

Glyphosate-Resistant Populations of *Amaranthus palmeri* Prove Difficult to Control in the Southern United States

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Outline of the Presentation

- **Pigweeds, Glyphosate and Transgenic Glyphosate-Resistant Cultivars, Selection**
- **Distribution of Resistant Populations**
 - Reported at weedscience.org (HRAC)
 - Confirmed Populations and Hectares
- **Need for New Management Systems**
- **Impacts on Tillage and Prospects for Conservation of Modes Herbicide Action**

Common Pigweed Species (*Amaranthus* spp.) in North America



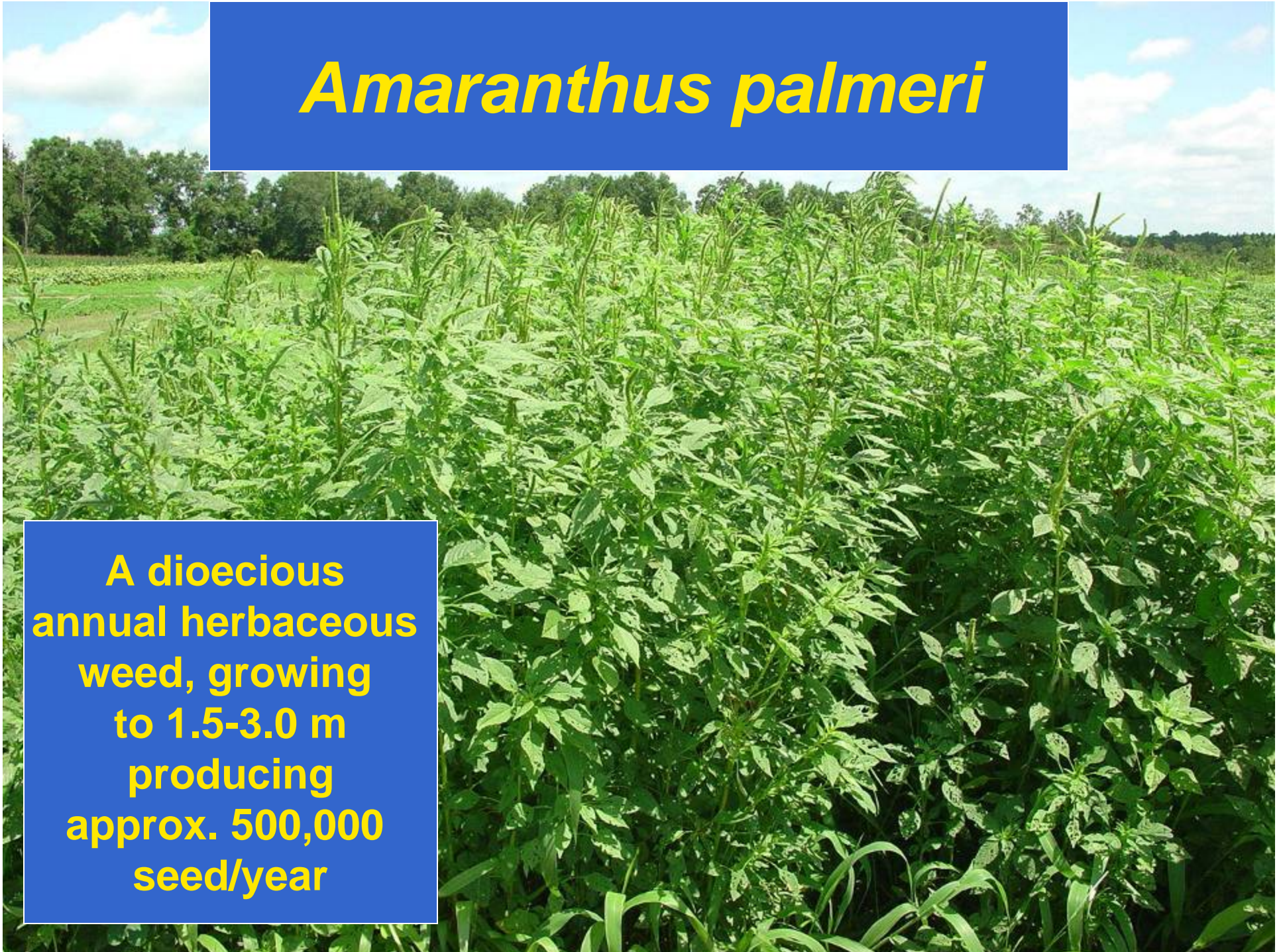
Relative Growth Rates of Amaranthus Species

- *Amaranthus palmeri* > *A. retroflexus*
- > *A. hybridus* > *A. rudis* > *A. spinosus*
- > *A. albus*
- In height and accumulation of biomass
- Palmer amaranth ~ 65% more biomass at
2 weeks after emergence

