

Symposium: Crop Specific Management Programs for Herbicide- Resistant Weeds

Jim Griffin, Daniel Stephenson, and Eric
Webster



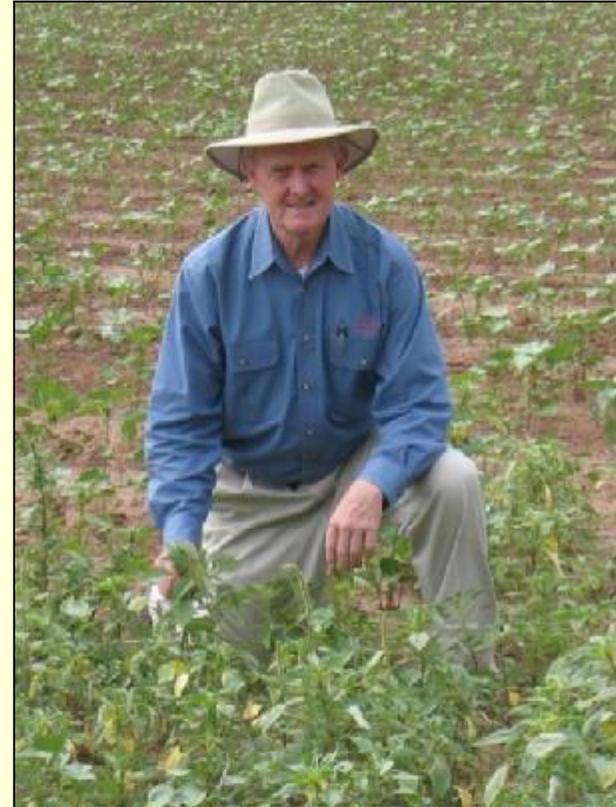
Plans For Symposium....

- Griffin
 - Update status of herbicide-resistant (HR) weeds in the U.S. and in Louisiana
 - Mechanism of HR weed development
- Stephenson - Specific management programs for rows crops
- Webster - Specific management programs for rice

Request that questions be held until the end ...

Herbicide Resistance

- Recent popular press articles state:
 - Resistance threatens the ability of crop producers to farm profitably
- Glyphosate gets the headlines, but numerous weed species are resistant to many herbicide modes of action.



“Glyphosate-resistant Palmer amaranth is the most significant threat to agriculture that I have seen in my 30+ years.” Dr. Ken Smith, Extension Weed Scientist, Univ. of Arkansas.

Herbicide Resistance?

Weed Science Society of America (WSSA) defines herbicide resistance as: "The inherited ability of a plant to survive and reproduce following exposure to a dose of herbicide normally lethal to the wild type."

Heap and Lebaron 2001 - "The evolved capacity of a previously herbicide-susceptible weed population to withstand a herbicide and complete its life cycle when the herbicide is used at its normal rate in an agricultural situation."



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Griffin 2013 - "Herbicide resistance implies that the herbicide at one time controlled the weed but no longer provides control."

