2013 Soybean and Wheat Weed Control Update

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Current Weed Control Issues

- Herbicide Resistance
- New Herbicide Technologies
- New Trait Technologies
Marestail Escapes from Glyphosate
Glyphosate Resistant Kochia Escapes in Soybeans
Glyphosate Resistant Waterhemp in Eastern Kansas
Palmer Amaranth Escapes in Cotton and Soybean Fields
Waterhemp and Palmer amaranth collections in 2011

▲ = Palmer amaranth
〇 = Common waterhemp
Waterhemp populations – Eastern Kansas, 2011

Population:

4
3
2

0 0.75 (1X) 1.5 (2X) 3 (4X)
Glyphosate rate, lb ae/a
Palmer amaranth – Cowley county, 2011

Cowley Co.
Susceptible

0 0.75 (1X) 1.5 (2X) 3.0 (4X)
Glyphosate rate, lb ae/a
Confirmed Glyphosate Resistant Waterhemp and Palmer Amaranth - 2011

= R Palmer amaranth
= R Common waterhemp
Palmer Amaranth – Barton County, 2012

Radium population

Susceptible

0  0.75 (1X)  1.5 (2X)  3 (4X)

Glyphosate rate lb ae/a
Palmer Amaranth - Cowley County, 2012

Cowley Co. Populations

Susceptible

0 0.75 (1X) 1.5 (2X) 3 (4X)

Glyphosate rate lb ae/a
Conclusions

• Glyphosate-resistant common waterhemp is present across much of eastern Kansas.
• Glyphosate-resistant Palmer amaranth appears to be present in south central Kansas and on the increase.
• Alternative weed management strategies need to be implemented to control GR pigweed species in Kansas.
Glyphosate Resistant Waterhemp and Palmer Amaranth Control

- Utilize an integrated approach incorporating residual and postemergence herbicides with different MOA

- Foundation preemergence herbicides
  - Soybeans: Prefix, Authority, Valor, Acetamides, Fierce
  - Corn: Atrazine/acetamide premixes, Lexar/Lumax, Balance Flexx, Corvus, Verdict
  - Sorghum: Atrazine Premixes, Lexar/Lumax, Verdict
  - Sunflower: Spartan, Dual, BroadAxe, Prowl
Glyphosate Resistant Waterhemp and Palmer Amaranth Control

- Utilize an integrated approach incorporating residual and postemergence herbicides with different MOA

- Postemergence herbicide options
  - Soybean – Flexstar, Cobra, Ultra Blazer, Glyphosate
  - Corn – Callisto, Laudis, Capreno, Impact, Armezon, Status, 2,4-D, Glyphosate
  - Sorghum – Huskie, atrazine, dicamba, 2,4-D
  - Sunflowers – Beyond or Express???

- Liberty Link programs in soybeans and corn
Managing Marestail

- Timing, Timing, Timing!
- Utilize dicamba, 2,4-D, Sharpen and/or residual herbicides in fall and early spring burndown in no-till.
- Atrazine + 2,4-D in corn or sorghum
- Liberty for late burndown control.
- Control marestail in the wheat crop.
- Don’t skimp on rate or appropriate spray additives.
- Use appropriate treatments.
Timing and Environment.
- The majority of kochia germinates early but will continue into the growing season. **Control prior to planting!**
- Apply herbicides before kochia gets too large and with optimal environmental conditions.
- Do not plant into uncontrolled kochia stands.