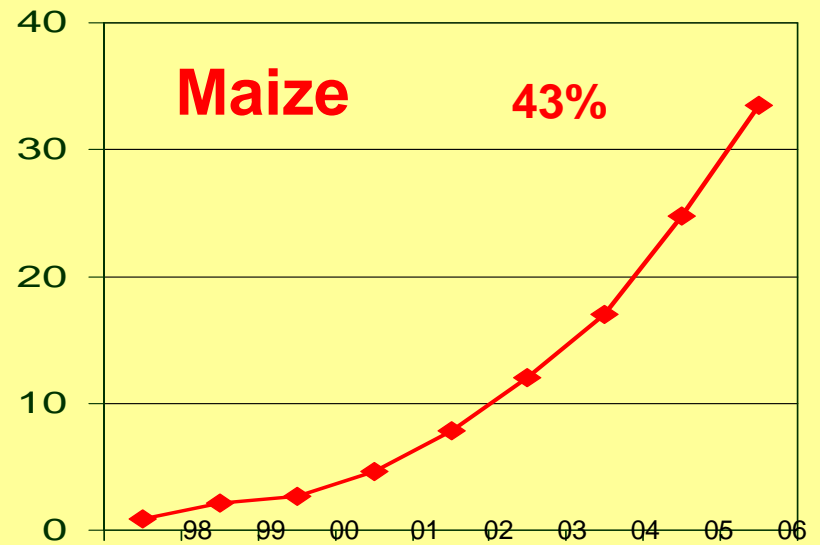
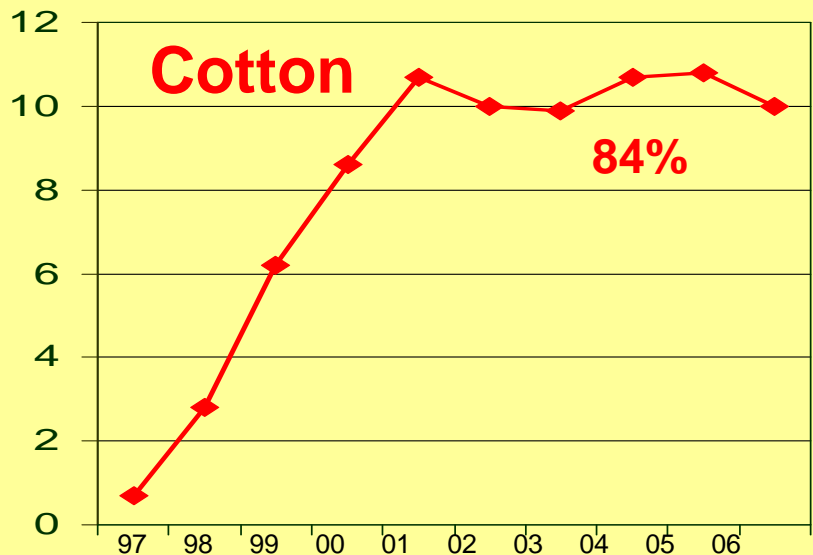
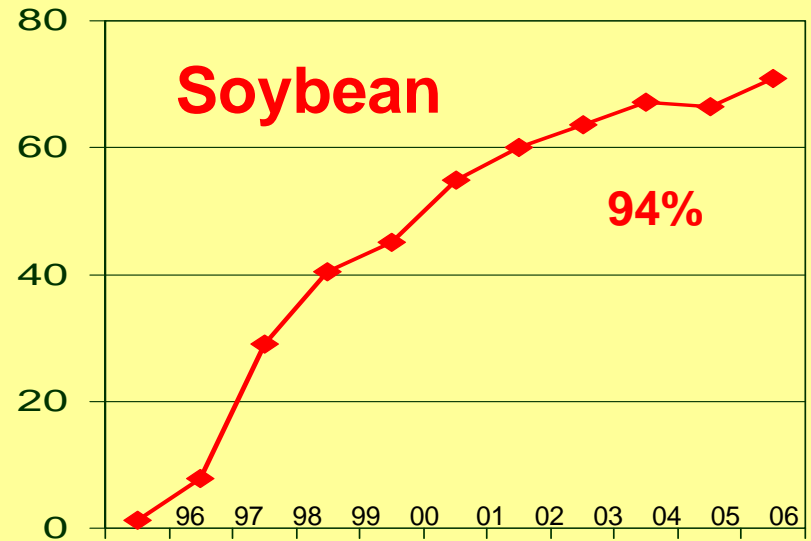
Sellers et al. 2003. *Weed Science* 51:329-333.

Amaranthus palmeri

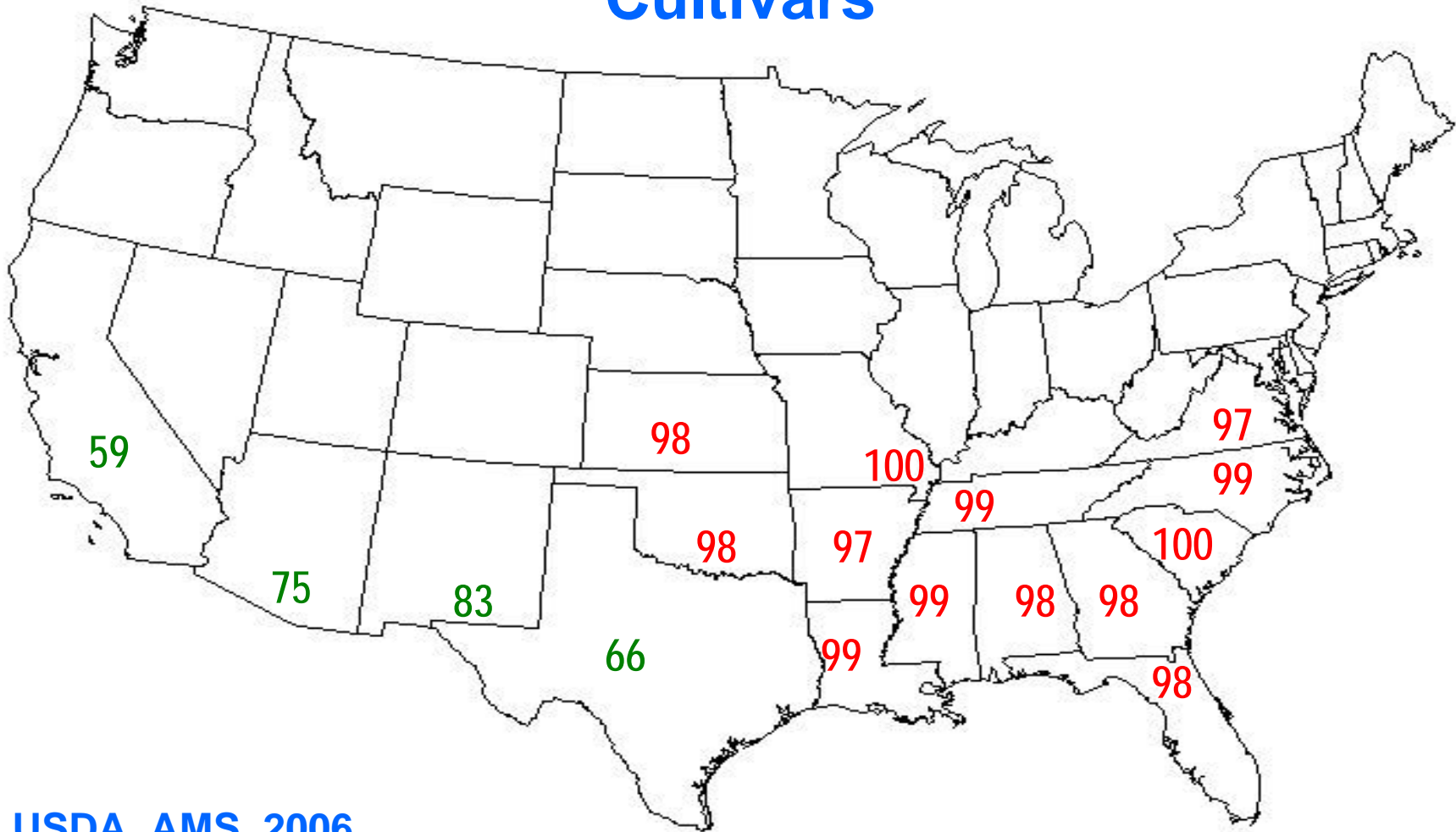
**A dioecious
annual herbaceous
weed, growing
to 1.5-3.0 m
producing
approx. 500,000
seed/year**



