Innovations in Cover Cropping

Modifying the Corn Cropping System to Enhance Cover Crops

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February 26, 2020

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Interseeding Cover Crops

Variability in Establishment

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Interseeding Cover Crops

Opportunities

Ability to incorporate mixtures of diverse species of cover crops

Earlier planting so better establishment in fall

Time & flexibility

Challenges

Establishing cover crop in dense corn populations prior to canopy closure

Establishing cover crop in narrow rows (30” or less)

Establishing cover crops shortly after herbicide applications

Seed depth and moisture

Cover Crop Diversity – Maximizing Function

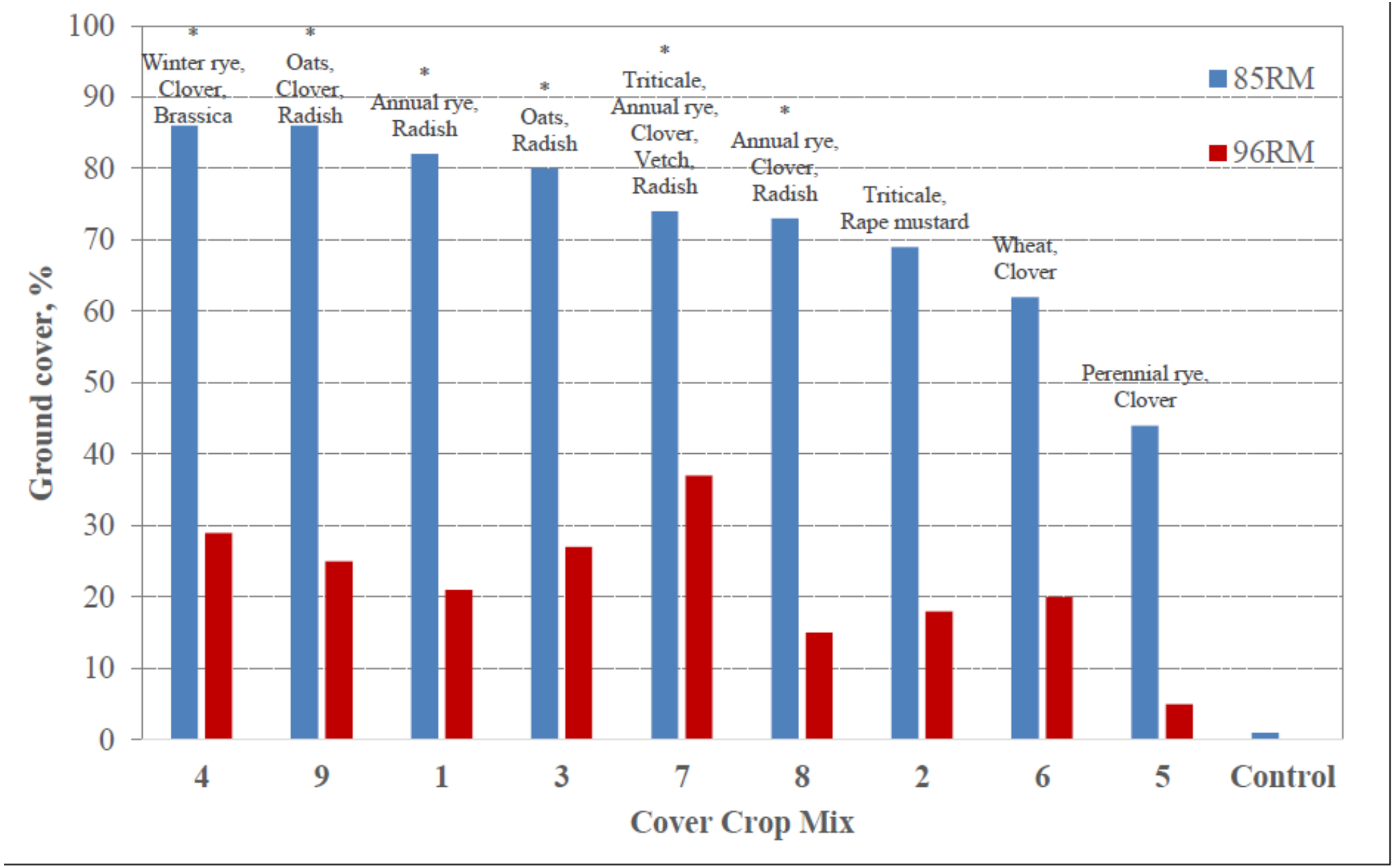
Everleaf Oats and Groundhog Radish

Winter Rye, Milvus Clover, T-Raptor Brassica

Soil Builder:
TriCal Triticale, MOI and KB Supreme Ryegrass, Crimson Clover, Hairy Vetch, Daikon Radish

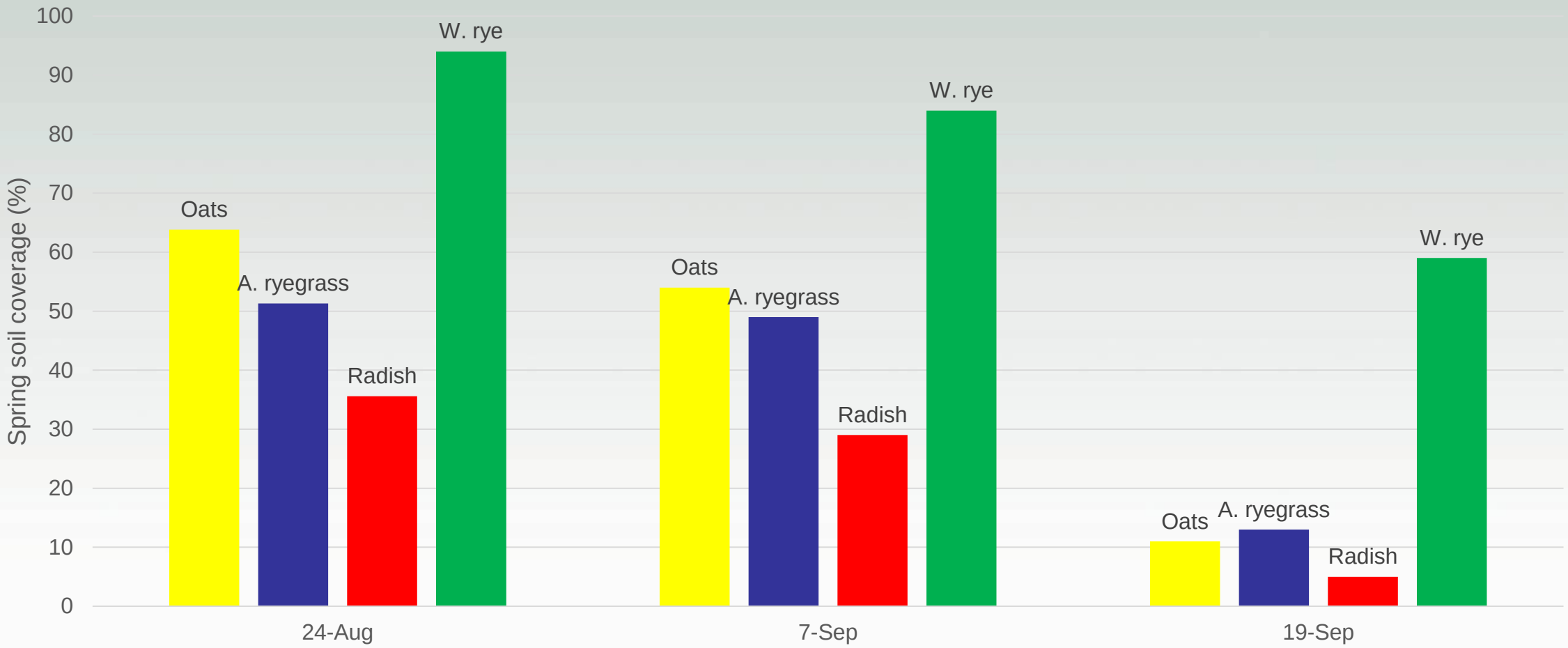
Prince Brand Rye Grass and Milvus Clover

Indy Mix:
Tillage Root Max Ryegrass, Crimson Clover, Tillage Radish



http://www.uvm.edu/extension/cropsoil/wp-content/uploads/20152016-CC-Mix-in-Corn-Silage-Report.pdf

Planting Date, Cover Crop & Spring Cover



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Cover Crop Interseeding

Late Season Interseeding

- https://youtu.be/S2GTPdoGJ4I

Penn State Interseeder

FLEXIBILITY - Spring Management of Cover Crops

Interseeding Cover Crops

- **<u>Challenges</u>**
- Establishing cover crop in dense corn populations prior to canopy closure
- Establishing cover crop in narrow rows (30” or less)
- Establishing cover crops shortly after herbicide applications
- Seed depth and moisture
- Still need time to grow once corn chopped

RESIDUAL HERBICIDES

- Used in many of our major crops
- Usually soil applied – but not always
- Generally provide 8 to 12 weeks of weed control
- If Half-life too short - lack of residual weed control (performance reduced)
- If Half life too long - carryover to following crop
- Interseeded cover crops are particularly vulnerable

HERBICIDE PERSISTENCE

- **Half-life**: the amount of time needed to degrade half of the herbicide present.

	50%	25%	12.5%	6%
2,4-D	1 day	14 days	28 days	35 days
Atrazine	60 days	120 days	180 days	240 days

GRASS HERBICIDES: RISK OF INTERSEEDED COVER CROP INJURY

	A. ryegrass	R Clover	Annual Ryegrass RedClover
• Dual II Mag 7.64 EC 1.67 pt IX	NO	Maybe	NO
• Zidua 85 WG 2.5 oz 1X	NO	Maybe	NO
• Outlook 6 EC ½ pt ½	OK	OK	OK
• Outlook 6 EC 1 pt	Maybe	OK	Maybe
• Harness 7 EC 1 pt ½X PRE	OK	OK	OK
• Harness 7 EC 2 pt 1X PRE	Maybe	OK	Maybe
• Prowl H2O 3.8 CS 1.5 ½X PRE	OK	OK	OK
• Prowl H2O 3.8 CS 3 pt 1X PRE	NO	Maybe	NO

Potential High Risk Products

- ~ containing Dual: Acuron, Bicep/Cinch, Camix, Expert, Halex GT, Lumax/Lexar, Zemax
- containing Zidua: AnthOM

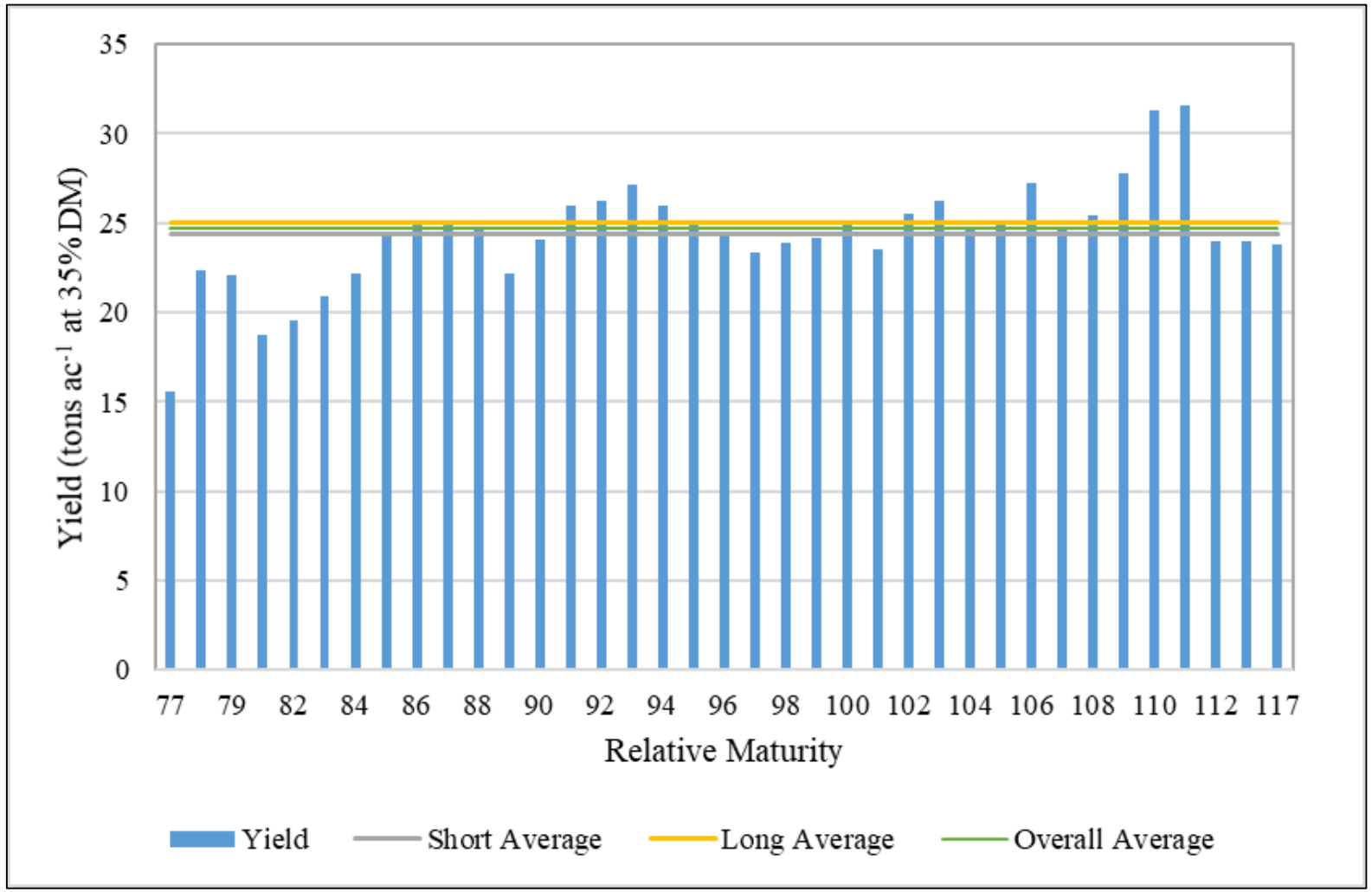
Penn State **Extension**

BROADLEAF HERBICIDES: RISK OF INTERSEEDED COVER CROP INJURY

	A. ryegrass	R Clover	A Ryegrass & C Clover
• Resolve 25 DF 0.5 oz ½X	OK	OK	OK
• Resolve 25 DF 1 oz 1X	OK	OK	OK
• Atrazine 1 pt ½X	OK	Maybe	Maybe
• Atrazine 2 pt 1X	Maybe	Maybe	Maybe
• Atrazine 3 pt 1½X	NO	NO	NO
• Metribuzin 4 oz 1X	NO	OK	Maybe
• Sharpen 1.5 fl oz ½X PRE	OK	OK	OK
• Sharpen 3 fl oz 1X PRE	Maybe	Maybe	Maybe
• Balance Flex 2 SC 5.3 fl oz 1X PRE	Maybe	Maybe	Maybe

