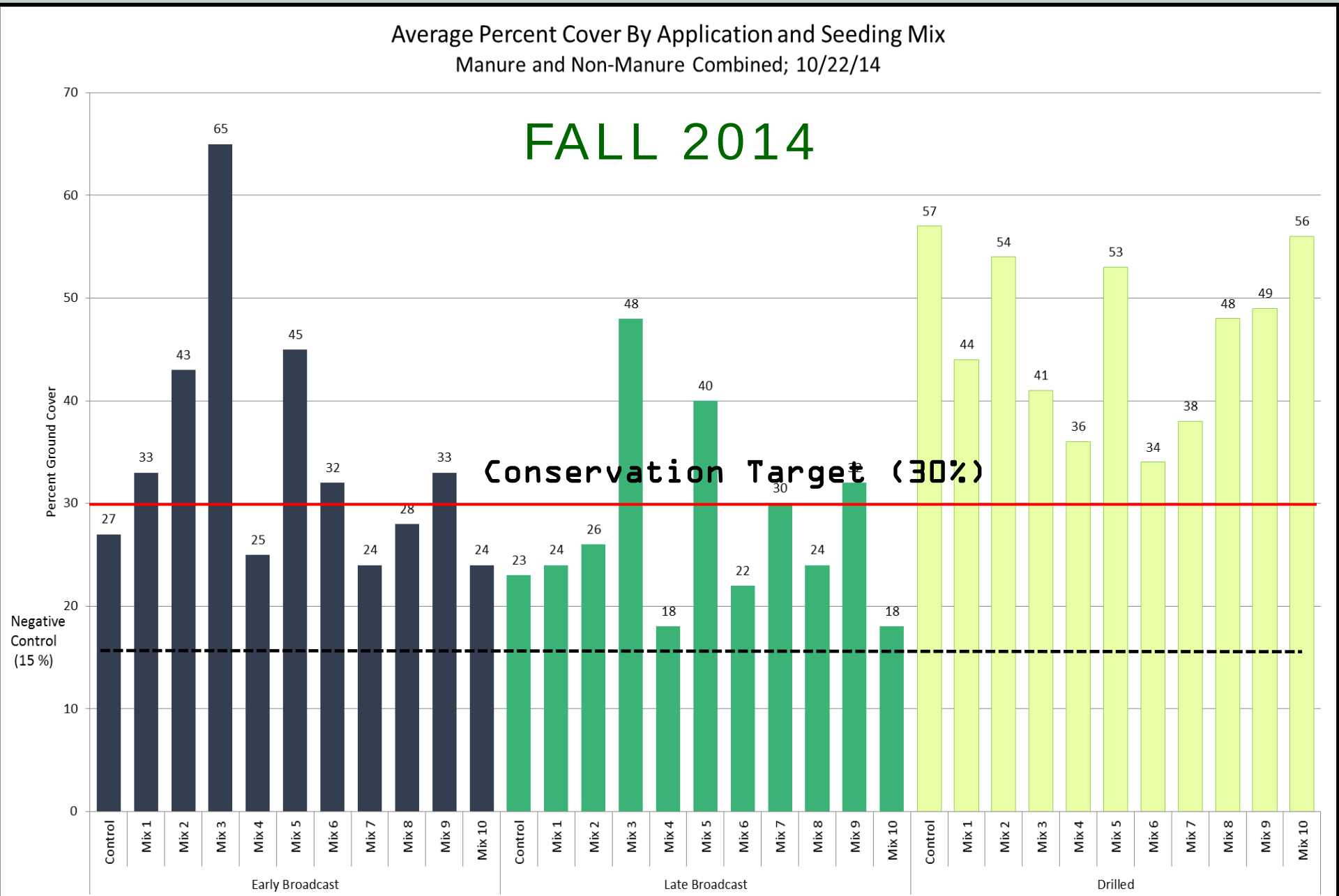
Mix	Grass	Legume	Brassica
CTRL	W. Rye		
1	Oat	Pea	Radish
2	Triticale	W. Pea	Rapeseed
3	ARG	W. Pea	Radish
4	W. Wheat	W. Pea	Radish
5	ARG	Berseem	Radish
6	Triticale	Crimson	Radish
7	Oats	Vetch	Mustard
8	Triticale	Vetch	Mustard

2015-2016 Mixes

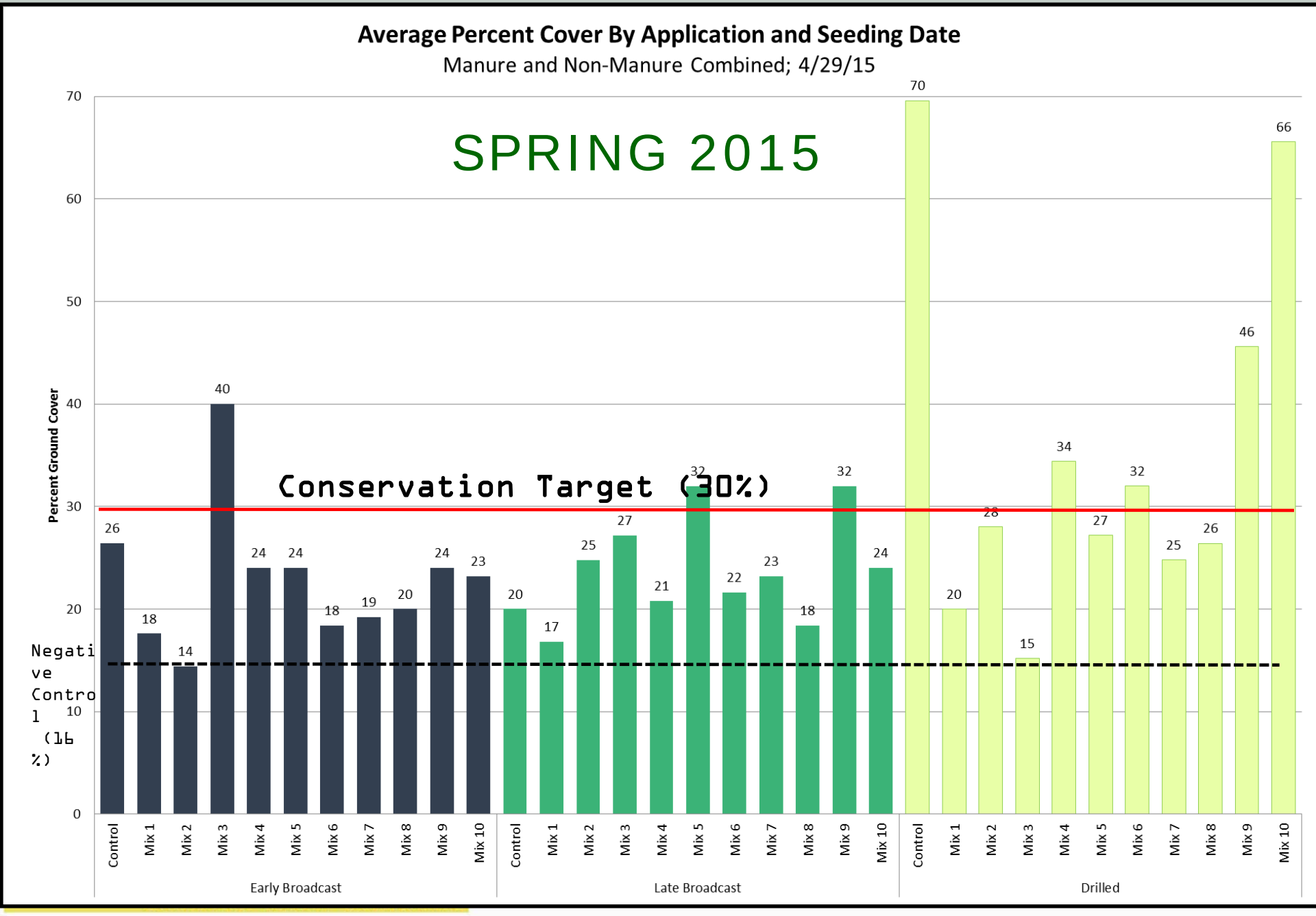
Mix	Grass	Legume	Brassica
CTRL	W. Rye		
1	Oat	Pea	Radish
2	Triticale	W. Pea	Rapeseed
3	ARG	W. Pea	Radish
4	W. Rye*	W. Pea	Radish
5	ARG	Berseem	Radish
6	W. Rye/Oat*		Radish
7	W. Rye/Oat*	Vetch	
8	Triticale	Vetch	Turnip*