Adoption of Glyphosate- Resistant Cultivars in the United States



Percent of Cotton Planted to Glyphosate-Resistant Cultivars



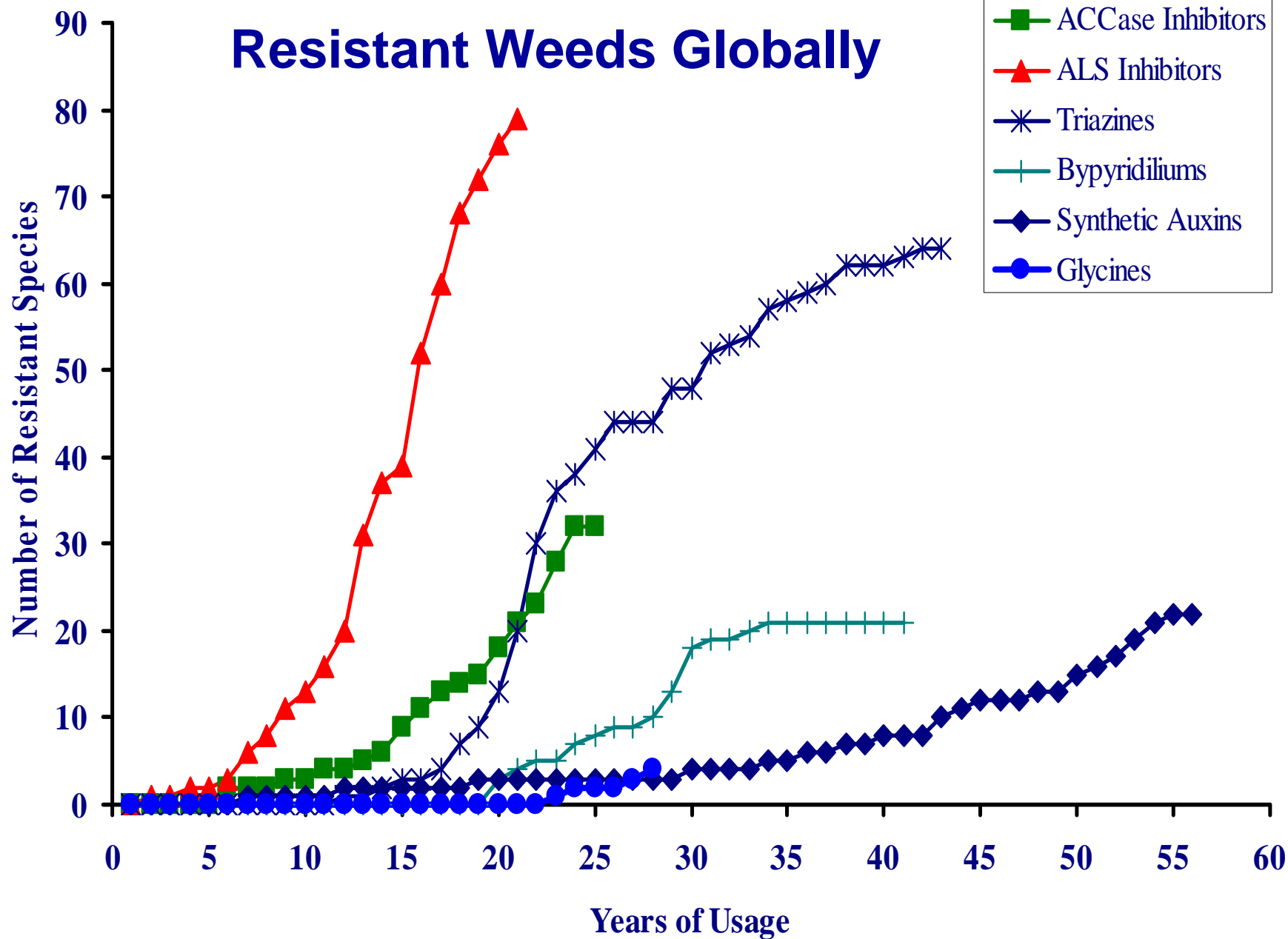
USDA, AMS. 2006.

Weed Resistance

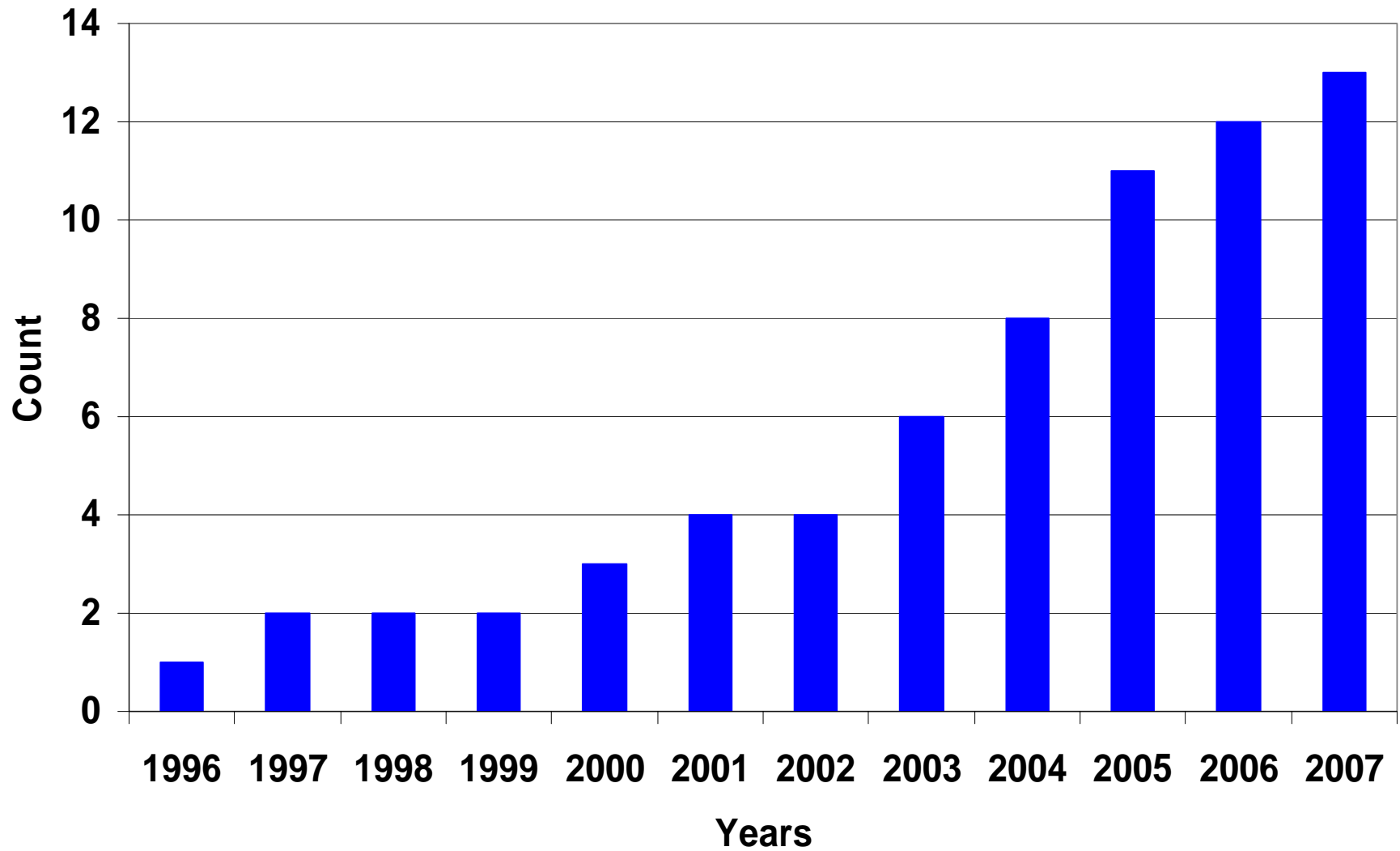
“Inherited ability of a weed population to survive and reproduce after exposure to a herbicide dose (rate) that would control an unselected population”

