Conyza species emphasis on *Conyza canadensis*

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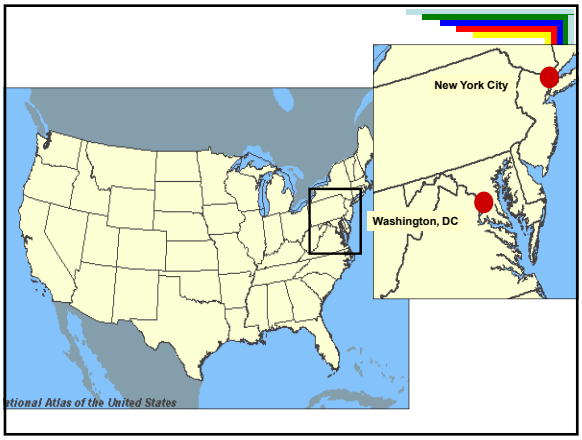
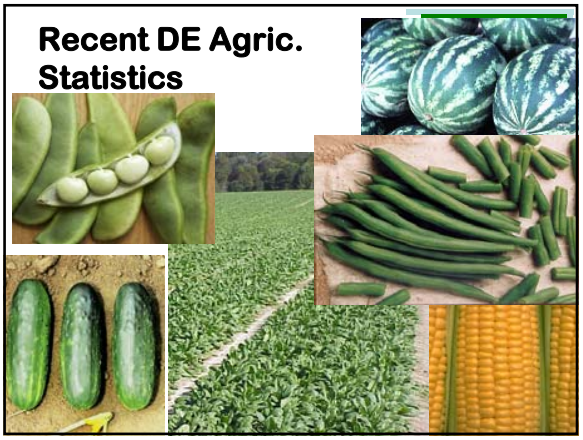
Cooperative Extension
University of Delaware
College of Agriculture & Natural Resources

