

Drill-interseeding cover crops into corn

Best management practices

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Interseeding approach & management goals

Drill-interseeding

Early corn growth stages



Drill-interseeding

Early corn growth stages



Drill-interseeding
Niagra Co. SWCD, NY
M. Seider

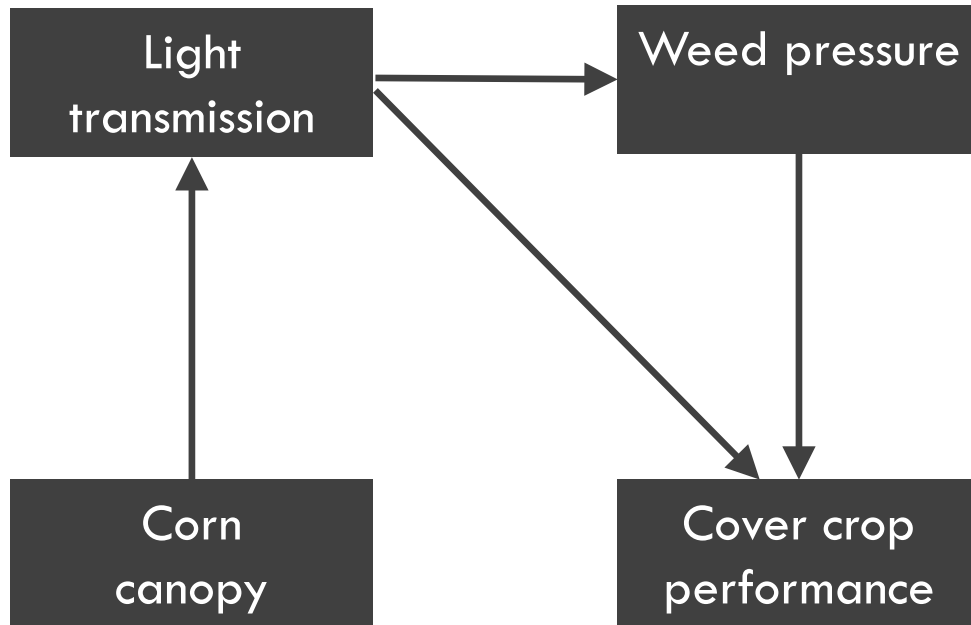


**Branton Farm's Rogator
LeRoy NY**



Interseeding cover crops

Light is the limiting resource when interseeding early



Adapted from Youngerman et al. (2018)



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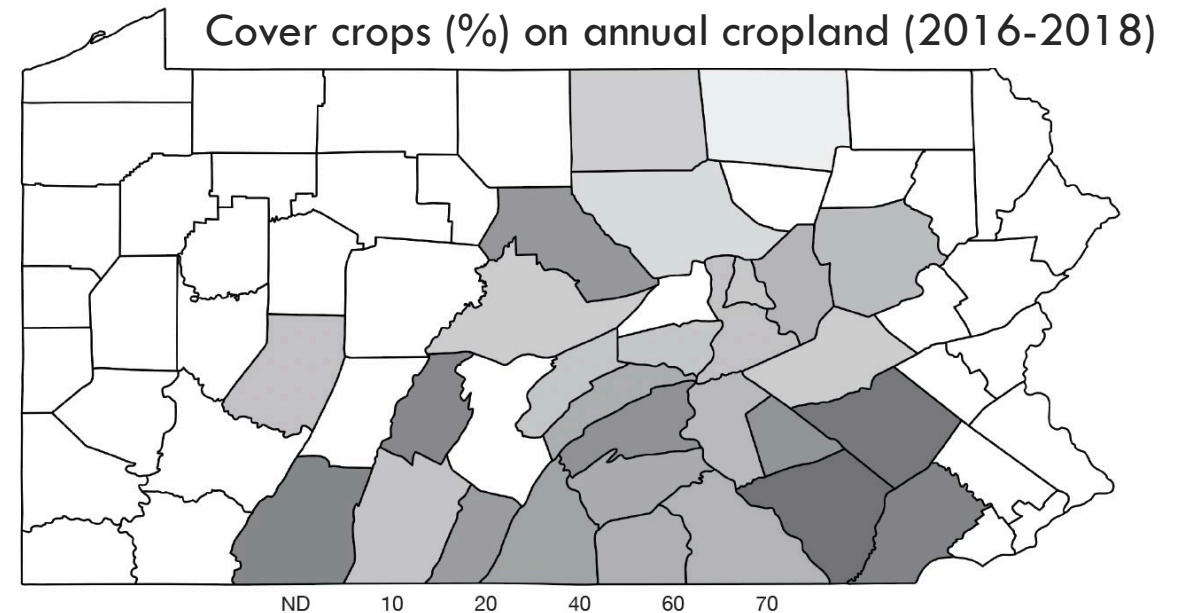
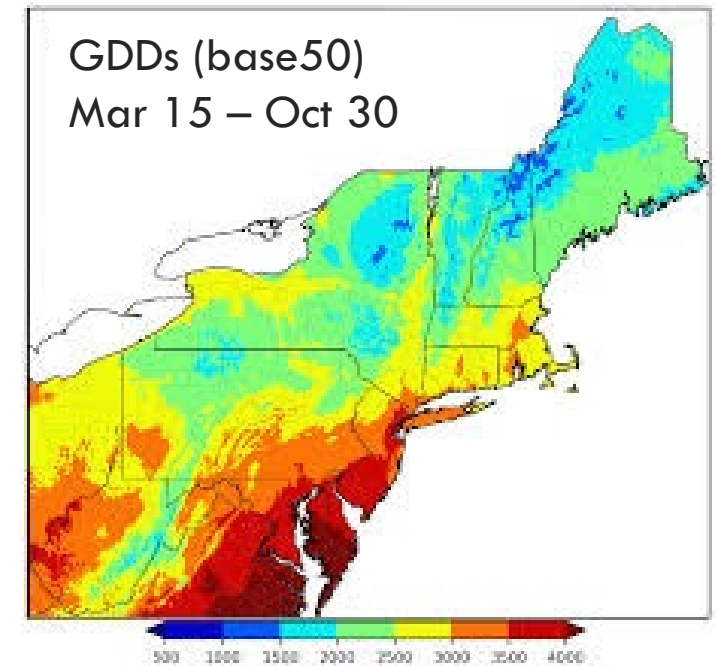
Interseeding vs. post-harvest seeding

Are fall GDDs a limiting resource in your system?

