Mark VanGessel
Weed / Crop Management

Conyza species

Topics
- Introductions
  - Where am I?
- Overview of agriculture in USA
- Conyza species
- Conyza biology and ecology
  - Emphasizing Conyza canadensis
- Conyza and herbicide-resistance

Recent DE Agric. Statistics
Recent DE Agric. Statistics
Milha 75,000 ha
Soja 80,000 ha (44,000 ha FSNT)
Trigo and cevada 35,000 ha
Vegetal (processo) 20,000 ha
Vegetal (fresco) 6,000 ha
Frango (carne) 252 million produced
Market value of crops sold

1 dot = $20 million

Source: USDA, ERS / 2012 Census of Agriculture data
Conyza

- In Asteraceae family
- Genus contains about 50 species worldwide
- Conyza canadensis and Conyza sumatrensis most widespread across the globe

Conyza Species

- Conyza canadensis; formerly Erigeron canadensis
  - horseweed, marestail, Canadian fleabane
- Conyza bonariensis
  - hairy fleabane, flaxleaf fleabane; C. crispa
- Conyza sumatrensis
  - Sumatran fleabane; C. albida
- Conyza primulifolia
  - Chilean fleabane

Other Conyza species in USA

- C. floribunda
- C. laevigata
- C. ramosissima
**Conyza species**

- *C. sumatrensis* is generally larger
  - hairy bracts but there are no long hairs near the top of the bracts
  - toothed leaves
- *C. bonariensis* is moderately sized
  - densely hairy bracts, especially hairy on the stems and around the leaf axils
  - toothed leaves

- *C. canadensis* is moderately sized
  - glabrous (hair free) or almost glabrous
  - toothless leaves
  - smallest seedhead
- *C. primulifolia* is smaller
  - largest seedhead

**Capitula (seedheads)**

Identification to species can be difficult
Hybridization is suspected based on genetic research in Brazil

**Similarities among Conyza spp.**

- Annual species
  - also listed as biennial by some sources
- Early successional species
- Taproot
- Rosette followed by bolting (upright growth)
- Tall
- Large number of seeds with pappus

**Table 1. Distinguishing features of three Conyza species (Sansom 2011)**

<table>
<thead>
<tr>
<th>Conyza canadensis</th>
<th>Conyza bonariensis</th>
<th>Conyza sumatrensis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leaves</td>
<td></td>
<td></td>
</tr>
<tr>
<td>yellowish green</td>
<td>greenish green</td>
<td>greenish green</td>
</tr>
<tr>
<td>seedling leaves</td>
<td>very hairy</td>
<td>very hairy</td>
</tr>
<tr>
<td>adult leaves glazed</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(branched or leaf edge)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>petals narrow</td>
<td>petals narrow</td>
<td>petals narrow</td>
</tr>
<tr>
<td>single valve cleft</td>
<td>single valve cleft</td>
<td></td>
</tr>
<tr>
<td>stems</td>
<td></td>
<td></td>
</tr>
<tr>
<td>glabrous</td>
<td>very hairy</td>
<td>very hairy</td>
</tr>
<tr>
<td>Average height 50 cm</td>
<td>50 cm</td>
<td>50 cm</td>
</tr>
<tr>
<td>Branching habit</td>
<td></td>
<td></td>
</tr>
<tr>
<td>branching from middle of main stem</td>
<td>branching from the base</td>
<td></td>
</tr>
<tr>
<td>secondary branches</td>
<td></td>
<td></td>
</tr>
<tr>
<td>more than 2 main branches</td>
<td></td>
<td></td>
</tr>
<tr>
<td>flowers</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ray flowers white</td>
<td>yellowish green</td>
<td>yellowish green</td>
</tr>
<tr>
<td>tubular</td>
<td>ray flowers green yellow</td>
<td></td>
</tr>
<tr>
<td>involucre to yellow</td>
<td></td>
<td></td>
</tr>
<tr>
<td>involucre to yellow</td>
<td></td>
<td></td>
</tr>
<tr>
<td>flowers of the involucre</td>
<td></td>
<td></td>
</tr>
<tr>
<td>brownish inner face</td>
<td>pappus present</td>
<td>pappus present</td>
</tr>
<tr>
<td>pappus</td>
<td></td>
<td></td>
</tr>
<tr>
<td>pappus</td>
<td></td>
<td></td>
</tr>
<tr>
<td>apex</td>
<td></td>
<td></td>
</tr>
<tr>
<td>crenate tipped</td>
<td></td>
<td></td>
</tr>
<tr>
<td>hairs</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figure 3. Rosette seeding (left), hairy feature seeding (above), Pfallen, K. Heinrich.
Stages of development