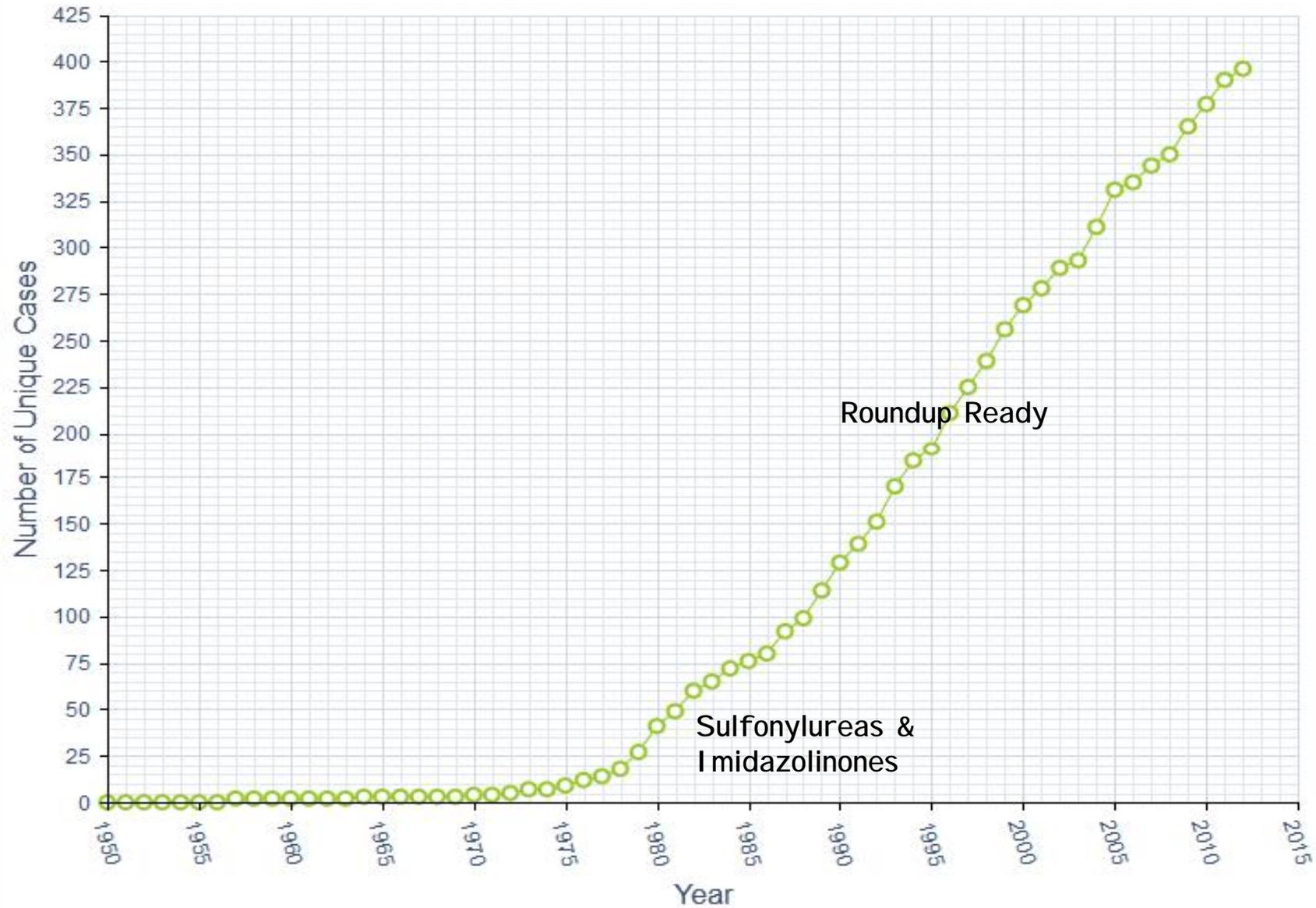
Herbicide-Resistant Weeds in U.S.

- 1957: Synthetic auxin-resistant (2,4-D) spreading dayflower
- 1964: Synthetic auxin-resistant (2,4-D) field bindweed
- 1970: Triazine-resistant (simazine) common groundsel
- 1972: Triazine-resistant (atrazine) smooth pigweed
- 1973: DNA-resistant (trifluralin) goosegrass
- 1975: Triazine-resistant (atrazine, simazine, metribuzin) lambsquarters