--- Weed Science Society of America

Resistant Weeds Globally



Glyphosate Resistant Weeds

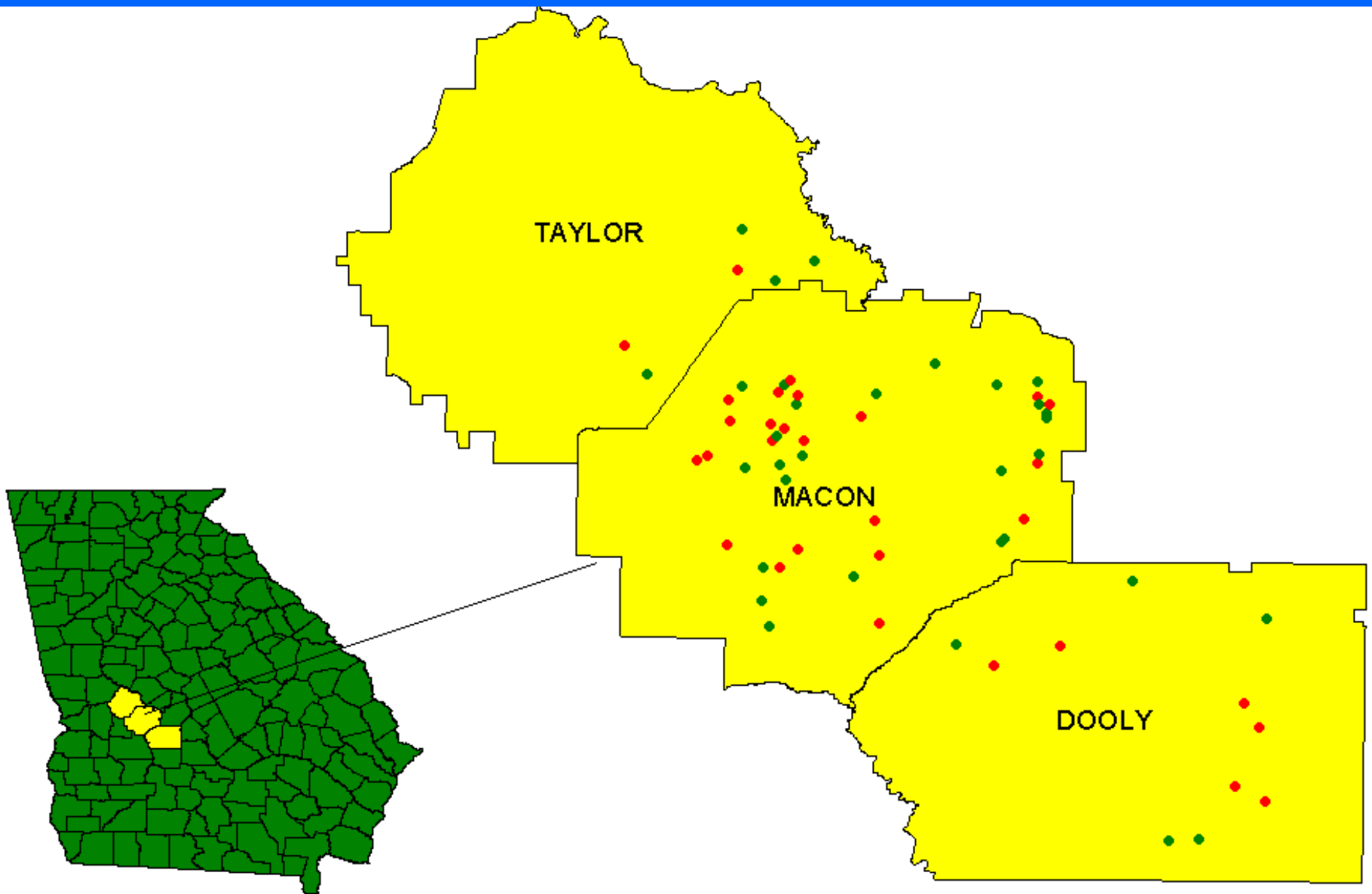


Reported Distribution of Glyphosate-Resistant Palmer amaranth

State	HRAC 6/08		IWSC 6/08	
	sites	hectares	counties	hectares
Arkansas	1	nr	15	304k
Georgia	101-500	100k-1M	20	112k
North Carolina	nr	nr	11	2k
South Carolina	nr	nr	3	4k
Tennessee	<5	101-500	3	1k