Topics

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



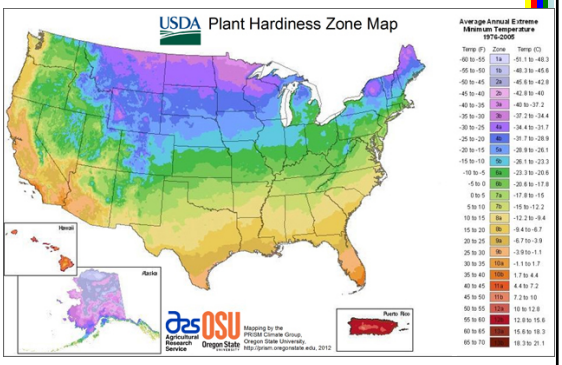
Recent DE Agric. Statistics



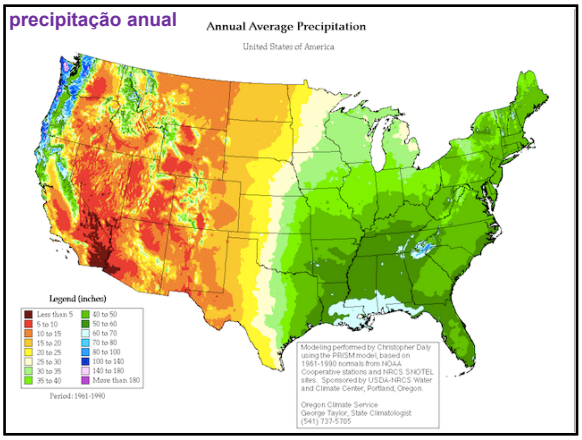
Recent DE Agric. Statistics

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

zonas de robustez



precipitação anual



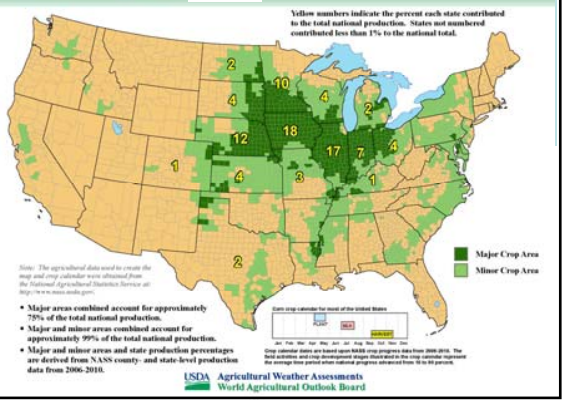
Area Planted

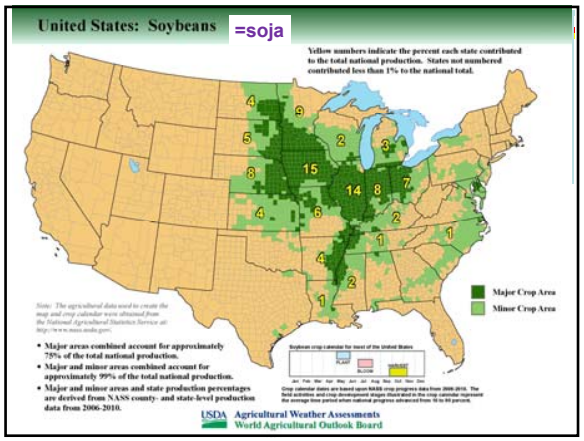
Crop	A	ha	Crop	A	ha
	million			million	
soybean	81	32.8	rice	2.6	1.1
corn	80.7	32.7	sunflower	1.9	0.8
wheat (all)	54.6	22.1	canola	1.8	0.7
__winter	39.5	16.0	dry beans	1.8	0.7
__spring	19	7.7	rye	1.6	0.6
hay crop	54.4	22.0	peanuts	1.6	0.6
__alfalfa	17.7	7.2	sugarbeet	1.2	0.5
__other hay	36.7	14.9	dry peas	1.1	0.4
sorghum (grain)	8.5	3.4	potatoes	1.1	0.4
cotton	8.08	3.3	vegetables (fresh)	1.4	0.6
barley	3.6	1.5	vegetables (process)	1.1	0.4
oats	3.1	1.3			

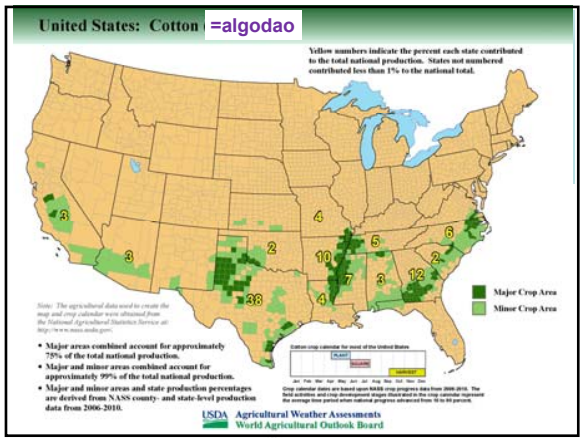
Area Planted

Crop	ha (mil)	%	Crop	ha (mil)	%
soja	32.8	24.9	arroz	1.1	0.8
milha	32.7	24.8	girassol	0.8	0.6
trigo (all)	22.1	16.8	canola	0.7	0.5
__inverno	16.0	12.1	feijoes secos	0.7	0.5
__primavera	7.7	5.8	centeio	0.6	0.5
choheita do feno	22.0	16.7	amendoins	0.6	0.5
__alfalfa	7.2	5.5	beterraba	0.5	0.4
__other hay	14.9	11.3	ervilhas secas	0.4	0.3
sorgo	3.4	2.6	batatas	0.4	0.3
algodão	3.3	2.5	vegetal (fresco)	0.6	0.5
cevada	1.5	1.1	vegetal (processo)	0.4	0.3
aveia	1.3	1.0			

United States: Corn =milha




United States: Soybeans
=soja
Yellow numbers indicate the percent each state contributed to the total national production. States not numbered contributed less than 1% to the national total.
Major Crop Area
Minor Crop Area
Major areas combined account for approximately 75% of the total national production.
Major and minor areas combined account for approximately 99% of the total national production.
Major and minor areas and state production percentages are derived from NASS county- and state-level production data from 2006-2010.
USDA Agricultural Weather Assessments
World Agricultural Outlook Board


