Cover Crops Herbicide Issues

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Plan Ahead

- How are you going to kill it?.....if needed
- Have a plan
- Have a back-up plan

Ryegrass control

- Different ryegrass varieties will respond differently to herbicides
- Utilize Roundup Ready crops for easy control of escapes

Not all herbicides work well to kill cover crops in cool weather

19 varieties, +different herbicides----576 plots

Selecting the right herbicide provides excellent control

Ryegrass
Spring Burndown Management

- Match herbicides to cover crop
  - Smaller easier to kill, less mulch
  - Warm weather greatly increases control
- Plan on 2 herbicide applications
  - May not be needed, but plan ahead
- Know your planters limitations
  - concerns over wet soils, dry soils, getting a crop stand

Spring Management

- **Annual ryegrass is easiest to kill pre-joint**
  - Jointing occurs at 7-10” in height
  - Date varies with location and season
- **Early control**
  - maximizes nitrogen release and decomposition rate
  - makes easier planting, conserves moisture

Plant growth stage

- Boot stage
  - Very poor time to spray
- Flowering stage
  - After pollen drop, easier to kill plant
  - May still make viable seed
  - Large amount of residue

Annual ryegrass is
6-7 months old April 1
With extensive root
system

4 inch tall ryegrass CAN have
roots 36-48 inches deep

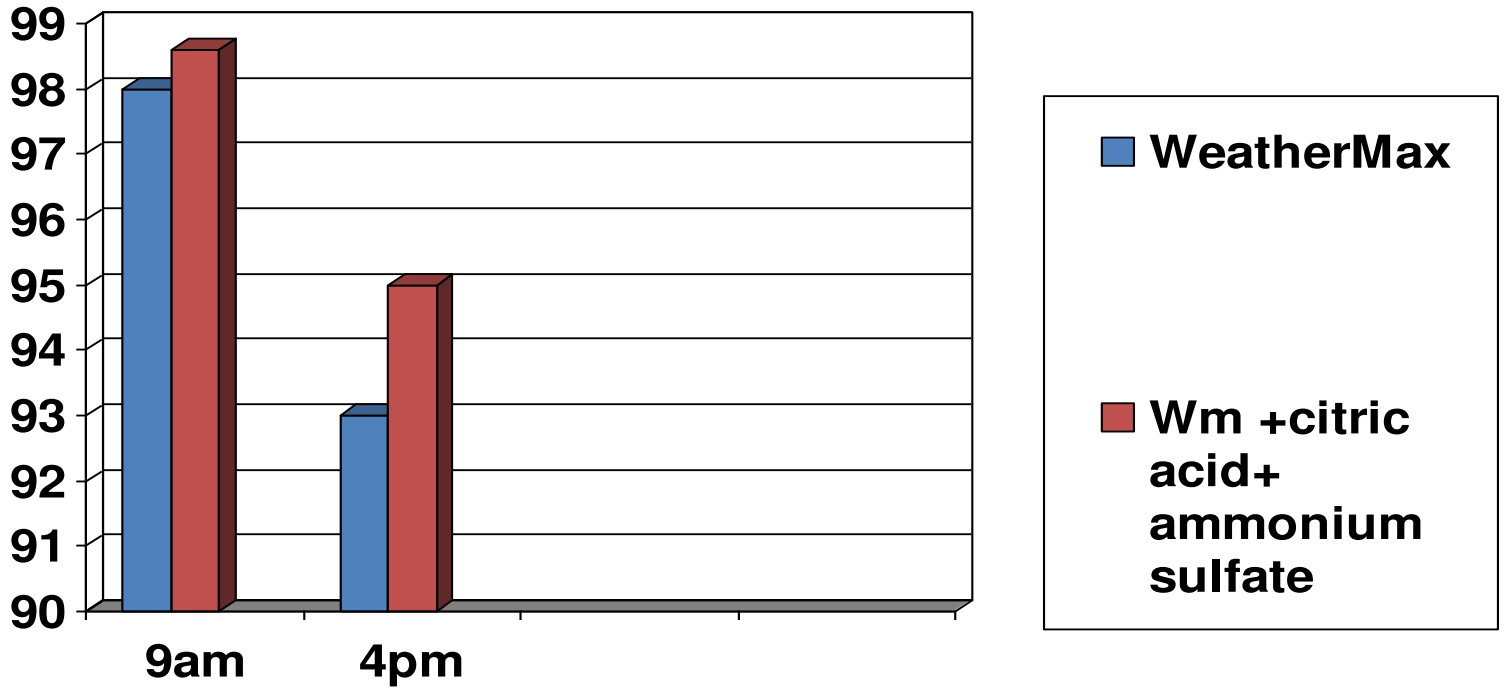
Treat it like an established
Forage grass-tall fescue
or bromegrass

