Effects of Cover Crops on Weed Control in Soybean





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Effects of Cover Crops on Weed Control in Soybean

- Herbicide Resistant Weeds
- Need for Integrated Weed Management
- Weed Science Research at SIU
 - Cover crops and marestail suppression
 - Soybean residual herbicide interaction with cereal rye residue
 - Annual ryegrass termination with glyphosate



The definition of insanity is doing the same thing over and over again and expecting a different result. - Einstein

Evolution of Herbicide Resistance

- New group 15 resistant waterhemp population confirmed by University of Illinois
 - Dual (*s*-metolachlor), Outlook (dimethinamid-P), Zidua (pyroxasulfone), and Warrant (acetochlor)
- Waterhemp resistant to 7 different herbicide sites of action
 - Yet these chemistries still have large value to control other weeds
- Relying on herbicides and reliance on new herbicides and modes of action alone are not sustainable options for the future
- Need Integrated Weed Management Approach
- Using multiple herbicide sites of action + cultural weed control
 - Herbicides programs + narrower rows, shallow cultivation, **cover crops**

Marestail (Horseweed) Problems in Soybean

- Challenge in no-till soybeans
- Reliance on herbicides to control marestail before planting
- Evolved Resistance to Soybean Herbicides:
 - ALS (group 2) ex. Chlorimuron (Classic), Chloransulam (FirstRate).
 - EPSPS (group 9) Glyphosate (Roundup)
 - PSI (group 22) ex. Paraquat (Gramoxone)

Marestail (horseweed) Biology



Late Summer to Early Fall/ Spring Emergence

Fall/Spring Rosette Late Spring/Early Summer Bolting

y Late Summer/Early Fall Flower and Seed Rain Photos: Mizzou, UK, SIU, Mizzou

Cover Crops and Marestail

- Marestail is highly sensitive to competition
- Struggle to emerge when competing with other plants
- Marestail emergence and establishment occurs in seasons when winter cover crops are planted and are actively growing and able to compete
- Cover crops may be key in integrated control of marestail

Marestail Management



 Determine impact of fall-sown cover crops and herbicide applications on suppressing marestail emergence development, and growth before no-till soybeans.





Project Timeline

2017					2018								
Sept (Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct
Corn Harvest and Marestail Seeded	Fall CO Drilled and Fa Herbid Spraye	2 I Ill cide ed				S H S a T	pring Ierbicide prayed nd Rye erminated	LL Soybe (Pioneer T09L) Planted rows at	ean POS 37 App of 32 15" Libe	T lications 2 fl oz/A rty			Soybean Harvest

Treatments

- 1. Untreated Check
- 2. Winter-kill CC: 50 lb/A Oats + 3 lb/A Tillage Radish
- 3. Over-winter CC: 100 lb/A Cereal Rye
- 4. Fall Herb w/o Residual: 34 fl oz/A 2,4-D LV4 + 2 fl oz/A Clarity
- 5. Fall Herb w/ Residual: 8 fl oz/A Clarity + 4 oz/A Valor XLT + 1% v/v COC
- 6. Spring Herb w/o Residual: **34 fl oz/A 2,4-D LV4**
- 7. Over-winter CC w/ Fall Herb: 100 lb/A Cereal Rye + 2 fl oz/A Sharpen + 1 % v/v MSO
- 8. Light disk + Over-winter CC: **100 lb/A Cereal Rye**
- 9. Over-winter CC + Spring Herb w/o Residual: 100 lb/A Cereal Rye + 34 fl oz/A 2,4-D LV4
- 10. Weed-free Control (Fall and Spring): **34 fl oz/A 2,4-D LV4 + 2 fl oz/A Clarity + 21 fl oz/A Roundup Weathermax**

Data Collection

0.25 m² Permanent Count and Pull



Individual Plant Diameter and Leaf Number



Data Collection

- Cover crop and weed biomass
- Weed control ratings (0-100) throughout fall and before any herbicide applications
- Soybean yield

Cereal Rye Biomass



Illinois = 1039 lbs/A, Burndown 4/27/18



Kentucky = 3243 lbs/A, Burndown 4/26/18

Kansas = 1124 lbs/A

Effect of Cereal Rye on Cumulative Marestail Emergence



PRIOR TO SOYBEAN PLANTING (IL + KY + KS) AFTER SOYBEAN PLANTING (IL + KY)

