Weed Management in Pumpkins

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Weed Science in Vegetable Crops, Ornamentals, and Invasive Weeds

Weed Identification

How to Identify Grass Weeds
- Growth pattern
  - Prostrate
  - Erect
- Roots
  - Fibrous
  - Rhizomatic
- Ligules
  - No ligule
  - Fringe of hairs
  - Membranous
- Auricle
  - Present or not

How to Identify Broadleaf Weeds
- Growth characteristics
  - Herbsaceous
  - Woody
  - Vines
- Leave characteristics
  - Cotyledon
    - Shape
    - Size
- True Leaf
  - Compound or simple
    - Shape
    - Size
    - Venation
    - Leaf surface - glabrous vs. pubescent

Leaf position
- Alternate vs. opposite

Root characteristics
- Fibrous vs. taproots
- Rhizomes vs. adventitious

Nodes and Internodes
- Length
- Bud shape and size

Flowers, fruits, and seeds

* Pictures courtesy of the Virginia Tech Weed ID guide
* Most pictures courtesy of the Virginia Tech Weed ID guide; Large crabgrass seedhead found at…http://www.turf.uiuc.edu/weed_web/crabgrass/crabgrass_sh.htm
Preemergence Herbicide Options

Curbit® 3 lb EC
- Common name: Ethalfuralin
- Mode of action: Mitotic inhibitor
- Manufacturer: Loveland Products
- Weeds controlled: Grasses and some small seeded broadleaf weeds
- Applications:
  - PRE: 3 to 4 1/2 pints/acre
    - No later than 2 days after seeding
    - Do not soil incorporate
    - May apply POST over top of transplants
    - Course soils: 3 pints/acre
    - Medium soils: 3 to 4 pints/acre
    - Fine soils: 4 to 4 1/2 pints/acre

Curbit® 3 lb EC - Grass Weeds Controlled
- Broadleaf signalgrass
- Crabgrass
  - Large
  - Smooth
- Goosegrass
- Foxtail millet
- Johnsongrass (seedling)
- Fall panicum
- Texas panicum

Curbit® 3 lb EC - Broadleaf Weeds Controlled
- Carpetweed
- Lambquarters
- Pigweed
  - Prostrate, redroot, smooth, spiny
- Purslane

Other Crops Where You can Use Curbit® 3 lb EC
- Cucumbers
- Melons
- Summer squash
- Winter squash
- Watermelons
- Consult label for specific rates, timings, and restrictions.

Dual Magnum® 7.62 lb EC
- Common name: s-metolachlor
- Mode of action: LCFA biosynthesis inhibitor
- Manufacturer: Syngenta
- Weeds controlled: Grasses, yellow nutsedge, and some small seeded broadleaf weeds
- Applications:
  - PRE: 1 to 1.33 pints/acre
    - Inter-row or inter-hill application
    - DO NOT APPLY to 1 foot band around the row
Grasses and Sedges Controlled by Dual Magnum® 7.62 lb EC

- Controls all the grasses controlled by Curbit® 3 EC, except Texas panicum, plus the following:
  - Barnyardgrass
  - Foxtails
    - green, giant, yellow, and bristly
  - Crowsfootgrass
  - Witchgrass
  - Yellow nutsedge

Broadleaf Weeds Controlled by Dual Magnum® 7.62 lb EC

- Controls all the broadleaf weeds controlled by Curbit® 3 EC, except lambsquarters, plus the following:
  - Additional Amaranthus spp.
  - Waterhemp (common, tall)
  - Powell amaranth
  - Palmer Amaranth
  - Tropical spiderwort

Other Crops Where You can Use Dual Magnum® 7.62 lb EC

- Corn
- Cotton
- Grasses grown for seed
- Rhubarb
- Sunflower
- Sorghum (grain or forage)
- Soybean
- Tomato
- Consult label for specific rates, timings, and restrictions.