Controlling annual ryegrass
What we have learned

- Systemic herbicides are VERY temperature sensitive
  - Plant must be actively growing to work
  - Annual ryegrass does not translocate when temperatures are <40 and/or weather is cold & cloudy
- Glyphosate products require translocation

  for over **4 hours before sunset** after application
  Which means no spraying after 2pm in cold weather

Time of day glyphosate



Temperatures 60 day and 40 night
3 replications

Plumer, U of Il

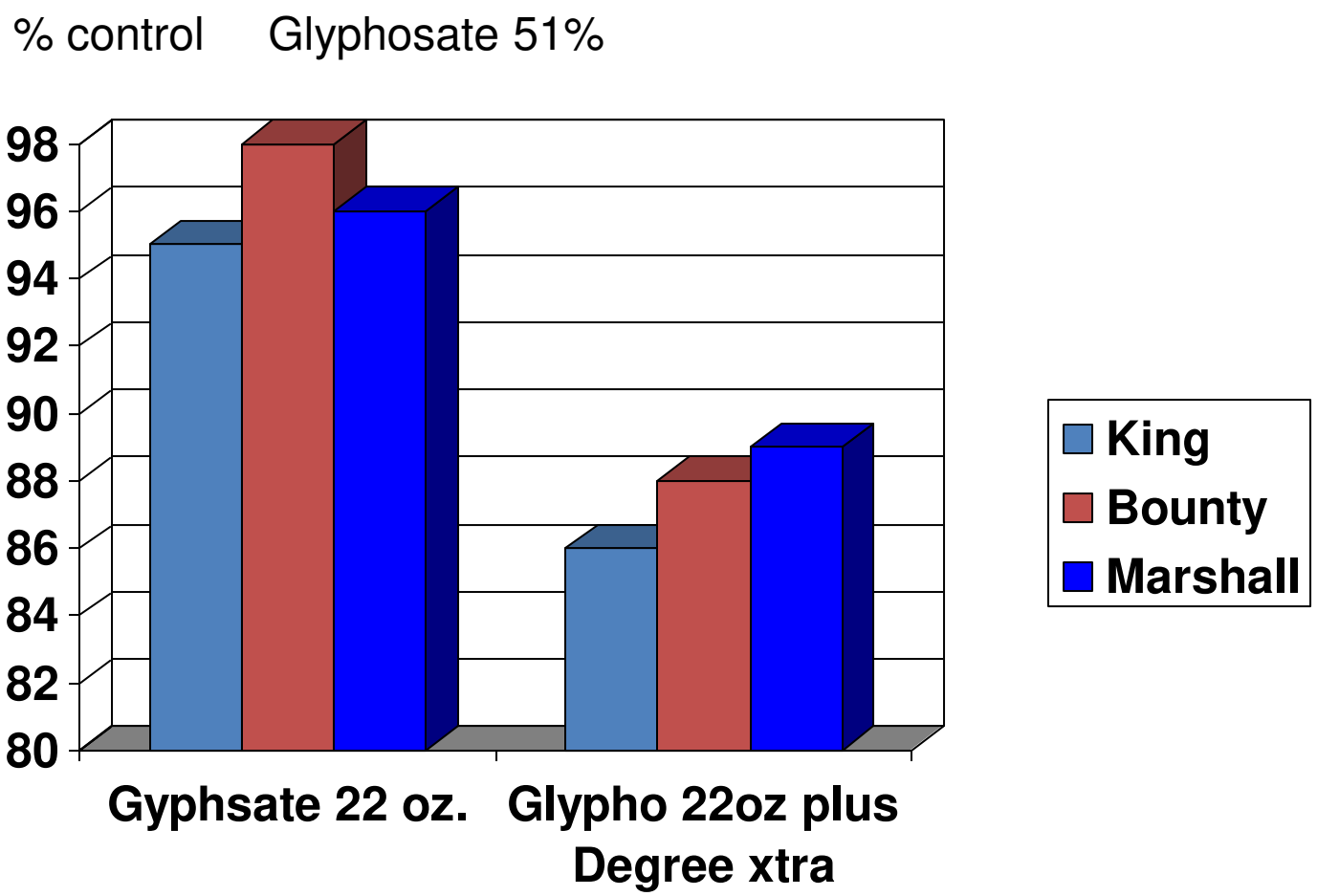
Glyphosate translocation Issues in Spring

- The minimum recommended rate is 1.25-1.5 lbs. acid equivalent
- only works when plant is actively growing
  - Need sunny days
  - Above 50 degree temperatures
  - Cold weather means spraying morning - early afternoon (night temps < 40)
  - Wait at least 2 days after any freezing weather to spray
  - NO atrazine, triazines or Callisto in mix
- Use additives
  - AMS in tank first
  - No more than15 gallons water/ acre for glyphosate
  - May add residuals like rimsulfuron(Basis) and proxasulfone(Zidua &Fierce) for increased control

How will you Kill It?

