Sweet Corn Herbicide Advancements

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Sweet Corn Pocket Guide

U of M contributions
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The Great Lakes Vegetable Working Group and North Central Integrated Pest Management Center
Soil Applied Herbicide Options

Preemergence options

- Annual grasses: Metolachlor products, Outlook, Micro-Tech, Prowl, Define, Acetochlor products (Harness, Surpass), Eradicane
- Annual broadleaves: Atrazine, Princep, Callisto

Premixes

- G-Max Lite (Outlook + atrazine)
- Bicep Lite II Magnum (Dual II Magnum + atrazine)
- Bullet or Lariat (Micro-Tech + atrazine)
- Camix, Lumax, Lexar
Postemergence Herbicide Options

Annual grasses
- Accent*, Accent Q*
- Poast, Poast Plus
- Option*

Annual broadleaves
- Aim
- Atrazine*
- Basagran
- Callisto
- Impact*
- Laudis*
- Permit
- Starane
- Stinger
- 2,4-D

* Activity on grasses and broadleaves
Postemergence Herbicide Options

POST Package Mixtures

- Laddok (atrazine + Basagran)
- Priority (Aim + Permit / Sandea)
New in 2008 Sweet Corn Herbicides

❖ Most (all?) acetochlor products labeled
❖ Option
❖ Laudis (747)
New Sweet Corn Herbicides in 2009

🧬 Accent Q
New products = improve weed mgt options, and = new tolerance concerns
HPPD inhibitors

Bleaching: Inhibition of 4-hydroxyphenyl-pyruvate-dioxygenase (4-HPPD)

In order on market introduction:
- Isoxaflutole (Balance)
- Mesotrione (Callisto)
- Topramezone (Impact)
- Tembotrione (Laudis)
Balance (Isoxaflutole)
- Never approved by MN or WI
- Tested on sweet corn in late 90's
- Bayer continues to pursue MN, WI label
Mesotrione 6 to 7.7 oz PRE labeled 2005
Below label 5 to 6 oz/A if t.m. with 0.75 lb/A atrazine have worked well in WI trials
PRE application lacks bleaching of POST
But, PRE decreased weed control spectrum
Callisto (mesotrione)

PRE package mixes

- Camix 3.67
  - 2.4 qt = 2 metolachlor + 0.2 mesotrione lb ai/A
  - 4 qt = 3.34 metolachlor + 0.33 mesotrione lb ai

- Lumax 3.94
  - 3 qt = 2 metolachlor + 0.75 atrazine + 0.2 mesotrione lb ai/A
  - 4 qt = 2.68 metolachlor + 1.0 atrazine + 0.268 mesotrione lb ai

- Lexar 3.7
  - 3 qt = 1.3 metolachlor + 1.3 atrazine + 0.168 mesotrione lb ai/A
  - 4 qt = 1.74 metolachlor + 1.74 atrazine + 0.224 mesotrione lb ai
Callisto

- NIS, no UAN/28% POST
- Recommend t.m. with atrazine
  - 0.25 to 0.5 POST, 0.75 lb/A PRE
    - Adds control of common ragweed
    - Enhances residual control
    - Some grass help

- Organophosphate insecticides interactions
  - Do not t.m. with OP insecticides
  - Do not apply OP insecticides within 7 days of applying Callisto
  - Do not use at all if Counter or Lorsban used
Callisto Rotation Restrictions

- Pea sensitivity to carryover
  - 18 mo. rotation interval for pea, dry bean, snap bean, beets, etc.

- Corn, soybean, potato, alfalfa 10 months

- Small grains 120 days
Impact (topramezone)

POST in field corn, sweet corn (processing and fresh mkt), pop corn labeled 2007 season
  1° broadleaf weed control
  2° partial grass control
    - Synergized by atrazine

Rate: 0.75 oz/A (2.8 lb ae / gal)
Adjuvant: MSO or COC plus nitrogen additive
PHI: 45 days
Impact (topramezone)

- 2ee - 9 mo for soybean plantback with reduced 0.5 fl oz rate
- 0.25 to 1.0 lb atrazine t.m. recommended
  - Reduced triazine rate to 0.5 to reduce carryover but reduces control
    - Reduces bdlf. efficacy and spectrum
    - Reduces carryover risk?
Impact (topramezone)

- Rotational restrictions (0.75 oz/A rate):
  - 3 mo – small grains
  - 9 mo – alfalfa, pea, potato
  - 18 mo – soybean, snap beans, other crops

2x Impact + atrazine
Laudis 3.5 SC  (tembotrione + isoxadifen 2:1)
Formerly AE 0172747, 747

- Field, seed, popcorn and sweet corn (processing and fresh mkt)
- HPPD-inhibitor
  - 1° broadleaf weed control
  - 2° partial grass control
    - Synergized by atrazine
- Bayer safener technologies
- Aqueous solution (shake!)
Laudis 3.5 SC (tembotrione)

POST Label in 2008
3 oz product / A +1% MSO + 8.5 lbs AMS/100 gal
- 0.082 lb ai/A tembotrione
- Efficacy with COC < MSO but COC can be used if:
  - Dicots main target
  - Excellent growing (kill) conditions

Atrazine T.M.
- Improves consistency
- Certain grasses and broadleaves from suppression to control
- Synergy interaction
Laudis 3.5 SC (tembotrione)

Up to V7 (V8 field corn, popcorn)

No insecticide interactions (Callisto does)

Carryover? Rotation expected to be:

- Small grains 4 mo.
- Soybean 8 mo.
- Pea, potato, snap beans, alfalfa 10 mo.
- Dry bean (red kidneys), sunflower 18 mo.
HPPD Herbicides

So, which should I use?