HIGH RISK: Callisto 4 SC 5.4 fl oz 1X PRE~ containing Callisto: Acuron, Camix, Halex GT, Instigate, Lumax/Lexar, Realm Q, Revulin, Resicore, Zemax containing >1.5 lb atrazine: Expert, Bicep/Cinch Magnu

Long and short season corn yields at Borderview Research Farm, 2011-2019



Corn yield data from long and short season trials 2011-2019.

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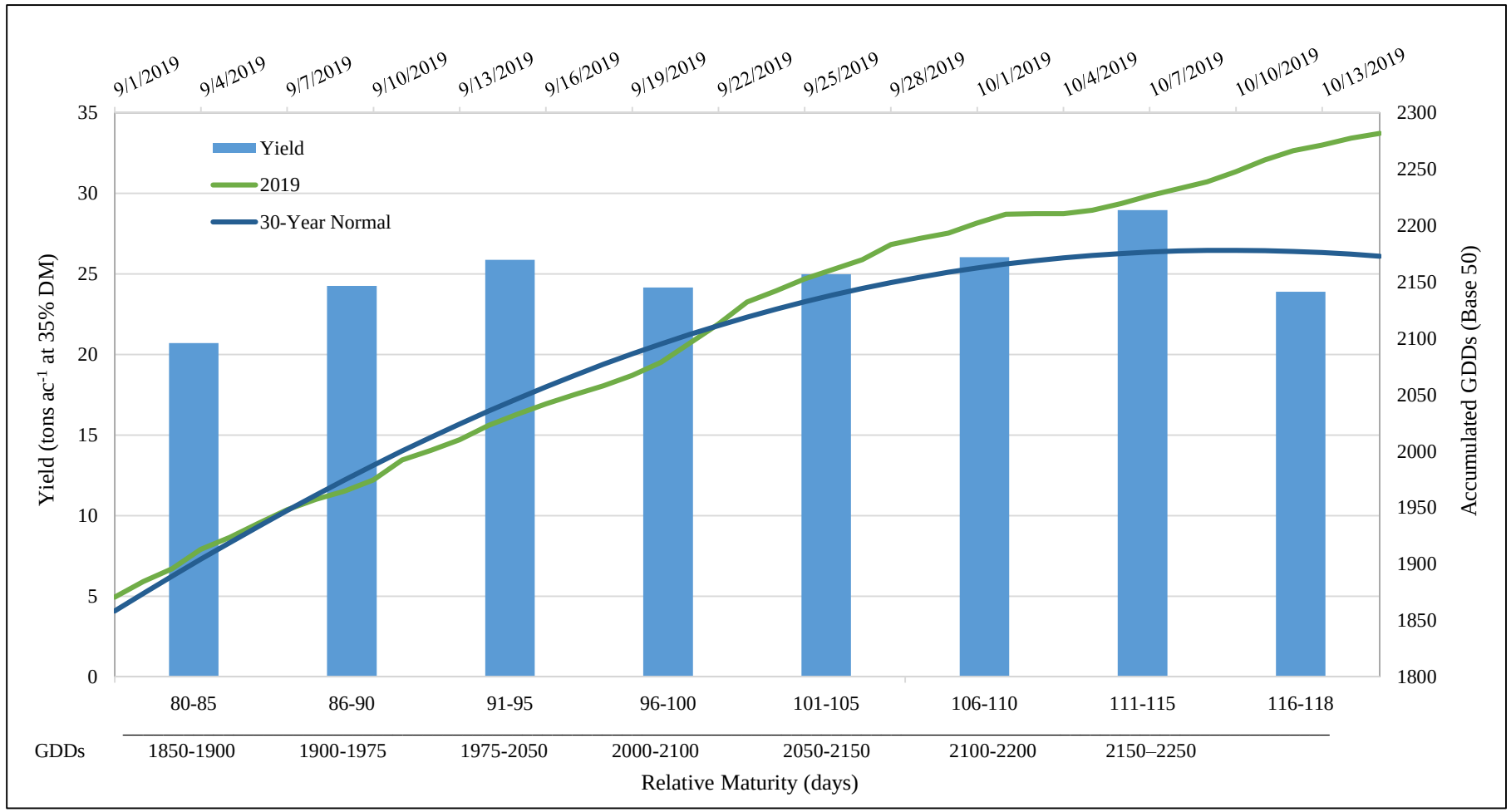
Yields and GDDs for long and short season corn 2011-2019



Corn yield data from long and short season trials 2011-2019. 2019 weather data from Borderview Research Farm, Alburgh, VT. Approximate GDDs needed for each RM from University of Minnesota Extension: https://extension.umn.edu/corn-hybrid-selection/selecting-corn-hybrids-grain-production

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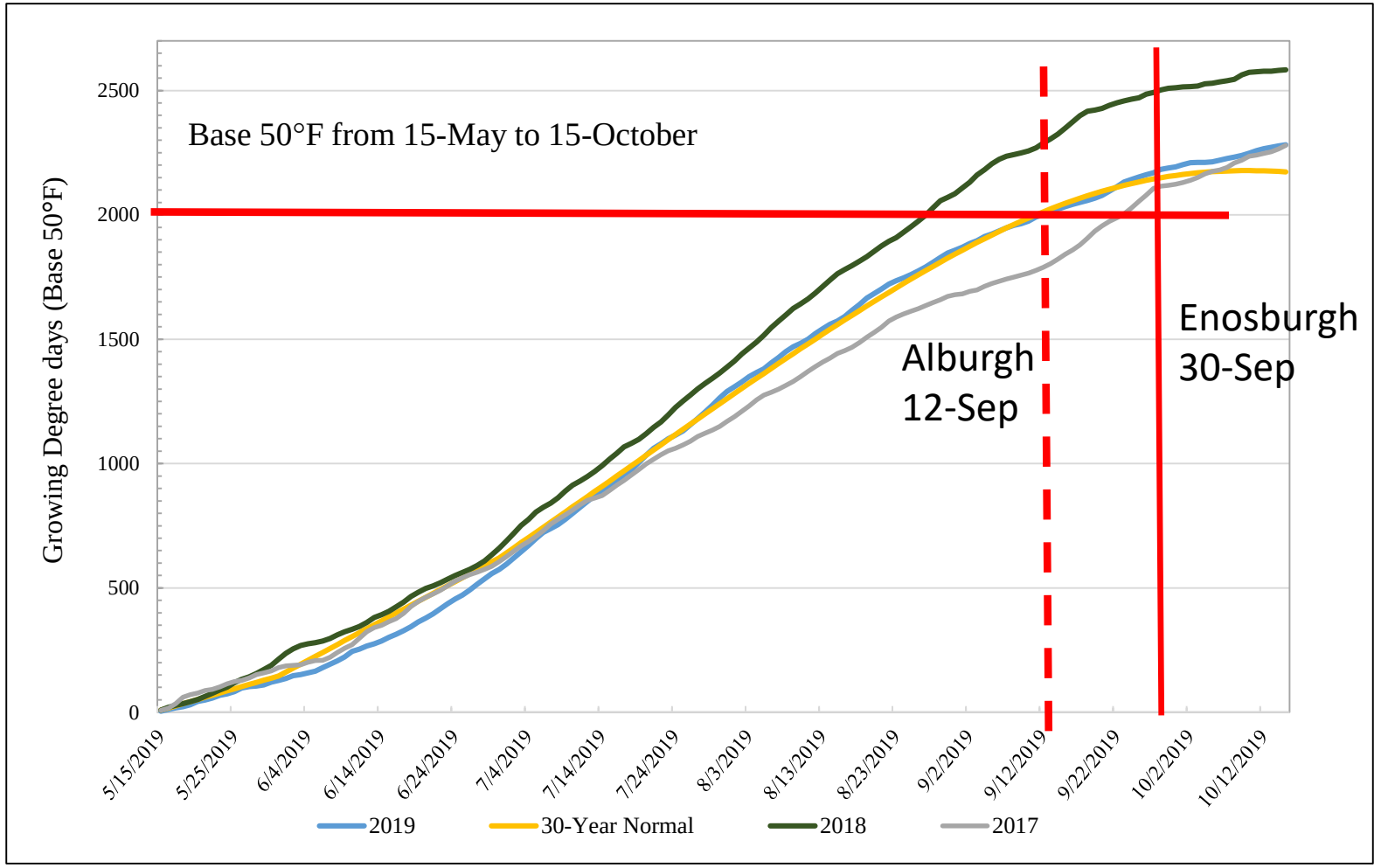
RM	GDDs
~80	1850-1900
~85	1900-1975
~90	1975-2050
95-100	2000-2100
101-105	2050-2150
106-110	2100-2200
111-115	2150-2250

		Accumulated GDDs (Base 50) from 15 May			
Year	Date	Vergennes	Newport	Enosburgh	Alburgh
2017	31-Aug	1735	1398	1585	1670
2017	30-Sep	2183	1737	1989	2123
2017	15-Oct	2317	1846	2206	2280
2018	31-Aug	2049	1732	1849	2085
2018	30-Sep	2473	2058	2233	2512
2018	15-Oct	2511	2058	2266	2584
2019	31-Aug	1744	1512	1625	1858
2019	30-Sep	2080	1776	1940	2194
2019	15-Oct	2155	1826	2296	2282

Harvest Date 90 to 95 RM Corn



Weather data from Borderview Research Farm, Alburgh, VT.

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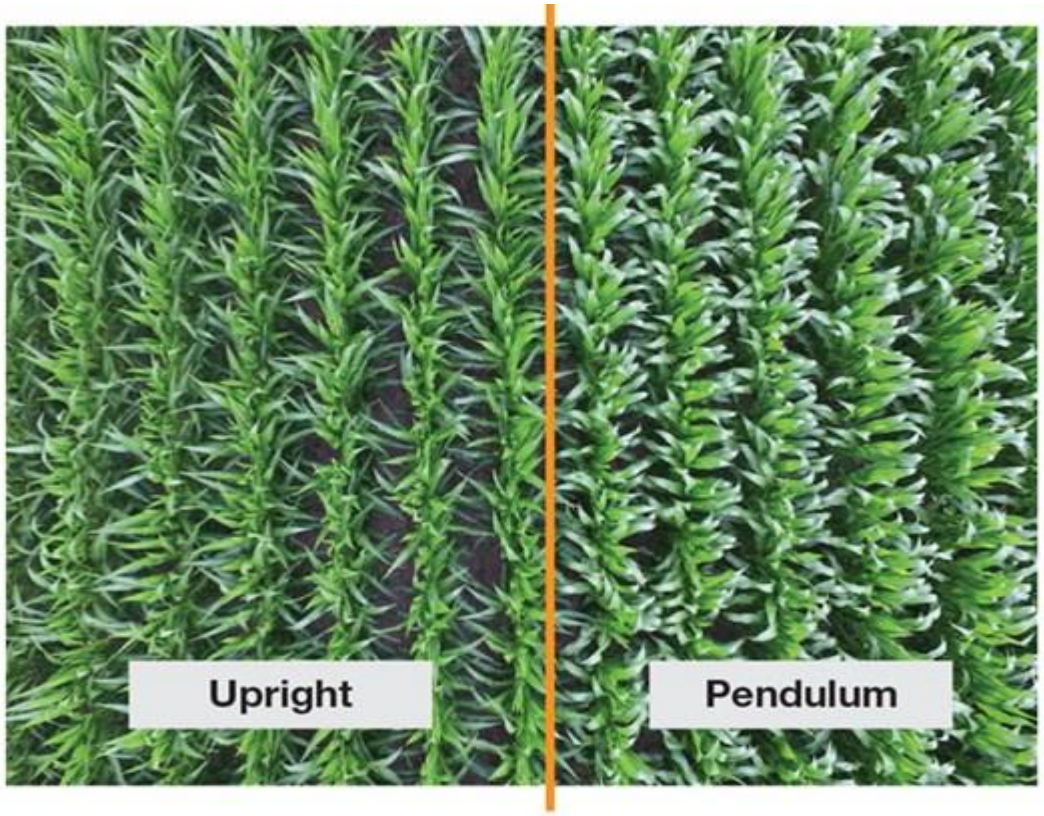
Variety Selection – New Focus