Field Failure- Macon County Georgia





1.3 kg ae glyphosate/ha



2.6 kg ae glyphosate/ha



5.2 kg ae glyphosate/ha

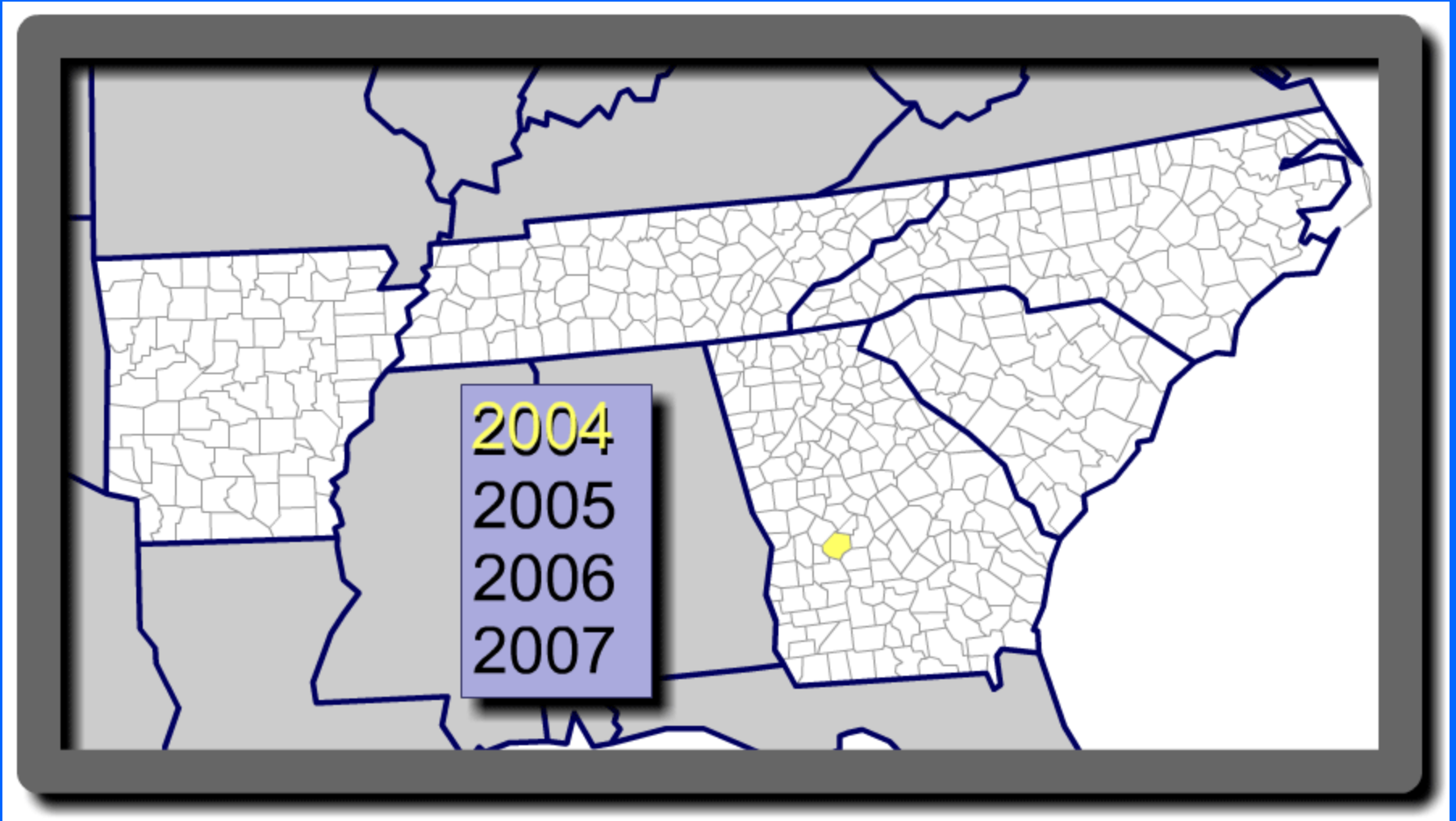


7.8 kg ae glyphosate/ha

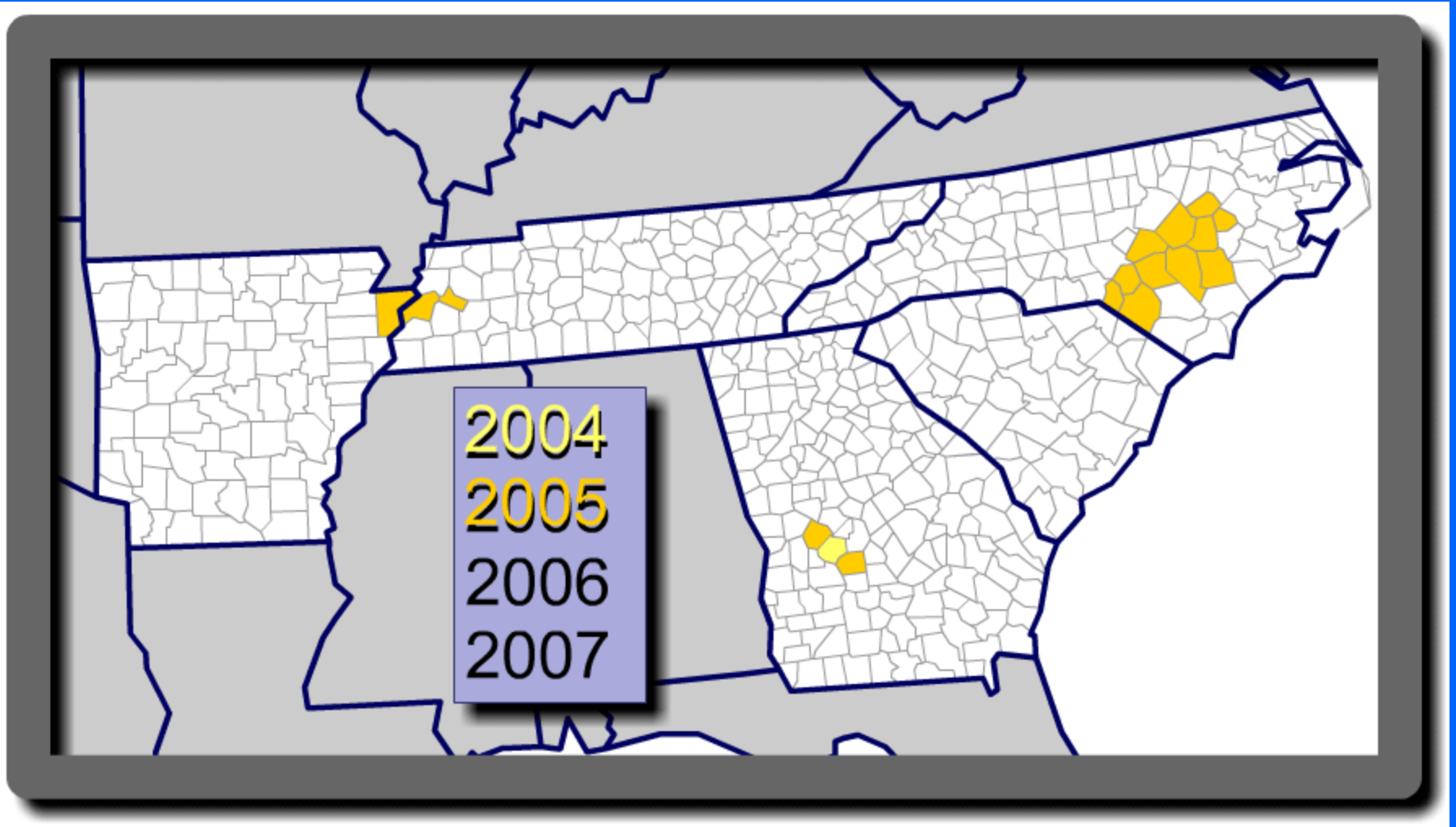


10.4 kg ae glyphosate/ha