Herbicide…Avoid antagonism!

- Consider the modes of action



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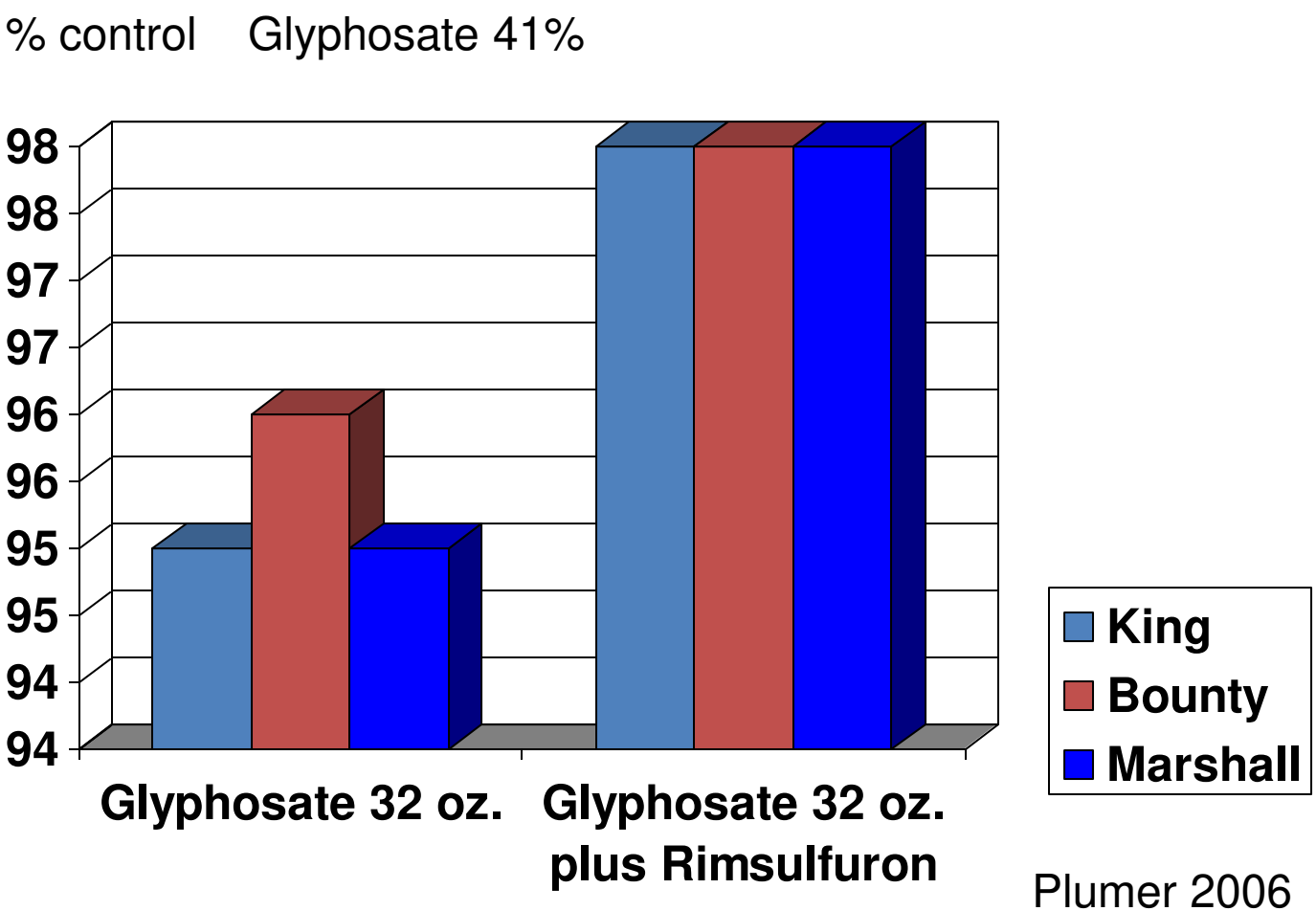


Plumer 2006

What to mix?

- NEVER mix atrazine or Callisto
- Can mix these herbicides;
  - Basis Blend Q
  - Resolve Q
  - 2,4-D
  - Princep
  - Sharpen??? Not early too much damage
  - Corvus?