United States: Cotton
=algodao
Yellow numbers indicate the percent each state contributed to the total national production. States not numbered contributed less than 1% to the national total.
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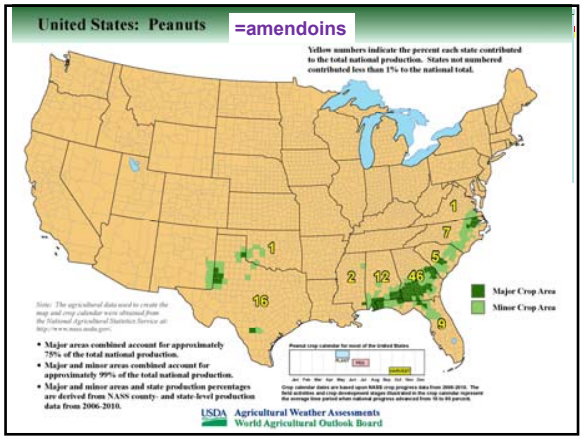
United States: Peanuts
=amendoins
Yellow numbers indicate the percent each state contributed to the total national production. States not numbered contributed less than 1% to the national total.
Major Crop Area
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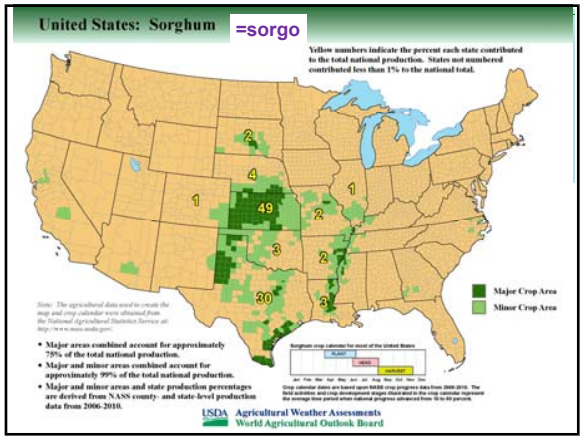
United States: Sorghum
=sorgo
Yellow numbers indicate the percent each state contributed to the total national production. States not numbered contributed less than 1% to the national total.
Major Crop Area
Minor Crop Area
Major areas combined account for approximately 75% of the total national production.
Major and minor areas combined account for approximately 99% of the total national production.
Major and minor areas and state production percentages are derived from NASS county- and state-level production data from 2006-2010.
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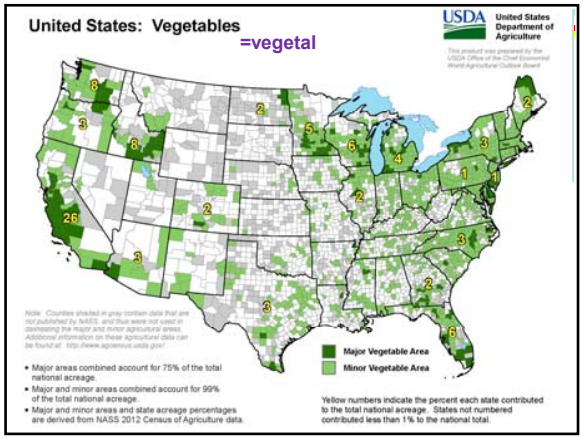
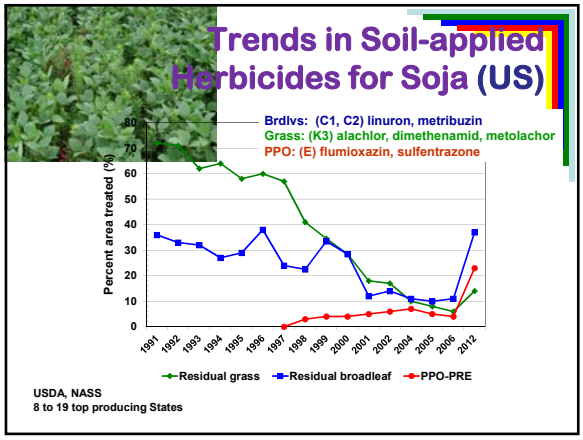
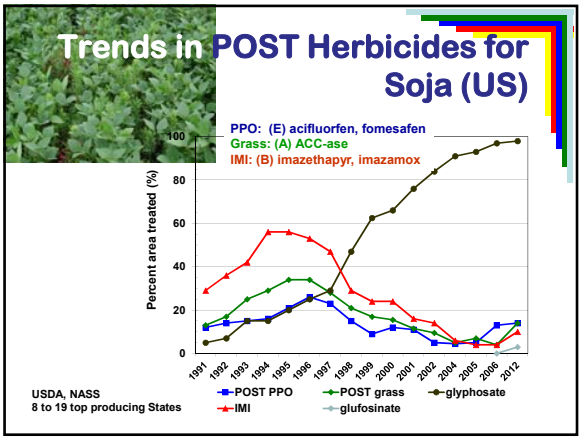

United States: Vegetables
=vegetal
USDA United States Department of Agriculture
Major Vegetable Area
Minor Vegetable Area
Major areas combined account for 75% of the total national acreage.
Major and minor areas combined account for 99% of the total national acreage.
Major and minor areas and state acreage percentages are derived from NASS 2012 Census of Agriculture data.
Yellow numbers indicate the percent each state contributed to the total national acreage. States not numbered contributed less than 1% to the national total.