Strategy® 2.1 lb EC

- Common name: Ethalfluralin (Curbit) 1.6 lbs ai/gal + Clomazone (Command) 0.5 lbs ai/gal
- Mode of action: Mitotic inhibitor + Carotenoid inhibitor
- Manufacturer: Loveland Products
- Weeds controlled: Grasses and some small seeded broadleaf weeds
- Applications:
  - PRE- 2 to 6 pints/acre
  - No later than 2 days after seeding
  - Do not soil incorporate
  - Do not apply postemergence over transplants
  - Do not use over or under plastic mulch
  - Course soils- 2 to 3 pints/acre
  - Medium soils- 3 to 4 pints/acre
  - Fine soils- 4 to 6 pints/acre

Weeds controlled by Strategy® over Curbit®

- Controls all the weeds controlled by Curbit® 3 EC plus the following:
  - Prickly sida
  - Spurred anoda
  - Velvetleaf
  - Venice Mallow
  - Cocklebur*
  - Common ragweed*
  - Smartweed*

* Suppression only

Other Crops Where You can Use Strategy® 2.1 lb EC

- Cucumbers
- Squash
- Melons
- Watermelons
- Consult label for specific rates, timings, and restrictions.
Postemergence Herbicide Options

Sandea® 75%DF
- Common name: Halosulfuron
- Mode of action: ALS-inhibitor
- Manufacturer: Gowan
- Weeds controlled: Broadleaf and sedge
- Applications:
  - PRE - ½ to ¾ oz/acre
  - POST over-the-top - ½ to ¾ oz/acre
  - 2 to 5 leaf stage (4 to 5 leaf stage direct seeded) before first flower
  - POST directed or row middle - ½ to 1 oz/acre
  - Maximum of 2 applications totaling 2 oz/acre
  - Must include 0.25% NIS

Sandea® 75%DF - Weeds Controlled
- Cocklebur (PRE, POST)
- Common Ragweed (PRE, POST)
- Giant Ragweed (POST)
- Eclipta (PRE, POST)
- Groundsel (PRE)
- Hemp sesbania (POST)
- Hairy galinsoga (PRE, POST)
- Papaya (PRE, POST)
- Pigweed (PRE, POST)
- Prickly sida (POST)
- Purslane (PRE*, POST*)
- Smartweed/ladysthumb (PRE, POST)
- Velvetleaf (PRE, POST)
- Wild mustard (PRE, POST)
- Wild radish (PRE, POST)
- Yellow Nutsedge (PRE*, POST*)
- Purple Nutsedge (PRE*, POST*)

Comparing the Postemergence Applied Grass Killers

<table>
<thead>
<tr>
<th>Common name</th>
<th>Clethodim</th>
<th>Sethoxydim</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trade name</td>
<td>Select Max®</td>
<td>Poast®</td>
</tr>
<tr>
<td>Manufacturer</td>
<td>Valent</td>
<td>BASF</td>
</tr>
<tr>
<td>Use rate</td>
<td>9 to 16 fl oz/acre annual</td>
<td>No more than 64 fl oz/acre per season</td>
</tr>
<tr>
<td>1.5 pints/acre</td>
<td>No more than 3 pints/acre per season</td>
<td></td>
</tr>
<tr>
<td>Days needed after transplant</td>
<td>14 days appl. window</td>
<td>14 days appl. window</td>
</tr>
<tr>
<td>Preharvest interval (days)</td>
<td>14</td>
<td>14</td>
</tr>
<tr>
<td>Adjuncts</td>
<td>0.25% NIS</td>
<td>1% COC</td>
</tr>
<tr>
<td>Grasses controlled</td>
<td>All annuals except goosegrass; excellent on perennial grasses</td>
<td>Excellent on annual grasses and most perennials</td>
</tr>
</tbody>
</table>