Annual Ryegrass
Herbicide trial

treatment	Control at 36 das
gly51 22oz	9.7
gly 51 32oz +2,4-D 16oz	10
gly 51 32oz + Callisto 7oz	6.3
gly51 32oz + Prowl H2O 3 pt	10
gly51 32oz + resolve 2 oz.	10
gly51 32 oz + Basis 1 oz	10
gly51 32oz + Balance Pro 4oz	10
gly 51 32 oz	10

Glyphosate + AMS+

surfactant+ 10 gal/a

LSD 0.05 0.6

Plumer, U of Il.

Sprayed at 1st to 2nd joint stage, in sunny morning, mid April, 6 reps

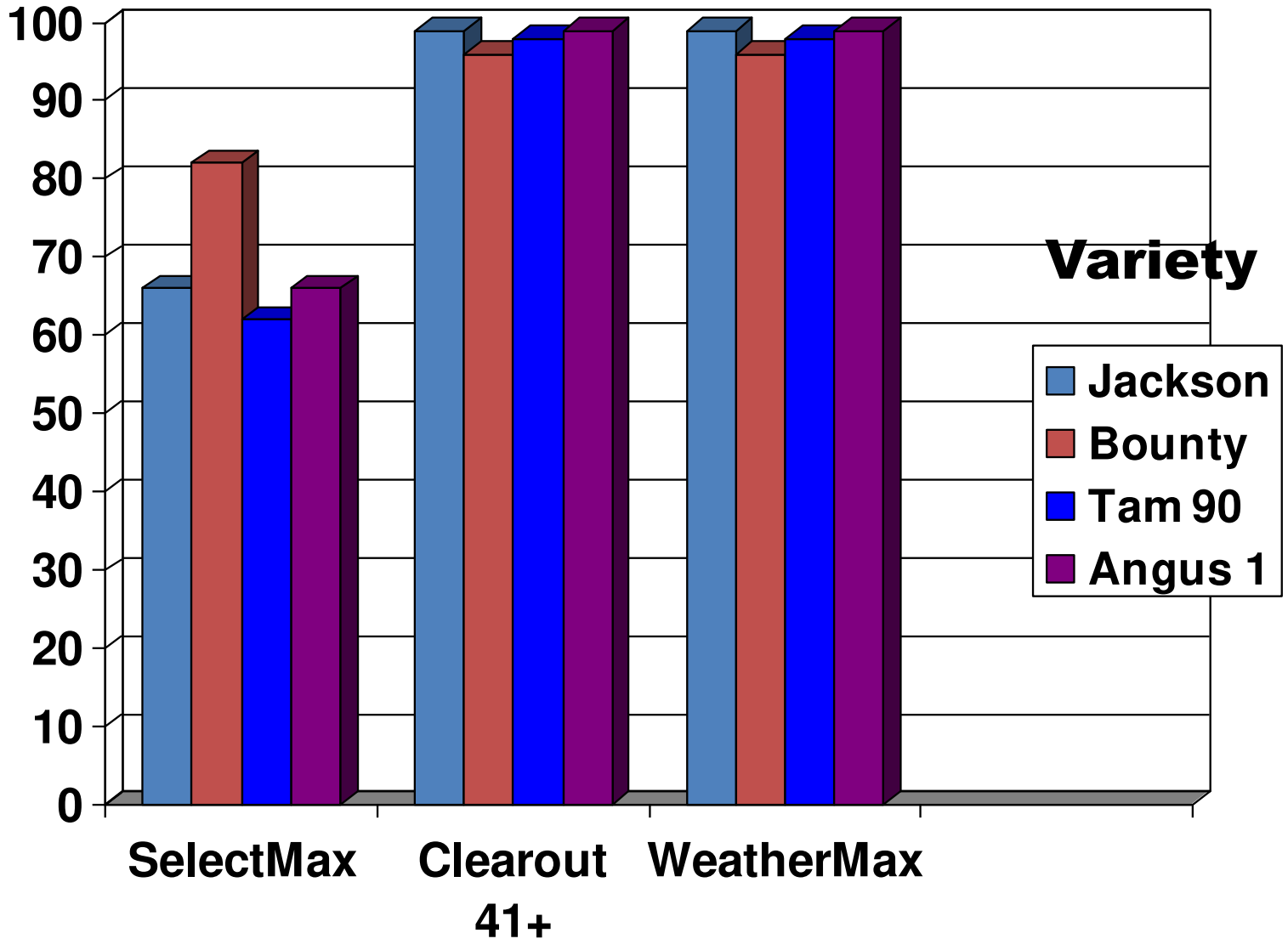
Ryegrass Herbicide Control

Gramoxone Inteon	3 pt	78%
Gramoxone Int / Aatrex /Princep	3 pt/2 qt/1 qt	85%
Round-up W.MAX	22 oz	98%
Round-up W.MAX / Degree Xtra	22 oz/3 qt	86%
Steadfast	.75 oz	47%
ClearOut 41 plus	1 qt.	93%
ClearOut 41 plus	1.5 qt	98%
ClearOut 41 plus /Basis	1.5 qt/.33 oz	98%