Trends in Soil-applied Herbicides for Soja (US)
Brdlvs: (C1, C2) linuron, metribuzin
Grass: (K3) alachlor, dimethenamid, metolachor
PPO: (E) flumioxazin, sulfentrazone
Percent area treated (%)
0
10
20
30
40
50
60
70
80
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2004
2005
2006
2012
Residual grass
Residual broadleaf
PPO-PRE
USDA, NASS
8 to 19 top producing States

Trends in POST Herbicides for Soja (US)



Conyza species

- *Conyza canadensis*; formerly *Erigeron canadensis*
  - horseweed, marestail, Canadian fleabane
- *Conyza bonariensis*
  - hairy fleabane, flaxleaf fleabane
- *Conyza sumatrensis*
  - Sumatran fleabane
- *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, is especially hairy on the stems and around the leaf axils
  - toothed leaves

Conyza species

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

Capitula (seedheads)

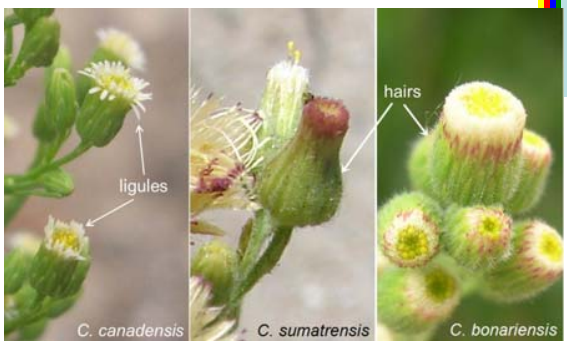


Table 1. Distinguishing features of three *Conyza* species (Sansom 2011)

	Conyza canadensis	*Conyza bonariensis*	*Conyza sumatrensis*
LEAVES	yellowish green, seedling leaves hairy adult leaves glabrous, (hairless) except leaf edges	greyish green very hairy	greyish green very hairy
	petiole narrow	petiole narrow	petiole broader in middle
	single visible rib	single visible rib	secondary veins visible
STEMS	glabrous	very hairy	very hairy
Average height (m)	1.5	1	2
Branching habit	branching from middle of main stem	secondary branches often taller than main stem & from the base	branching towards top of main stem
FLOWERS	ray florets white, ligulate slightly protruding	tubular, ray florets greenish yellow	tubular, ray florets cream
	inner disc florets yellow	inner disc florets inconspicuous, white	inner disc florets inconspicuous
Bracts of the involucre	glabrous brownish inner surface	densely hairy, some long hairs at apex are	hairy but no long hairs near apex
	pappus cream	red/purple tipped	pale at the top

Comparison of C. canadensis and C. bonariensis

Hembree and Shrestha, UC-Davis

Table 1. Key characteristics of horseweed and hairy fleabane

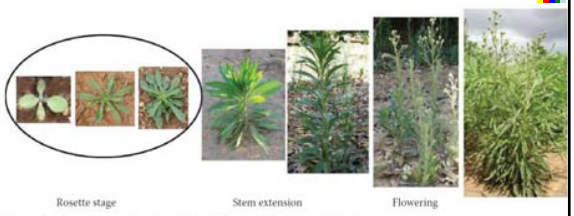
Characteristics	Horseweed	Hairy fleabane
Leaves	Seed leaves dull green, oval, covered with soft, fine hairs. True leaves dark green with fine toothed margins, forming a compact rosette. Lower leaves inversely lance shaped, usually serrated margins, with short stalks. Upper leaves more narrow, without stalks, smooth around the margins, alternate and crowd around the stem, up to 4" long.	Seed leaves dull green, oval, covered with soft, fine hairs. True leaves light or dull green, somewhat crinkled. Mature leaves narrow, crinkled, grayish in color, slightly toothed around the margins, less than 3" long.
Mature plant	Erect, single stem, up to 10' tall, somewhat rough to the touch, with shaggy hairs.	Multi-branched, without a central stem growing 1½ to 3' tall, hairy.
Flowers	Small, yellowish flower heads at the ends of branched stems at the top of the plant.	Small, yellowish flower heads at the ends of branched stems at the upper part of the plant.
Seed	Tiny, narrow, tan colored, with firm grayish hair (pappus) at upper end. Up to 230,000 per plant.	Tiny, narrow, tan colored, with firm grayish hair (pappus) at upper end. 10,000 or more per plant.