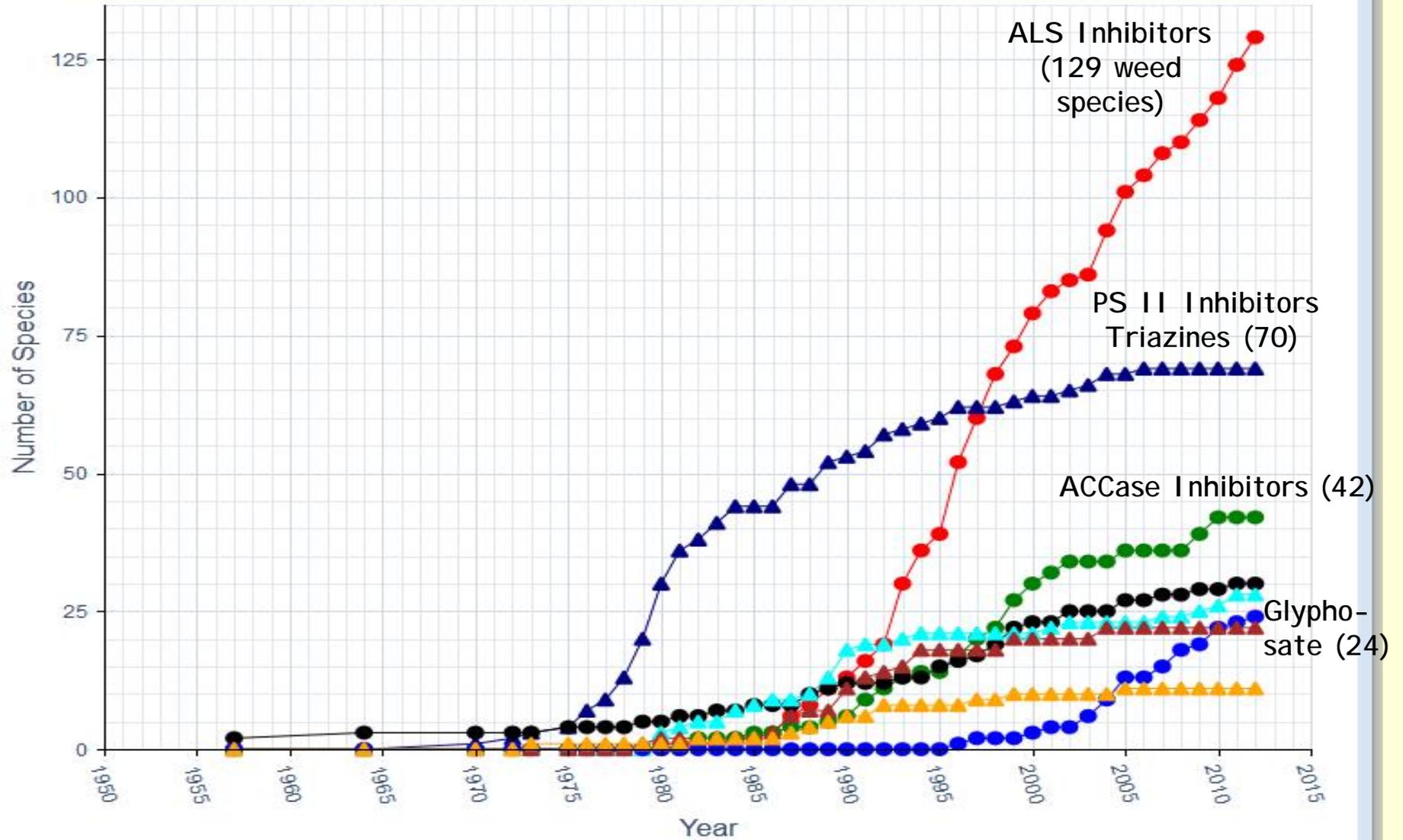
2013: 142 weed species confirmed as herbicide resistant in U.S.