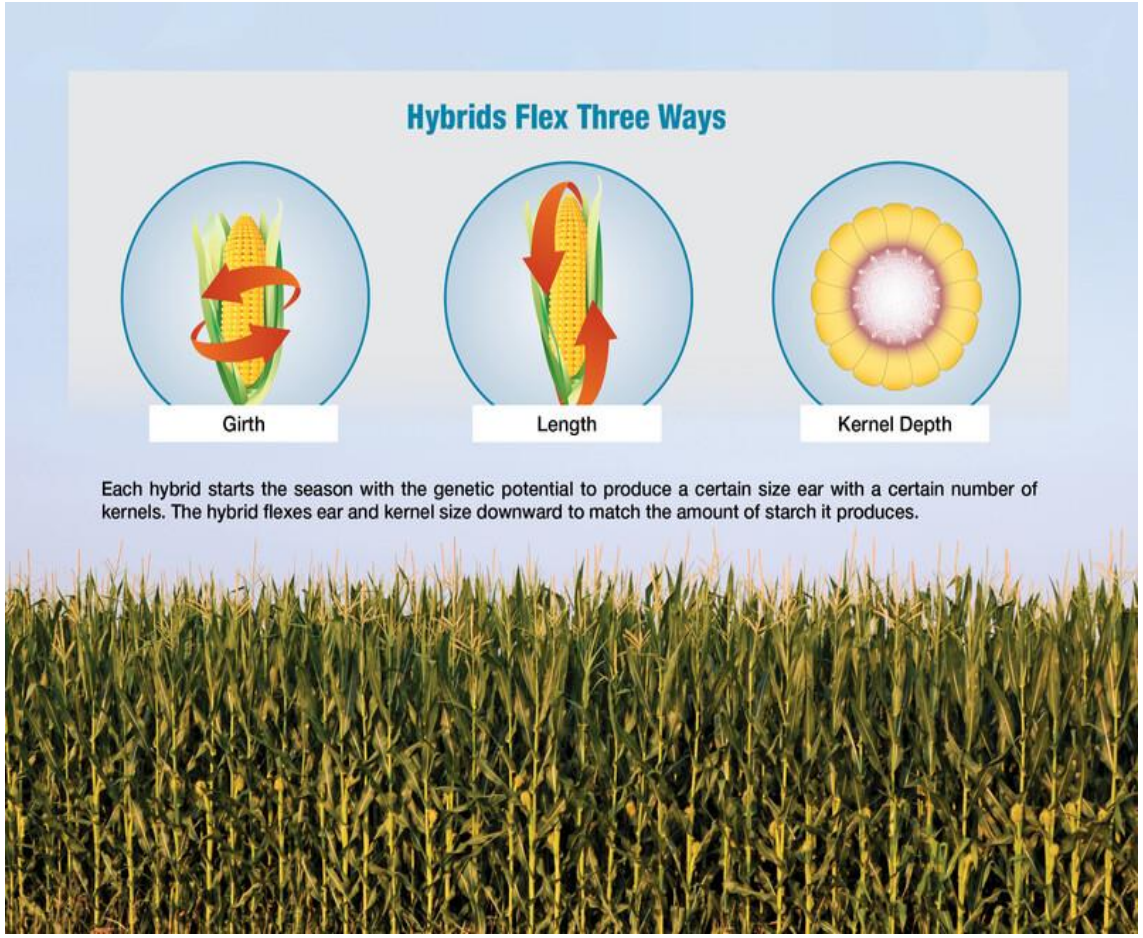
- Hybrid ear type
  - flex, semi-flex, semi-determinate or determinate
- Plant structure
  - upright, semi-upright, semi-pendulum or pendulum leaves



Upright corn leaves maximize photosynthesis when high populations are planted in narrow rows. Pendulum leaves are suited for lower populations to decrease water loss by evapotranspiration while maintaining photosynthetic activity. Pendulum-leaf hybrids flop out and intercept sunlight like solar panels, capturing light before it gets down low.

Flex Characteristics of Corn

- Girth (G): Flex in girth occurs from planting to V6.
- Early Length (L1): Flex length takes place between V6 and VT.
- Late Length (L2): Flex in length occurs from VT to R4.
- Depth (D): Flex in kernel depth takes place between R4 and R6.

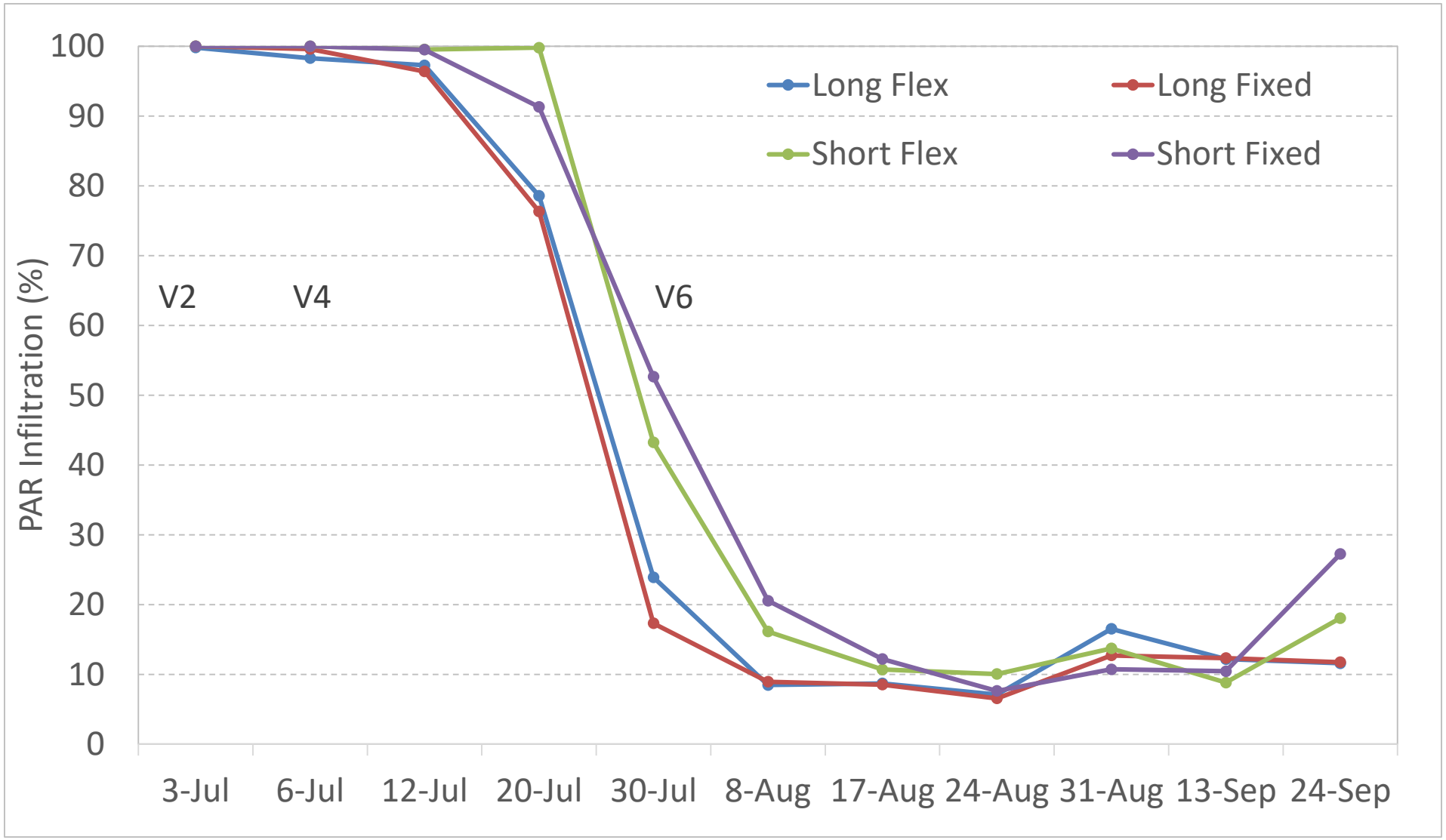


2020 – Corn & Conservation Variety Trials

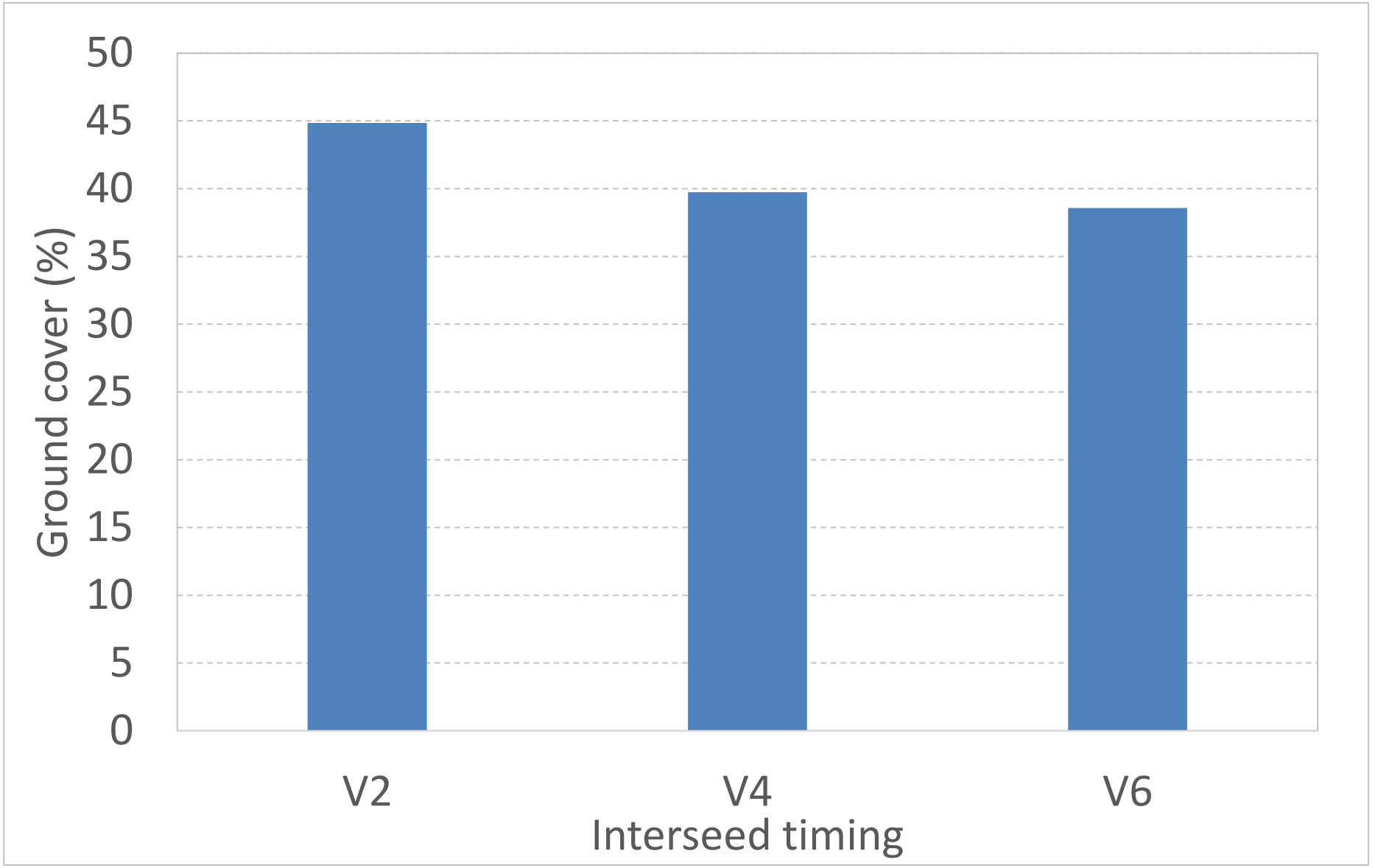
Variety	Test Weight lbs bu^{-1}	Crude protein	F
Abenaki	61.4	13.0	
Bronze Orange	57.4	**13.1**	
Cascade Ruby-Gold	60.0	11.8	
Dakota White	61.1	12.8	
Early Riser	60.9	10.9	
Elliot's White	57.5	10.2	
Flint's Flint Corn	61.3	12.4	
Minnesota 13	59.0	9.7	
Oaxacan Green	57.8	11.3	
Osage Brown	56.7	10.4	
Roter Tessinmais	**62.7**	11.8	
Wapsie Valley	61.6*	11.3	
LSD (p = 0.10)	1.27		
Trial Mean	59.8	11.5	