Fall 2014: Mixes Better Drilled, Except Mix 3

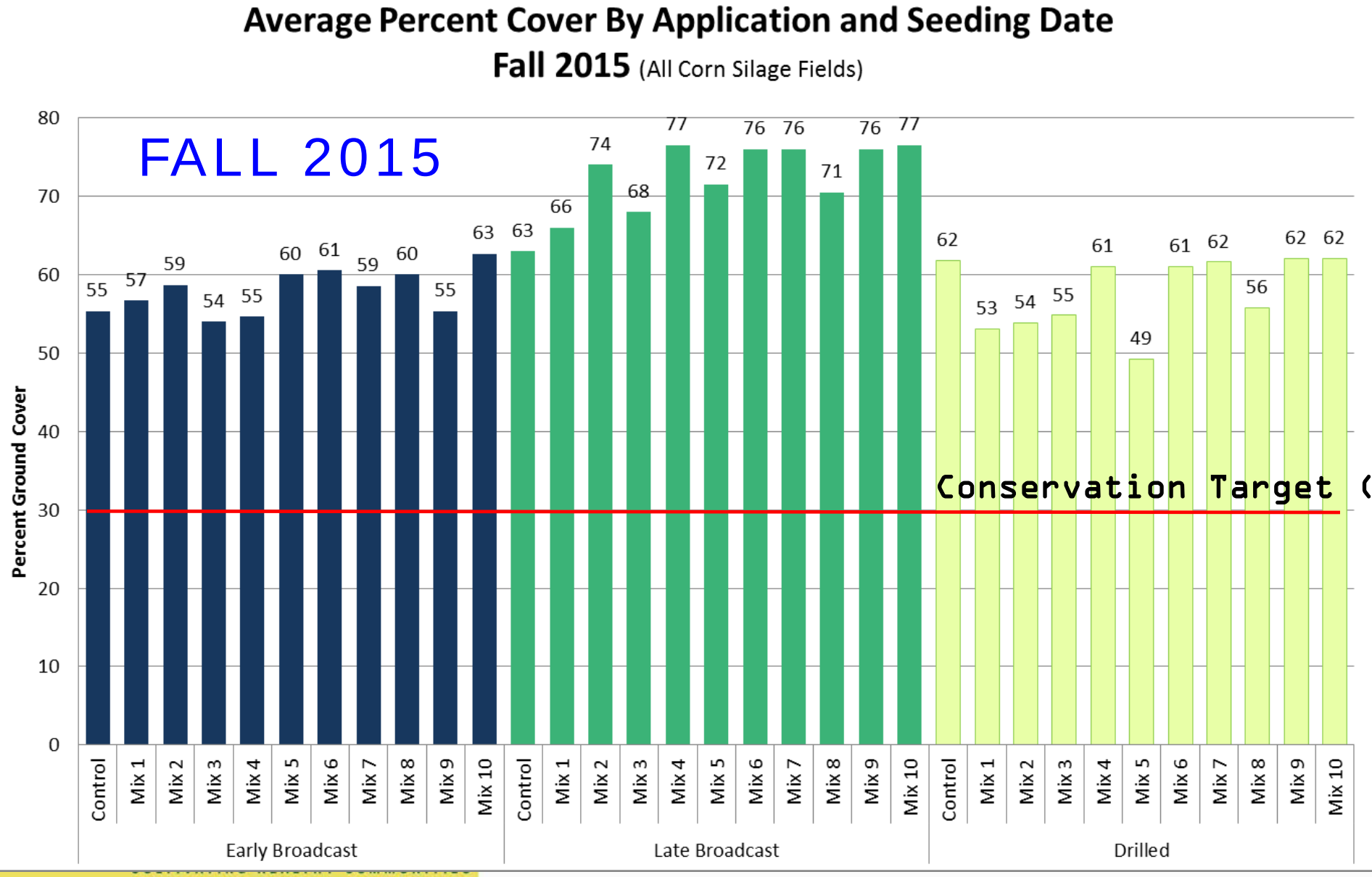
(Annual Rye, Winter Pea, Tillage Radish)