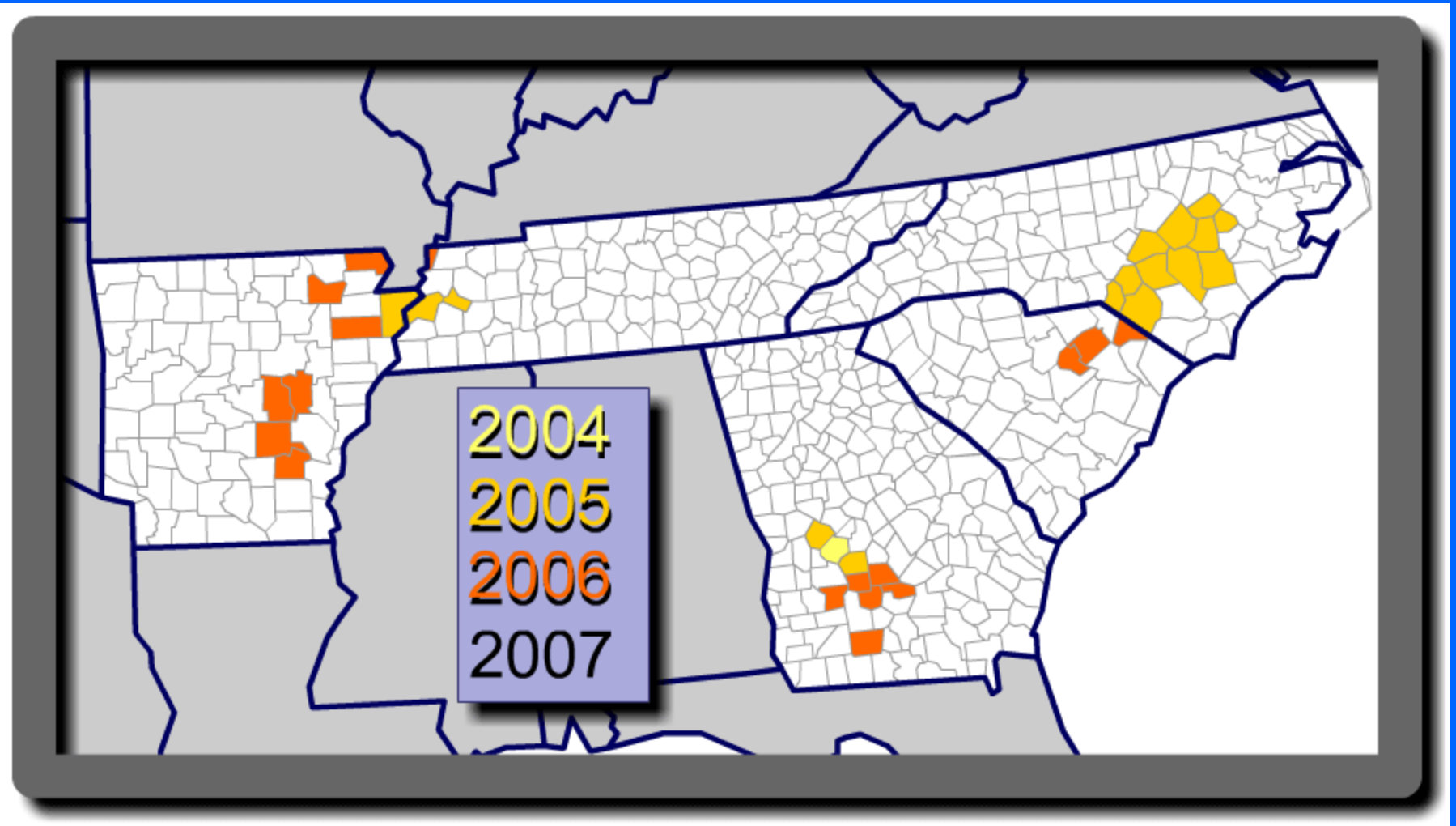
Initial Confirmation of Glyphosate Resistance in Palmer amaranth - Georgia



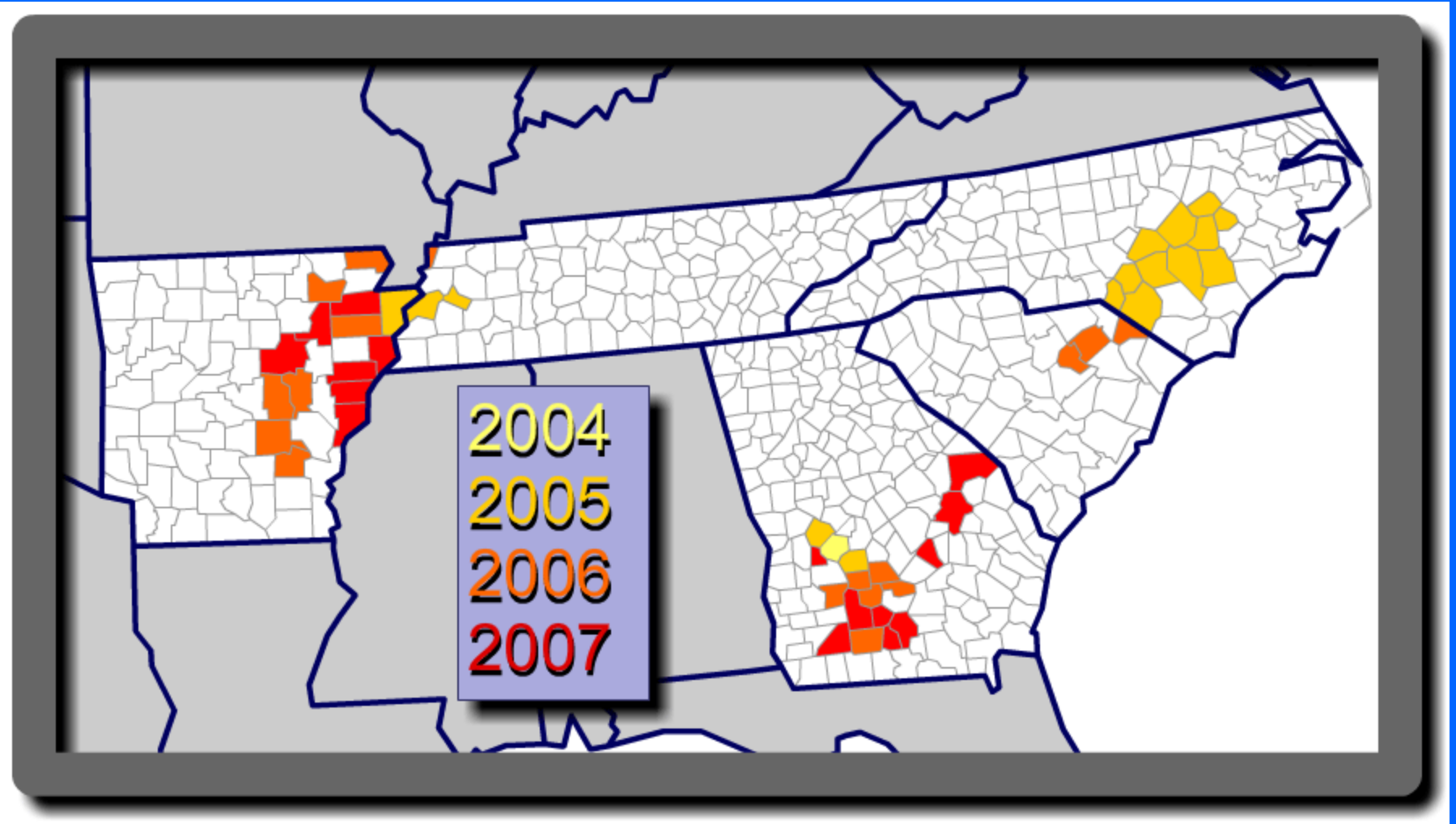
Additional Populations Confirmed in Arkansas, North Carolina, and Tennessee