10 gal/a + AMS with glyphosate

R.Hines, M.Plumer

% control Sprayed April 16, all varieties jointed, rating 30 days after spraying



Select Max at 12 0z/a Clearout and Weather Max at 1.22#ai/a

Annual Ryegrass at boot stage of growth

Variety	Gramoxone 48 oz	Liberty 32 oz	Power Max 40 oz	PowerMax Sharpen	PowerMax Corvus
Gulf	90	15	98	95	99
King	50	15	98	98	95
KB Royal	70	10	98	95	95
Marshall	45	10	98	98	95
Bounty	80	10	99	98	98

Plumer, 2012

Fixing a poor spray job in cold weather

- Don’t respray glyphosate?
  - Damaged plant may not translocate

- Full rate of Gramoxone in 30 gallon water
  - Add Basis Blend Q for corn..

OR

- Followup spray in 2-3 weeks if needed when weather is warmer --Select, Accent, Steadfast Q, WITH full additive package !!

Intense ryegrass pressure will injure corn

Gramoxone Inteon + Bicep

Cornfield after treatment with Accent

HOW to **FAIL** in Ryegrass Control

- Spray in afternoon with cold or cloudy weather
- Use AI nozzles with coarse droplets
- Use AMS substitute product
- Use 15-20 gallons of water per acre
- Dump glyphosate in before AMS
- Mix other herbicides with glyphosate

Hairy Vetch, Clovers, and Rapeseed

- 2-4-D will be extremely effective

Cereal Rye

- Cereal rye can easily be killed with chemicals

- Can be crimped once in the reproductive stage
  - Cereal rye after pollen drop
  - Hairy Vetch in full bloom

Be able to spray when needed!!

Plan Ahead

- What Herbicides did you use on you cash crop?

Herbicide Carryover concerns

- Plan in advance what fields will go to cover crops
- Plant growth may be inhibited
  - Poor fall establishment
  - Poor fall growth
  - Increased winter kill/damage
  - High pH may cause carryover
- Know what herbicides and restrictions

Herbicide Issues

- Brassicas very sensitive
  - Classic, Pursuit, Scepter, Warrant, Python, Optill and mixes like Canopy
  - Little guidance on labels
- Late post application may kill all cover crops
  - Including grasses, legumes

Herbicides with Carryover Concerns (not complete)

- Authority
- Balance Flexx
- Callisto
- Canopy
- Capreno
- Classic
- Corvus
- Extreme
- First Rate
- Flexstar GT
- Hornet
- Liberty
- Lumax
- Optill
- Prefix
- Pursuit
- Python
- Reflex
- Scepter
- Surestart
- Valor
- Warrant
- Zidua

Cover Crop Response to Corn and Soybean Residual Herbicides

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School of Agriculture, Western Illinois University, Macomb, IL

Introduction

Cover crops are being included more frequently in corn and soybean cropping systems to suppress weeds and improve soil quality. Ideally cover crops should be sown before mid-September to allow good establishment and biomass accumulation. Perhaps the optimum time for cover crop planting is to interseed the cover crops about the time of canopy closure (Roth et al. 2012). This allows the cover crops to become established under the canopy without competing with the cash crop, and to then grow rapidly as the corn or soybean crop matures.

One of the common questions asked by producers interested in planting cover crops is how they will respond to herbicide residues. Pesticide labels rarely include specific rotation restrictions for many of the species commonly used as cover crops, and there are few Extension resources that provide information (Curran and Lingenfelter 2012). Some herbicides are likely to persist in relatively large quantities into the fall and may interfere with cover crop growth, or may be injurious to cover crops planted near the time of canopy closure.

Objective

To evaluate the effect of corn and soybean herbicides expected to be injurious to cover crops on representative cover crop species.

Materials and Methods

The project was divided into two experiments: 1) cover crops following corn herbicides and 2) cover crops following soybean herbicides. The corn herbicide study was established on a Sable silty clay loam soil with 1.8% organic matter. The soybean herbicide study was established on a Osco silt loam soil with 2.8% organic matter. Each experiment was in a randomized complete block design with four replications. Plots were 3 x 9 m.