- Fall GDDs threshold will depend on management goal
- Example: Cereal rye may require >1000 GDD_{40F} to minimize winter-spring N leaching (Sedghi and Weil, 2022)
- Most legume & brassica species perform poorly when seeded after late season grain harvest



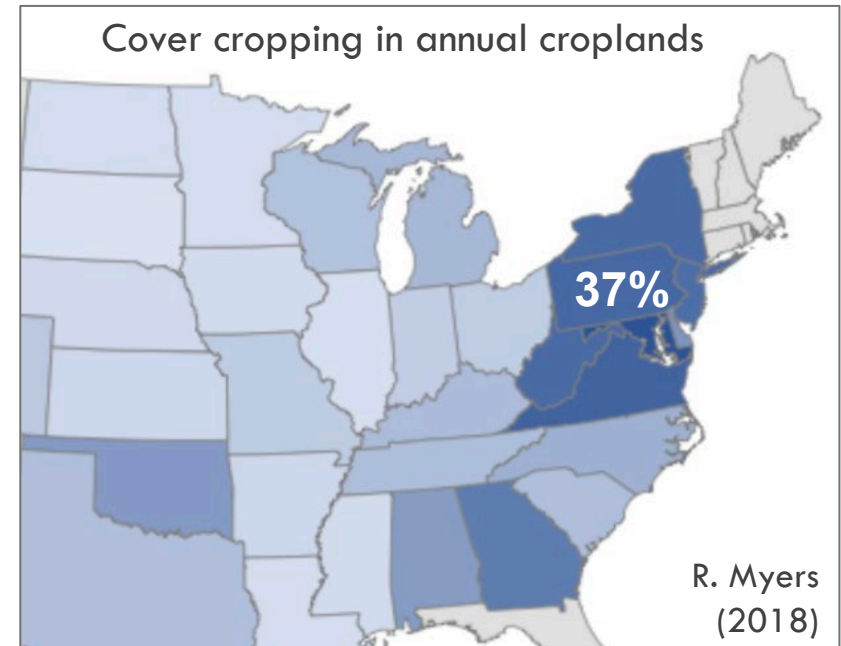
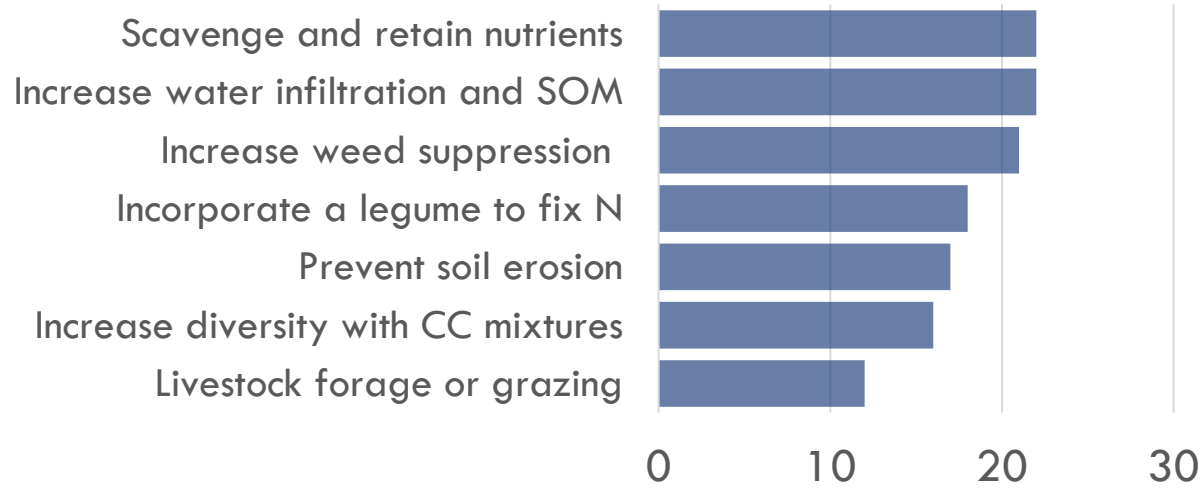
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2021 PSU Agronomy Guide (S. Duiker)

Interest in interseeding within Northeast

Management goals that drive interest in practice?

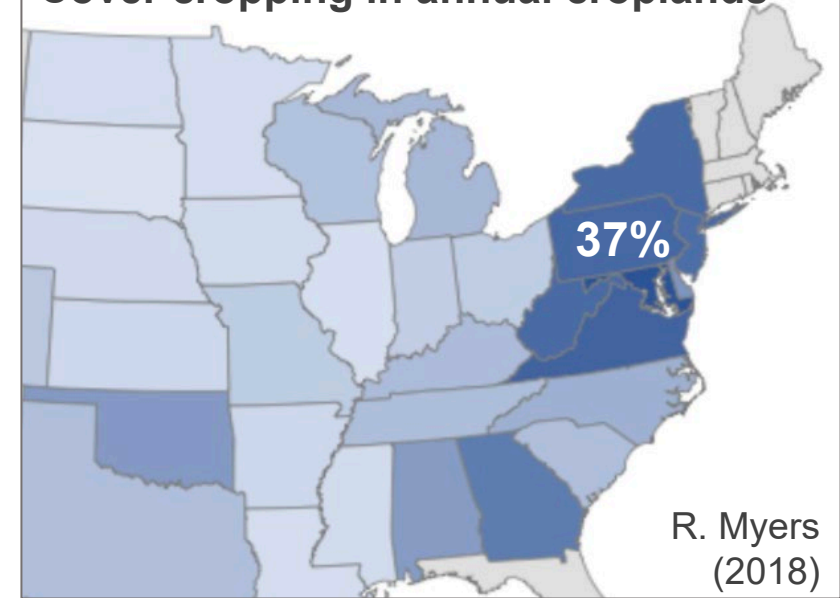


Management goals

Determine species selection and performance targets



Cover cropping in annual croplands



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Interseeding is of interest to you because of which cover cropping management goals?