Spring 2015: Winter Rye, Mix 9 & 10 Drilled



Better Cover Crop Mixes for Vermont



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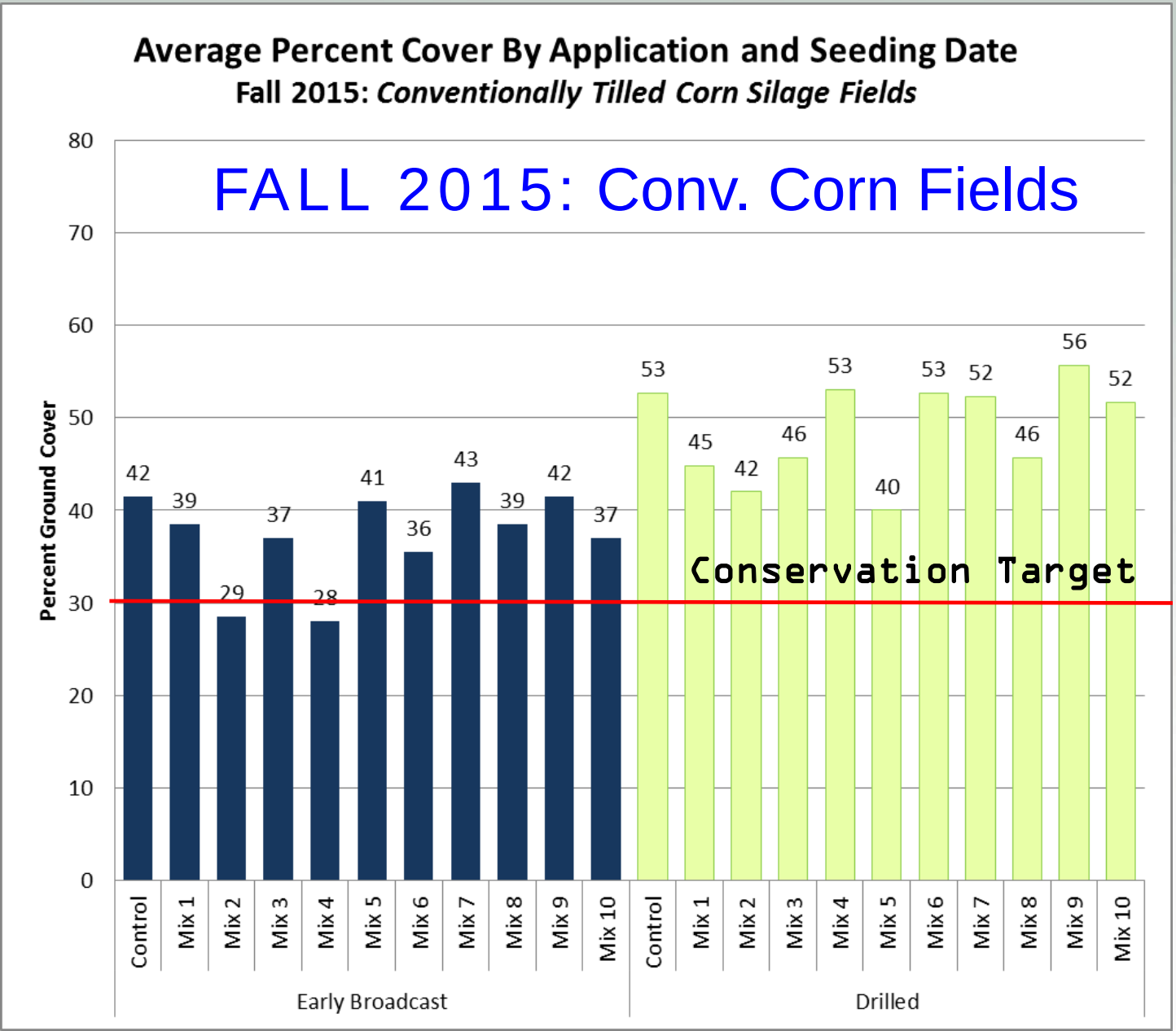
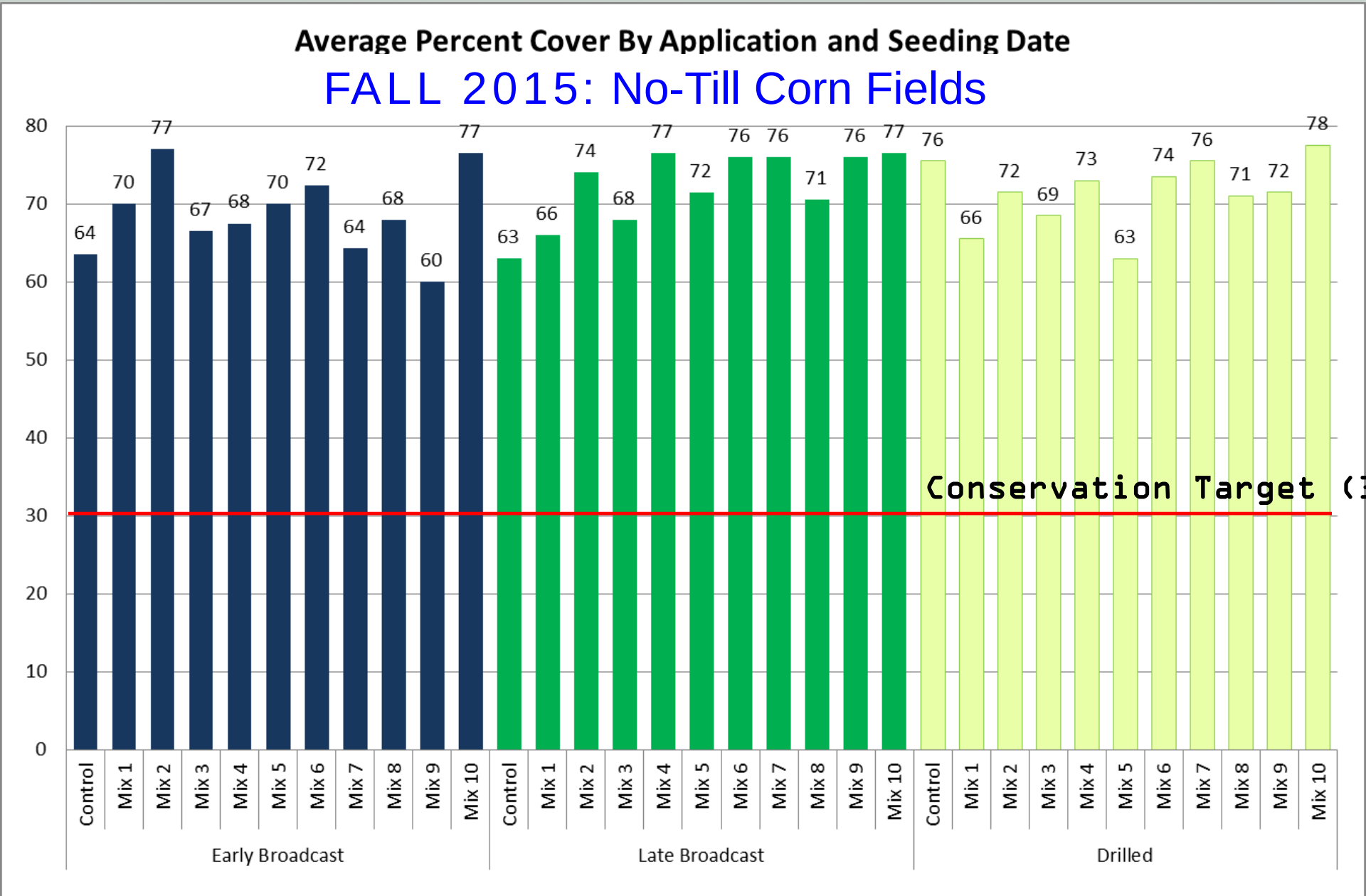
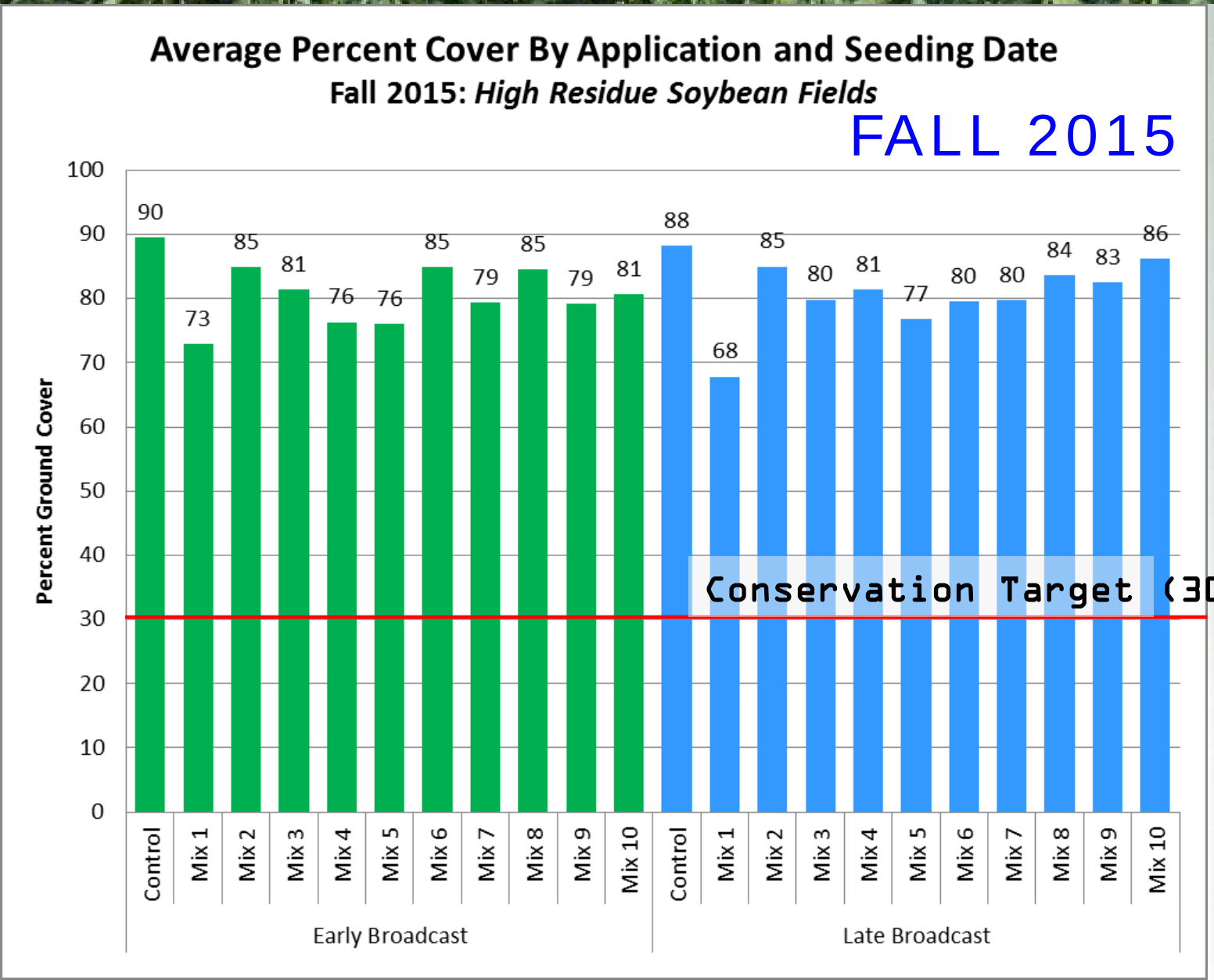