C. sumatrensis

hairy stem

C. sumatrensis, left
C. bonariensis, right

Stages of development



Rosette stage | Stem extension | Flowering

Figure 3. *Conyza* control options with glyphosate (Saborido 2011)

Life-cycle in N. America

C. canadensis

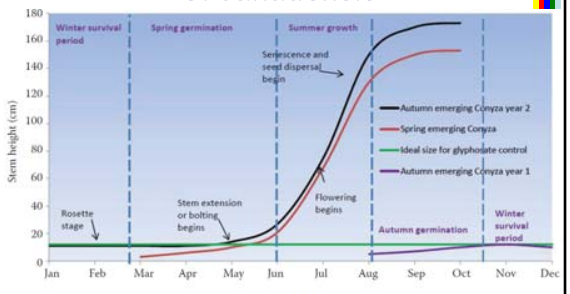


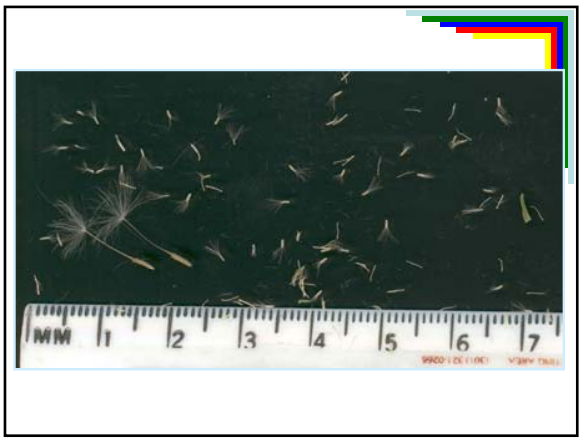
Figure 1. The lifecycle of *Conyza canadensis* – adapted from Loux *et al.* (2004)

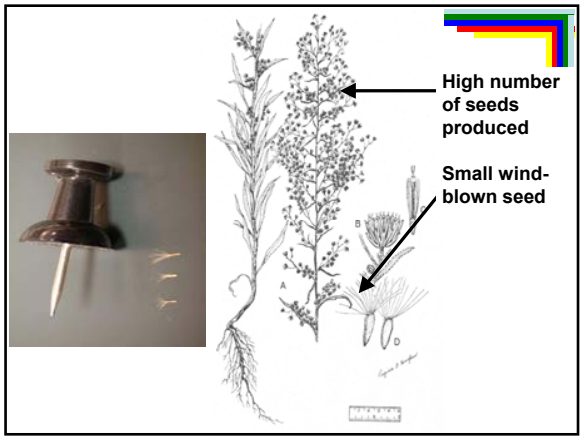
Similarities among *Conyza* spp.

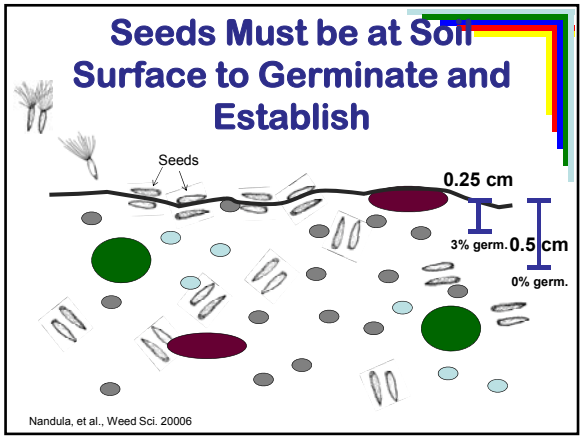
- Annual species
  - also listed as biennial
- Early succession species
- Taproot
- Rosette followed by bolting (upright growth)
- Tall
- Large number of seeds with pappus