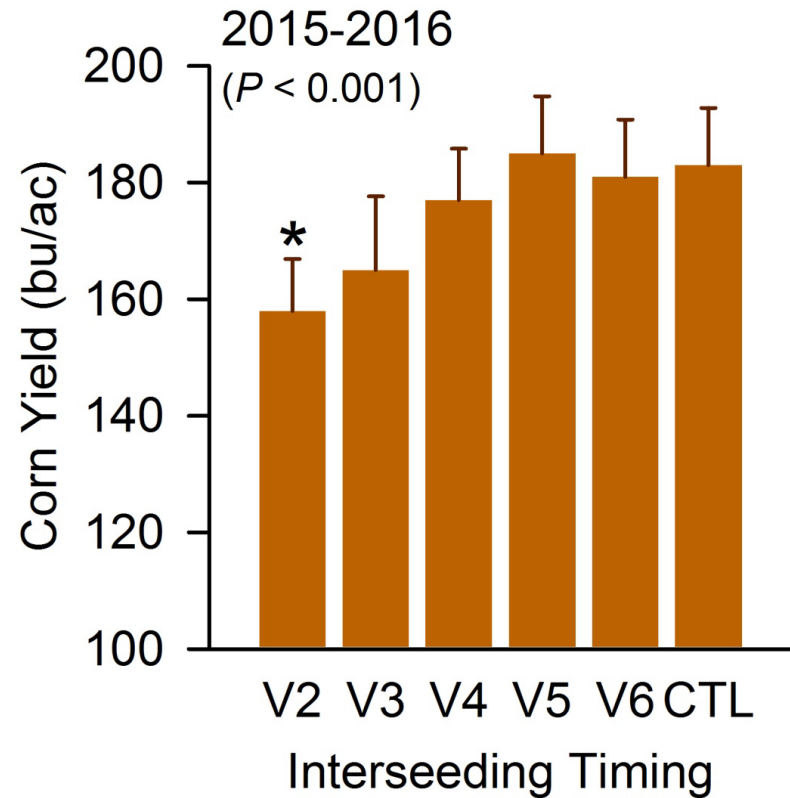
Interseeding timing & species selection



Interseeding timing

Current recommendation is **V3-V5** corn

- Partitions light resources
- Syncs weed & fertility management



Currán et al. (2018)



Species selection

Factors

- Shade tolerance
- Drought tolerance
- Winter hardiness
- N scavenging



Species selection & seeding rate

Current recommendations for 30" corn systems

Species	Traits	As monoculture	In mixture
Grasses		-- lb / ac --	-- lb / ac --
annual ryegrass	winter-hardy	15-20	10-15
orchardgrass	winter-hardy	15-20	10-15
cereal rye	winter-hardy	60-90	45-60
Legumes			
medium red clover	winter-hardy	8-10	5-8
Crimson clover	winter hardy or kill	10-15	8-12
Brassica			
Daikon radish	winter-kill	3-5	1-2

Caswell et al. (2018)