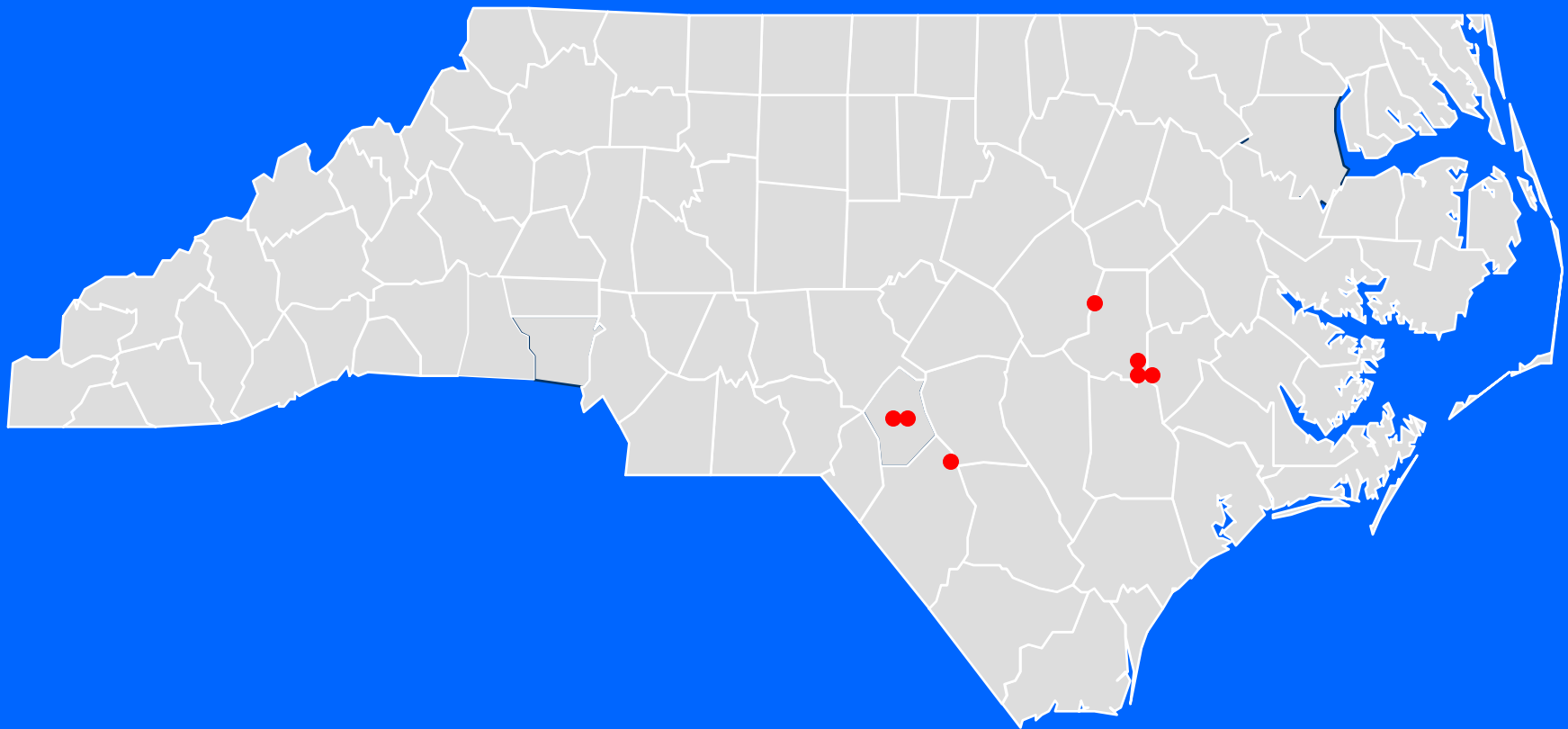
More Counties Affected



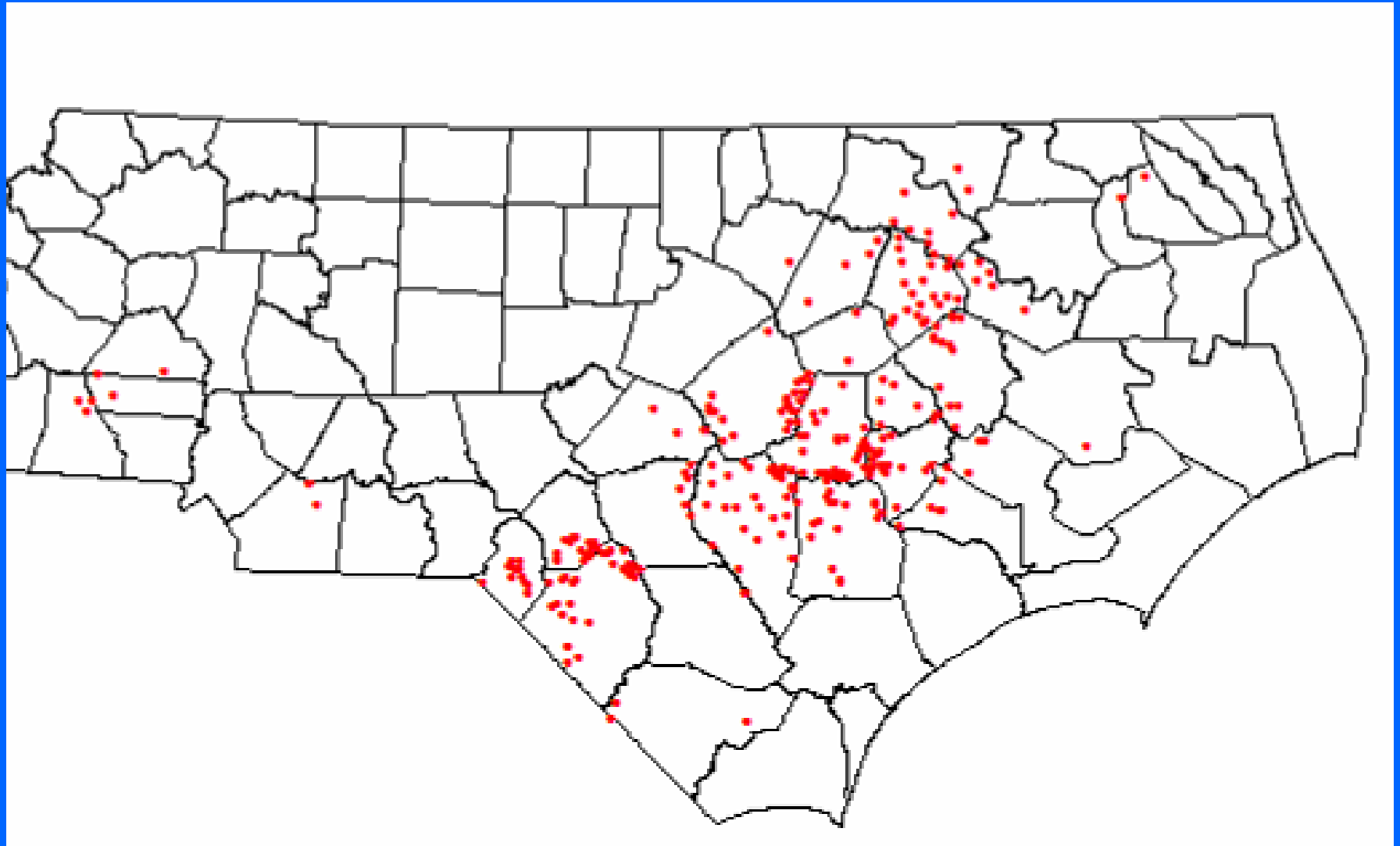
Populations Continue Expansion; Some Monitoring Efforts Will be Discontinued