Herbicides were applied on Oct 4, 2013 using a backpack sprayer with a 137 cm boom in a carrier volume of 160 L ha^{-1} using TTI 11002 nozzles. At the time of application the soil temperature was 26 C and the soil was wet. On Oct 5, 2013, 1.8 cm of rain incorporated the herbicide.

Herbicides were applied at four doses (labeled rate and 50%, 25%, and 12.5% of the labeled rate). Corn herbicides and doses (g ha^{-1}) were: 2,4-D amine (1120, 280, 70, 17.5), atrazine (1120, 560, 280, 140), dicamba (1120, 280, 70, 17.5), isoxaflutole (48, 24, 12, 6), mesotrione (210, 105, 53, 26), and one dose of thiencarbazone-methyl+tembotrione (7.5+37.8). Soybean herbicides were: chlorimuron-ethyl (17.5, 8.8, 4.4, 2.2), cloransulam methyl (35.3, 17.7, 8.8, 4.4), flumioxazin (107, 53.5, 26.8, 13.4), fomesafen (329, 165, 82, 41), pyroxasulfone (240, 120, 60, 30), sulfentrazone (420, 210, 105, and 53), and sulfentrazone + chlorimuron-ethyl (420+52.5, 210+26, 105+13, 53+6).

Cover crop species were planted in 76 cm rows perpendicular to the plot length. Soft red winter wheat (53 kg ha^{-1}), cereal rye (65 kg ha^{-1}), winter rapeseed (3 kg ha^{-1}), red clover (7 kg ha^{-1}), Austrian winter pea (58 kg ha^{-1}), hairy vetch (9.7 kg ha^{-1}), radish (6 kg ha^{-1}), crimson clover (2.6 kg ha^{-1}), annual ryegrass (1.2 kg ha^{-1}), and turnip (1.3 kg ha^{-1}) were planted on October 9, 2013.

Visual evaluations of injury on a scale of 0 (no injury) to 100 (plant death) were made 3 weeks after planting. Data were analyzed using ARM and graphs were fit to data for some species-herbicide combinations using a 2-parameter power equation in Sigma Plot 10.0.

Figure 1. Example of plot layout. This plot was treated with

Results

Table 1. Cover crop response to herbicide residue. Ratings represent response to maximum dose. None = no response, Slight = 0-20% injury, Moderate represents 21-40% injury and Severe represents >41% injury.

	Cereal Rye	Wheat	Annual Ryegrass	Crimson Clover	Red Clover	Austrian Winter Pea	Hairy vetch	Radish	Winter Rape	Turnip
2,4-D amine	None	None	None	None	None	None	None	None	None	None
atrazine	None	None	Slight	Moderate	Moderate	None	Slight	Slight	Slight	Slight
chlorimuron	None	None	Slight	Slight	None	Slight	Slight	Moderate	Moderate	Moderate
cloransulam	None	None	Slight	Slight	Slight	None	Slight	None	None	Severe
dicamba	None	None	Slight	Severe	Severe	Severe	Severe	Severe	Moderate	Moderate
flumioxazin	None	None	None	Slight	Slight	None	Slight	None	None	None
fomesafen	None	None	None	Slight	Slight	Severe	Slight	Severe	Slight	Severe
isoxaflutole	None	None	Slight	Severe	Severe	Severe	Moderate	Severe	None	Severe
mesotrione	None	None	Slight	Severe	Severe	Severe	Severe	Severe	Severe	Severe
pyroxasulfone	None	None	Moderate	None	None	None	Slight	None	None	None
sulfentrazone	None	None	Slight	Slight	Slight	Slight	Moderate	Severe	Moderate	Severe
sulfen.+chlorim.	None	None	None	Slight	None	Severe	Slight	Severe	Severe	Severe
TCM+tembo.	None	None	Moderate	Slight	None	None	Slight	Slight	Slight	Slight

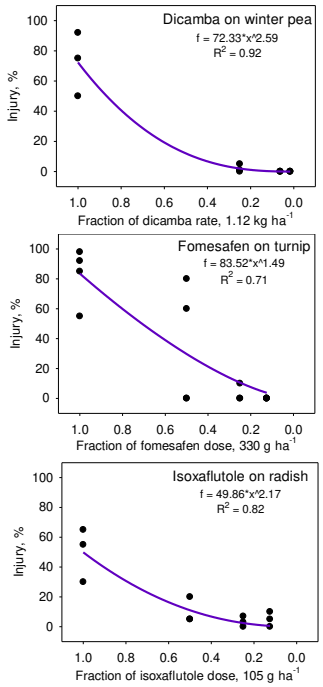

Figure 2. Cover crop response to herbicide dose simulating a series of herbicide half-