Annual ryegrass monocultures

Erosion control and nitrogen scavenging



Annual ryegrass monocultures

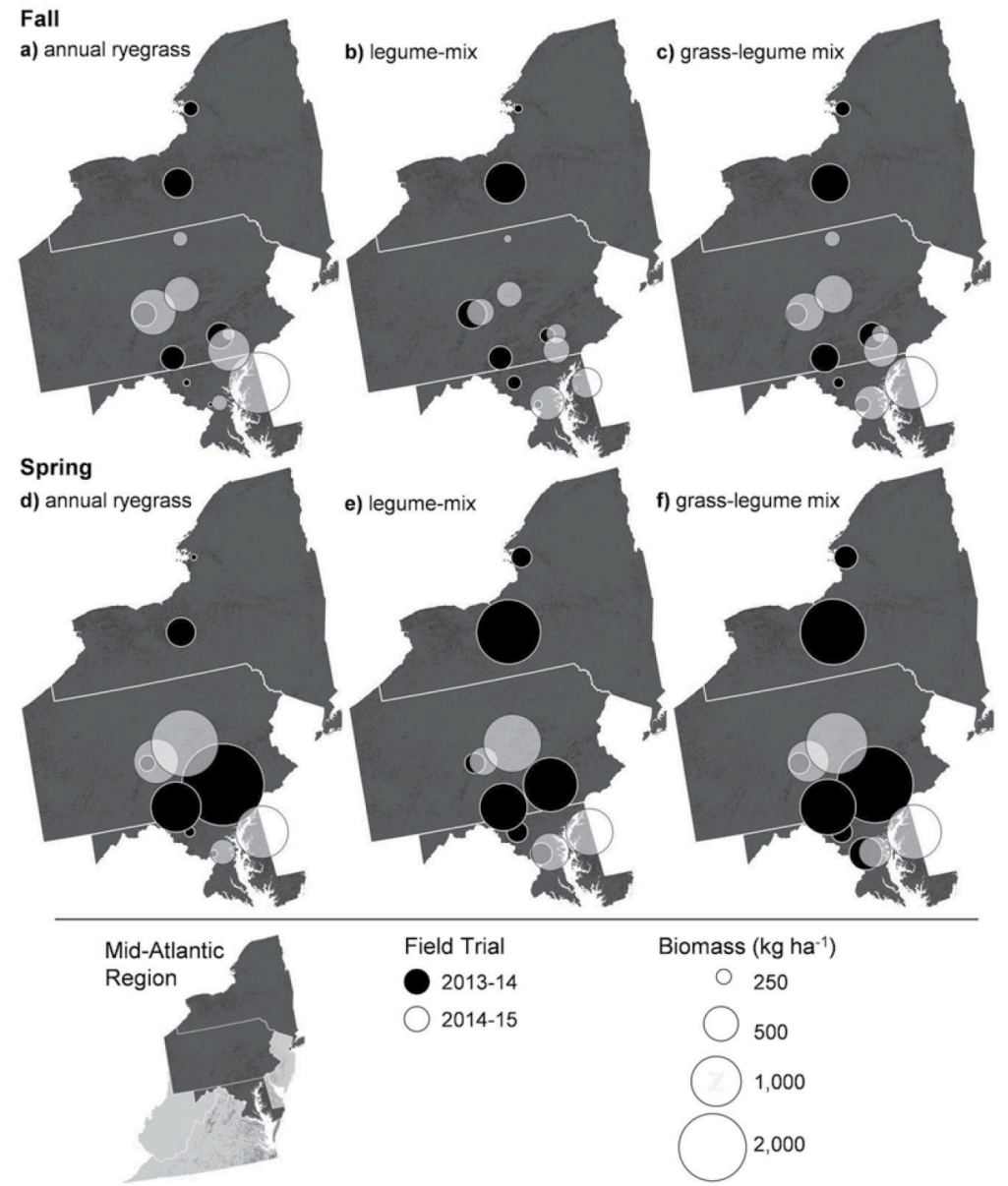
Erosion control and nitrogen scavenging



Interseeding mixtures

Lessons learned from NRCS-CIG (2013-2014)

- Averaged across locations, mixtures outperformed monocultures
- High variability among locations
- Spring biomass was correlated to fall biomass but highly variable



Interseeding mixtures

Lessons learned from Pennsylvania organic grain farms

- Daikon radish dominated in high-fertility soils
- Daikon radish was more dominant in drilled vs. broadcast
- Spring biomass suffered due to daikon radish dominance

Wallace et al. 2020

Mixture	Rate (lb/ac)
annual ryegrass	10
orchardgrass	10
Daikon radish	3



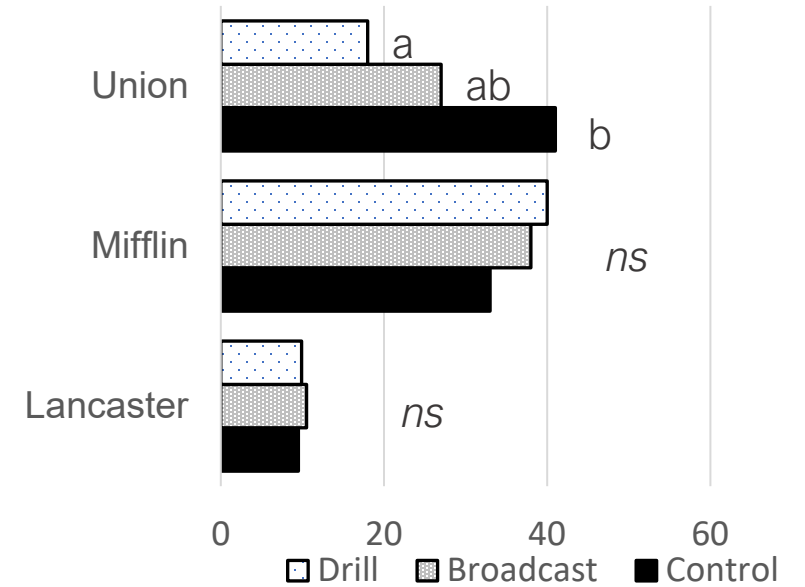
Interseeding mixtures

Lessons learned from Pennsylvania organic grain farms

- Daikon radish dominated in high-fertility soils
- Daikon radish was more dominant in drilled vs. broadcast
- Spring biomass suffered due to daikon radish dominance
- Interseeding reduced fall nitrate leaching potential