Life cycle of Conyza canadensis in North America

Life cycle of Conyza canadensis and Conyza bonariensis

Infested sites

- Grain and row crops
  - corn, soybeans, cotton, wheat
- Perennial crops
  - coffee, orchards, grapes, nut crops, berries
- Nurseries
- Forests
- Industrial sites, roadsides, fencelines, railways
Important to consider the ecology and biology of the plant.

High number of seeds produced.

Small wind-blown seed.
Dispersal

- Seed is capable of moving in the atmosphere for >100 km
- Are seeds able to move secondary movement?
  - Move with wind after reaching the ground

Seed Biology

- *C. canadensis* germinates readily in without light

Seeds Must be at Soil Surface to Germinate and Establish

Emergence

- Similar patterns reported with *C. sumatrensis*
  - 80% fall emergence and 20% spring emergence in Argentina
Seedlings found in “open area”
Seedling density much lower under crop canopy
What is impact of plant canopy?

Impact of Open Canopy on Fall Density

- Soybeans
  - none
  - Group III
  - Group IV
- Annual grasses

Impact of Open Canopy on Fall Density

<table>
<thead>
<tr>
<th>Density (No./m²)</th>
<th>No soybeans</th>
<th>Early maturing</th>
<th>Late maturing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weed-free</td>
<td>400</td>
<td>250</td>
<td>200</td>
</tr>
<tr>
<td>Grassy weeds</td>
<td>300</td>
<td>150</td>
<td>100</td>
</tr>
</tbody>
</table>

Safe-Sites for Development
Looked at number of plants to develop in:
- Natural vegetation
- Natural vegetation - mowed
- Perennial grasses only
- Broadleaves only
- Bare ground
- Bare ground - disturbed

Spread Seeds in the Fall and Monitored for Emergence
Seedling Establishment

- Average of 4 sites
- Counts made in late November

Effect of Crop Residue on ERICA Establishment

- Interaction with crop residue
  - Higher horseweed densities with less residues and/or "more fragile" residue
  - Quick establishment of other weed species may prevent horseweed from establishing

Effect of Winter Cover Crop

- Popularity of cover crops for nutrient management

Effect of Rye on ERICA Establishment

- Rye seedling rates
  - 0
  - 0.5 bu/A = 33 kg/ha
  - 1 bu/A = 65 kg/ha
  - 2 bu/A = 130 kg/ha

- Spring nitrogen applications
  - 0 or 33 kg/ha
Effect of Rye on ERICA Establishment

Evaluating Seed Longevity

Seed Longevity
- Seeds maintained in freezer had almost 100% germination at 36 mos
- Seeds buried 10 cm had 30% germination at 18 mos and 15% at 36 mos
- Seeds on soil surface had 5% germination at 12 mos and continued to decline to 36 mos

Other
- Allelopathic compounds have been identified that suppress germination and growth of other weed species
- At high densities, plants respond with reduced height, branching, and biomass, as well as fewer seeds
- C. bonariensis also hosts for important insect pests in Brazil
  - Stinkbugs and caterpillars

GR Conyza canadensis Management in DE
- Not an issue to control in maize
- Tillage
- Use of 2,4-D (soybeans) pre-plant
  - re-plant restrictions / more management
- Glufosinate or saflufenacil
- Use of residual herbicides