Foundation preemergence herbicides
- Corn: Lexar/Lumax, Balance Flexx, Corvus, Sharpen, Verdict, atrazine (unless also triazine resistant)
- Soybeans: Authority, Sharpen, OpTill

Postemergence herbicide options
- Corn – Dicamba, Status, Starane, Callisto, Laudis, Capreno, Impact
- Soybean – Extreme*, Raptor*, Synchrony*
  * Unless also ALS resistant
New Herbicides and Technologies for Soybeans

- Autumn Super
- OpTill PRO
- Zidua?
- Fierce?
- Anthem?
- Liberty Link Soybeans
Autumn Super (Bayer)

- Autumn Super contains 6% Iodosulfuron-methyl (Autumn) + 45% thiencarbazone-methyl
- Apply 0.3 to 0.5 oz product with COC or MSO at 1% v/v and UAN at 1.5-2 qt/a or AMS at 1.5-3 lb/a
- Generally recommended as tank-mix with 2,4-D, dicamba, and/or glyphosate
  - Fall or spring up to 1 month before corn planting
  - Fall or spring up to 2 months before soybean planting
  - Three months before wheat planting
  - DO NOT USE if intending to plant any other crop for 9 to 18 mo. + 15 to 30” rainfall requirement
OpTill PRO

- Prepack mix from BASF containing Sharpen, Pursuit, and Outlook. (OpTill plus Outlook)
- Dual chambered jug containing 2.5 lb Op-Till and 1.56 Gal Outlook will treat 20 acres
  - Equals 1 oz Sharpen, 4 oz Pursuit, 10 oz Outlook/acre
- Timing: Fall, Preplant through preemergence
- Burndown and residual control of grass and broadleaf weeds, including better residual grass and pigweed control than with OpTill.
OpTill PRO

- Apply with MSO plus AMS or UAN for optimum burndown activity.

- Similar rotation restrictions to Pursuit:
  - 4 months: wheat, rye
  - 8.5 months: corn
  - 9 months: alfalfa, clover
  - 9.5 months: Clearfield sunflower and canola
  - 18 months: sorghum, oats, cotton, sunflower
  - 40 months: other crops not listed on the label
Pyroxasulfone

- New active ingredient formerly known as KIH-485 that was developed by Kumiai and will be marketed in several different products from various companies.
- Similar mode of action to acetamide herbicides such as Dual and Harness, but active at much lower rates and has more broadleaf activity and longer residual.
- Products with pyroxasulfone include Zidua, Fierce, Anthem
Zidua

- New product from BASF containing 85% pyroxasulfone.
- Preplant through preemergence, or postemergence in corn and soybeans.
- Rates: 2 to 2.5 oz/a?
- Weeds: preemergence control of annual grass and broadleaf weeds, including pigweeds.
- Registration pending.
Fierce

- Premix from Valent containing 33.5% flumioxazin (Valor) and 42.5% pyroxasulfone (Zidua) WDG.
- Timing: Fall, EPP through preemergence.
- Application rate: 3 to 4.5 oz/acre
  - 3 oz Fierce = 2 oz Valor + 1.5 oz Zidua
- Preemergence control of grass and broadleaf weeds, including pigweeds.
- Registration pending
Anthem

- New premix from FMC containing pyroxasulfone and Cadet.
- Preplant, preemergence, or postemergence in corn and soybeans.
- Rates: 7 - 9 fl oz/a?
- Weeds: annual grass and broadleaf weeds, including pigweeds.
- Registration pending.
Glyphosate Resistant Kochia Management

- **Timing and Environment.**
  - The majority of kochia germinates early but will continue into the growing season.
  - Apply herbicides before kochia gets too large and with optimal environmental conditions.
  - Do not plant into uncontrolled kochia stands.

- **Foundation preemergence herbicides**
  - Soybeans: Authority, Valor, Sharpen, OpTill (Pro), Boundary, metribuzin (Beware of soil limitations)

- **Postemergence herbicide options**
  - Soybean – Extreme*, Raptor*, Synchrony*
    * Unless also ALS resistant
Glyphosate Resistant Pigweed Control

- **Timing:** Waterhemp and Palmer amaranth generally are warm season weeds that don’t germinate until later in the spring and into the summer
  - Fall and early spring treatments probably will not provide season-long control
- **Foundation preemergence herbicides**
  - Soybeans: Authority, Valor, Fierce, Prefix, OpTill Pro, metolochlor, Intrro, Outlook, Prowl
- **Postemergence herbicide options**
  - Soybean – Flexstar, Cobra, Ultra Blazer
- **Liberty Link programs**
Glyphosate resistant waterhemp control at Ottawa, KS in 2011 (Peterson, Adee, Shoup, and Putman).