Discussion

- Our goal in conducting the research was to develop response curves for each species/herbicide combination as shown in Figure 2. However, because of a relatively late planting date and limited growth of some species, response across replications for most herbicide-cover crop species was inconsistent and did not support the development of curves.
- The ratings in Table 1 indicate crop response to herbicides at the full dose and represents a worst case scenario. The amount of injury to the cover crops was less than we had expected.
- Injury was slight or none for most herbicides at 12.5% of labeled rate, which represents 3 half-lives (see Figure 2 for examples). Exceptions to this included chlorimuron and "sulfentrazone + chlorimuron" on turnip where injury was moderate.
- The mustard species (radish, winter rapeseed, and turnip) were the most sensitive of the species we evaluated (Table 1).

References

- Curran and Lingenfelter, (2012), Herbicides and Fall Cover Crop Establishment, Penn State Extension, ttp://extension.psu.edu/plants/crops/news/2012/08/herbicides-and-fall-cover-crop-establishment
- Gruver, (2010), Cover Crops for the 21st Century, Midwest Cover Crops Council, http://www.mccc.msu.edu/states/illinois.html

Acknowledgements

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Figure 3. Radish showing bleaching in a plot treated with mesotrione

Figure 4. Winter rapeseed treated with sulfentrazone+chlorimuron (420+52.5 g ha^{-1}) showing symptoms characteristic of ALS-inhibiting herbicides.

Figure 5. Austrian winter pea in a plot treated with dicamba (1120 g ha^{-1}) showing twisting.

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2,4-D amine	None	None	None	None	None	None	None	None	None	None
atrazine	None	None	Slight	Moderate	Moderate	None	Slight	Slight	Slight	Slight
chlorimuron	None	None	Slight	Slight	None	Slight	Slight	Moderate	Moderate	Moderate
cloransulam	None	None	Slight	Slight	Slight	None	Slight	None	None	Severe
dicamba	None	None	Slight	Severe	Severe	Severe	Severe	Severe	Moderate	Moderate
flumioxazin	None	None	None	Slight	Slight	None	Slight	None	None	None
fomesafen	None	None	None	Slight	Slight	Severe	Slight	Severe	Slight	Severe
isoxaflutole	None	None	Slight	Severe	Severe	Severe	Moderate	Severe	None	Severe
mesotrione	None	None	Slight	Severe	Severe	Severe	Severe	Severe	Severe	Severe
pyroxasulfone	None	None	Moderate	None	None	None	Slight	None	None	None
sulfentrazone	None	None	Slight	Slight	Slight	Slight	Moderate	Severe	Moderate	Severe
sulfen.+chlorim.	None	None	None	Slight	None	Severe	Slight	Severe	Severe	Severe
TCM+tembo.	None	None	Moderate	Slight	None	None	Slight	Slight	Slight	Slight

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Trade Name	Common Name	Cereal Rye	Wheat	Annual Ryegrass	Crimson Clover	Red Clover	Austrian Winter Pea	Hairy vetch	Radish	Winter Rape	Turnip
2,4-D amine	**many**	None	None	None	None	None	None	None	None	None	None
atrazine	**Aatrex**	None	None	Slight	Moderate	Moderate	None	Slight	Slight	Slight	Slight
chlorimuron	**Classic**	None	None	Slight	Slight	None	Slight	Slight	Moderate	Moderate	Moderate
cloransulam	**Firstrate**	None	None	Slight	Slight	Slight	None	Slight	None	None	Severe
dicamba	**Clarity**	None	None	Slight	Severe	Severe	Severe	Severe	Severe	Moderate	Moderate
flumioxazin	**Valor**	None	None	None	Slight	Slight	None	Slight	None	None	None
fomesafen	**Reflex**	None	None	None	Slight	Slight	Severe	Slight	Severe	Slight	Severe
isoxaflutole	**Balance**	None	None	Slight	Severe	Severe	Severe	Moderate	Severe	None	Severe
mesotrione	**Callisto**	None	None	Slight	Severe	Severe	Severe	Severe	Severe	Severe	Severe
pyroxasulfone	**Zidua**	None	None	Moderate	None	None	None	Slight	None	None	None
sulfentrazone	**Authority Spartan**	None	None	Slight	Slight	Slight	Slight	Moderate	Severe	Moderate	Severe
sulfen.+chlorim.	**Canopy**	None	None	None	Slight	None	Severe	Slight	Severe	Severe	Severe