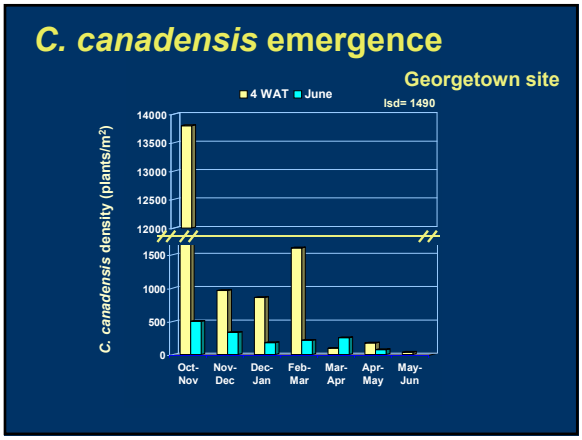
Infested sites

- Grain and row crops
  - corn, soybeans, cotton, wheat
- Perennial crops
  - coffee, orchards, grapes, nut crops, berries
- Nurseries
- Forests
- Industrial sites, roadsides, fencelines, railways


MM
1
2
3
4
5
6
7

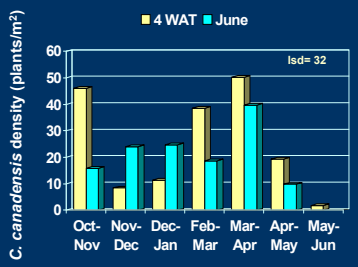

High number of seeds produced
Small wind-blown seed


Seeds Must be at Soil Surface to Germinate and Establish
Seeds
0.25 cm
3% germ.
0.5 cm
0% germ.
Nandula, et al., Weed Sci. 20006


C. canadensis emergence
Georgetown site
4 WAT
June
lsd= 1490
C. canadensis density (plants/m²)
14000
13500
13000
12500
12000
1500
1000
500
0
Oct-Nov
Nov-Dec
Dec-Jan
Feb-Mar
Mar-Apr
Apr-May
May-Jun

C. canadensis emergence

Seaford site



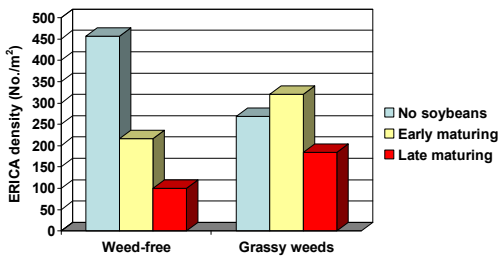
- Seedlings found in "open areas"
- Density of seedlings in plots much lower

- 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



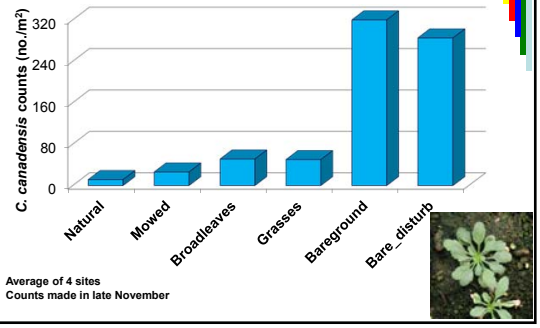
Safe-Sites for Development

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



Effect of Crop Residue on *C. canadensis* Establishment

Effect of Crop Residue on *C. canadensis* Establishment

Effect of Crop Residue on *C. canadensis* Establishment

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

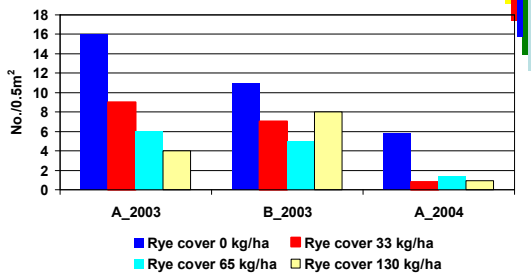
Effect of Winter Cover Crop

- Popularity of cover crops for soil health and nutrient management

Effect of Rye on *C. canadensis* Establishment

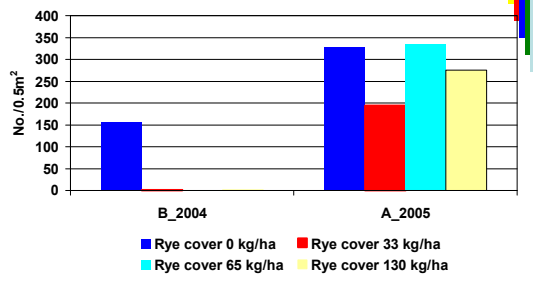
- Rye seedling rates
  - 0
  - 0.5 bu/A = 33 kg/ha
  - 1 bu/A = 65 kg/ha
  - 2 bu/A = 130 kg/ha
- Spring nitrogen applications
  - 0 or 33 kg/ha