<table>
<thead>
<tr>
<th>Herbicide</th>
<th>Rate</th>
<th>Waterhemp Control</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(oz/a)</td>
<td>6/28 (%)</td>
</tr>
<tr>
<td>Roundup Power Max</td>
<td>22</td>
<td>-</td>
</tr>
<tr>
<td>Valor XLT/ RUPM</td>
<td>4/22</td>
<td>91</td>
</tr>
<tr>
<td>Valor XLT/RUPM+Flexstar</td>
<td>6.5/22+20</td>
<td>89</td>
</tr>
<tr>
<td>Auth XL/RUPM+Flexstar</td>
<td>6.5/22+20</td>
<td>98</td>
</tr>
<tr>
<td>Auth First/RUPM+Flexstar</td>
<td>6.5/22+20</td>
<td>90</td>
</tr>
<tr>
<td>Fierce/RUPM+Flexstar</td>
<td>4.5/22+20</td>
<td>100</td>
</tr>
<tr>
<td>LSD (5%)</td>
<td></td>
<td>7</td>
</tr>
</tbody>
</table>

Note: LSD values are given as LSD (5%).
Fierce/Roundup PM+Flexstar
Liberty Link Soybeans

- Liberty Link soybeans introduced in 2009.
- Allows the use of Liberty on LL soybeans.
- Timing is critical for good weed control.
Liberty 280

- New formulation of glufosinate (Ignite) containing 2.34 lb ai/gal.
- Rate: 22 to 36 oz/a.
  - Single application at 29-36 oz/A.
  - Sequential applications 1 to 2 weeks effective.
  - Total maximum per season = 65 oz/A.
- Timing: Emergence to bloom stage of soybean growth.
- Adjuvant: AMS at 3 lb/A.
Liberty 280

- Application timing, spray coverage, temperature, humidity, light intensity, and time of day all critical to performance.
- Works best as part of a sequential weed control program with preemergence residual herbicides.
- Do not graze treated crop or cut for hay.
Future Technologies in Soybeans

- No new novel herbicide modes of action or active ingredients on the horizon
- Crops stacked with multiple traits
- Dicamba resistant soybeans (Xtend) from Monsanto
- 2,4-D resistant soybeans (Enlist) from Dow AS
- HPPD resistant soybeans from Bayer and Syngenta
Roundup Ready 2 Xtend Soybeans

- Soybeans that contain a gene that confers resistance to dicamba stacked with the Genuity Roundup Ready 2 trait technology.
- Resistant gene isolated from a soil bacteria.
- Resistance is based on metabolism of dicamba by soybeans.
- Regulatory approval for the modified soybeans expected in fall of 2012.
- “Ground Breaker” demonstrations planned for 2013.
- Full scale commercialization planned for 2014.
Roundup Ready 2 Xtend Soybeans

Dicamba Products

- New low volatile formulation of dicamba being developed jointly by Monsanto and BASF, which will be the only dicamba products labeled on Xtend soybeans

- Monsanto dicamba products for Xtend soybeans
  - Roundup Xtend – Glyphosate + dicamba premix
  - XtendiMax – new dicamba product by itself

- BASF dicamba product for Xtend soybeans
  - Engenia – new dicamba salt by itself, similar to XtendiMax
  - Standard rate of dicamba will be 0.5 lb ae/a, which = 16 fl oz Banvel
Crop Response of RR2 Xtend Soybeans

Droopy soybeans in right row 3 hr after treatment

Soybeans in center two rows treated with 1.5 lb dicamba
Roundup Ready 2 Xtend Soybeans
Weed Control Programs

- Strongly encourage use of residual herbicides as part of program.
- Treat weeds postemergence prior to exceeding 4 inches in height.
- Do not apply with AMS.
RR2 Xtend Soybean Weed Control Programs