UNTREATED CEREAL RYE

Effect of Any Herbicide on Cumulative Marestail Emergence



■ NO HERBICIDE ■ ANY HERBICIDE

Effect of Fall Residual Herbicide on Cumulative Marestail Emergence



■ FALL HERBICIDE WITHOUT RESIDUAL ■ FALL HERBICIDE WITH RESIDUAL

Individual Plant Diameter and Leaf Number

- KS marestail in cereal rye w/ no fall herbicide had fewer leaves than marestail in no rye and no herbicide
- IL and KY had similar diameters and leaf numbers across treatments
 - Winter-killed marestail
 - Number of plants available was limited
 - Restricted true comparison across treatments

KS + KY Soybean Yield



SIU Soybean Yield



Take-away from Year 1

- Cereal rye reduced marestail emergence by 56%
- Fall herbicide with residual reduced marestail emergence by 53% compared to fall herbicide without residual
- In most instances across states, cover crops did not reduce soybean yields.
- The combination of a cereal rye cover crop and herbicides may be an effective integrated approach
 - Control marestail before soybean
 - Slowing the development of herbicide resistance
- Repeating in 2019





University of Missouri

SIU

Duration of residual herbicide efficacy in cover crops in Liberty Link soybeans (<u>SIU Data Only</u>)

- Objective: Test interactions of soil residual herbicides and cover crop residue to develop recommendations for the best residual herbicides in cover crop systems.
- Cereal Rye Drilled: Oct 9, 2017 @ 60 lbs/A
- Cereal Rye Terminated: April 10, 2018 @ F8 or flag leaf stage (about 18 inches)
- Soybean Planted: May 10, 2018
- PRE herbicides applied: May 10, 2018
- Carbondale Rainfall May 16-20, 2018: 2.73 inches



Spray Pattern Cereal Rye

Spray Pattern No Cover Crop



1,660 lbs Dry Matter/A



 No statistical difference in weed control with or without cereal rye

DAYS UNTIL 4" WATERHEMP



CARBONDALE

WATERHEMP DENSITY (PLANTS/SQUARE FT@ 4" Height)



CARBONDALE

Take-away from Year 1

- Herbicide w/ two sites of action: **Fierce** (Valor + Zidua)
- Of the group 15 herbicides: **Warrant** and **Zidua** controlled waterhemp better than Dual and Outlook in rye residue
- Greater rye biomass may enhance weed suppression compared to no cover crop
- Greater rye biomass may change the efficacy of some residual herbicides

Annual Ryegrass Controversy

- May be considered one of the most herbicide-resistant weeds world wide
- Documented annual ryegrass resistance in United States (weedscience.org)
 - Group 1 (ACCase) including Select Max (Clethodim), Poast Plus (Sethoxydim), Assure II (quizalofop), Axial XL (pinoxaden)
 - Group 2 (ALS) including Raptor (imazamox), Osprey (mesosulfuron), PowerFlex HL (pyroxsulam)
 - Group 9: Roundup (glyphosate)
 - Group 10: Liberty (glufosinate)
 - Group 15: Define (flufenacet)
 - Group 22: Gramoxone (Paraquat)
- Documented 2, 3, and 4 way multiple resistance
- Risks: Introduces seedbank, potential shift to herbicide resistance

Annual Ryegrass Controversy

- Benefits in the roots: Scavenges nitrogen, improves soil structure, and air and water infiltration
- The Right Window to Spray
 - Spray herbicides from late March to mid-April
 - Target plant heights of 6 to 9 inches
 - Ryegrass should be actively growing when:
 - Soil temperatures > 45°F
 - Daytime temperatures > 55°F
 - Nighttime temperatures > 40°F for 3 days
 - Do not spray if expected nighttime temperatures are not at least 40°F for 3 days after the application
 - Soil moisture allows for field access with sprayer

(Oregon Ryegrass Growers Seed Commission)





Annual Ryegrass Burndown Trial 2016 + 2017

- Objective: Evaluate control of annual ryegrass with
 - Roundup WeatherMax under ideal application
 - conditions at three growth stages
- Planting date: 9/18/2015 and 10/14/2016
- Applications: 12 GPA at 30 PSI
- 44 fl oz/A Roundup WeatherMax