Chronological Increase in Resistant Weeds Globally

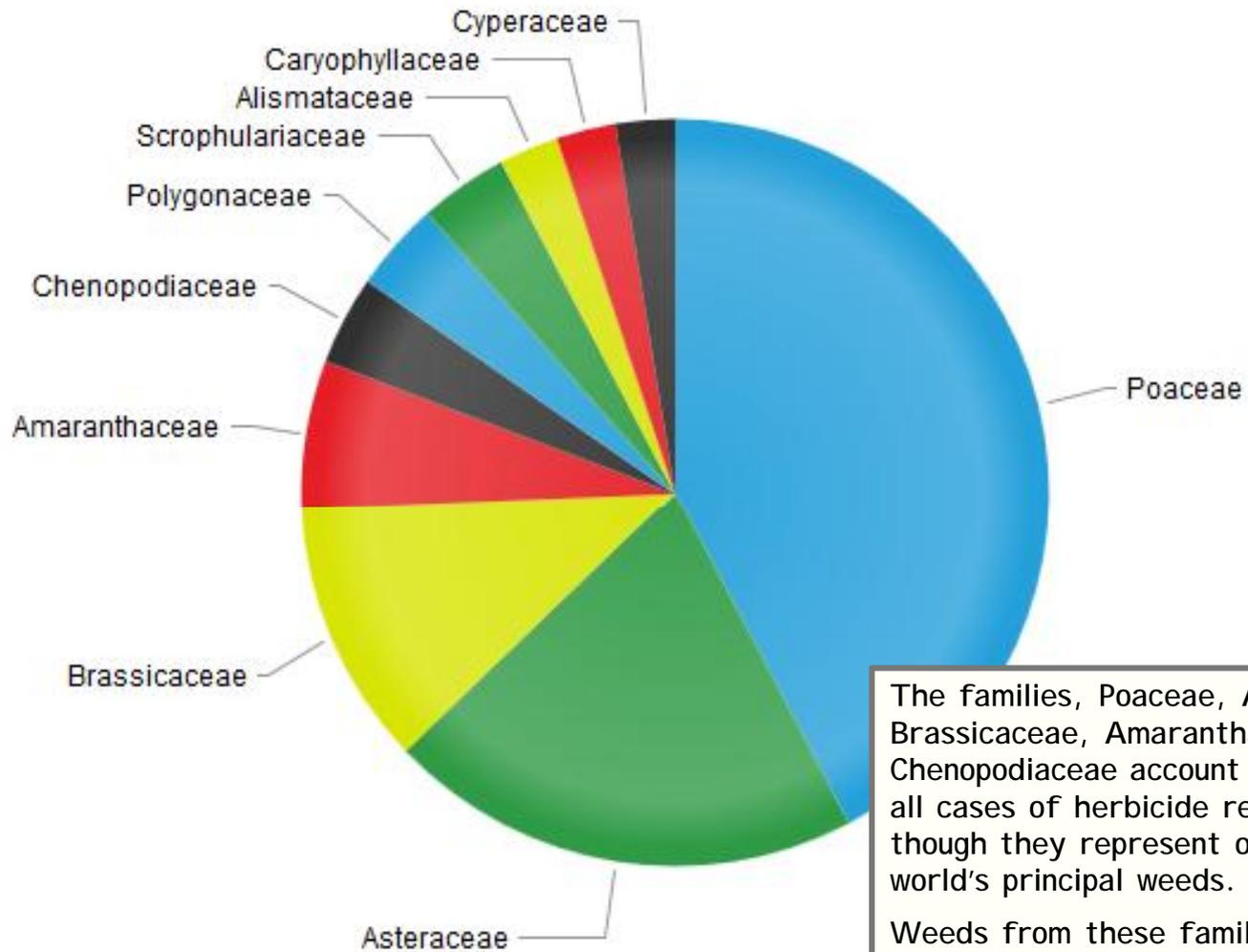


Chronological Increase in Resistant Weeds Globally

■ ALS Inhibitors ■ Triazines ■ ACCase Inhibitors ■ Synthetic Auxins ■ Bipyridiliums ■ Glycines ■ Ureas, Amides
■ Dinitroanilines



% of Herbicide-Resistant Species by Weed Families (top 10)



The families, Poaceae, Asteraceae, Brassicaceae, Amaranthaceae, Chenopodiaceae account for about 70% of all cases of herbicide resistance even though they represent only 50% of the world's principal weeds.

Weeds from these families are prone to the development of herbicide resistance.