Untreated
RR2 Xtend Soybean Weed Control Programs

Valor XLT+Roundup Xtend (EPP) fb Roundup Xtend + Warrant (P)
RR2 Xtend Soybean Weed Control Programs

Glyphosate Resistant Waterhemp
RR2 Xtend Soybean Weed Control Programs
RR2 Xtend Soybean Weed Control Programs
RR2 Xtend Soybean Weed Control Programs

Roundup Xtend (EP)/Roundup Xtend (P)
RR2 Xtend Soybean Weed Control Programs

Authority First (PRE)/Roundup Xtend (P)
Roundup Ready 2 Xtend Soybeans
Stewardship Guidelines

- Use spray configuration that produces coarse to ultra coarse droplets. Do not use XR or TT spray tips.
- Apply in a minimum of 10 gpa spray solution.
- Apply at minimum effective boom height.
- Apply between wind speeds of 3 to 10 mph.
- Adhere to buffer zone requirements.
- Clean sprayer equipment thoroughly.
Enlist Soybeans

- Soybeans that contain a 2,4-D resistant gene that is also stacked with both glufosinate and glyphosate resistant traits.
- 2,4-D resistance is based on metabolism of 2,4-D by soybeans
- Resistant gene isolated from a soil bacteria
- Regulatory approval for the modified soybeans expected in summer of 2013
- Full scale commercialization anticipated for 2015
Enlist Soybeans

2,4-D Product

- New choline 2,4-D formulation that has less volatility losses than 2,4-D amine.
- 2,4-D choline will be the only 2,4-D formulation labeled for use on Enlist soybeans.
- Enlist Duo will be a premix of glyphosate and 2,4-D choline and will be the only 2,4-D choline product available initially.
- Standard rate will be 3.5 pt/A., which is equal to 0.75 lb ae glyphosate + 0.75 lb ae 2,4-D (~ 1.5 pt LV4 2,4-D).
- Maximum of 3 applications per season, including burndown.
Soybeans may exhibit some drooping or wilting symptoms several hours after treatment, but recover by the next day.

Soybeans may exhibit some foliar necrosis following application, especially in tank-mixes, but new growth is unaffected.
Necrosis on Enlist Soybeans

Enlist Duo, 75 oz/A

Enlist Duo + Liberty
Enlist Soybeans
Weed Control Programs

- Strongly encourage use of residual herbicides as part of preplant burndown or preemergence program.
- Treat weeds postemergence prior to exceeding 4 inches in height.
- Apply Enlist Duo with AMS only.
Enlist Soybean Weed Control Programs
Enlist Soybean Weed Control Programs

Sonic (PRE) fb Enlist Duo
Enlist Soybean Weed Control Programs

Enlist Duo (EP) fb Enlist Duo (P)
Enlist Soybeans
Stewardship Guidelines

- Use spray configuration that produces coarse to very coarse droplets, but not ultra coarse droplets.
- Apply in a minimum of 10 gpa spray solution.
- Apply at minimum effective boom height.
- Apply between wind speeds of 3 to 10 mph.
- Adhere to buffer zone requirements.
- Clean sprayer equipment thoroughly.
2,4-D and Dicamba Tolerant Soybeans

Potential Benefits

- Improved control of hard to control weeds
  - Morningglory, velvetleaf, kochia, buckwheat, smartweeds, etc

- Improved control of herbicide resistant weeds
  - Marestail, pigweeds, ragweeds, kochia

- Excellent crop tolerance on resistant varieties

- Expanded rate options

- Improved flexibility of burndown options without preplant interval restrictions
2,4-D and Dicamba Tolerant Soybeans

Potential Benefits

- Expanded herbicide mode of action options
  - Herbicide resistant weed management
- Stacking of herbicide resistant traits
  - Treatment flexibility in terms of herbicide options
- Reduced potential for drift to nearby resistant crop varieties
- Reduced potential for tank contamination when treating subsequent resistant crop varieties
2,4-D and Dicamba Tolerant Soybeans