100 to 120 bushel

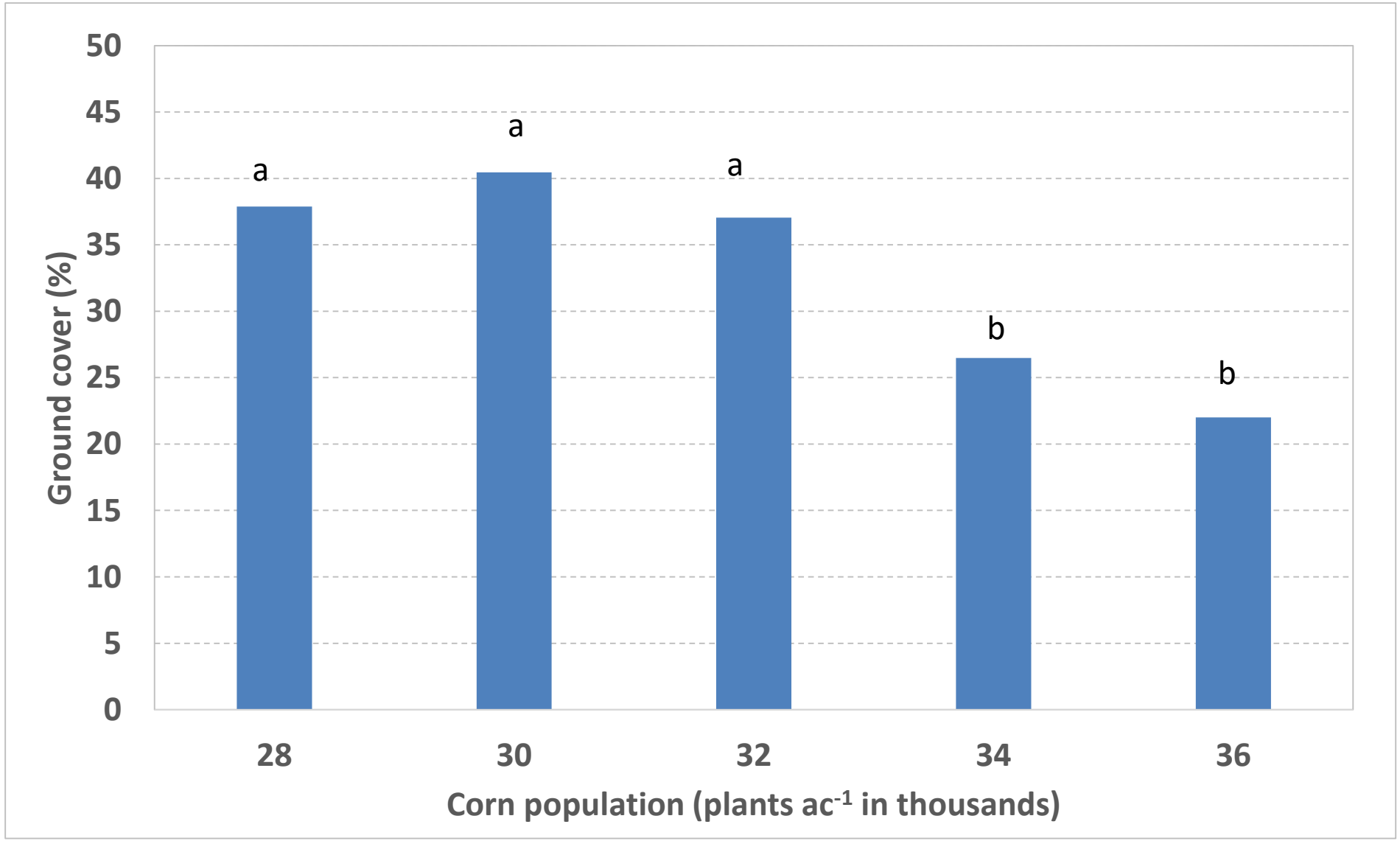
Interseed Timing & Variety Selection



Cover Crop Interseeding Timing



Corn Population



Materials & Methods

Location: *Borderview Research Farm, Alburgh, VT*

Plot size: *20 x 30 ft.*

Corn variety: *Syngenta NK8618 (86 RM)*

Corn planting date: *30-May 2019*

Cover crop planting date: *5-Jul*

Corn harvest date: *30-Sep 2019*

Cover crop sample date: *27-Sep 2019*

Treatments

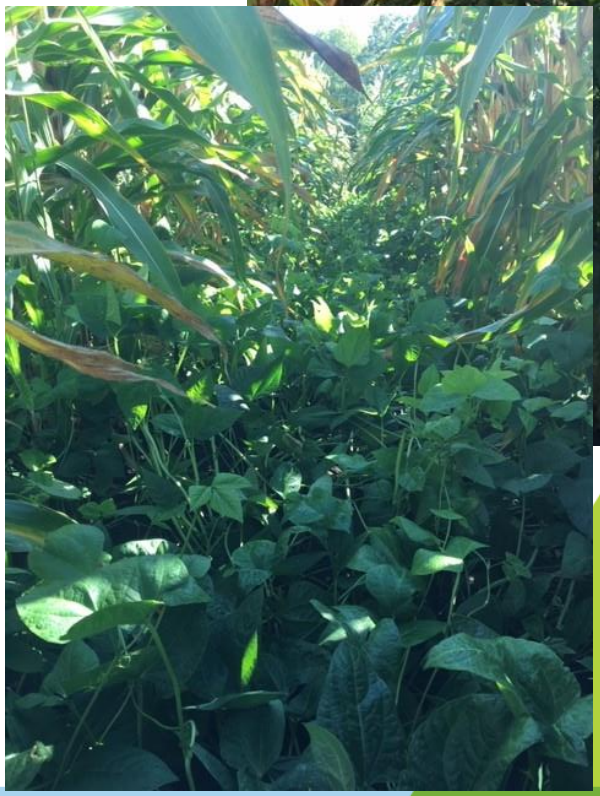
30" row with 30,000 seeds acre^{-1} **(30_30)**

30" row with 34,000 seeds acre^{-1} **(30_34)**

60" row with 49,000 seeds acre^{-1} **(60_49)**

Randomized complete block design with 4 replicates

Cover crop mix in 60" (left) compared to 30" (right).



Cow pea (left) and summer solar mix (right) in 60" rows .

Borderview Research Farm,
Alburgh VT 2019

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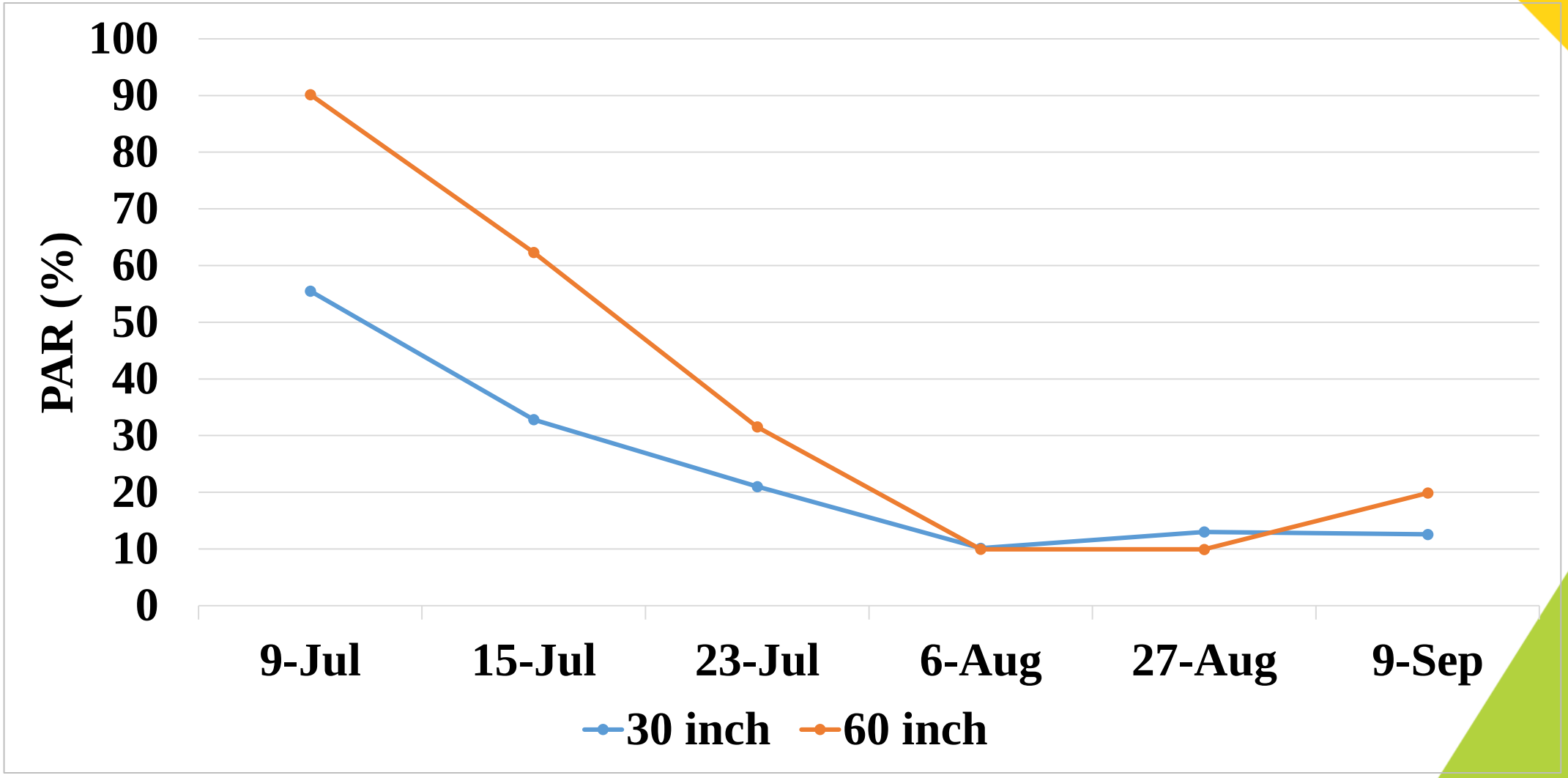

Figure 1. Percent light infiltration under corn canopy by row spacing, Alburgh, VT, 2019.