Wallace et al. 2020

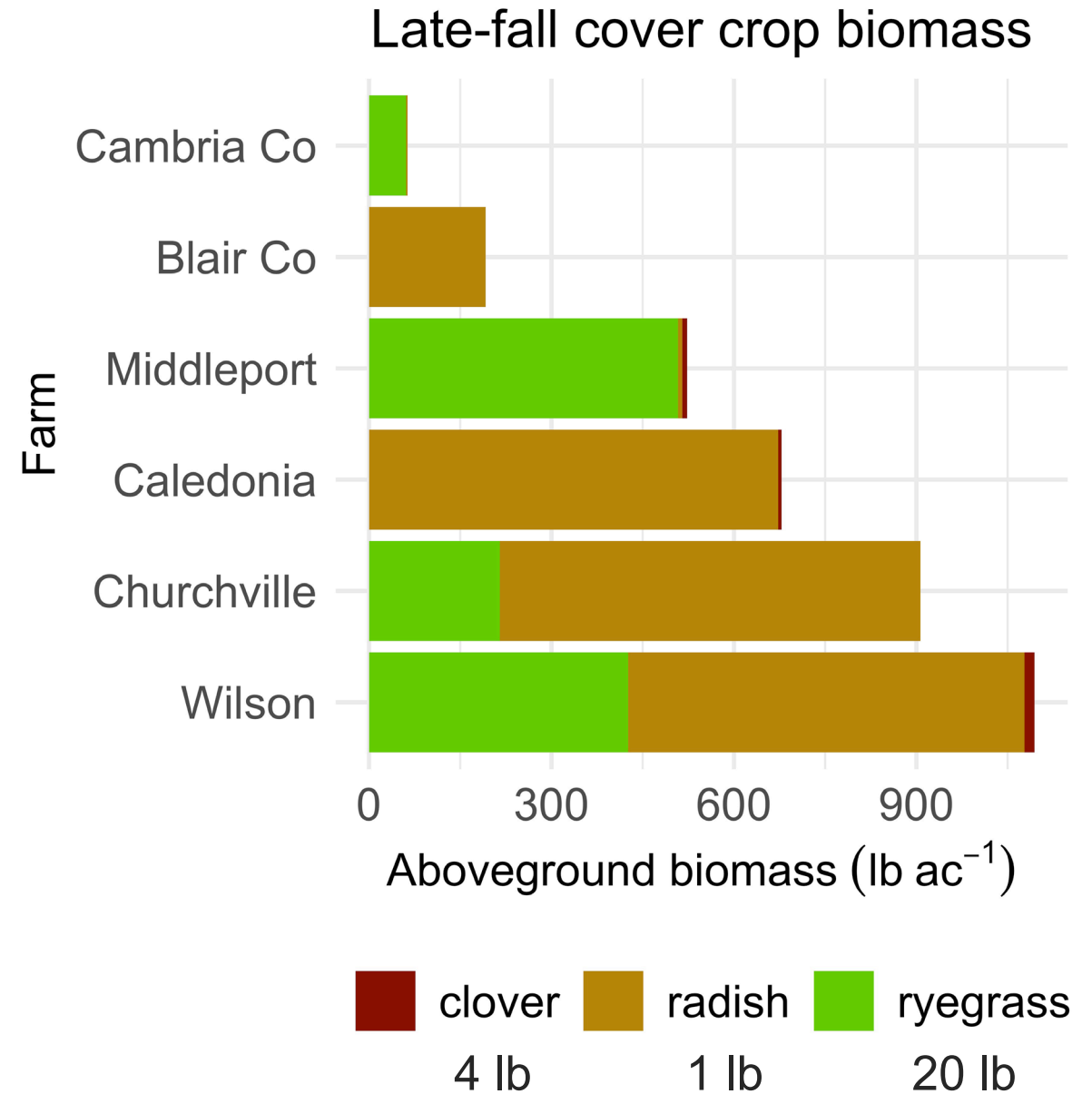
Fall soil inorganic N
(mg N / kg dry soil)



Interseeding mixtures

Northeast SARE On-Farm Trials

- Cover crop mixture expression differed dramatically among locations
- Total cover crop biomass production was not well correlated with corn yield
- All farms harvested corn after Oct 30th, leaving few GDDs for post-harvest seeding cover crops



Weed control & interseeding

Weed control & interseeding

Balancing management goals

Critical Period of Weed Control



- Interseeding too early leads to weed escapes
- Recommend POST glyphosate before interseeding
- Must consider change to pre-plant residual program



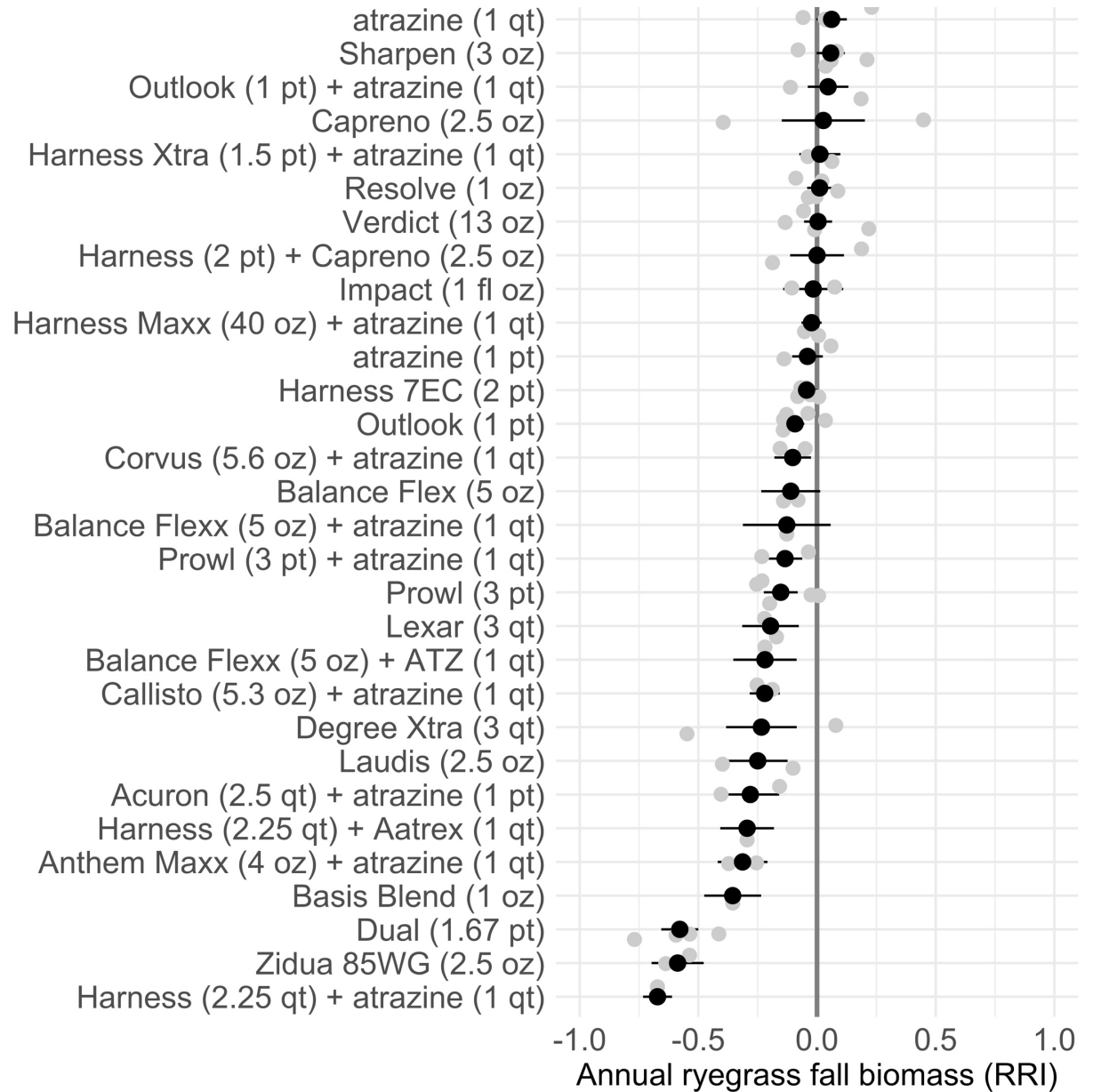
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Weed control & interseeding