Better Cover Crop Mixes for Vermont



Cover Crop Mixes in Soybeans



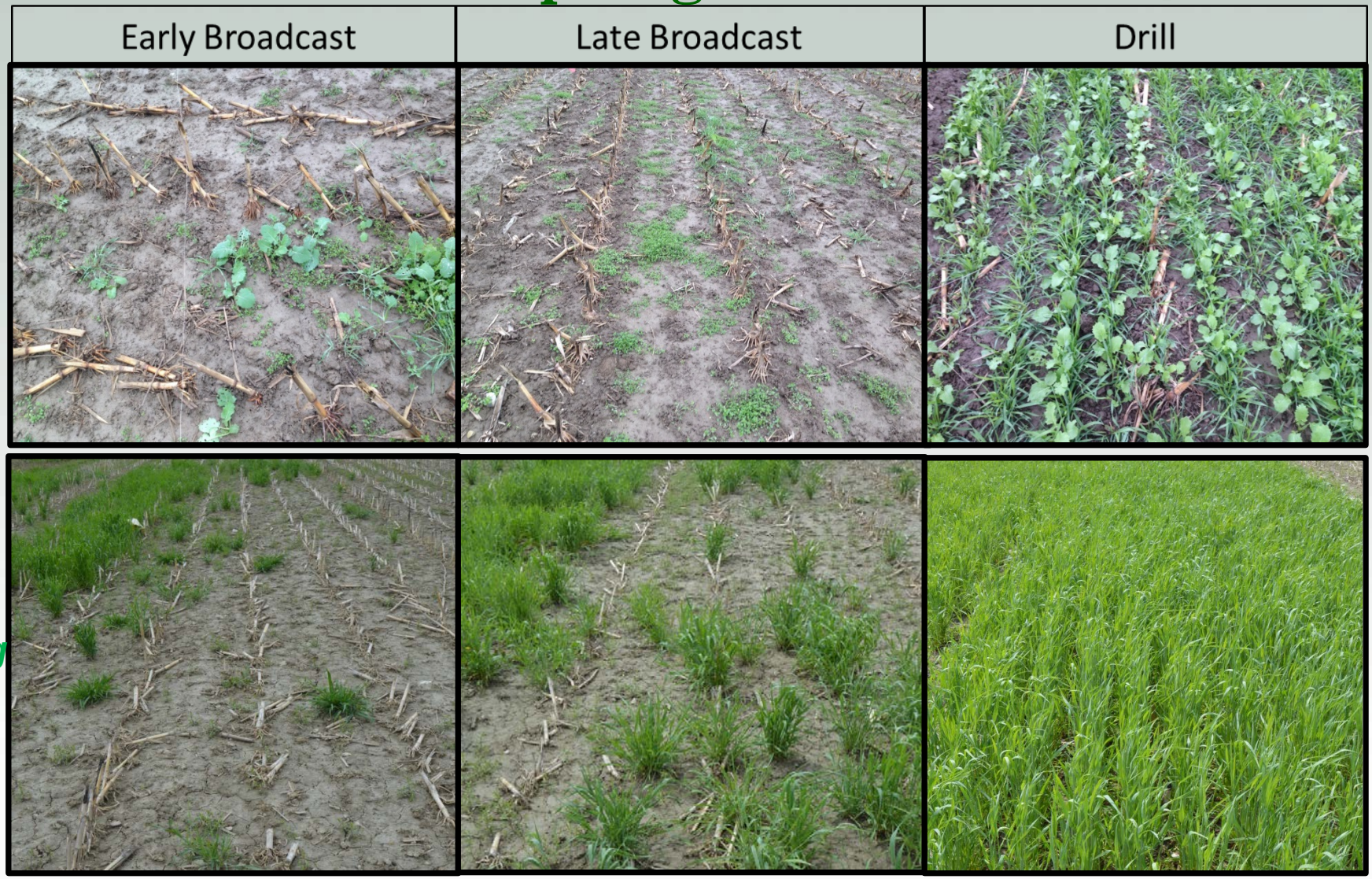
Control Fall & Spring: 100 lbs Winter Rye

	Early Broadcast	Late Broadcast	Drill
Fall			
Spring			

Mix 3 Fall & Spring: ARG+W. Pea+Radish

	Early Broadcast	Late Broadcast	Drill
Fall			
Spring			

Mix 10 Fall & Spring: Rye + Crimson Clover + Rapeseed



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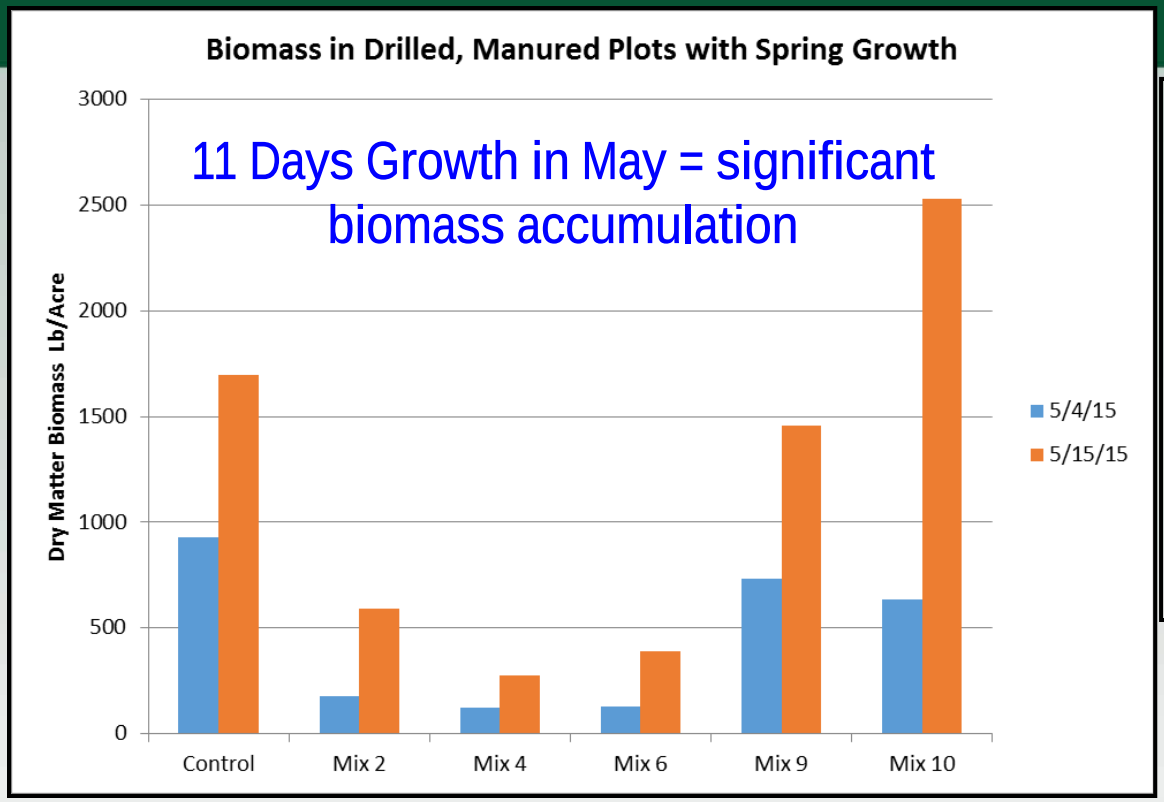

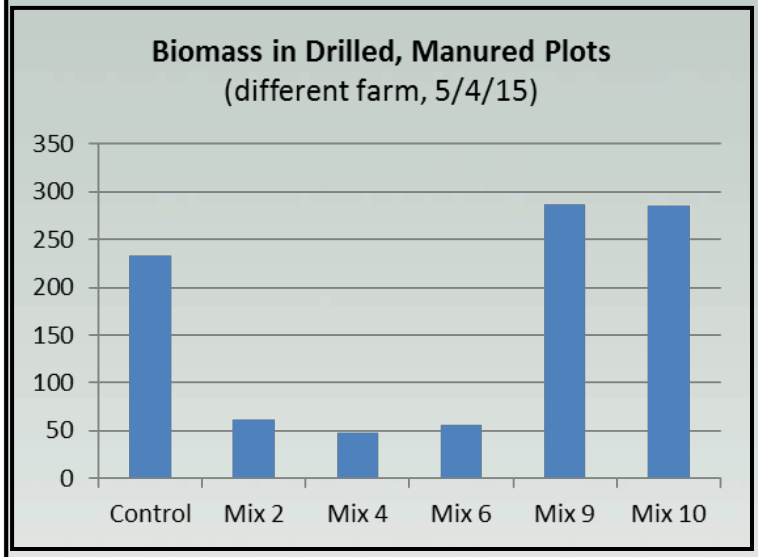

Mix 9 & 10 showed promise in the fall and spring . Season length and termination date will affect biomass perfor