Effect of Rye on *C. canadensis* Establishment



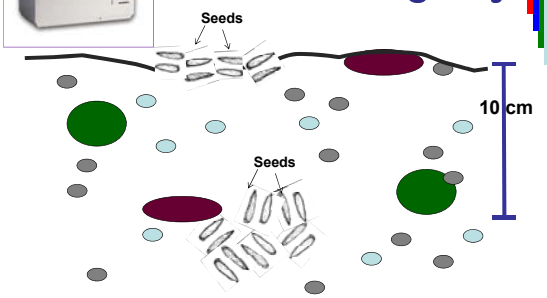
Nitrogen at 33 kg/ha had no impact

Effect of Rye on C. canadensis Establishment

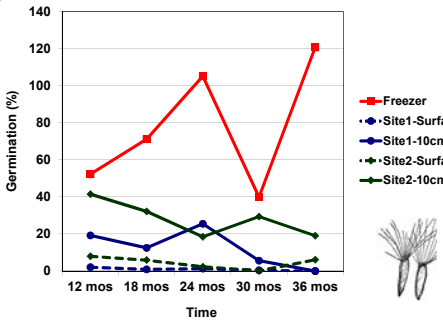


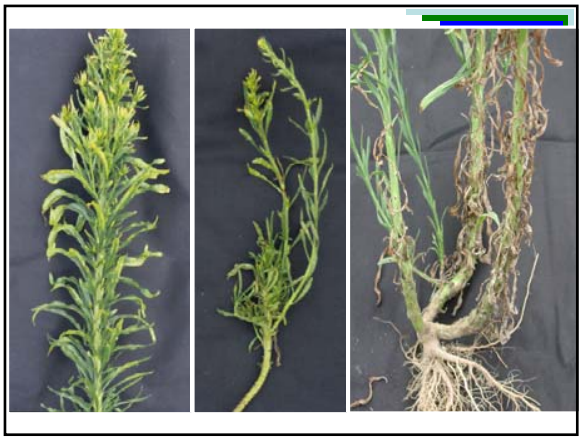
Nitrogen at 33 kg/ha had no impact

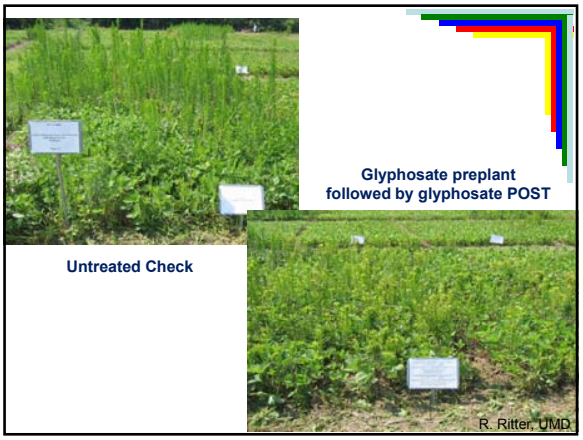
Evaluating Seed Longevity

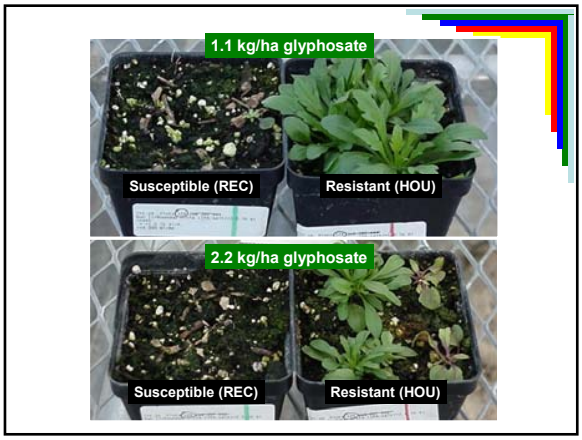


Seed Longevity





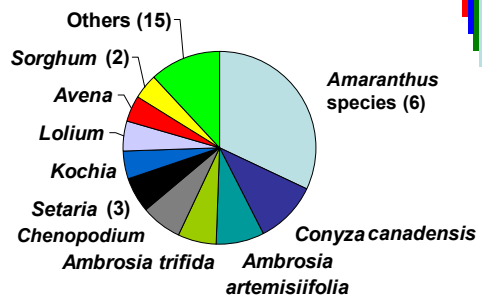




HR *Conyza* species

- *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?