Herbicide Resistant Weeds in Louisiana

Herbicide Resistant Weeds in United States

#	Species	Common Name	FirstYear	Site of Action
State: Louisiana				
167	<i>Xanthium strumarium</i>	Common cocklebur	1992	Organoarsenicals (Z/17)
168	<i>Echinochloa crus-galli</i>	Barnyardgrass	1995	Ureas and amides (C2/7)
169	<i>Sorghum halepense</i>	Johnsongrass	1997	ACCCase inhibitors (A/1)
170	<i>Rottboellia exalta</i>	Itchgrass	1997	ACCCase inhibitors (A/1)
171	<i>Echinochloa crus-galli</i>	Barnyardgrass	1998	Synthetic Auxins (O/4)
172	<i>Leptochloa panicoides</i>	Amazon Sprangletop	2009	ACCCase inhibitors (A/1)
173	<i>Amaranthus palmeri</i>	Palmer Amaranth	2010	Glycines (G/9)
174	<i>Sorghum halepense</i>	Johnsongrass	2010	Glycines (G/9)

167 MSMA (Sanders); 168 Propanil (Sanders); 169 Select/Fusilade (Miller & Sanders); 170 Fusilade (Sanders); 171 Facet (Sanders); 172 Clincher/Ricestar HT (Norsworthy); 173 Glyphosate (Stephenson); 174 Glyphosate (Griffin)

Are There Other Herbicide Resistant Weeds in Louisiana?

- Most likely there are others that have not been “confirmed” but are suspect, e.g., glyphosate-resistant horseweed, ryegrass; ALS-resistant weeds
- To post on the “International Survey of Herbicide-Resistant Weeds” website:
 - Resistance must be “confirmed” by an unbiased scientist through comparison of resistant and susceptible plants of the same species in a replicated and scientifically sound trial.

How do Weeds Become Resistant to Herbicides?

- Caused by over reliance on herbicides with the same mode of action
 - ACCase herbicides – Select, Fusilade, or Assure used for grass control in several crops over several years
 - ALS herbicides – used in several crops over years
 - Glyphosate products – used in several crops over years
- Use of herbicides with the same mode of action impose “selection pressure” on a weed population