Balancing management goals

- Risk of CC injury is high when interseeding 4-5 weeks after planting for many common corn herbicides (e.g., Acuron)
- Shorter-lived residual herbicide combinations may provide 2-4 weeks of weed control and still permit interseeding
- Short-lived residuals likely provide greater POST efficacy & management flexibility

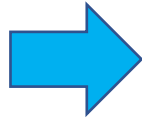


Residual herbicides

Relative sensitivity of cover crops (2019 - 2021)

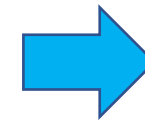
Cover crop spp.

- ✓ Taxonomic group
- ✓ Seed mass (mg)



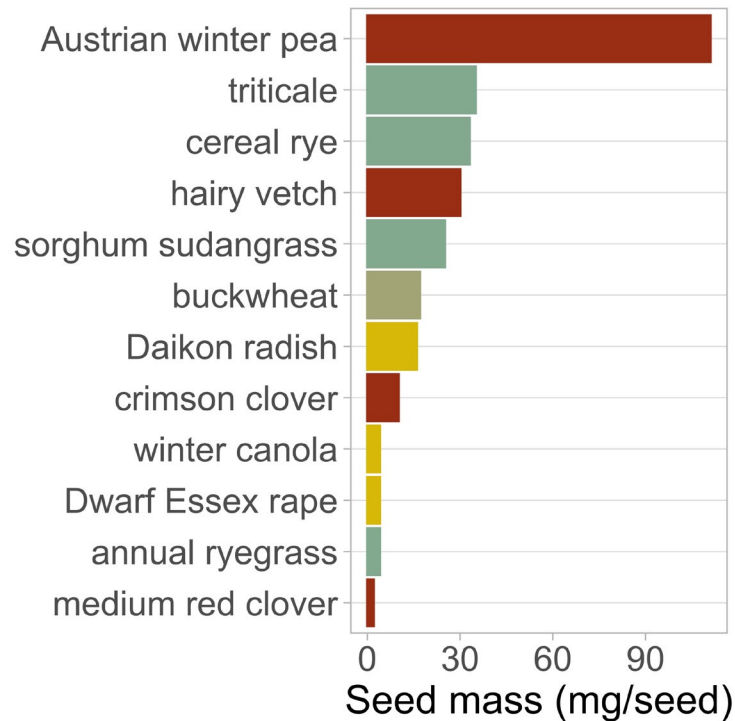
Dose response studies

- ✓ residual corn herbicides
- ✓ simulated half-lives

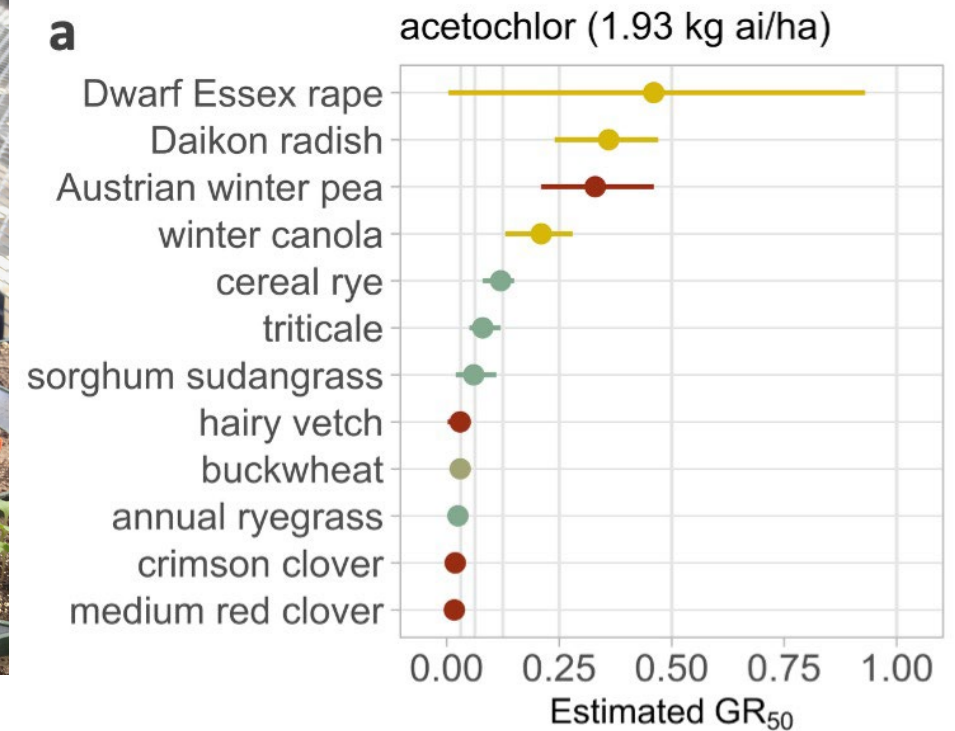


Relative sensitivity

- ✓ Based on 1X rates
- ✓ 50% biomass reduction



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Decision support tools

Cover crop relative sensitivity tables.