Mix 9: Winter Rye, Austrian Winter Pea,
Mix 10: Winter Rye, Crimson Clover, Rape

CIG Mix #6 2015:
Rye + Oats + Radish

Broadcast 8/5/2015
Drilled 9/23/2015
Picture 10/14/2015

No manure

True in Fall 2015 also

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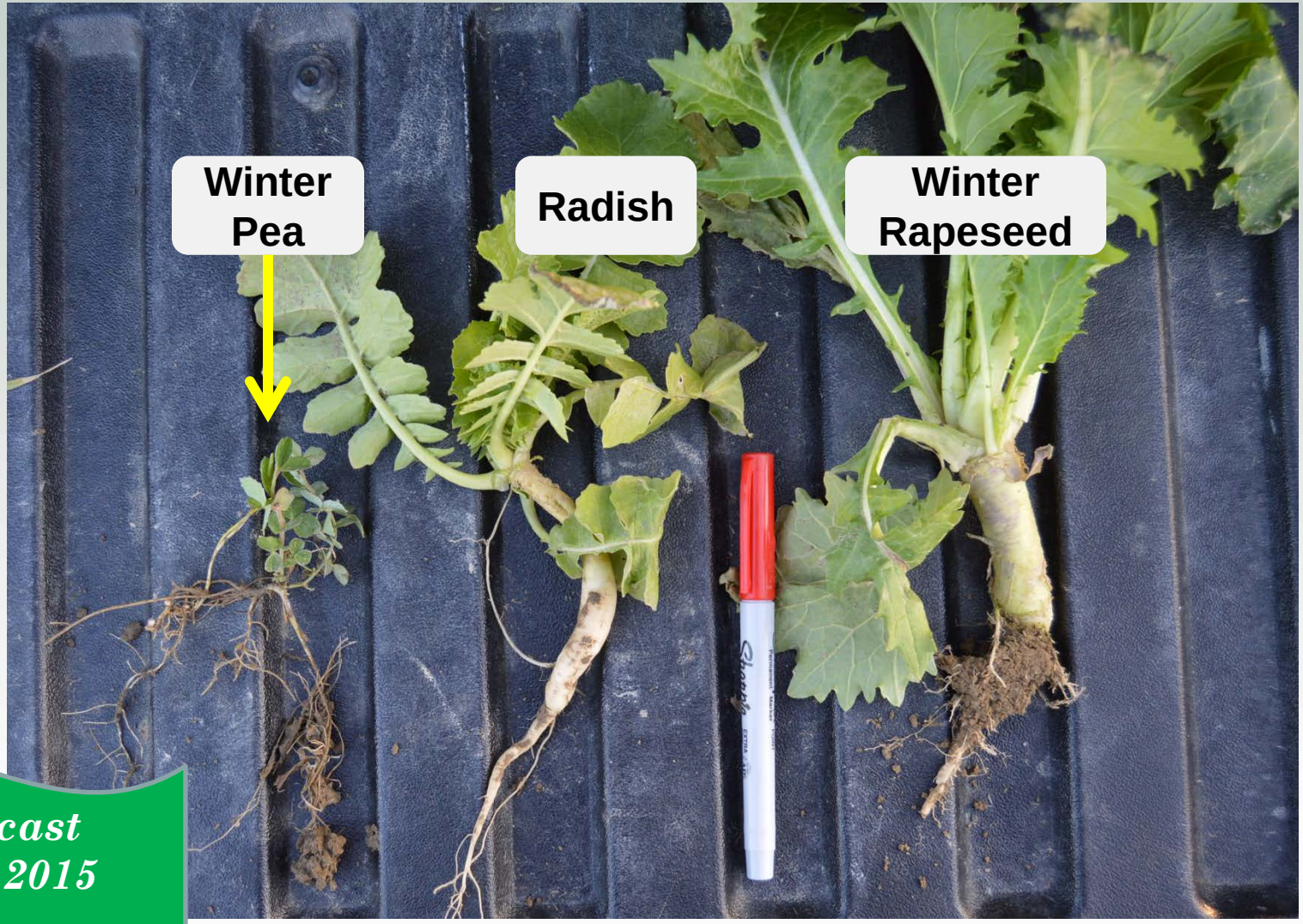
Better Cover Crop Mixes for Vermont



Broadcast
Aug. 5, 2015

Picture: Dec. 11, 2015

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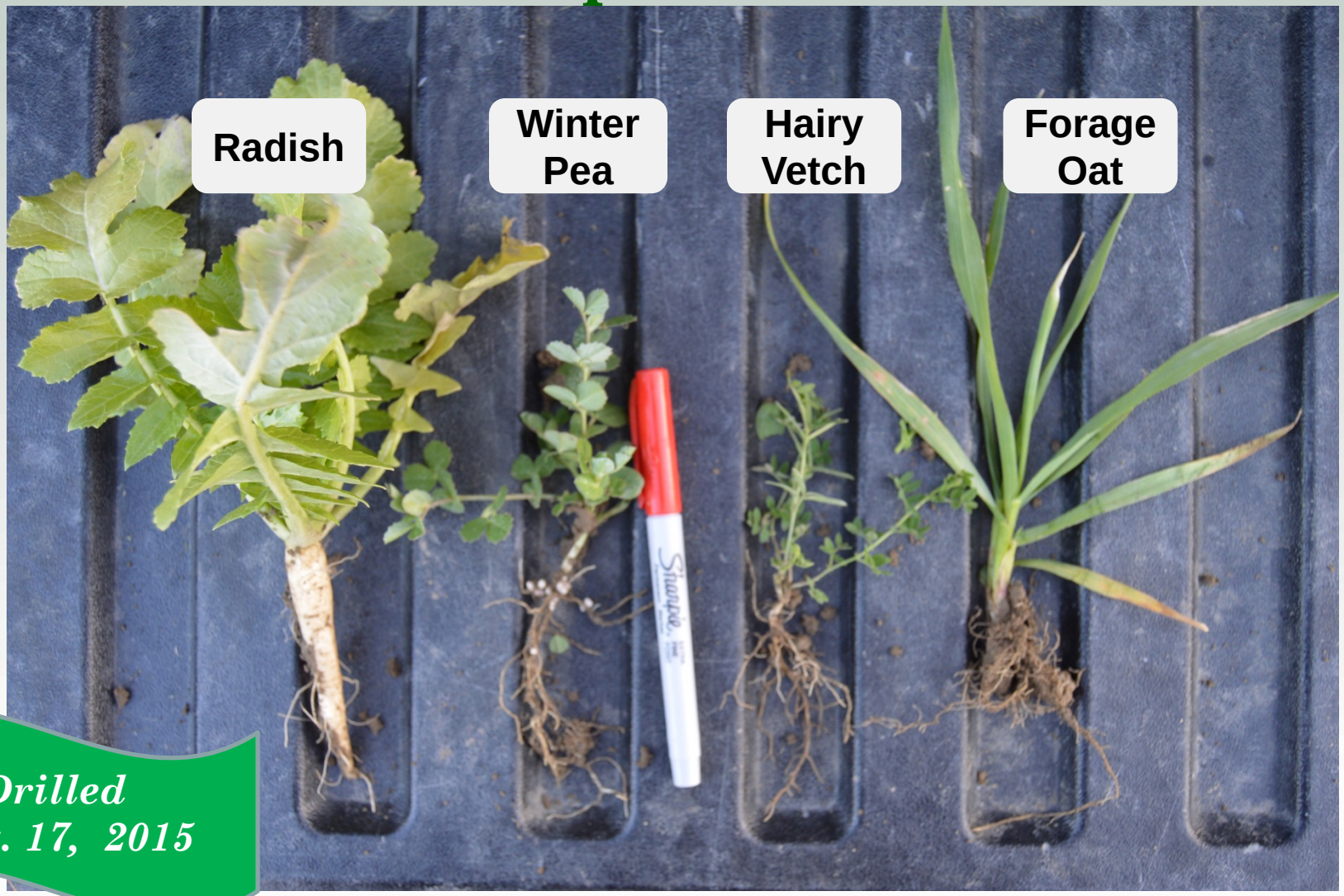

Drilled
Sept. 17, 2015

Picture: Dec. 11, 2015

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OPENING A NEW WINDOW OF OPPORTUNITY FOR COVER CROP MIXES

Cereal Grains in the Rotation & Prevented Plantings

Vorsteveld Farm, Panton

CROP ROTATIONS:

Add a cereal grain to your rotation…

open up a great cover cropping or rotation opportunity

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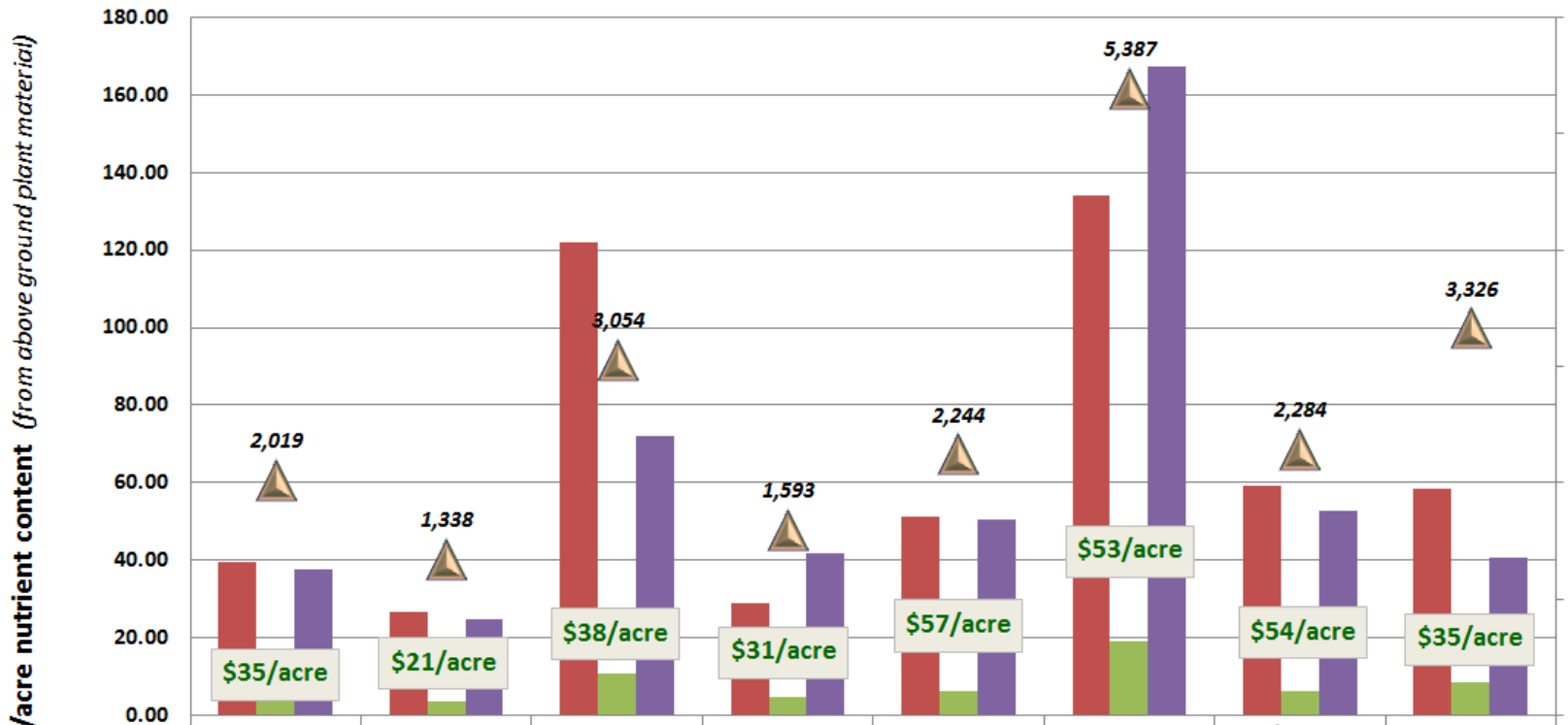
Cover Crop Mixes After Winter Rye Harvest



	Rye & Radish	Radish	Seedway SW-RA	Seedway SW-RAR	Seedway SW-RCT	Seedway SW-ROP	Crimson Clover & Radish	CCS Tillage Max 'Indy'
Nitrogen (N)	39.56	26.57	121.95	29.04	51.13	134.11	59.31	58.37
Phosphorus (P)	5.25	3.60	10.86	4.84	6.11	19.09	6.27	8.40
Potassium (K)	37.56	24.72	71.88	41.72	50.60	167.37	52.80	40.63
Dry Matter Biomass (lbs/ac)	2019	1338	3054	1593	2244	5387	2284	3326

Cover Crops in Prevented Plantings


Winter Rye


Forage Oats

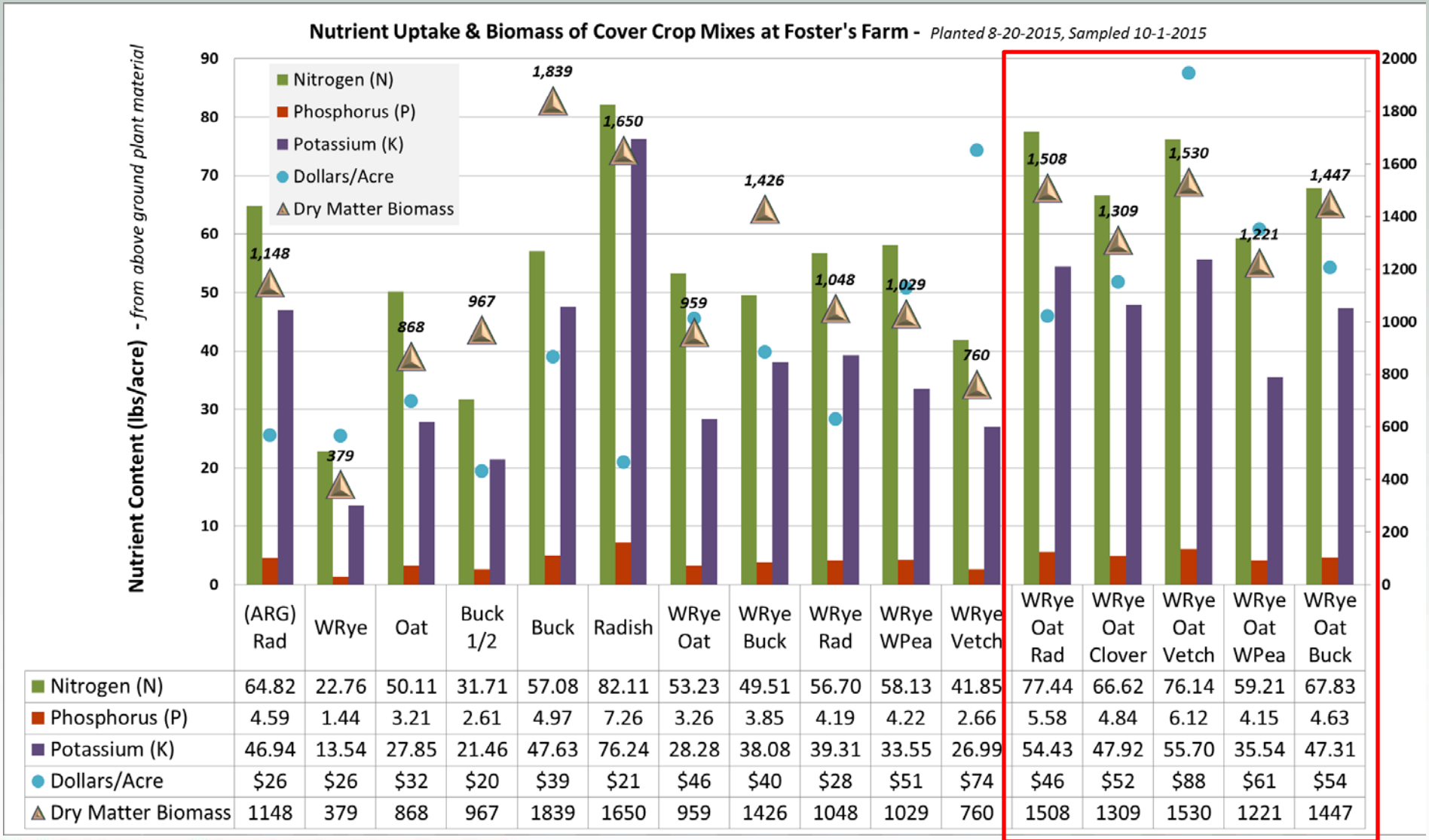

Buckwheat


Radish


Rye, Oat, Radish


Foster Bros. Farm, Middlebury

Cover Crop Mixes in Prevented Plantings



	(ARG) Rad	WRye	Oat	Buck 1/2	Buck	Radish	WRye Oat	WRye Buck	WRye Rad	WRye WPea	WRye Vetch	WRye Oat Rad	WRye Oat Clover	WRye Oat Vetch	WRye Oat WPea	WRye Oat Buck
Nitrogen (N)	64.82	22.76	50.11	31.71	57.08	82.11	53.23	49.51	56.70	58.13	41.85	77.44	66.62	76.14	59.21	67.83
Phosphorus (P)	4.59	1.44	3.21	2.61	4.97	7.26	3.26	3.85	4.19	4.22	2.66	5.58	4.84	6.12	4.15	4.63
Potassium (K)	46.94	13.54	27.85	21.46	47.63	76.24	28.28	38.08	39.31	33.55	26.99	54.43	47.92	55.70	35.54	47.31
Dollars/Acre	$26	$26	$32	$20	$39	$21	$46	$40	$28	$51	$74	$46	$52	$88	$61	$54
Dry Matter Biomass	1148	379	868	967	1839	1650	959	1426	1048	1029	760	1508	1309	1530	1221	1447

Elmwood Fine Sandy Loam

Vorsteveld Farm, Panton

50 lbs Winter Rye
50 lbs Forage Oat
4 lbs Radish

Drilled September 10
Picture October 29

Will get spring manure

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50 lbs Winter Rye
50 lbs Forage Oat
4 lbs Radish

Broadcast seed Sept 10
Incorporated with manure injection (low dist)
Picture October 29