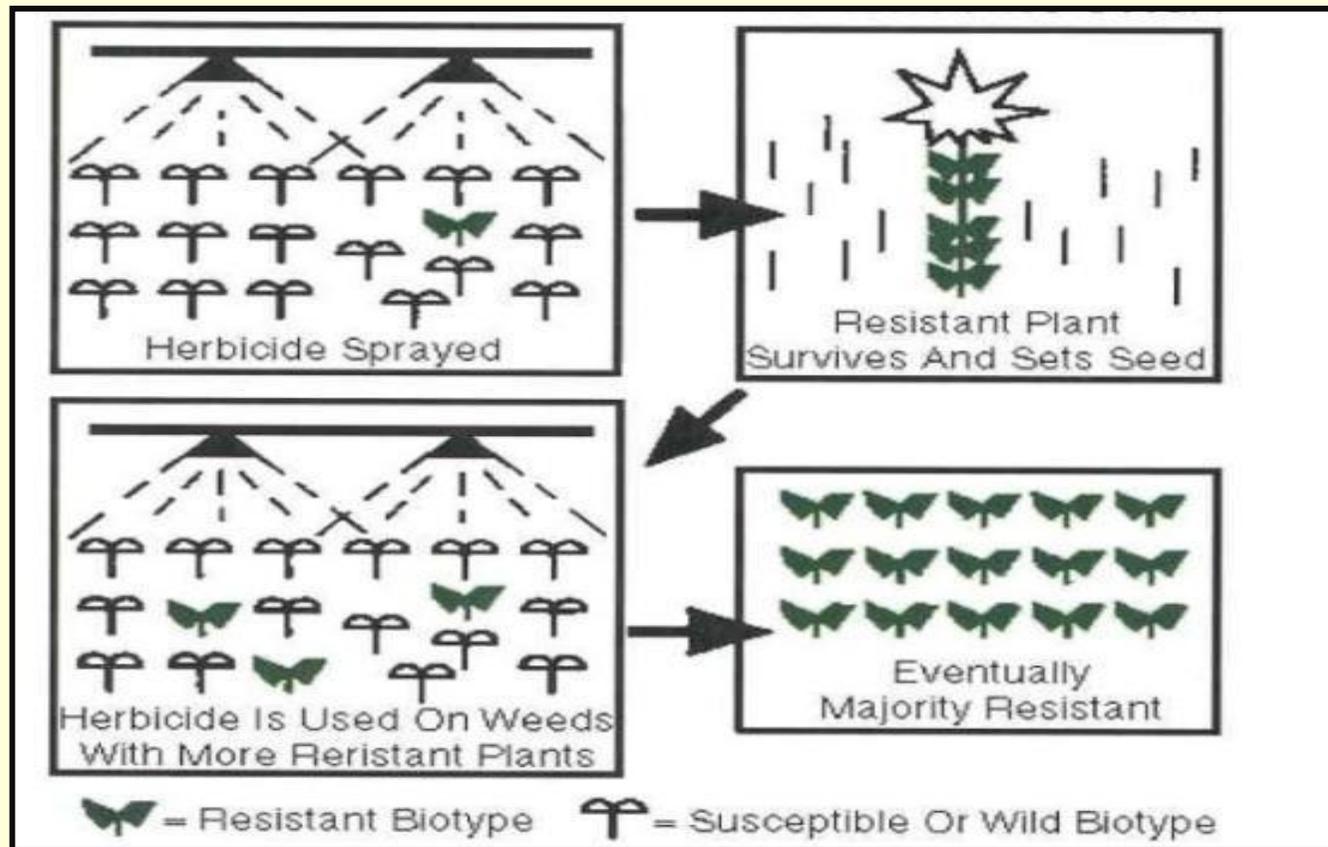


Note: Herbicides do not cause a genetic mutation in the weed making it resistant to the herbicide.

Rather, the “resistant” weed has always been present in the population, but at a very low level.

Development of HR Weeds

The problem arises because of selection pressure imposed on a weed population with repeated use of herbicides with the same mode of action.



This process can occur very slowly or very rapidly depending on the weed.