Lessons learned from screening

- ✓ Small-seeded legumes are highly sensitive to a range of herbicides
- ✓ Winter cereals are less sensitive than annual ryegrass to most herbicides
- ✓ Brassicas responded similarly among species and may be tolerant to several commonly used herbicides

TABLE. Relative sensitivity to G15 herbicides. Likelihood of injury:

Highest risk	4-5	Moderate risk	2-3	Lowest risk	>/< 1
Grasses	Zidua	Dual	Outlook	Harness	
Annual ryegrass	5	>5	>5	5	
Sorghum sudangrass	>3	>3	4	4	
Cereal rye	<1	>2	2	3	
Triticale	<1	>2	>2	>3	
Legumes					
Medium red clover	>2	>1	>2	>5	
Crimson clover	>2	>3	4	>5	
Hairy vetch	>1	>2	>3	5	
Austrian winter pea	<1	<1	<1	>1	
Brassica					
Winter canola	>4	<1	<1	>1	
Forage rape	>4	<1	<1	>2	
Daikon radish	>4	<1	>1	>1	
Polygonaceae					
Buckwheat	5	>2	>4	5	



Corn management & cover crop interseeding

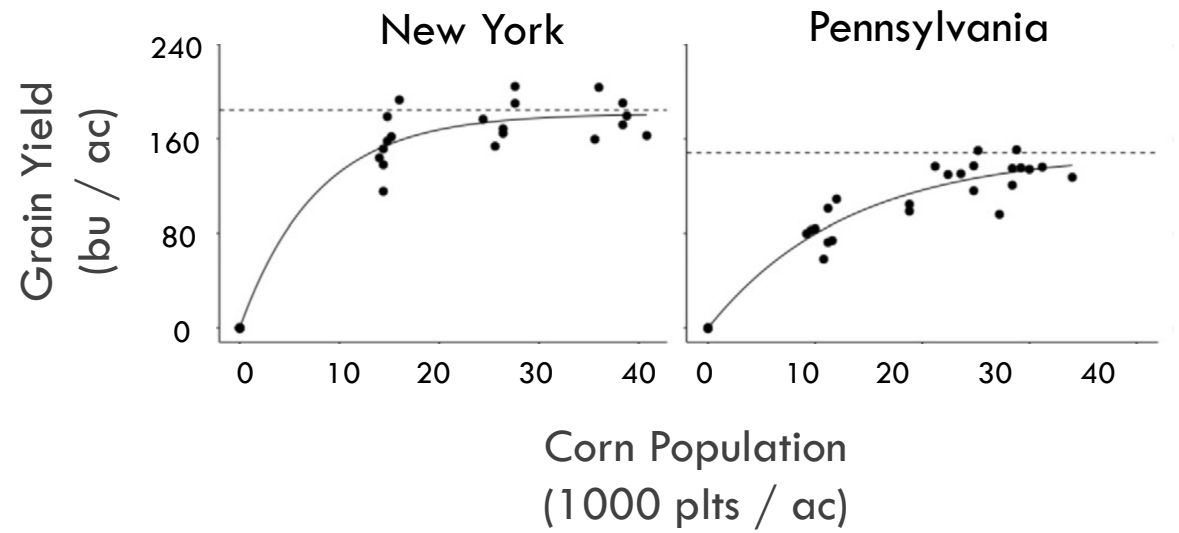
Cultural practices

Corn populations & flex-ear hybrids

- **Flex-ear hybrid** (def): alters (+/-) ear girth, length and kernel depth in response to environmental stress

Mid-Atlantic study (NY, PA, NY)

- Reducing seed drop by 10% (~28K) did not reduce yield of flex-ear hybrid
- Produced a measurable increase in light transmission in corn canopy.



Youngerman et al. (2018)

Youngerman et al. (2018)

Cultural practices

Leaf architecture & flex-hybrids

- **Open architecture:** flat leaf orientation captures sunlight and retains soil moisture (recommended for lower populations & poor soils)

NE SARE study (2020; PA & NY)

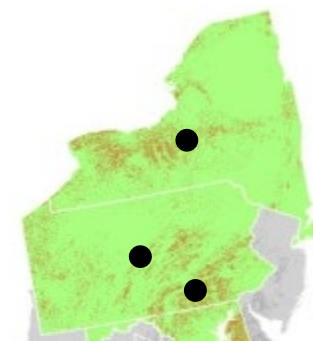
- At standard corn populations (32K) and row spacing (30"), biomass (ryegrass, red clover) was greater in determinate – upright variety



Determinate / Upright



Semi-flex / Open

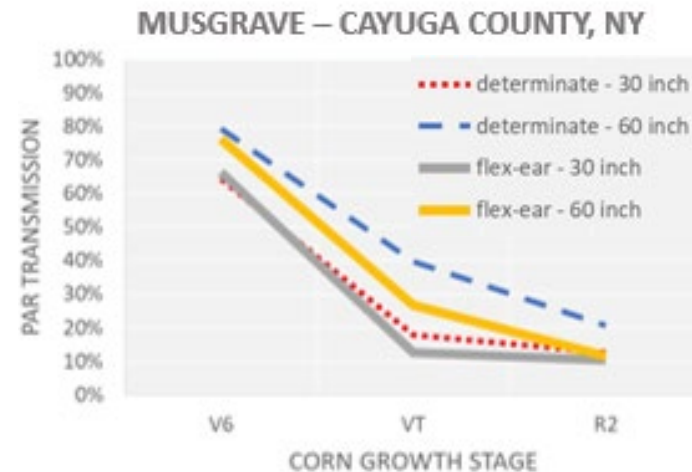
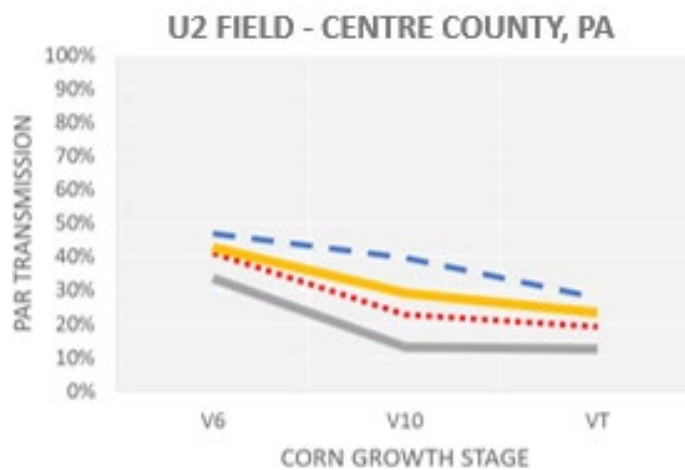