Months to plant forage crops after herbicide application on soybean

		NON-LEGUME FORAGE CROPS										LEGUME FORAGE CROPS					
		ANNUAL RYEGRASS	BARLEY	BUCKWHEAT	CEREAL RYE	OATS	PEARL MILLET	SORGHUM	TRITICALE	WHEAT	RADISH	ALFALFA	CLOVER	COWPEA	FIELD PEA	VETCH	MAX ROTATION (a)
PREPLANT-INCORPORATED	Prowl H2O	10, 12 (m)	4 (q)	12	12	12	12	10, 12 (m)	12	4 (q)	12	12	12	0	12	12	12 (f)
	Trifluralin (Trefian TR-10)	12, 14 (m)(q)	12, 14 (m)(q)	5	5	12, 14 (m)(q)	12, 14 (m)(q)	12, 14 (m)(q)	5	5	5	5	5	5	5	5	12, 14 (m)(q)
PREEMERGENCE HERBICIDES	Authority Assist	30 (b)	9.5	30 (b)	4	18	30 (b)	18	30 (b)	4	30 (b)	12	30 (b)	30 (b)	30 (b)	30 (b)	30 (b)
	Authority MTZ	18	4	18	18	18	18	12, 18 (c)	18	4	18	12	18	18	18	18	18
	Boundary 6.5 EC	12	4.5, 8 (d)	12	12	12	12	12	12	4.5, 8 (d)	18	4.5	12	12	12	12	18
	Dual II magnum	12	4.5	(e)	4.5	4.5	12	12	12	4.5	2 (f)	4	9	12	12	12	12
	Enlite (g)	4	4	30	4	12	30	9	30	4	30	12	12	9	9	30	30
	Envive (f)(h)(i)	4	4	30	4	30	30	10	30	4	30	12	18	12	12	30	30
	Fierce	(j)	(j)	(j)	(j)	(j)	(j)	(j)	(j)	(j)	12	(j)	(j)	(j)	(j)	(j)	12
	FirstRate (f)	18	12	18	18	9	18	9	18	4	18	9	18	18	9	18	18
	Gangster	(b)	(b)	(b)	(b)	9	(b)	9	(b)	3	(b)	(b)	(b)	(b)	9	(b)	30
	INTRRO	(e)	(e)	(e)	(e)	(e)	(e)	(e)	(e)	(e)	(e)	(e)	(e)	(e)	(e)	(e)	(e)
	Lorox DF	4	4	12	4	4	12	0 (f)(l)	12	4	4	4	4	4	4	4	12
	Metribuzin 75	18	4	18	18	18	18	18	18	4	18	4	18	18	8	18	18
	Metribuzin 75DF	18	4	18	18	18	4	18	18	4	18	4	18	18	8	18	18
	OpTill (k)	40 (b)	9.5	40 (b)	4	18	40 (b)	18	40 (b)	3	40 (b)	4	4	1	4	40 (b)	40 (b)
	OpTill PRO (k)	40 (b)	9.5	40 (b)	4	18	40 (b)	18	40 (b)	4	40 (b)	9	9	9	4	40 (b)	40 (b)
	Outlook	(e)	4	(e)	4	4	(e)	(e)	(e)	4	(e)	(e)	(e)	(e)	(e)	(e)	(e)
	Prefix	(l)	(l)	(l)	(l)	(l)	(l)	(l)	(l)	(l)	18	18	18	18	10	18	18
	Pursuit	40 (b)	9.5	40 (b)	4	18	40 (b)	18	40 (b)	4	40 (b)	4	4	0	0	40 (b)	40 (b)
	Python WDG	9	4	9	4	4	9	9	9	4	26	4	26	26	4	26	26
	Sharpen (f)(r)	6	0	6	0	0	0	0	0	0	6	6	6	6	3	6	6
	Sulfentrazone+cloransulam (Authority First DF)	30 (b)	12	30 (b)	12	12	30 (b)	12	30 (b)	4	30 (b)	12	30 (b)	12	12	30 (b)	30 (b)
	Valor (f)	6, 12 (q)(s)	4	6, 12 (q)(s)	4	5, 10 (s)	6, 12 (q)(s)	1 (q)	6, 12 (q)(s)	2 (q)	6, 12 (q)(s)	5, 10 (s)	5, 10 (s)	6, 12 (q)(s)	4	6, 12 (q)(s)	6, 12 (q)(s)
	Valor XLT (h)	4	4	30	4	30	30	10	30	4	30	12	18	12	12	30	30
	Warrant	(e)	(e)	(e)	(e)	(e)	(e)	(e)(x)	(e)	4	(k)	9	9	(e)	(e)	9	(e)
	Zidua	(j)	(j)	(j)	(j)	(j)	(j)	(j)	(j)	(j)	12	(j)	(j)	(j)	(j)	(j)	12