Vergennes B Clay-undrained

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Vorsteveld Farm, Panton

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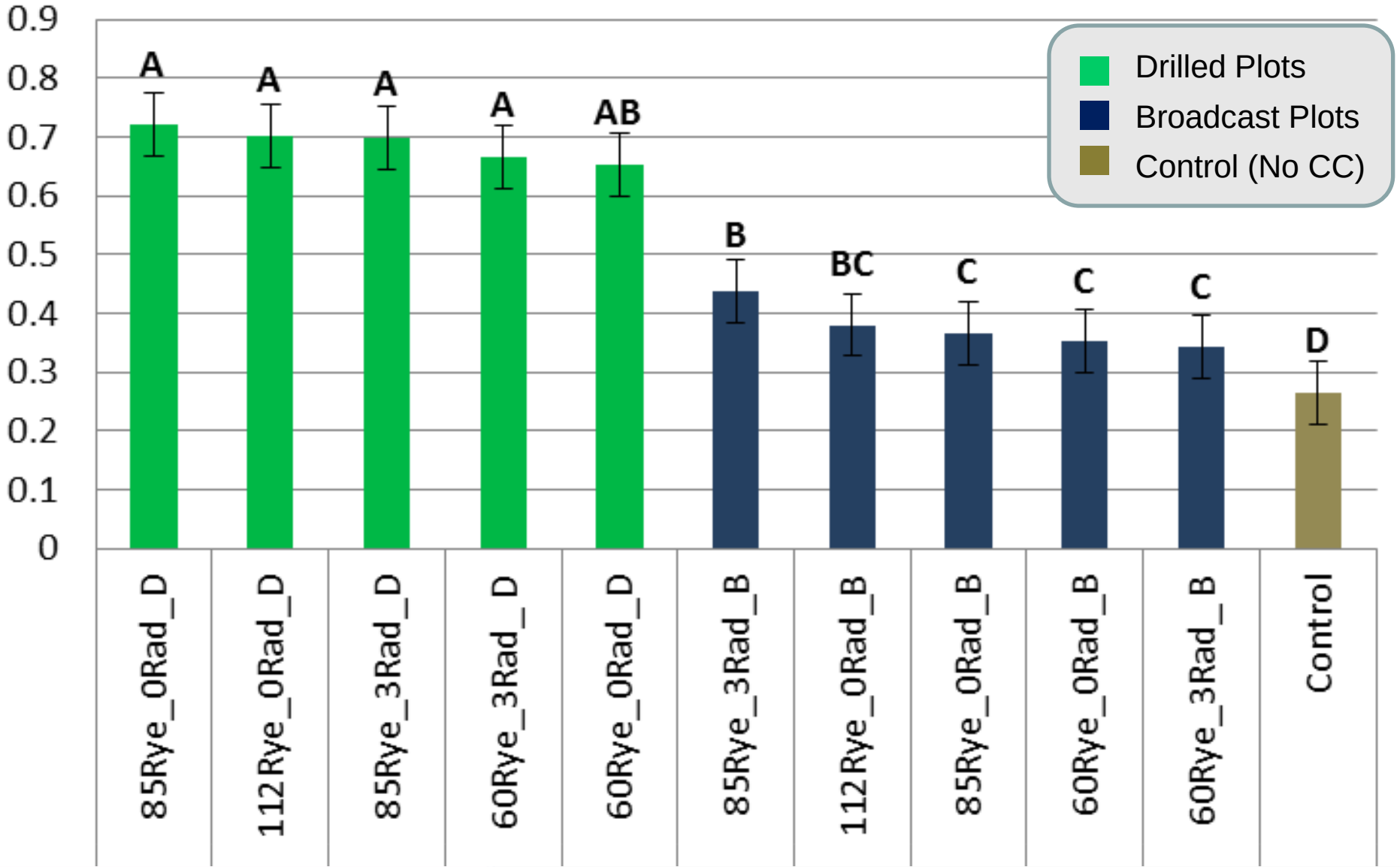
Vorsteveld Farm, Panton

Pictures
Jan. 25, 2016

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.

Rye-Radish: Percent Cover
Fall 2014

NORTHEAST SARE Sustainable Agriculture Research & Education



85 lbs Winter Rye +
3 lbs Radish

Planted 9/9/2015

Picture 10/2/2015

4000 gallons/acre dairy manure

Vergennes B Clay

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

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85 lbs Winter Rye +
3 lbs Radish

Planted 9/9/2015

Picture 11/6/2015

4000 gallons/acre dairy manure

Vergennes B Clay

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

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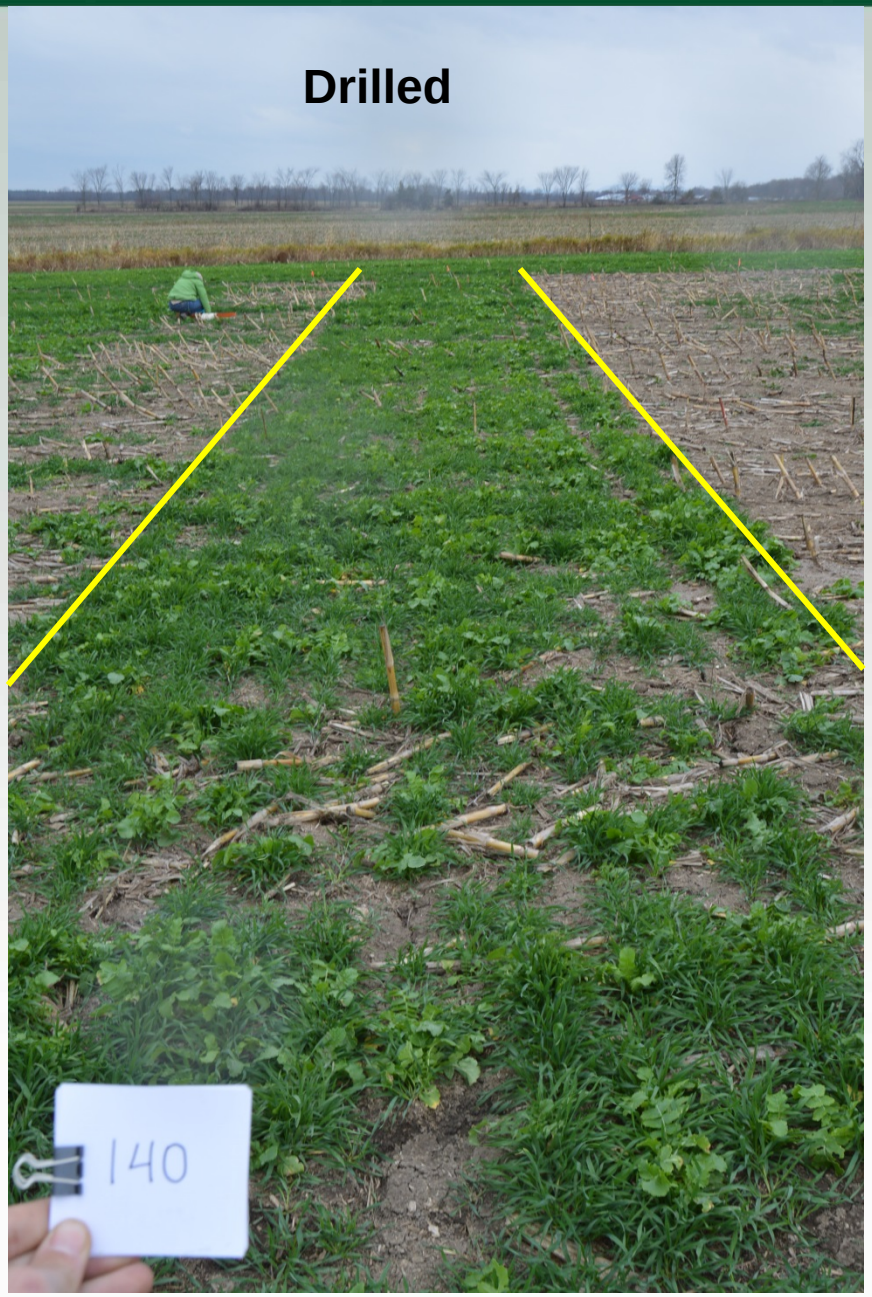
Broadcast