Cultural practices

Wide-row corn (60" row spacing): farmer-led interest in solar corridors & livestock integration

NE SARE study (2020; PA & NY) Wide-row (60" spacing)

- 2-fold increase in light transmission (PAR) at corn tassling
- Greater light transmission when using determinate/upright varieties



Cultural practices

Wide-row corn (60" row spacing): farmer-led interest in solar corridors & livestock integration

NE SARE study (2020; PA & NY)

Wide-row (60" spacing)

Ryegrass, red clover, cereal rye

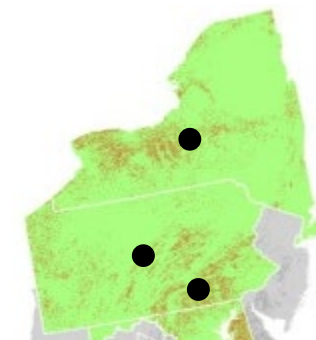
- Cover crop biomass was greater in determinate – upright variety
- Corn yield: 15 to 45% yield drag
- Weed pressure: 4-fold increase



60" Determinate/Upright



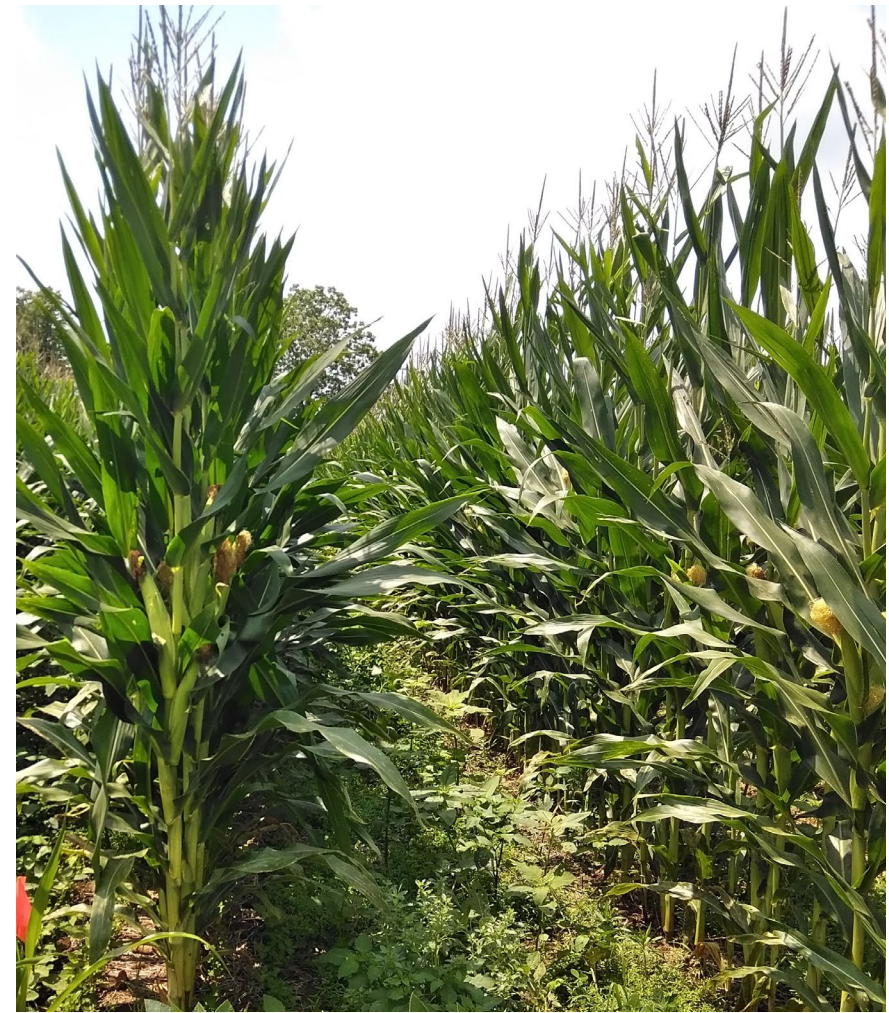
60" Semi-flex / Open



Wide-row interseeding

Observations on potential

- Return on investment will likely be limited to integrated livestock systems
- If CC will be livestock feed, herbicide options are limited to glyphosate, with few exceptions
- Mixtures of warm season covers will be needed to suppress late emerging weeds (buckwheat, millets, cowpea)
- Some cool season covers may go to seed and become volunteer weed issue



SUMMARY

- Early drill-interseeding holds potential in fall-GDD limited crop sequences
- Management goals will determine species selection & interseeding strategy
- Soil fertility and corn management practices will drive cover crop performance
- Weed control is a limiting factor and will constrain interseeding timing & species
- Try it on a few acres. Evaluate & adapt.
- Consult: farmer groups, land grants, SWCDs, NRCS, etc.



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ACKNOWLEDGEMENTS

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What is the biggest barrier to early (V3-V4) interseeding in your system?

Questions

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