2009 UD-REC
Control 4 WAT
Apply Based On Weed Size

Brazil Trial
- glufosinate (400 g/ha)
- glyphosate (1440 g/ha)
- glufosinate + metribuzin (400 + 960 g/ha)
- glyphosate + metribuzin (1440 + 960 g/ha)
- glyphosate + diuron (1440 + 1000 g/ha)
- glufosinate + diuron (400 + 1000 g/ha)
- Hairy fleabane: Conyza bonariensis
- Horseweed: Conyza canadensis

Brazil Summary
- Treatments containing glufosinate were more effective in horseweed and hairy fleabane control than glyphosate
- Glufosinate plus metribuzin or diuron provided residual control for more than 60 days after the application

Delaware
- Conducted two years
  - Peach trees with GR-ERICA seeds
- Applied in late fall of 2007 and 2008
- Visual weed control ratings in May after application
Treatments

- Glyphosate (840 g/ha) alone
  + diuron (1700 g/ha)
  + simazine (2800 g/ha)
  + norflurazon (1700 g/ha)
  + flumioxazin (336 g/ha)
  + diuron + oryzalin (1680 + 2240 g/ha)

Peach Trees

Carya canadensis control

How resistance in agronomics can impact vegetables:
- More seed production (seedbanks) and greater likelihood for seed movement
- GR resistance can be an issue for cover crop management

Herbicide Site of Action

*C. canadensis*

<table>
<thead>
<tr>
<th>Herbicide group</th>
<th>Site of Action</th>
<th>Active ingredient</th>
<th>Multiple</th>
</tr>
</thead>
<tbody>
<tr>
<td>G / 9</td>
<td>EPSP</td>
<td>glyphosate</td>
<td>D, B</td>
</tr>
<tr>
<td>D / 22</td>
<td>PS I Electron diveters</td>
<td>paraquat</td>
<td>G</td>
</tr>
<tr>
<td>C1 / 5</td>
<td>Photosystem II</td>
<td>atrazine</td>
<td>C2, G</td>
</tr>
<tr>
<td>B / 2</td>
<td>ALS</td>
<td>chlorimuron</td>
<td>G, C1</td>
</tr>
<tr>
<td>C2 / 7</td>
<td>Photosystem II</td>
<td>linuron</td>
<td>C1</td>
</tr>
</tbody>
</table>

First Report in 1980, Group D

*C. bonarilensis*: G, D, C1, D+G
*C. sumatrensis*: G, B, D, E, B+G, B+D+G

Susceptible

Resistant
HR *Conyza* species

- *Conyza canadensis* (62)
  - Australia, Asia, Europe, Middle East, North America, South America
- *Conyza bonariensis* (18)
  - Australia, Europe, Japan, Middle East, North America, South America, South Africa
- *Conyza sumatrensis* (10)
  - Asia, Europe, South America
- *Conyza primulifolia* (none reported)

What Species Are Most Troublesome?

Resistance in *Conyza*

- In Israel, C.c and C.b collected from roadsides 90% resistant to pyrithiobac
  - However, very little of this herbicide is used
- *C. canadensis* glyphosate non-target site (reduced translocation) is most commonly reported
  - also target-site (Pro-106-Ser), higher level of resistance
- Reduced translocation also reported in C. *bonariensis*

Resistance

- Outcross of HR genes (R to S populations) occurs (~5% in controlled studies)
- Pollen movement
  - 2.5% of pollen from source was deposited ~450 m downwind
  - Pollen able to rise up to 100 m in atmosphere
Applying *C. canadensis* Ecology to Management

- Has been beneficial for making more informed decisions – i.e. need for residual herbicides; need for more integrated approaches (cover crops); eliminating *C. canadensis* from seedbank not practical
- Still more work to be done; has not found the “silver bullet”
- Concern with multiple resistance
  - Cover crops in combination with fall herbicide treatments look promising

What Makes *Conyza* Unique?

- It’s ability to disperse locally as well as over great distances
- Treat as if HR biotype is the predominate biotype in the area
- Well adapted to no-till or perennial crop production

OBRIGADA!