Gramoxone Inteon® 75%DF
- Common name: Paraquat
- Mode of action: PSI inhibitor
- Manufacturer: Syngenta
- Weeds controlled: Broadleaf and small grasses
- Applications:
  - POST directed or hooded application 1.9 to 2.4 pt/acre
    - For weed control or harvest aid
    - Do not contact foliage of desirable crop
  - Maximum of 3 applications
  - Must include 0.25% NIS

Estimated Cost of Herbicides

<table>
<thead>
<tr>
<th>Herbicide</th>
<th>Use Rate</th>
<th>Estimated Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Curbit®</td>
<td>3 to 4 ½ pt/acre</td>
<td>$23 - $35</td>
</tr>
<tr>
<td>Dual Magnum®</td>
<td>1 to 1.33 pt/acre</td>
<td>$15 - $20</td>
</tr>
<tr>
<td>Strategy®</td>
<td>2 to 6 pt/acre</td>
<td>$25 - $75</td>
</tr>
<tr>
<td>Sandea®</td>
<td>0.5 to 0.75 oz/acre</td>
<td>$20 - $40</td>
</tr>
<tr>
<td>Gramoxone Inteon®</td>
<td>1.9 to 2.4 pt/acre</td>
<td>$8 - $10</td>
</tr>
<tr>
<td>Poast®</td>
<td>1.5 pt/acre</td>
<td>$15</td>
</tr>
<tr>
<td>Select Max®</td>
<td>9 to 16 fl/oz</td>
<td>$10 - $17</td>
</tr>
</tbody>
</table>
Building a Weed Management Program in Pumpkin

- Preemergence herbicides are important
  - Yield impacts are greatest within 3 to 5 weeks after crop emergence
- Postemergence tank mix compatibility
  - Do not mix Sandea with POST grass killer
  - Space broadleaf and grass herbicide applications 3 to 5 days apart
- Know your weeds to reduce costs!!!!!!

Building a Weed Management - Weed Scenarios

- Johnsongrass (or other perennial grasses)
  - PRE herbicide to Select Max or Poast
- Morningglory or Field Bindweed
  - PRE herbicide to hooded application to the row middles with paraquat
- Yellow Nutsedge
  - PRE Dual Magnum and/or POST Sandea
- Malvaceae weeds
  - Velvetleaf, spurred anoda, prickly sida, mallow spp.
  - PRE Strategy, and/or POST Sandea (velvetleaf, prickly sida)
- Eastern black nightshade
  - PRE Dual Magnum
- Pigweed spp.
  - PRE herbicide and/or POST Sandea (weak on spiny and prostate pigweed)
- Common lambsquarters
  - PRE Curbit or Strategy

Introduction

Objectives

Materials & Methods

Results & Discussion

Conclusion

Aminocyclopyrachlor at a glance

- Aminocyclopyrachlor is an auxin mimic herbicide containing chlorine, amino, and carboxylic acid groups which are prevalent components of chemistry that mimic indole-3-acetic acid.
- The first pyrimidine carboxylic acid herbicides and are currently under development / registration by DuPont Crop Protection.
- The structure of aminocyclopyrachlor is very similar to pyridine carboxylic acid herbicides like picloram, clopyralid and aminopyralid with two exceptions……
Aminocyclopyrachlor at a glance

- Provides broad-spectrum control of several broadleaf weeds and certain grasses including glyphosate, ALS- and triazine resistant weeds.

- Proposed uses of aminocyclopyrachlor includes:
  - Total vegetation management (Non-agricultural areas)
  - Brush control on private public and military lands
  - Natural or wildlife management areas
  - Restoration on native perennial grasses
  - Professional turf fields
  - Pasture & rangeland areas

Objectives

- Investigate PRE, POST and POST-directed applications of aminocyclopyrachlor and/or aminocyclopyrachlor-methyl alone and in combinations with other herbicides for broadleaf weed control and curcurbit crop tolerance.