All three best used with 0.5 - 0.75 lb ai atrazine to round out broadleaf efficacy
HPPD Efficacy excellent

Callisto

Laudis

Impact
New products = new carryover concerns?
HPPD Carryover Trials*

Tested soybean (WI), pea, snap beans, sugar beets (MN), red kidneys (MN)

Impact
Snaps - 2X, GR, Bronzing
Soybean, red kidneys?

Callisto
Snaps, pea, sugar beets - 2X GR, Chlorosis

Laudis
Sugar beets 2X GR
Red kidneys?

*atrazine interaction, 0.75 / 1.25 lb ai 2006
HPPD Herbicides

Callisto  Impact  Laudis

So, which should I use?

Efficacy
  - Broadleaves  POST similar t.m. with atrazine
  - Grasses  Laudis ≧ Impact >> Callisto

Crop Tolerance
  - Impact ≧ Laudis > Callisto

Crop Rotation Limitations
  - Impact ~ Callisto > Laudis

Insecticide interactions
  - Only Callisto
HPPD Herbicides

With the advent of Laudis and Impact:
Where do we use Callisto?

Soil applied - Camix, Lumax are a good fit, depending on crop rotation

Vol. potato control POST with Callisto
  – Better than Starane
HPPD Herbicides

With the advent of Laudis and Impact:
Where do we use Accent?

Grass control:
- Accent > Laudis
  - Green foxtail, woolly cupgrass
- Laudis > Accent
  - Crabgrass

Long-term Laudis use could shift grasses to dominance by green foxtail and fall panicum

Accent rescue treatment?
- But height cutoff if intend to rescue a failed POST trt.
Acetochlor Sweet Corn Label 2008

2nd generation acetamide

- High unit activity on grasses and some broadleaves
- Safener allowed use on corn (& sweet corn)
  - Prior to acetochlor, acetamides that were marketed did not 'require' a safener for acceptable tolerance

Many products:
Degree/TopNotch ME, Harness/Surpass EC
Degree Xtra / Keystone, FulTime / Harness Xtra, Harness Xtra 5.6, others
Acetochlor Sweet Corn Label 2008

EC (Harness/Surpass) or encapsulated/ME (Degree/TopNotch) acetochlor formulations

Do not apply early post to sweet corn (is allowed on field corn)

Restricted Use Product - ground water concerns
  - surface water issues evolving in MN
Acetochlor Sweet Corn Label 2008

Do not apply to the following soils if ground water depth is $\leq 30$ ft.

<table>
<thead>
<tr>
<th>Soil texture</th>
<th>O.M.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sands</td>
<td>$&lt; 3%$</td>
</tr>
<tr>
<td>Loamy sands</td>
<td>$&lt; 2%$</td>
</tr>
<tr>
<td>Sandy loams</td>
<td>$&lt; 1%$</td>
</tr>
</tbody>
</table>

Limits use in both MN and WI
Acetochlor Sweet Corn Label 2008

Rotational crops - **Surpass** supplemental label 5/24/07

Corn (types not specified)
Anytime - 0 months after application

Wheat (types not specified)
4 Months after application
Acetochlor Sweet Corn Label 2008

Rotational crops - **Surpass** supplemental label 5/24/07

Spring following application

Alfalfa, barley, clover, dry beans, guar, kudzu, lentil, lespedeza, lupin, millet, pearl or proso, oats, pea, potatoes, rye, sorghum, soybeans, sugar beets, sunflower, trefoil, tobacco, triticale, vetch, wild rice.

2 Dry beans includes: adzuki, kidney, lima, navy, pinto

3 Approved rotation crops list does not include any species of succulent beans or succulent peas

4 Lupin includes: grain, white, white sweet

5 Pea includes: blackeyed, chick, cow, Crowder, field pigeon, Southern
Accent

Accent Q

- nicsulfuron + isoxadifen safener
  - Targeting high-value specialty crops
  - Differentiates from generics for DuPont
- Accent through the 2008 season
- Accent Q in in distribution system for 2009
Accent Q Evaluations

Accent Q = nicosulfuron + isoxadifen

- Sweet corn labeled in 2009
- Standard rate:
  0.9 oz/a (equivalent to 0.66 oz/a Accent + isoxadifen)

Multi-state hybrid evaluation

- DE, MN, OR, WI
- Same 39 sensitive, intermediate and tolerant hybrids
- Accent vs Accent Q at increased rate
  - 1.09 oz/a Accent + 1% COC + 2 lb/a AMS
  - 1.09 oz/a Accent + 0.41 oz/a isoxadifen + 1% COC + 2 lb/a AMS