Glyphosate-Resistant Palmer amaranth



Photo: Dr. Larry Steckel - Univ. of Tenn

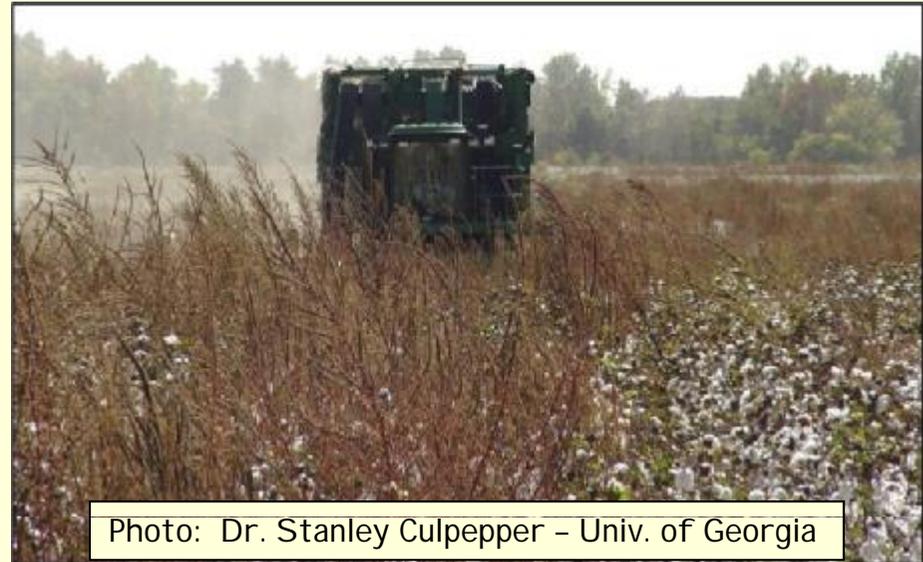


Photo: Dr. Stanley Culpepper - Univ. of Georgia

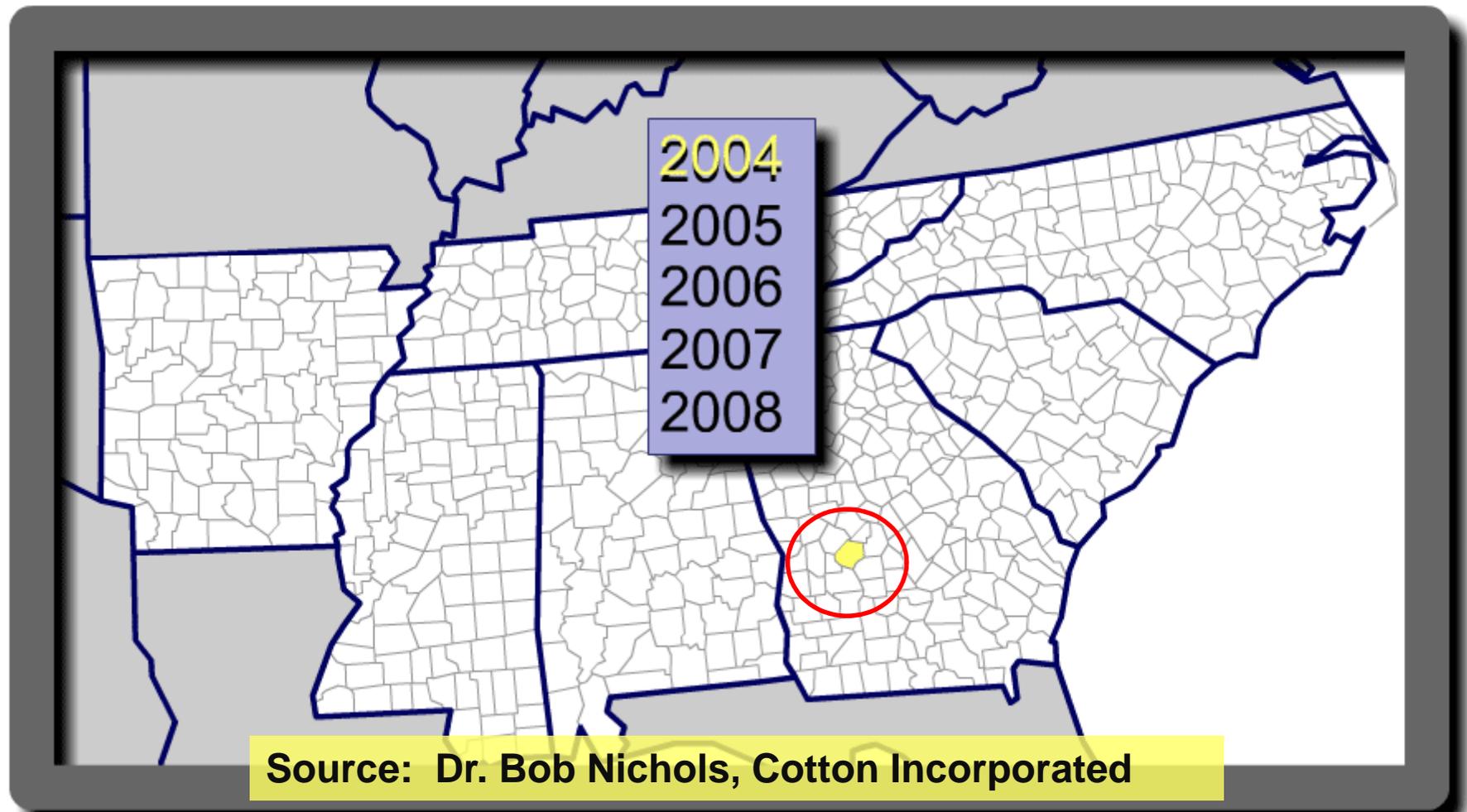


Photo: Dr. Jason A. Bond - Miss. State Univ.