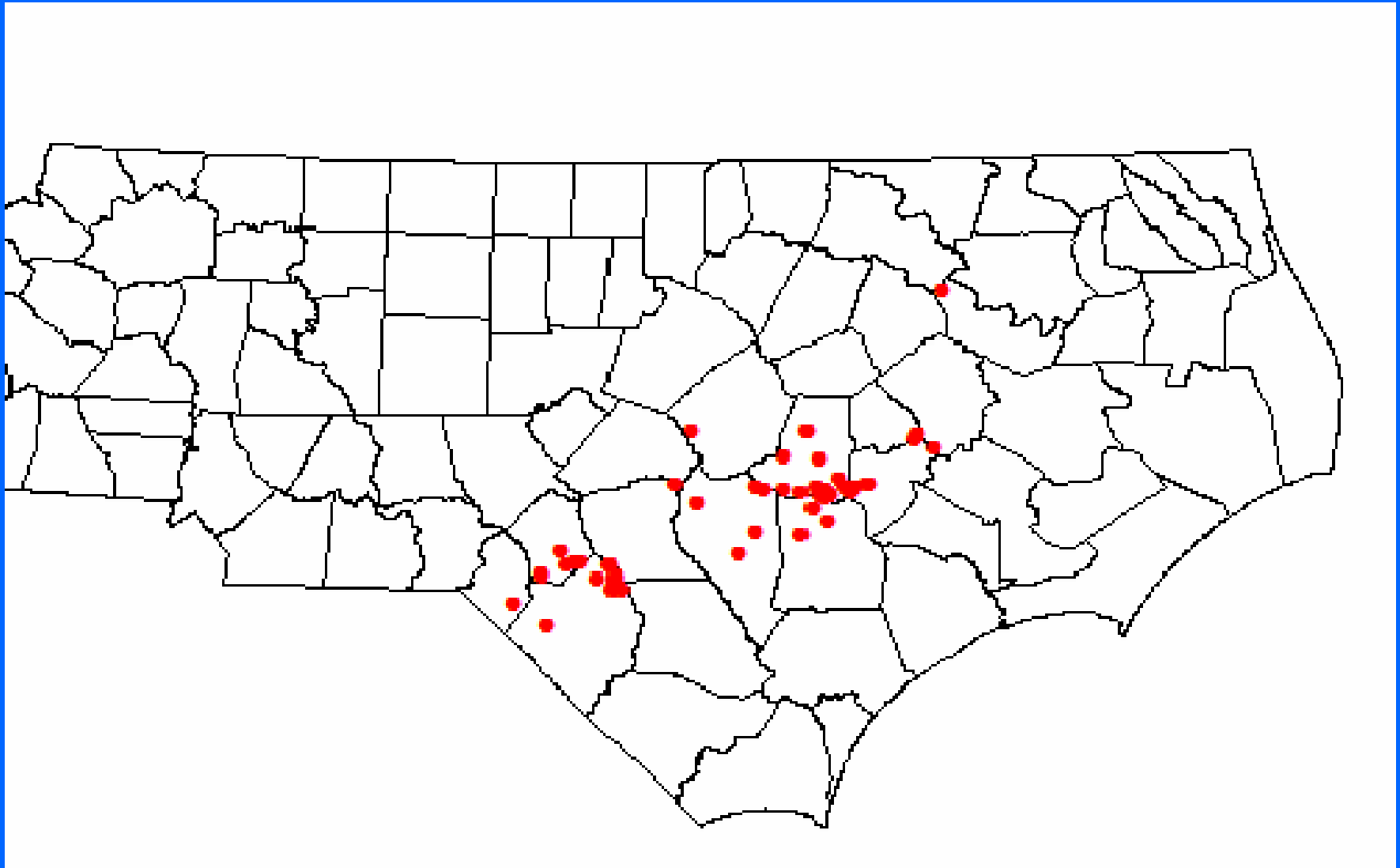
Suspected Glyphosate-Resistant Palmer Amaranth – 2005



Fall Seed Collection 2005 (290 Fields)



Resistant Locations 2006 (52 fields)



Cotton, Hoke County, North Carolina Glyphosate-Resistant Palmer Amaranth



Soybean, Wayne County, North Carolina Glyphosate-Resistant Palmer Amaranth



Cotton Weed Management Systems

- **Conventional**
 - Full tillage, pre-plant incorporated, early and late post-directed; 2-3 cultivations
- **Glyphosate - Resistant Cultivar**
 - Conservation tillage, burn down, two post emergence glyphosate applications, layby
- **Glyphosate - Resistant Weed(s)**
 - Tillage (?)
 - Pre-emergence residual, glyphosate + residual early post, layby(s), cultivations (?)

Possible Weed Management Program for Glyphosate-Resistant Palmer amaranth in Cotton

burn down – glyphosate + dicamba

pre-emergence – pendimethalin +
fomesafen

early post - s-metolachlor

layby – MSMA + diuron

Impacts of Glyphosate-Resistant Palmer amaranth

- **Increase complexity and costs of weed management in cotton and soybean**
- **Compromise conservation tillage in the short term and possibly the long-term**
- **May precipitate a cascade of resistance in post emergence broad-leaf herbicides**

Possible Resistance Cascade in Post Emergence Herbicides

- Glycines 'Solved' ALS resistance in Soybean Weed Management
- If Glyphosate is compromised and
- ALS herbicides are compromised and
- Protoporphyrin oxidase herbicides are compromised
- What's left?

Strategies for Management of Glyphosate-Resistant Palmer Amaranth

**No new post emergence chemistry
in the short term**

- 1. Use More Modes of Action**
- 2a. New Cover Crop Strategies or**
- 2b. Use Precision Cultivation**
- 3. Rotate with Other Crops to Reduce Populations**

Weed biomass in conservation-tilled soybean as affected by cover crop and herbicide regime (51 DAP)

Price, A. J., D. W. Reeves, and M. G. Patterson. 2006. Evaluation of three winter cereals for weed control in conservation-tillage non-transgenic soybean. *Renewable Agric. and Food Sys.* 21:159-164.