Factors Evaluated

- Four Varieties: Assist, Coldsnap, Fria, King @ 25 lb/A
- Termination timings: 1-node; 2-nodes; 3-nodes
- Nozzle Type: <u>XR 8002</u> (fine droplets) and <u>TTI 11002</u> (ultra coarse) @ 30 psi
- Dicamba DGA (1.5 fl oz/A Clarity) in Tank-mix: Dicamba (TTI nozzles only) and No Dicamba



	tillers /	/ leaves /	leaves /	nodes /	1st node	2nd node	3rd node	plant
	plant	tiller	stem	plant	ht inches	ht inches	ht inches	ht inches
App	Α							
Assis	st 2-4	3-4	4-5	0-1	0-1.25			6-10
Cold	snap 2-4	2-3	2-4	0-1	0-1			8-10
Fria	2-6	2-3	2-4	0-1	0-1			6-8
King	3-4	2-3	3-4	0-1	0-0.5			8-10
Appl	В							
Assis	st 2-4	3-5	4-5	1-2	1-1.75	0-0.5		8-11
Cold	snap 2-4	3-4	4-5	2	1.5-2	0.5-1		10-13
Fria	2-4	3-4	4-5	0-2	0.75-1	0-0.25		10-12
King	2-3	3-4	4-5	1-2	1	0.25		8-10
App	С							
Assis	st 2-4	4-5	6-7	3-4	4.5-5	3	0.25-1.5	12-15
Cold	snap 2-4	4-6	6-7	3-4	7-12	3-8	0.5-4	14-18
Fria	2-4	4-5	5-6	3-4	3-3.5	2-2.5	0.5-1	12-15
King	2-3	3-4	6-7	3	4	2-2.5	0.25-0.5	12-15



Data Collection

- Intervals: 14 and 28 days after glyphosate application (14 and 28 DAT)
- Oven-dry biomass: lbs dry matter/A
- Visual Percent Control Ratings:
 - 0 = No burndown control; 100 = Complete burndown control

Biomass 28 DAT

- No significant differences in biomass
 - By Nozzle Type
 - By Variety
 - Dicamba Present in Tank-mix
- Significant differences in biomass
 - By Year
 - By Node

Average Biomass by Termination Timing 28 DAT



Percent Control

- No significant differences in control
 - By Nozzle Type
 - By Variety
 - Dicamba Present in Tank-mix
- Significant differences in control
 - By Year
 - By Node

Average Burndown Control by Year 28 DAT



Average Burndown Control by Year and Termination Timing 28 DAT



2016 Soil and Air Temperature 3 DAT



2017 Soil and Air Temperature 3 DAT



Plant Heights by Termination Timing

Termination Timing	2016 Plant Height (in)	2017 Plant Height (in)
1 Node	10-11	6-10
2 Node	12-17	8-13
3 Node	20-26	12-18

Would Saturated Soil Influence Translocation?





April 12, 2016

April 28, 2017

What Does Varying Control Look Like?





75%

Summary of Results

- No differences in control based on Variety, Nozzle Type, or Dicamba Presence.
- Differences in burndown control were dependent on year and application timing
- Temperatures and plant height at termination didn't explain lack of control in 2017
- Highest average control was 92% at 2nd Node in 2016,
 - Sounds good, but 8% will go to seed and become weed if not controlled with second application

Use with Caution and Careful Management

- Consider chance of wet spring
 - May not be able to get into the field to spray and ryegrass may get too big.
- Choose higher rates of glyphosate: 1.5 to 2.5 lbs ae/A (44 fl oz to 71 fl oz/A Roundup Powermax or Weathermax)
- Use AMS
- Spray mid-day to get good translocation
- Spray when night temps are above 40 °F
- Even the right weather and growth stage may not always equal successful burndown
- Plan ahead for two applications

Options for Incomplete Annual Ryegrass Termination

- Escapes in Soybean
 - Roundup Ready 1, 2, and Roundup Ready 2 Xtend use another shot of labeled rate of Roundup in crop
 - Liberty Link, use Select Max, Poast Plus, or Fusilade DX
- Escapes in Corn
 - Re-spray Roundup in Roundup Ready Corn
 - Atrazine and Callisto can reduce Roundup effectiveness by 40%
 - Simazine and other residuals are okay with Roundup
 - Can use Accent Q (nicosulfuron), Steadfast Q (nicosulfuron + rimsulfuron), or Option (foramsulfuron) on escapes

Final Thoughts

- Cover crops are great tools for soil conservation and soil health
- May play integral role in sustainability and prolonging effectiveness of herbicide technology
- Benefits of cover crops come with challenges
- Continue learning how to manage for success

Questions?