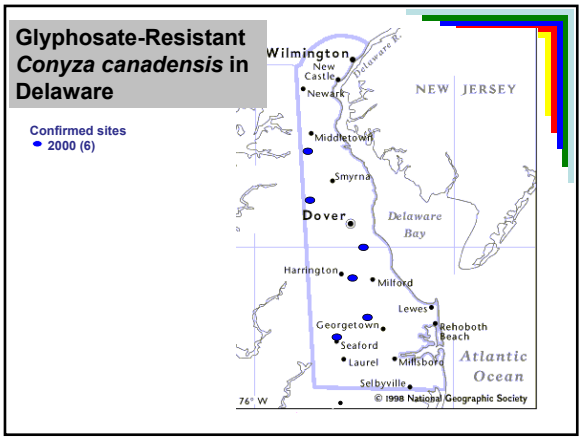
US Extension Specialists

Herbicide Site of Action

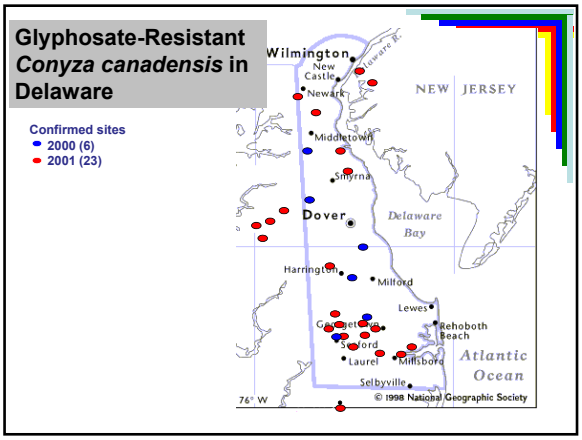
Symbol	Site of Action	Active Ingredient	Multiple
G / 9	EPSP	glyphosate	D + G
D / 22	PS I Electron diverters	paraquat	B + G
C1 / 5	Photosystem II	atrazine	B + C1
B / 2	ALS	chlorimuron	C1 + C2
C2 / 7	Photosystem II	linuron	

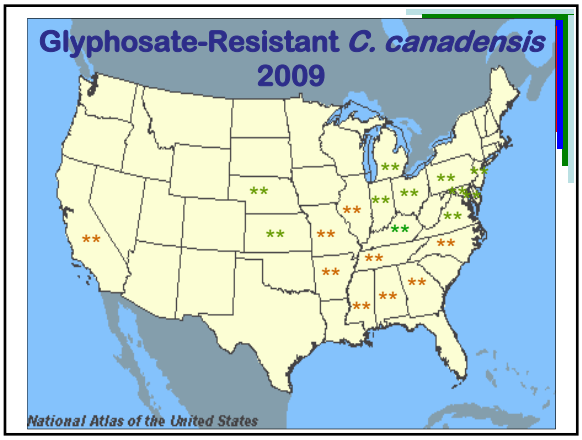
First report was C1 in 1989

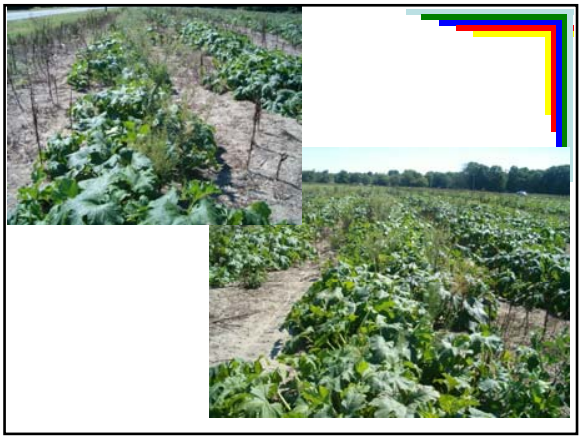
Glyphosate-Resistant *Conyza canadensis* in Delaware



Glyphosate-Resistant *Conyza canadensis* in Delaware







Untreated check

R. Ritter, UMD

Saflufenacil preplant – 25 g/ha

R. Ritter, UMD

Glufosinate Preplant

R. Ritter, UMD

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 *C. canadensis* Unique?

- It's ability to disperse locally as well as over great differences
- Treat as if it is the predominate biotype in the area
- Well adapted to no-till crop production