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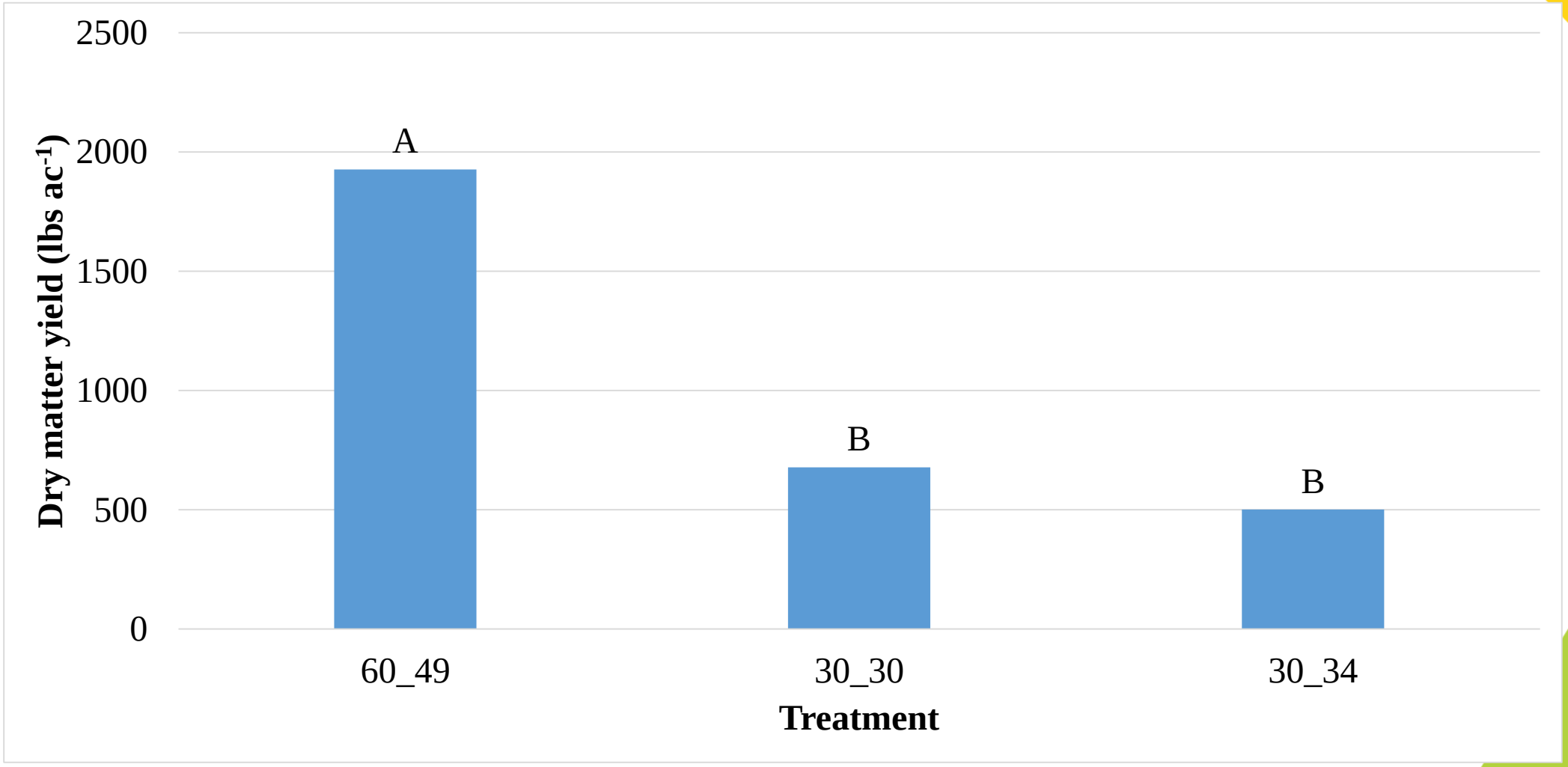
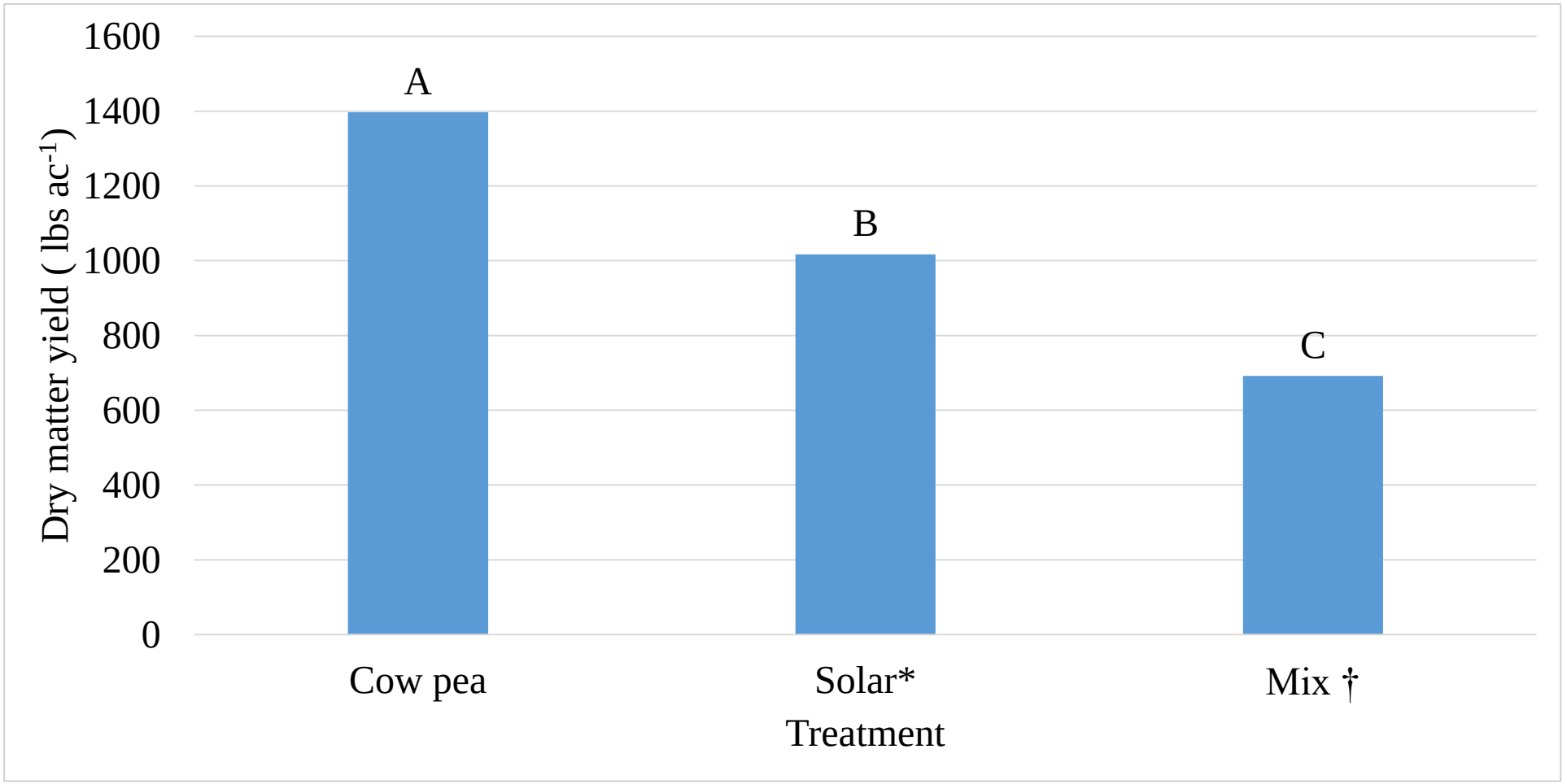


Cover crop dry matter yield (lbs ac^{-1}) by treatment (row spacing + population), Alburgh, VT, 2019.



Cover crop dry matter yield (lbs ac^{-1}) by cover crop type, Alburgh, VT, 2019.

RESULTS

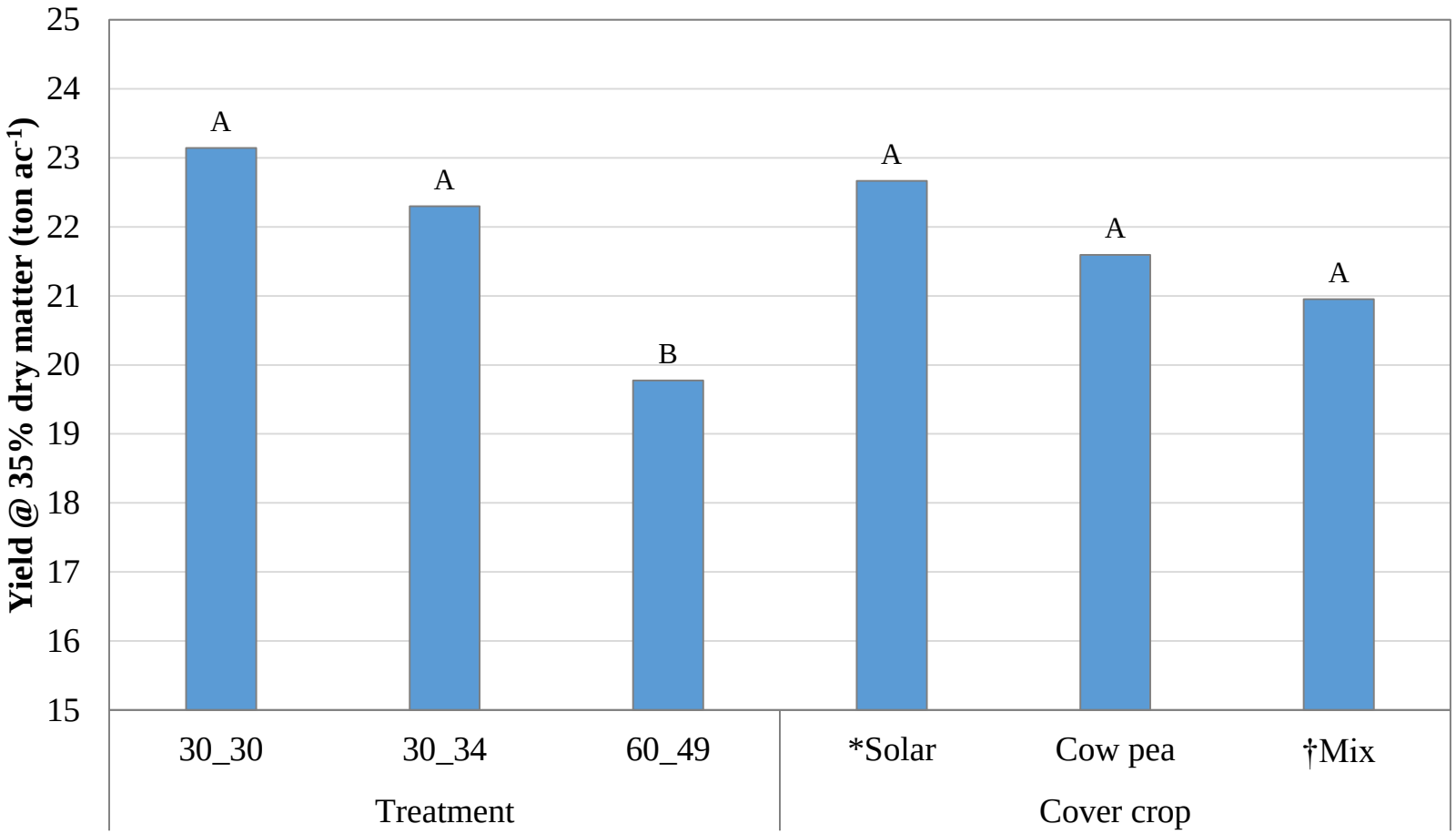


Figure 5. Corn yield at 35% dry matter (ton ac^{-1}) by treatment (row spacing + population) and by cover crop type, Alburgh, VT, 2019.

Treatments that share letters performed statistically similar to one another.

*- cow pea 'Iron Clay', buckwheat 'VNS', sunn hemp "VNS', Peredovik sunflower

†- annual ryegrass, tillage radish, red clover

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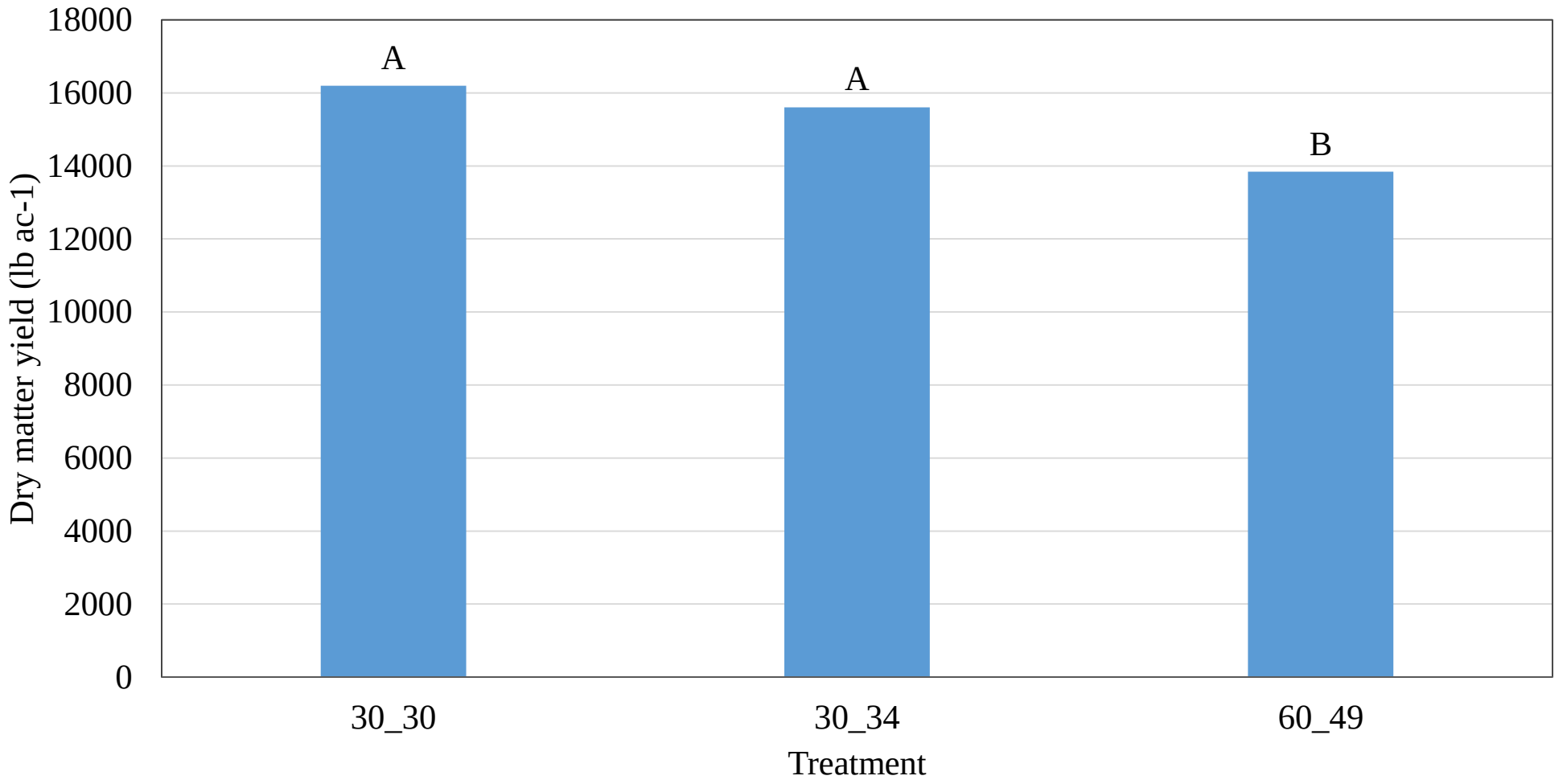


Corn dry matter yield (lb ac^{-1}) by treatment (row spacing + population), Alburgh, VT, 2019.

On Farm

Farmers at two sites in Franklin County, VT planted corn with row widths of 60" in 2019.

Cover crop was interseeded late June.

Farmers measured yield and dry matter at harvest.