- Compare these multiple herbicide mixtures to commercial standards (i.e. clomazone + ethalfluralin, halosulfuron, etc.)

- Evaluate weed control potential of these herbicide mixtures at different timings of application.

Materials & Methods

- A total of four field studies were conducted in late spring to fall of 2009 at The University of Tennessee Plateau Research and Education center in Crossville, Tennessee.
**Weeds Evaluated**

- Common ragweed: *Ambrosia artemisiifolia*
- Smooth groundcherry: *Physalis subglabrata*
- Ladysthumb: *Polygonum persicaria*
- Yellow nutsedge: *Cyperus esculentus*
- Ivyleaf morningglory: *Ipomoea hederacea*
- Common purslane: *Portulaca oleracea*
- Large crabgrass: *Digitaria sanguinalis*

**Crops Evaluated**

- Pumpkin: *Curcubita pepo* var. magic lantern
- Cucumber: *Cucumis sativa* var. speedway
- Watermelon: *Citrullus lanatus* var. crimson sweet
- Cantaloupe: *Cucumis melo* var. aphrodite

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**First Study**

PRE selectivity of the auxin herbicide aminocyclopyrachlor-methyl, the ALS-inhibitor halosulfuron & the PPO-inhibitor fomesafen to a variety of cucurbit crops.

<table>
<thead>
<tr>
<th>Herbicide Treatment</th>
<th>Application Rate (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 aminocyclopyrachlor-methyl</td>
<td>9 g ai/ha</td>
</tr>
<tr>
<td>2 aminocyclopyrachlor-methyl</td>
<td>18 g ai/ha</td>
</tr>
<tr>
<td>3 aminocyclopyrachlor-methyl</td>
<td>35 g ai/ha</td>
</tr>
<tr>
<td>4 aminocyclopyrachlor-methyl</td>
<td>70 g ai/ha</td>
</tr>
<tr>
<td>5 halosulfuron</td>
<td>40 g ai/ha</td>
</tr>
<tr>
<td>6 fomesafen</td>
<td>280 g ai/ha</td>
</tr>
<tr>
<td>7 Handweeded Untreated Check</td>
<td></td>
</tr>
</tbody>
</table>

**Second Study**

Evaluation of PRE applications aminocyclopyrachlor-methyl alone and in mixtures with clomazone, halosulfuron, naptalam and ethalfluralin for PRE weed control in pumpkin.

<table>
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<tr>
<td>1 aminocyclopyrachlor-methyl</td>
<td>18 g ai/ha</td>
</tr>
<tr>
<td>2 aminocyclopyrachlor-methyl + ethalfluralin</td>
<td>1680 g ai/ha</td>
</tr>
<tr>
<td>3 aminocyclopyrachlor-methyl + clomazone</td>
<td>420 g ai/ha</td>
</tr>
<tr>
<td>4 aminocyclopyrachlor-methyl + clomazone</td>
<td>420 g ai/ha</td>
</tr>
<tr>
<td>5 aminocyclopyrachlor-methyl + naptalam</td>
<td>1120 g ai/ha</td>
</tr>
<tr>
<td>6 aminocyclopyrachlor-methyl + naptalam</td>
<td>1120 g ai/ha</td>
</tr>
<tr>
<td>7 aminocyclopyrachlor-methyl + halosulfuron</td>
<td>26 g ai/ha</td>
</tr>
<tr>
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<tr>
<td>10 aminocyclopyrachlor-methyl + ethalfluralin</td>
<td>1680 g ai/ha</td>
</tr>
<tr>
<td>11 ethalfluralin + clomazone</td>
<td>1680 g ai/ha</td>
</tr>
<tr>
<td>12 ethalfluralin + naptalam</td>
<td>1680 g ai/ha</td>
</tr>
<tr>
<td>13 ethalfluralin + halosulfuron</td>
<td>1680 g ai/ha</td>
</tr>
<tr>
<td>14 ethalfluralin</td>
<td>1680 g ai/ha</td>
</tr>
<tr>
<td>15 Untreated Control</td>
<td></td>
</tr>
</tbody>
</table>

**Third Study**

Evaluation of POST-directed applications of aminocyclopyrachlor-methyl alone and in mixtures with halosulfuron and naptalam for weed control in pumpkin.