Potential Risks

- Spray drift to non-resistant varieties and crops
- Spray tank contamination on subsequent applications to non-resistant varieties and crops
- Misapplication to non-resistant fields
  - Poor record keeping
  - Miscommunication with applicator
2,4-D and Dicamba Tolerant Soybeans
Potential Risks

- Perception that herbicide resistant crops will solve all weed problems
  - Discourage use of residual herbicides
- Over reliance on new technology and development of 2,4-D and/or dicamba resistant weeds
- Further development of weeds with multiple resistance to different herbicide MOA’s
2,4-D and Dicamba Tolerant Soybeans

Summary

- New herbicide resistant crop technologies will provide new options to help with weed control, but need to be part of an integrated weed management program that utilizes residual herbicides and different herbicide modes of action to optimize weed control and crop production, while sustaining the technology.

- Stewardship will be critical to long-term success.
New Herbicide Developments in Wheat

- Preemergence Treatments
  - Several in development
  - Prepare
  - Olympus
- PowerFlex HL
- Carnivore
Pre-Pare

- New product from Arysta containing 70% flucarbazone (Everest).
- Preplant through preemergence to wheat.
- Rates: 0.3 oz/acre
- Weeds: postemergence and residual control or suppression of bromus species and certain broadleaf weeds.
Pre-Pare

- Generally applied with glyphosate as part of burndown treatment in no-till.
- Follow-up postemergence application of Everest 2.0 at 0.5 fl oz/acre generally recommended for improved control of bromus species.
- Do not rotate to soybeans or sunflower for 9 months, or corn for 11 months.
Olympus

- Now labeled as a Preplant/preemergence application with glyphosate for residual weed control in wheat.
  - Preplant through preemergence to wheat.
  - Rates: 0.6 oz/acre
  - Weeds: postemergence and residual suppression of bromus species and certain broadleaf weeds.
  - Can be used in sequence with a spring application of Olympus at 0.6 oz/acre.
  - Total seasonal Olympus rate should not exceed 1.2 oz/a.
# Weed Control in winter wheat at Manhattan, KS in 2010 (Peterson and Thompson).

<table>
<thead>
<tr>
<th>Herbicide</th>
<th>Rate</th>
<th>Time</th>
<th>Downy brome</th>
<th>Cheat</th>
<th>Rye-grass</th>
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<tr>
<td>Prepare</td>
<td>0.3</td>
<td>PRE</td>
<td>40</td>
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<tr>
<td>Olympus</td>
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<tr>
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<td>98</td>
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<tr>
<td>Olympus/Olympus</td>
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<td>FP/SP</td>
<td>96</td>
<td>100</td>
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<tr>
<td>LSD (5%)</td>
<td></td>
<td></td>
<td>8</td>
<td>11</td>
<td>17</td>
</tr>
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</table>
PowerFlex HL

- More concentrated formulation of PowerFlex from Dow AgroSciences that contains 13% pyroxsulam compared to 7.5% in PowerFlex.
- Use pattern for PowerFlex HL is similar to PowerFlex except the use rate is 2 oz/A instead of 3.5 oz/A.
- Soybeans, sorghum, sunflower, and cotton can be planted 3 months after application, but not prior to April 30.
- Alfalfa, corn, or canola should not be planted until 9 months after application.
Carnivore

- New premix from Winfield containing MCPA, bromoxynil (Buctril), and fluroxpyr (Starane) for postemergence broadleaf weed control in wheat and oats
- Stage: 2-leaf to flag leaf emergence wheat
- Rates: 1 to 2 pt/A
- Weeds: most broadleaf weeds, including kochia
- Do not graze for 45 days after application
New Herbicides in Sunflower

- BroadAxe
BroadAxe

- New premix from FMC containing Spartan and Dual Magnum.
- Preplant or preemergence
- Rates: 19 to 28 oz/A depending on soil type and application timing.
- Weeds: annual grass and broadleaf weeds, including pigweeds and kochia.
- Do not use on sand soils with less than 1% organic matter.
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