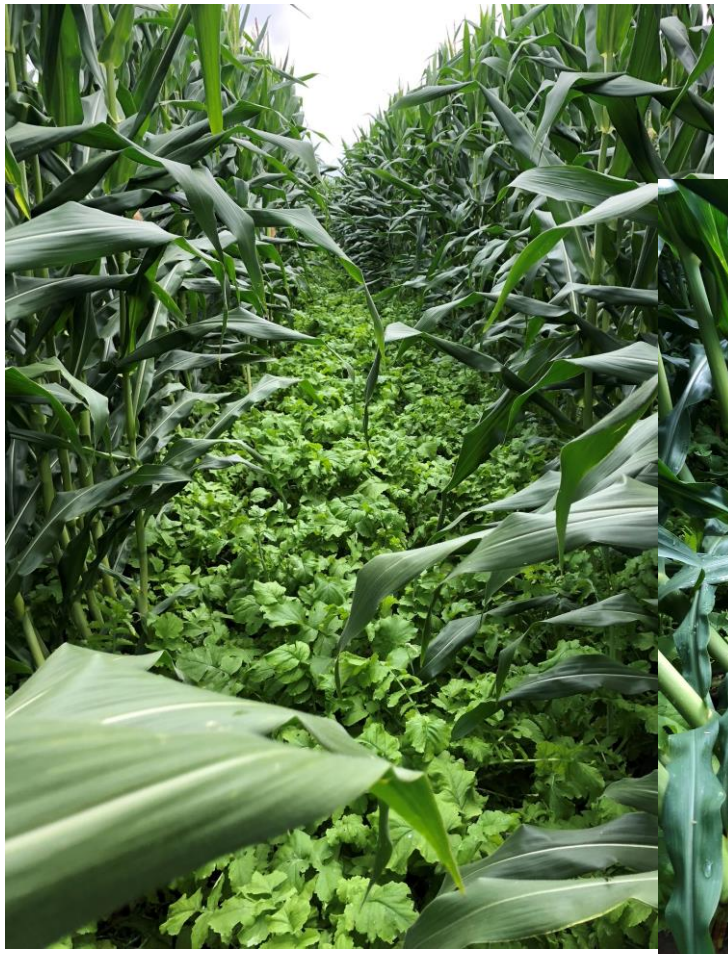
Farm	Machia's	Manning's
Cover crop planting date:	28-Jun	27-Jun
Cover crop mix	Annual ryegrass (85%), radish (15%)	Annual ryegrass (80%), clover (15%), radish (5%)
Rate (lb/ac)	30	30
Herbicide application	Acuron (high rate)	Round Up (high rate)

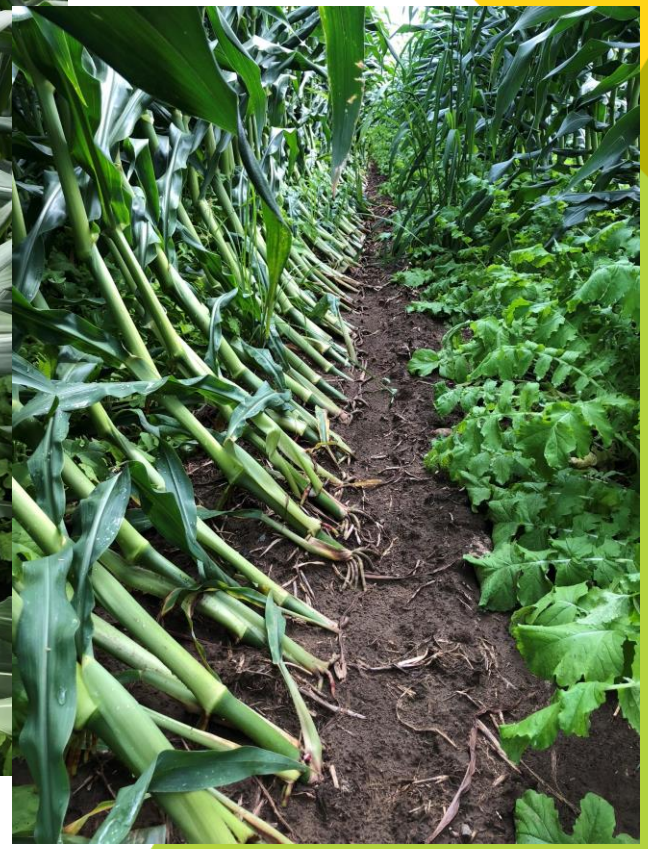
On Farm

On Farm

July 2019

Aug. 2019

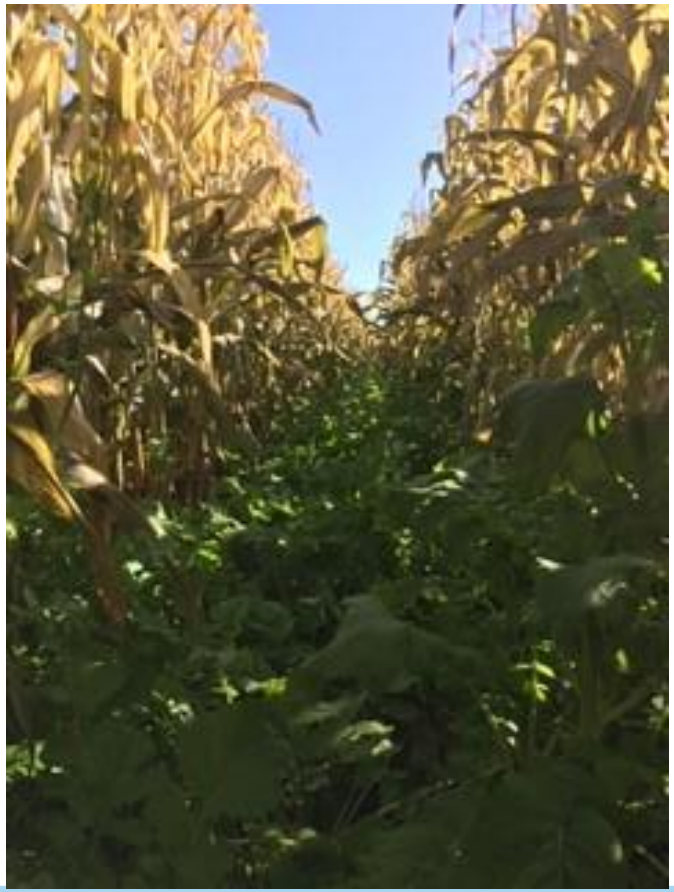


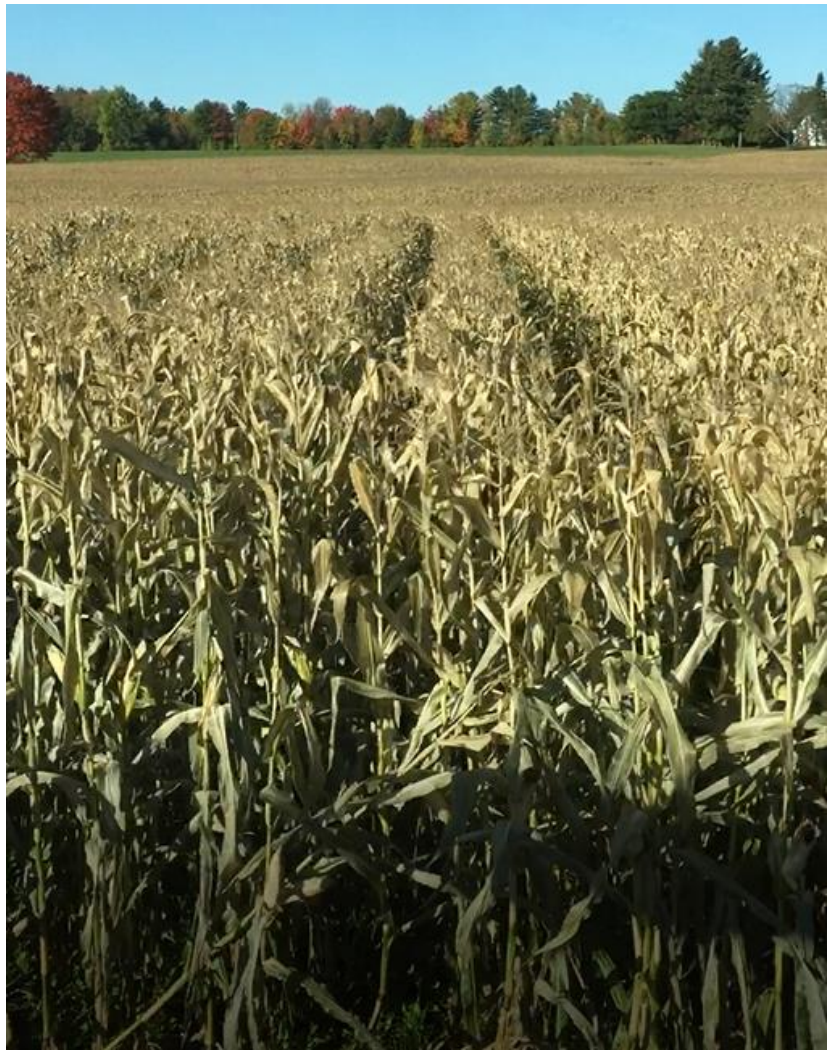


Pictures of 60" corn at Machia's farm

On Farm

60” rows at harvest (11-Oct. 2019).





Pictures of 60” corn at Machia’s farm

On Farm

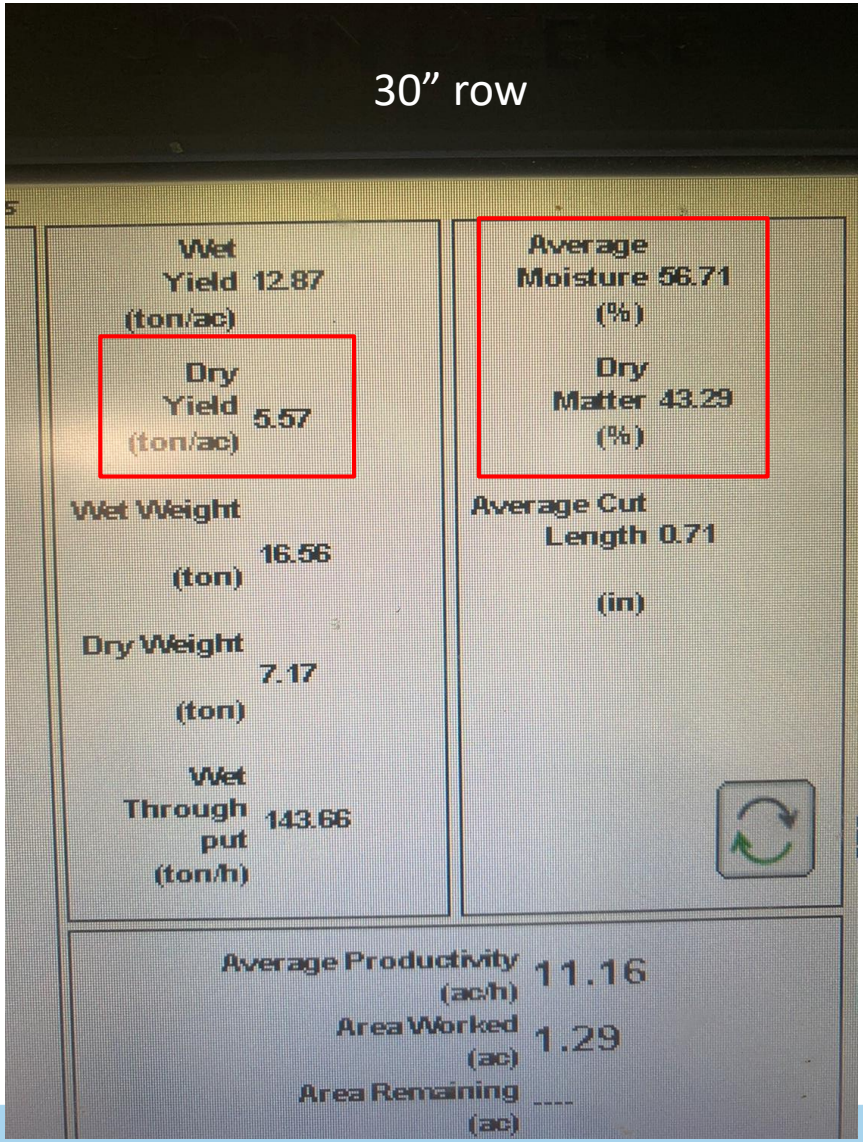
60” corn rows before (left) and after (right) harvest at Nick Manning’s.