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<td>18 g ai/ha</td>
</tr>
<tr>
<td>4 aminocyclopyrachlor-methyl</td>
<td>35 g ai/ha</td>
</tr>
<tr>
<td>5 Untreated Check</td>
<td></td>
</tr>
</tbody>
</table>

**Fourth Study**

Evaluation of crop safety to aminocyclopyrachlor-methyl and aminocyclopyrachlor applied POST over the top in pumpkins.

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<td>5 Untreated Check</td>
<td></td>
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Results & Discussion

First Study:
PRE selectivity of the auxin herbicide aminocyclopyrachlor-methyl, the ALS-inhibitor halosulfuron & the PPO-inhibitor fomesafen to a variety of cucurbit crops.

Second Study:
Evaluation of PRE applications aminocyclopyrachlor-methyl alone and in mixtures with clomazone, halosulfuron, naptalam and ethalfluralin for PRE weed control in pumpkin.
Injury to pumpkin from PRE applications of aminocyclopyrachlor-methyl alone and in mixtures clomazone, halosulfuron, naptalam and ethalfluralin.

PRE applications aminocyclopyrachlor-methyl alone and in mixtures with clomazone, halosulfuron, naptalam and ethalfluralin for PRE weed control in pumpkin.

PRE applications aminocyclopyrachlor-methyl alone and in mixtures with clomazone, halosulfuron, naptalam and ethalfluralin and their impact on pumpkin yield.

Third Study: Evaluation of POST-directed applications of aminocyclopyrachlor-methyl alone and in mixtures with halosulfuron and naptalam for weed control in pumpkin.
Evaluation of POST-directed applications of aminocyclopyrachlor-methyl alone and in mixtures with halosulfuron and naptalam for weed control in pumpkin.

Fourth Study:
Evaluation of crop safety to aminocyclopyrachlor-methyl and aminocyclopyrachlor applied POST over the top in pumpkins.

Evaluation of aminocyclopyrachlor-methyl and aminocyclopyrachlor application POST over the top in pumpkins. 14, 28 & 56 DAT

Symptomology expressed by aminocyclopyrachlor-methyl applied POST over the top in pumpkins.

Symptomology expressed by aminocyclopyrachlor applied POST over the top in pumpkins.

Conclusion
Conclusion

- Aminocyclopyrachlor-methyl applied alone at 9 to 70 g ai/ha PRE was safe to pumpkin (2 years of research). Cucumber, cantaloupe, and watermelon injury is often unpredictable over rates and years. However, all cucurbits have provided similar yields compared to halosulfuron, fomesafen and the untreated check.

- The combination of the auxin mimic herbicide aminocyclopyrachlor-methyl plus the auxin transport inhibitor naptalam provided a “synergistic improvement” in pumpkin yield over either herbicide applied alone.

- Aminocyclopyrachlor-methyl applied POST at 35 g ai/ha one or in mixtures with naptalam or halosulfuron provided 56 to 93% control of common ragweed and smooth groundcherry in comparison compared to 10 to 50% control with naptalam or halosulfuron applied alone.

- Aminocyclopyrachlor-methyl mixtures with naptalam provided 60 to 93% control of ivyleaf morningglory.

- Mixtures of aminocyclopyrachlor-methyl plus halosulfuron provided 55 to 87% control of yellow nutsedge versus 47 to 48% control with halosulfuron alone.

- Aminocyclopyrachlor was slightly less injurious in POST over the top applications on pumpkins compared to its ester formulation.

Special Thanks

http://hortweeds.tennessee.edu