Drilled



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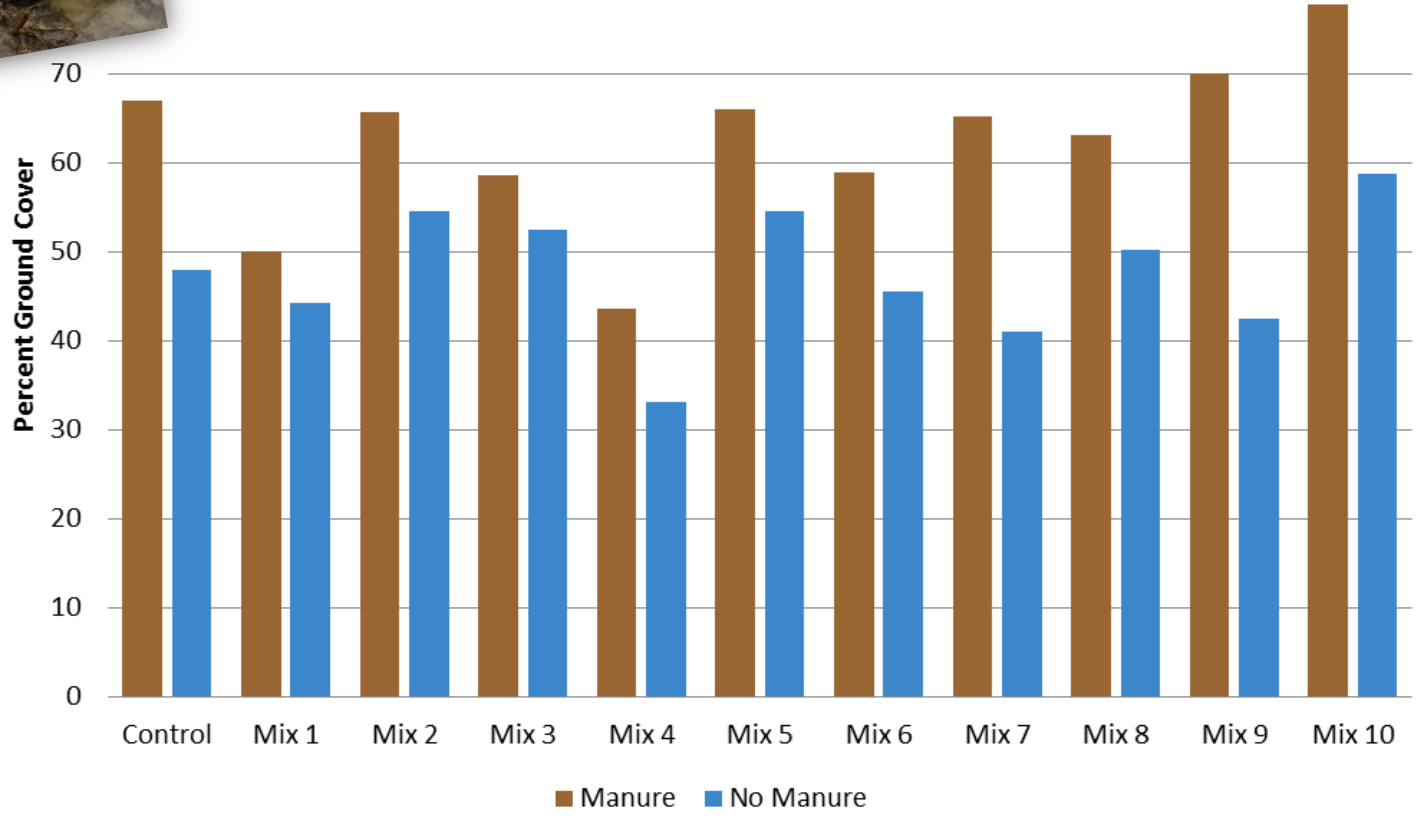
Manure... makes plants grow more, particularly when plants were drilled

Average Percent Cover of Cover Crops on Two Field Plots with Manure and Two Field Plots without Manure
Drilled Plots Only (11/12/14)



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COVER CROPS & MANURE:
PERFECT PARTNERS

Triticale/Hairy Vetch Cover Crop Plots with/without manure @ VYCC

Hairy Vetch Treatment (lbs./ac.)	Manure	AVG DM Yield lbs/Ac	AVG lbs N/acre	AVG lbs P/acre	AVG lbs K/acre	FALL 2013 AVG % Cover	SPRING 2014 AVG % Cover
10	Yes	939.0	28.4	6.2	43.7	32%	62%
20	Yes	**1115.1**	**34.0**	**7.4**	**52.6**	**35%**	60%
30	Yes	1035.0	31.7	6.9	48.4	34%	**64%**
10	No	250.8	12.3	2.4	16.8	17%	42%
20	No	**522.8**	**17.1**	**3.5**	**24.2**	**21%**	37%
30	No	501.5	16.5	3.4	23.1	16%	**43%**

Manure

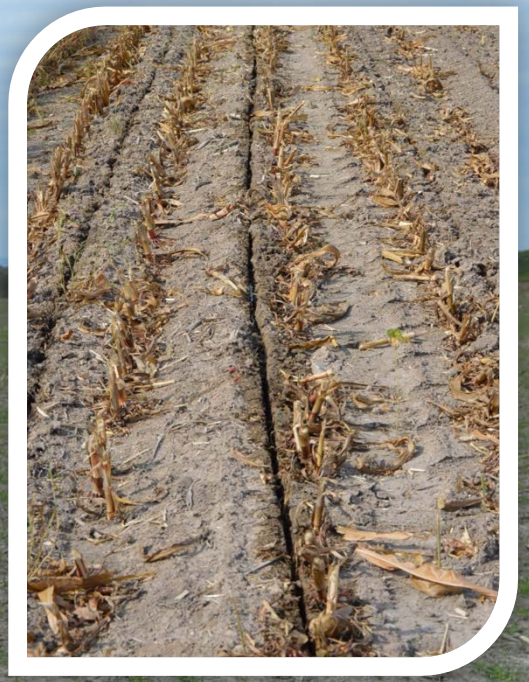
No Manure


Manure Injection & Cover Crops
Cover Crop Broadcast
Manure Injected right after….helps incorporate seed.

Blue Spruce Farm

Winter Rye No-Till Drilled into Injected Field

October 6, 2015 (1 mo. After planting)



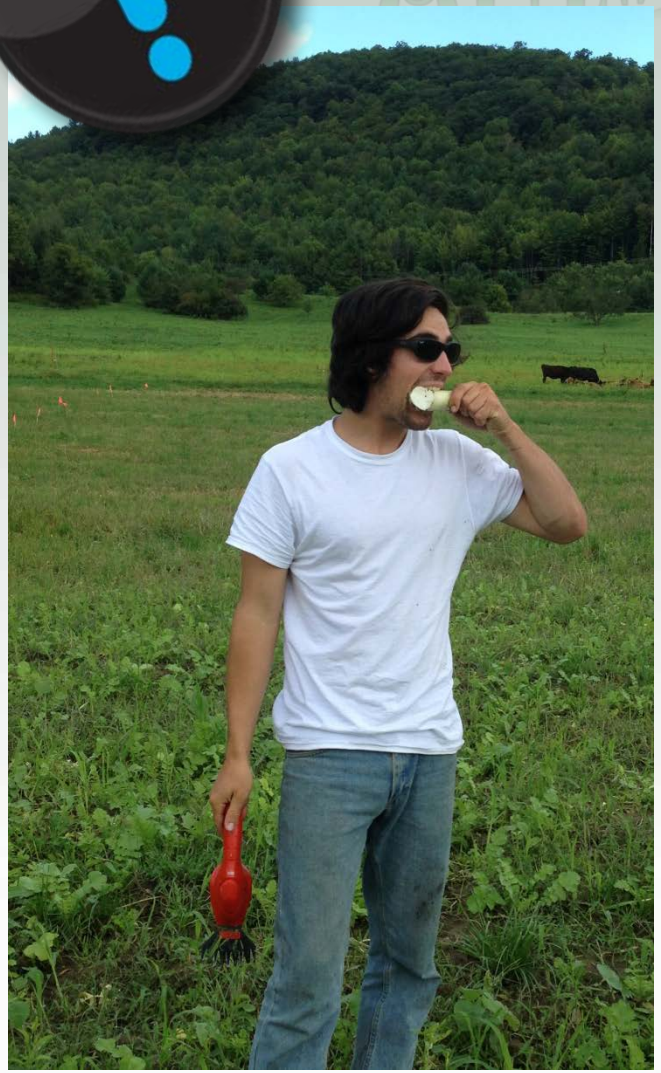
Blue Spruce Farm

Winter Rye No-Till Drilled into Injected Field

November 18, 2015 (2+ mo. After planting)


Nea-Tocht Farm
Fall Manure Injection into 4"
Winter Rye Cover Crop

QUESTIONS??



DIVERSITY TASTES GOOD!!

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MULTI-SPECIES COVER CROP MIXES

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