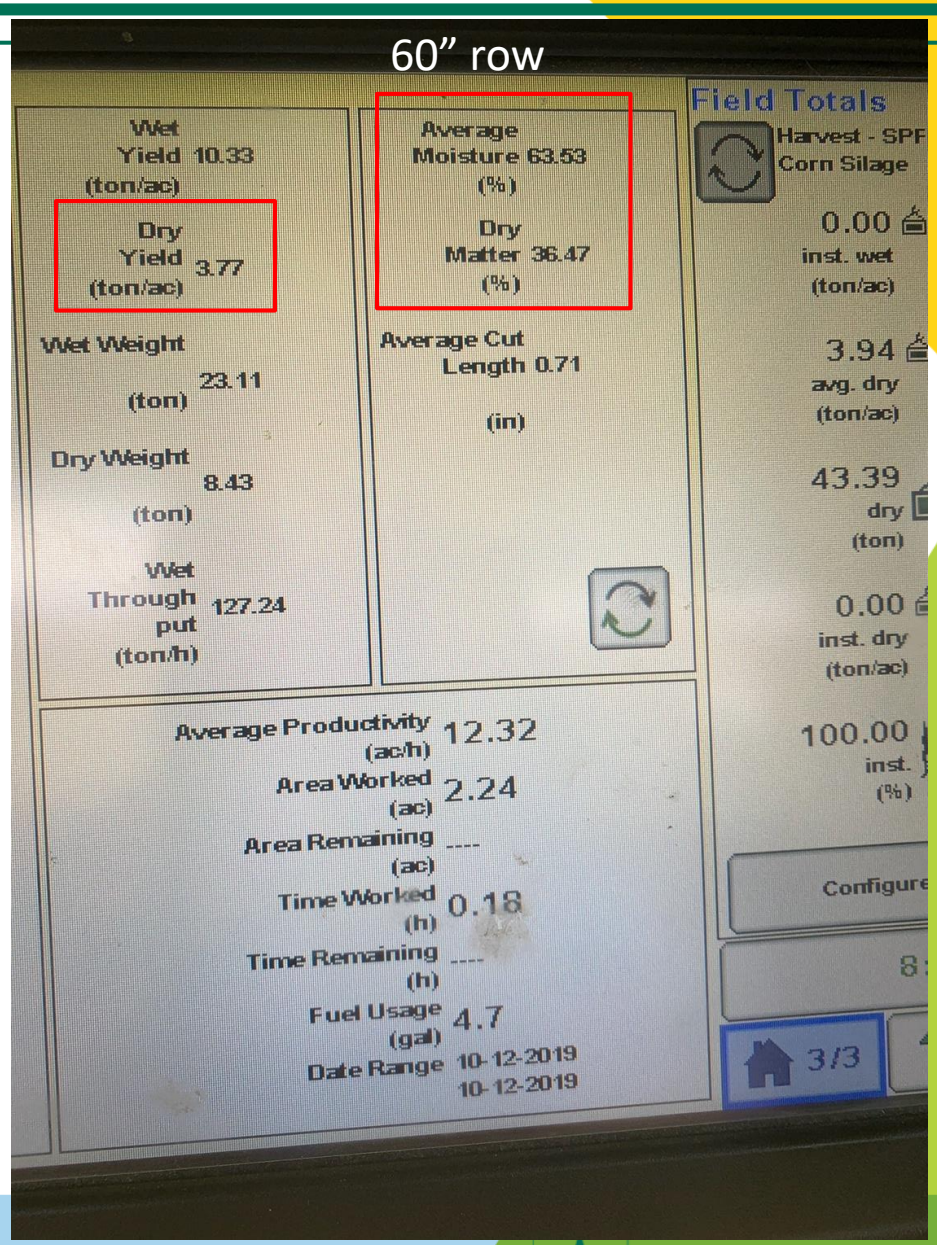
On Farm

Comparing corn yields in 30" vs. 60" row width.

Lower yield & dry matter in 60" rows.

- Wet field conditions where 60" corn was planted





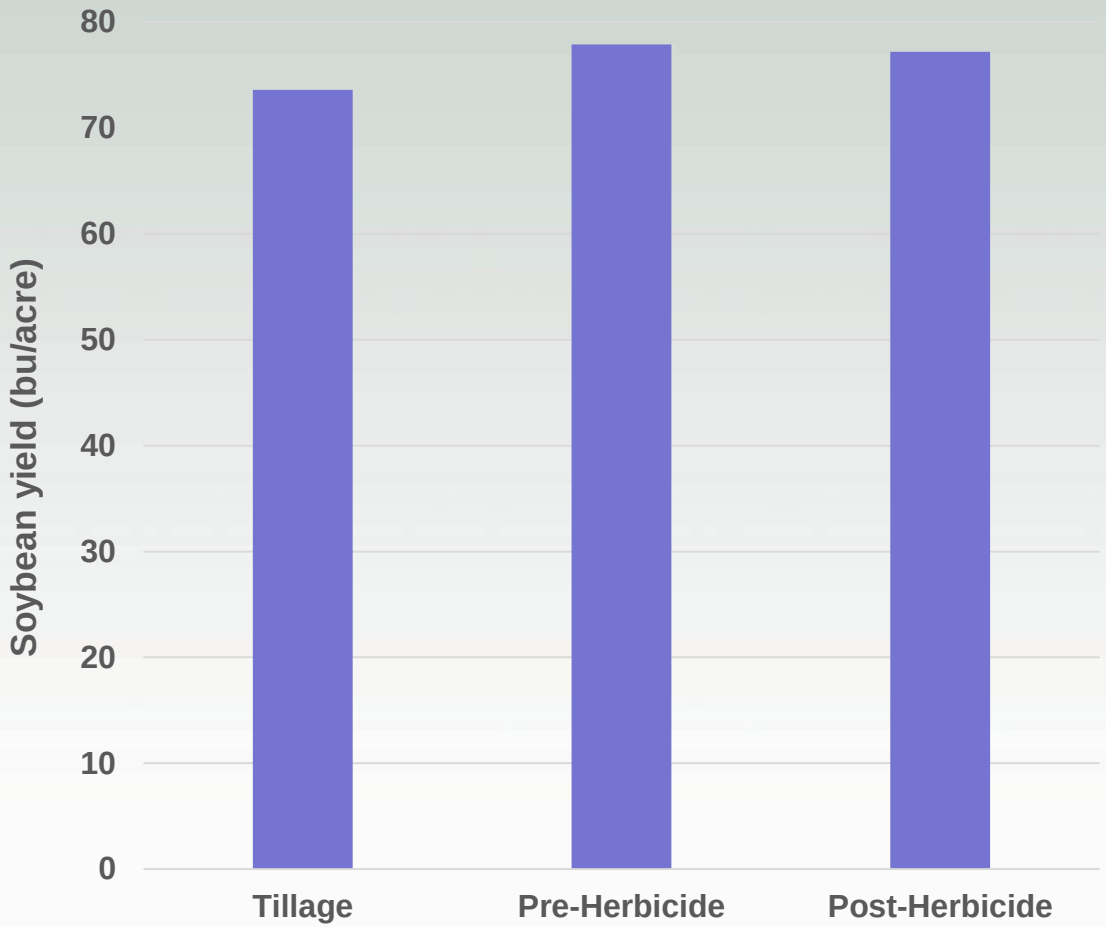
The University of Vermont

Challenges/Things to Consider

Planting corn in 60" rows needs refining to be a viable solution for farmers

- Studies done in Midwest (Gailans et.al. 2018) (Nelson, 2014) (Gailans et.al. 2019) have shown mixed results in terms of improved corn yield & cc biomass production in 60" rows compared to 30". If this method can be refined, wide row corn has the potential for:
    - Improving corn yield & cc biomass production
    - Improving soil fertility by growing more legume (cow pea) cover crop
    - Grazing livestock on cc after corn harvest

Cover Crop Termination& Soybean Yield



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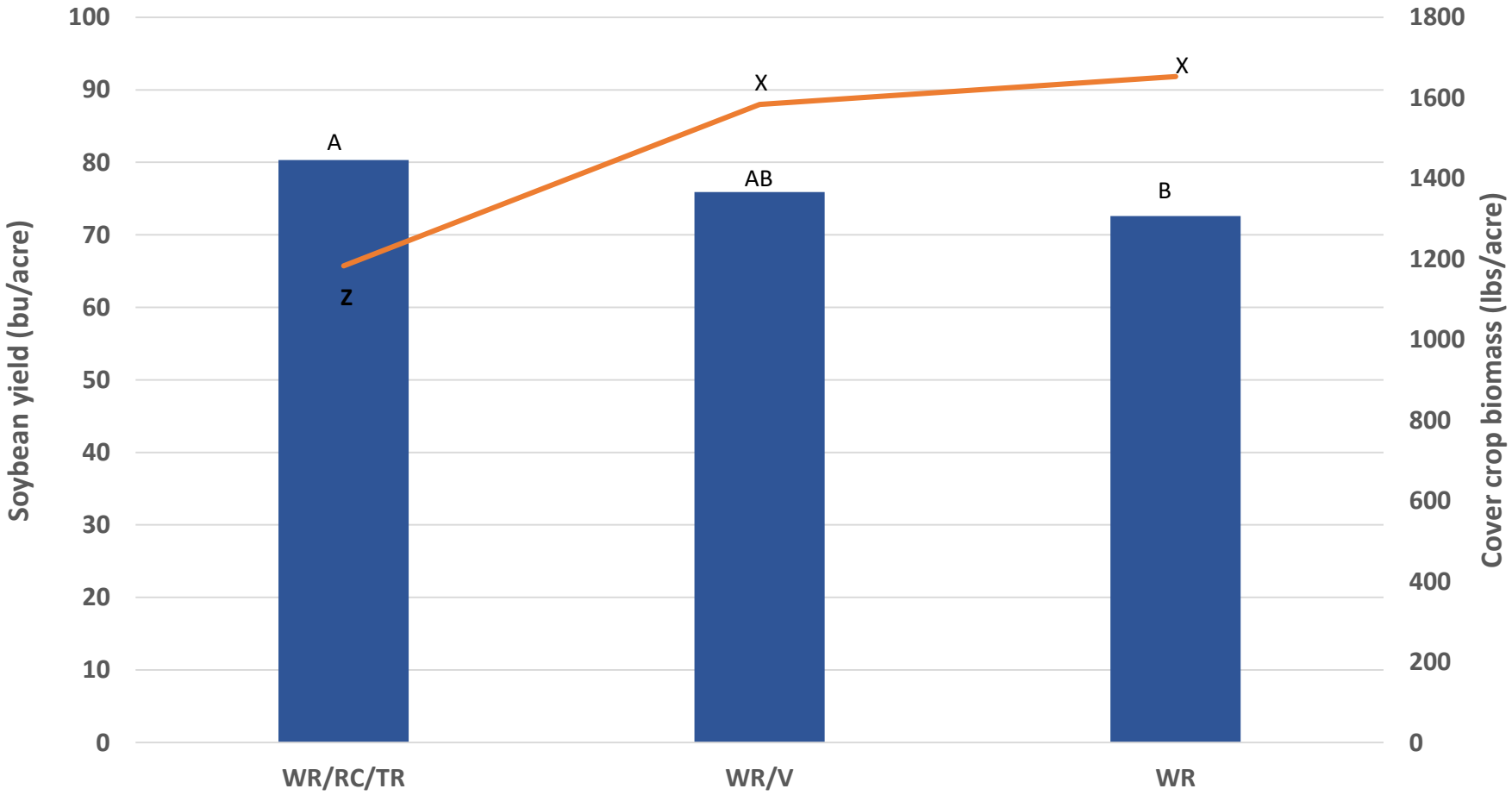
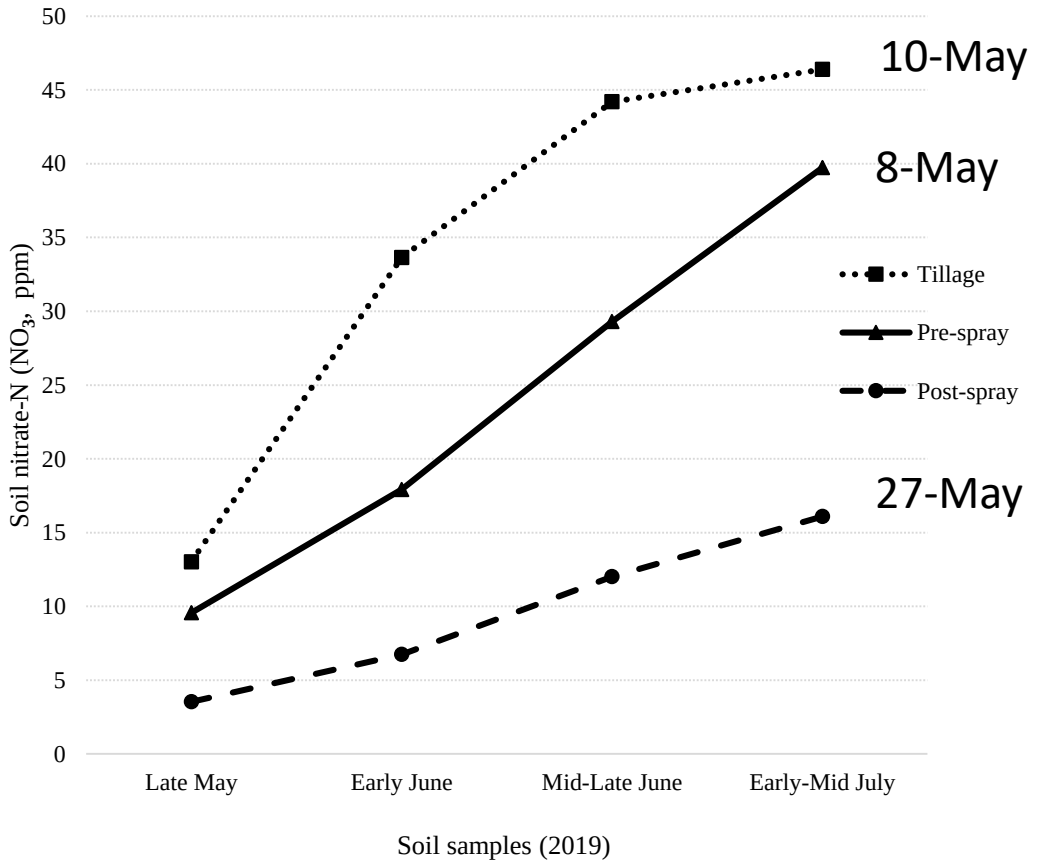
Cover Crop & Soybean Yield



Cover Crop Termination& Soybean Yield



Grazing Cover Crops: Ideas and strategies from across the country

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We aren't currently seeing a lot of cover crop grazing in Vermont.