Does the safener increase tolerance to Accent?
### Accent vs Accent Q

#### Injury Summary 7 DAT

**Hybrid averages among locations**

<table>
<thead>
<tr>
<th></th>
<th>Chlorosis (%)</th>
<th>Stunting (%)</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Accent</td>
<td>Accent Q</td>
</tr>
<tr>
<td>DE</td>
<td>15</td>
<td>5</td>
</tr>
<tr>
<td>MN</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>OR</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>WI</td>
<td>10</td>
<td>4</td>
</tr>
</tbody>
</table>

#### Injury by Hybrid Tolerance Class

(avg. % stunting and range across locations)

<table>
<thead>
<tr>
<th>Tolerance Class</th>
<th>Accent</th>
<th>Accent Q</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensitive</td>
<td>15 (5-16)</td>
<td>8 (0-9)</td>
</tr>
<tr>
<td>Intermediate</td>
<td>9 (4-22)</td>
<td>5 (3-16)</td>
</tr>
<tr>
<td>Tolerant</td>
<td>7 (2-16)</td>
<td>4 (0-9)</td>
</tr>
</tbody>
</table>
Punch
- at 7 days at WI
- note chlorosis

Accent

Accent Q
Accent Q

Homozygous sensitive hybrids still killed by Accent Q

Injury from Accent Q about 50% less than Accent

General ranking of tolerance
- Accent Q > Accent > Option

Reduced risk of injury should expand options for using Accent Q on sweet corn
Option vs Accent Tolerance Evaluation
Boerboom 2006 MWFPA

Crop injury (%)

GH 2547  Jubilee  GH 2042  SS Jubilee  Early Gold  GG 446  Basin  Bonus

Crinkle Only (MN)

Stunting - higher level of injury (WI)
Sethoxydim resistance

- Insensitive ACC-ase inhibitor selected through tissue culture at the U of M
- Not transgenic (not GMO)
Sethoxydim on Sweet Corn

- Adjuvants: 1 qt/a COC + 2.5 lb/a AMS
- Timing: Emergence to before pollen shed (Poast/ Poast Plus pts/A)
- Weeds: 0.5 / 0.75 10” wild proso millet
- 1.0 / 1.5 6” crabgrass, 8” foxtails
- 1.5 / 2.25 8” quackgrass
- Tank mixtures:
  - atrazine, Basagran, Laddok S-12
- Rotational restrictions:
  - 0 days (labeled crops) or 30 days (other crops)
Poast Protected Sweet Corn

Wild proso millet control
- Poast – 2 applications maximum allowed

Recommendation
❖ PRE grass herbicide; POST Poast
  - limited number of hybrids

❖ Alternatives:
  ● Accent
    ➢ narrower application window
    ➢ limited to approved hybrids
  ● Laudis / Impact
    ➢ safer than Accent
    ➢ residual -> control but carryover?
Define (flufenacet) Bayer

Oxyacetamide - Bayer has indicated will be phased out

Various reasons
New and Potential Sweet Corn Herbicides

2008 field evaluations

Status

Accent Q

BAS 800 (Kixor or saflufenacil)
Leaf Wrapping From Status Suregold @ 7 DAT (not all plants affected)
Status Injury Summary at 7 Days

Trial averages among locations

- Delaware 30% injury
- Minnesota 3% “grassy”
- Oregon 9% lodging severity
- Wisconsin 13% leaf wrapping

Response among hybrids (average across locations)

- Sensitive 17% (range 8 - 48%)
- Intermediate 11% (range 6 - 21%)
- Tolerant 10% (range 2 - 18%)
Status at 5 oz/a on Celestial
Arlington, WI
Status

At a potential 2.5 oz/a Status “sweet corn” rate

Suregold - similar or greater amount of leaf wrapping than Clarity at 7 days; rapid recovery

Differential injury among locations and hybrids at 5 oz/a rate; good recovery

Although injury is related to previous tolerance ratings for Accent, the level and variability of injury is concerning

Status is not labeled on sweet corn at this time
BAS 800 and BAS 781 from BASF

Kixor = saflufenacil (PPO inhibiting herbicide)
- Burndown and Preemergence corn herbicide
- Broadleaf weed activity
- 2010 launch anticipated
- BAS 800 – saflufenacil
- BAS 781 – saflufenacil + Outlook

Limited evaluation on sweet corn
BAS 800 and BAS 781

Multi-state hybrid evaluation
- DE, MN, OR, WI
- Same 39 sensitive, intermediate and tolerant hybrids
- BAS 800 – 2x use rate
  - MN - 10 fl oz + Outlook 10 fl oz
  - DE, OR, WI - 6 fl oz/a + 10 fl oz/a Outlook
- BAS 781 – 2x use rate
  - MN - 50 fl oz
  - DE, OR, WI - 40 fl oz/a
- Applied Preemergence

Does sweet corn have tolerance to saflufenacil?
BAS 800 at Minnesota

GH 2042 – 60% stunting

Overland
– Treated 65% stunting

Lancaster – 35% stunting

– Nontreated check