Can we get inspired by farmers from other regions?

Cover Crops

Protecting Lake Champlain

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NRCS Natural Resources Conservation Service

CHAMPLAIN VALLEY FARMER COALITION INC.

UVM Extension Crop, Soil and Pasture Team | Middlebury, Vermont | (802) 388-4969

Please contact us for more information about cover crops and other farming practices that protect soil and water

"Livestock grazing on cover crops can bring a whole new dimension of cropping systems." – *Jim Isermann, Illinois farmer*

Left:Oat and radish cover crop pre-grazing.
Right: Turnip and oat cover crop post-grazing. Photos courtesy of Jim Isermann.

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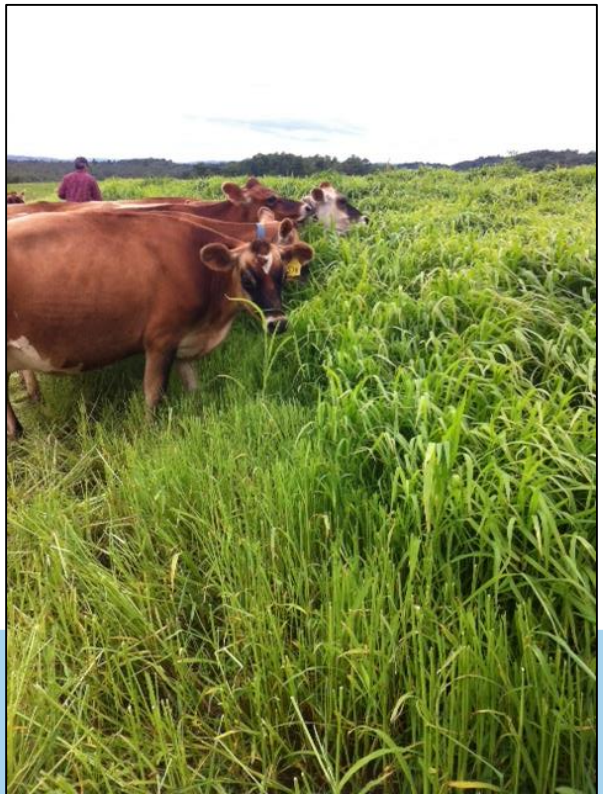
Opportunities

Feed savings for livestock producers
or
an additional enterprise for crop producers



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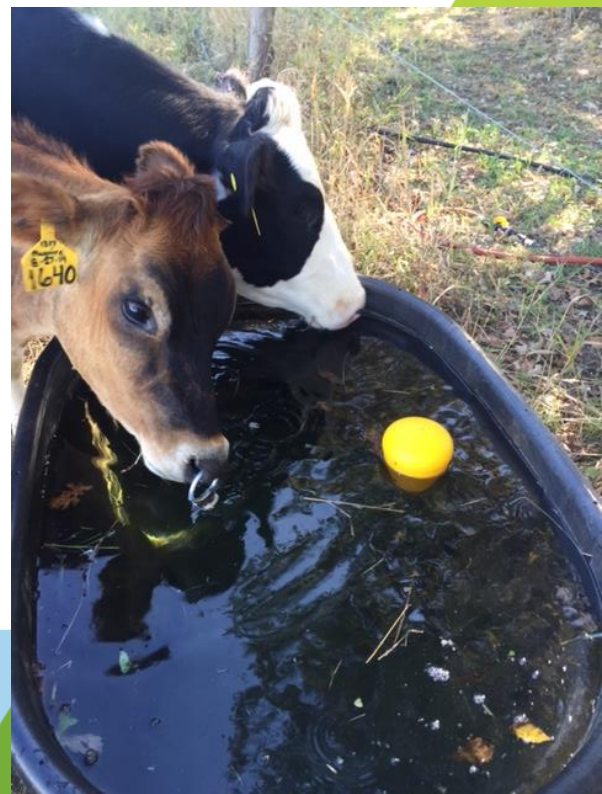
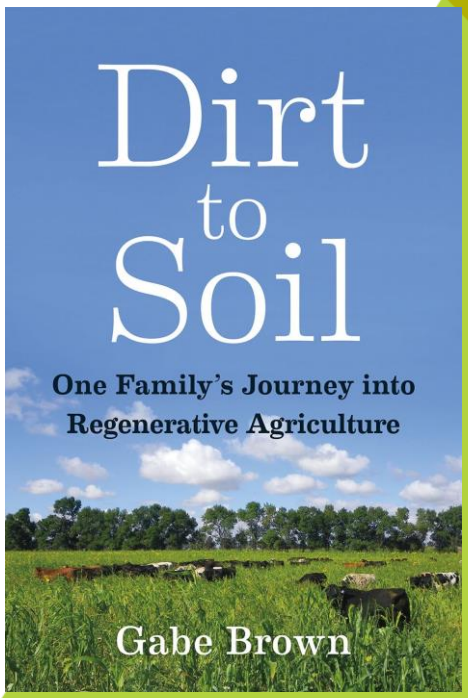
"Logistics will be one of the biggest barriers to grazing more cover crops. Fence, water, mineral feeders and handling facilities must all be planned." – *Jim Isermann, Illinois farmer*



Gabe Brown, Brown's Ranch – North Dakota

5,000 acres of cropland, 350 cow/calf pairs, 200-600 stockers



Images courtesy of Chelsea Green

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Mark Schleisman, M & M Farms – Iowa

2,000 acres cropland, 1,300 acres cover crops, 360 cow/calf pairs

Cover crops interseeded between August 15 and 31

Triticale base with radish, turnip and/or rapeseed, 22% CP in forage

Economic example from Practical Farmers of Iowa study: 3.8 tons of dry matter per acre of above ground biomass on a 150 acres field, equaling 570 tons of dry matter. Cattle to graze 85% of the forage, consuming 484.5 tons dry matter. If cattle received the same amount of dry matter in the form of hay (assuming hay was purchased, cost $80 per ton, and contained 85% dry matter), this would have cost Mark $44,574 or $297.16 per acre.

Practical Farmers of Iowa – extensive resources and economic data on cover crop grazing

PRACTICAL farmers of Iowa
working together, always learning

Livestock Research

Economic Benefits from Utilizing Cover Crops as Forage

Staff Contact:
Meghan Filbert– (515) 232-5661
meghan@practicalfarmers.org

Cooperators:
- Ben Albright - Lytton
- Wesley Degner - Lytton
- Bill Frederick - Jefferson
- Mark Schleisman - Lake City

Funding By:
Iowa Dept. of Agriculture and Land Stewardship's Water Quality Initiative

Web Link:
http://bit.ly/pfilivestock

In a Nutshell

- Planting cover crops, then grazing or harvesting them, is a practical way to effectively reduce nutrient pollution, plus provide economic benefits to cattle owners.
- This represents a win-win for livestock producers and water quality for Iowa.

Key findings

- Four farmers in northwest Iowa reported that in the fall and winter of 2015, cover crops provided 0.07 to 3.74 tons of dry matter per acre.
- Grazing this cover saved farmers $1,306 to $22,801 in hay or other stored feed expenses

Project Timeline:
August 2015 - March 2016

Cereal rye and oats greening up and almost ready to be grazed by Ben Albright's cattle near Lytton.

Methods

Another way to add value: Rental agreements for cover crop grazing

Many producers who grow cover crops **may not currently graze or do not plan to graze**, but can still obtain income from this crop as a potential feed resource

Considerations:

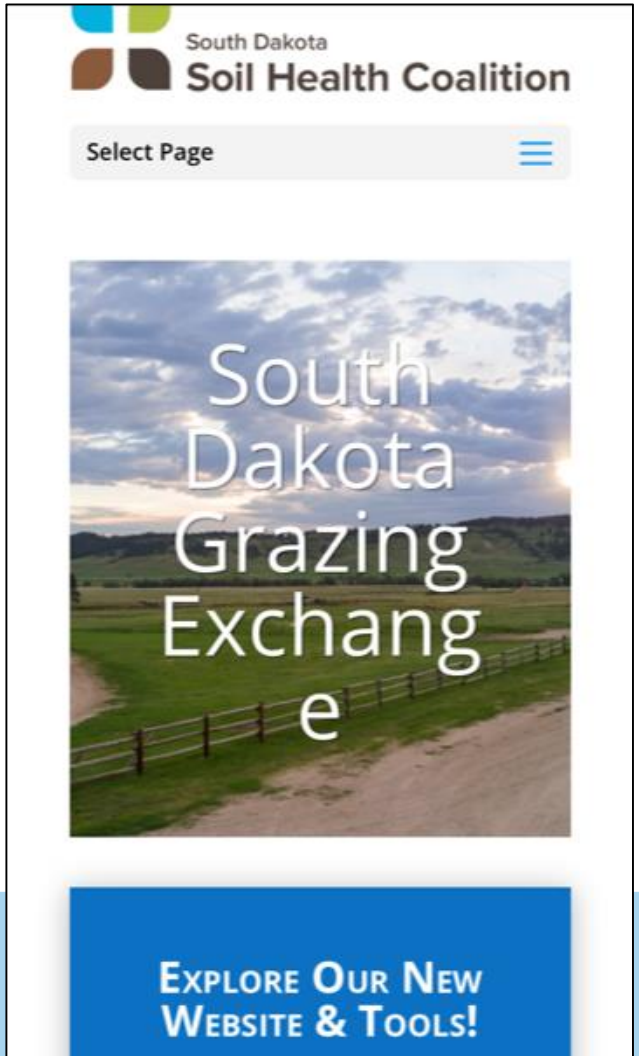
- Infrastructure
- Fair payment and rates
- Responsibilities of each party

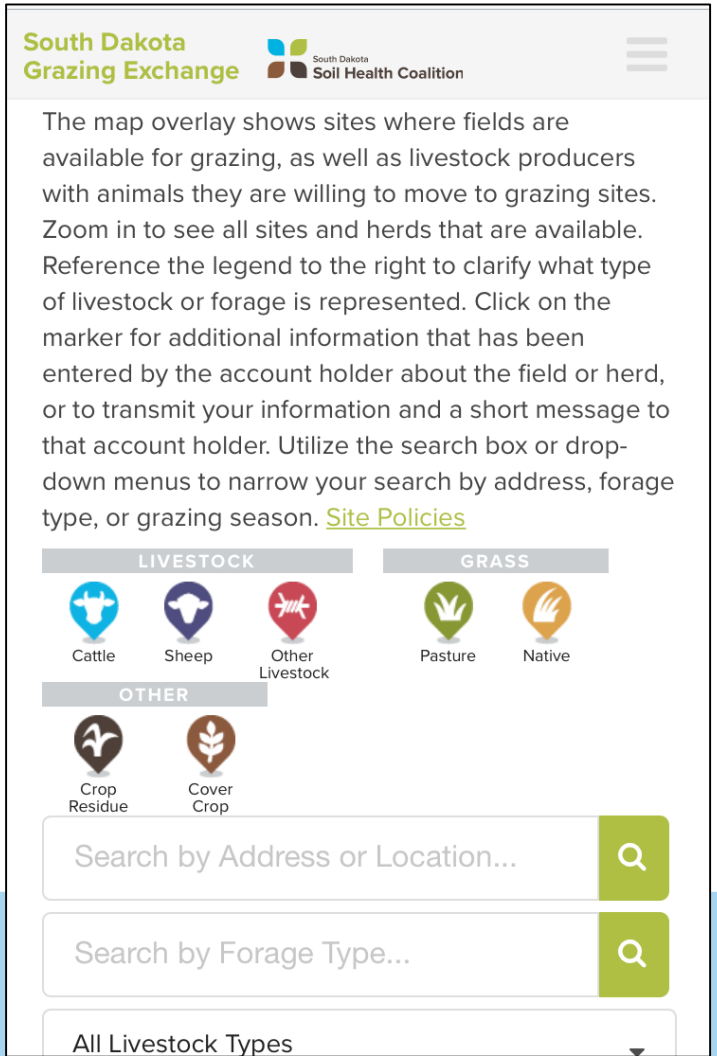
Key questions to answer when negotiating a lease

Resources available from Practical Farmers of Iowa and from the University of Nebraska – Jay Parsons, Dept. of Agricultural Economics

- What is the latest agreeable planting date? What species will be planted? Who will pay for establishment?
- How and when will cover crop be terminated?
- Will permanent or temporary fence be used? Long term lease with grazer if grazer installs more permanent fence?
- Is a reliable water source present? How will water be delivered to animals?
- What is the emergency feed source?
- Will livestock owner provide liability insurance?
- What's the start date for grazing? What's the grazing period? What is stocking rate and is it appropriate?
- What is contingency plan? If inadequate forage, how is livestock owner compensated? Or if not grazed, will forage be harvested? By whom?
- What are the crop insurance requirements?

Got grazing? New online matchmaking tool in South Dakota





This Grazing Exchange website thru the South Dakota Soil Health Coalition connects forage producers and livestock producers within the state to put vegetation to work

THE UNIVERSITY OF VERMONT EXTENSION

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