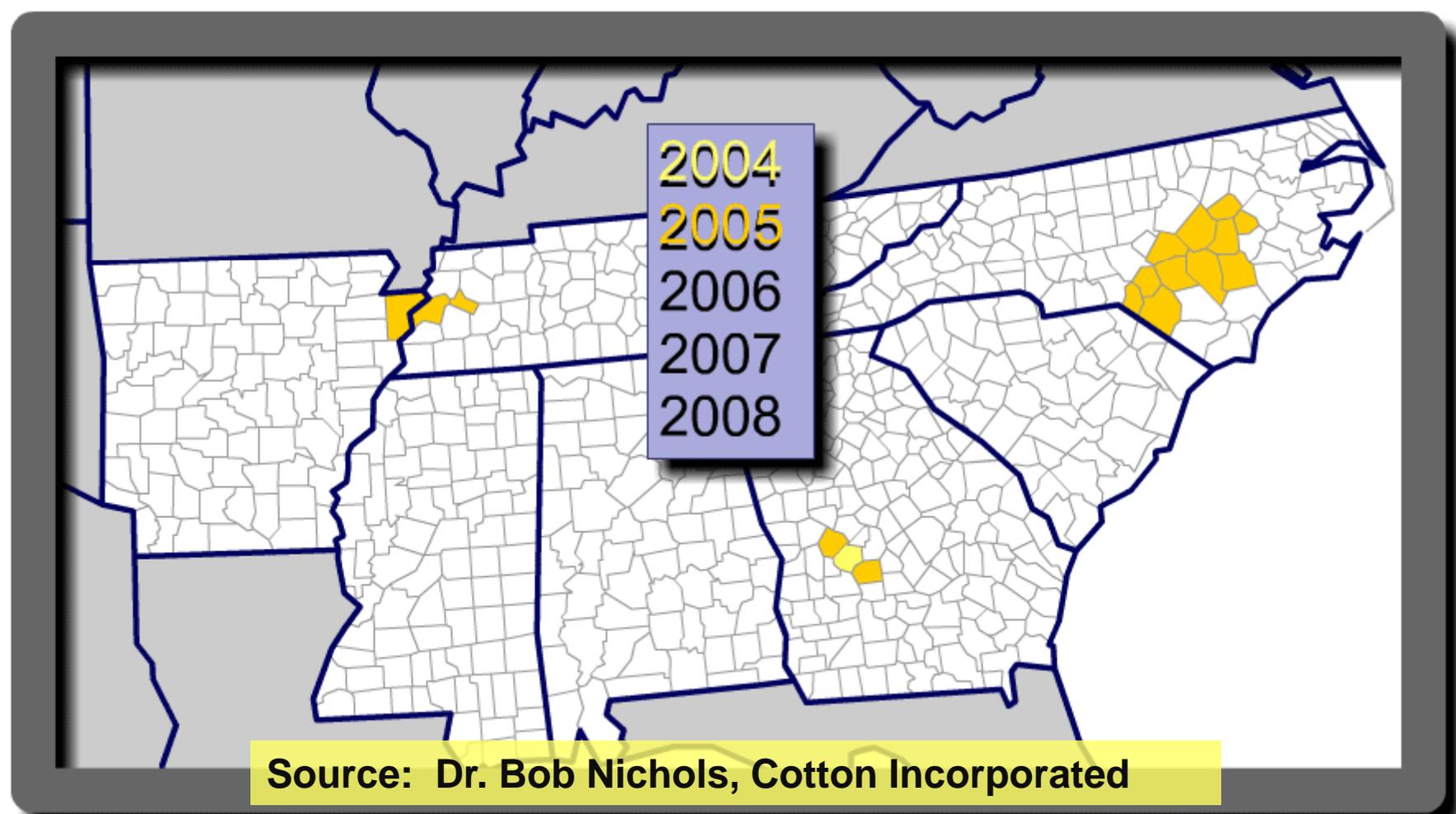
Glyphosate-Resistant Palmer amaranth

Counties with Confirmed Populations of Glyphosate-Resistant Palmer Amaranth



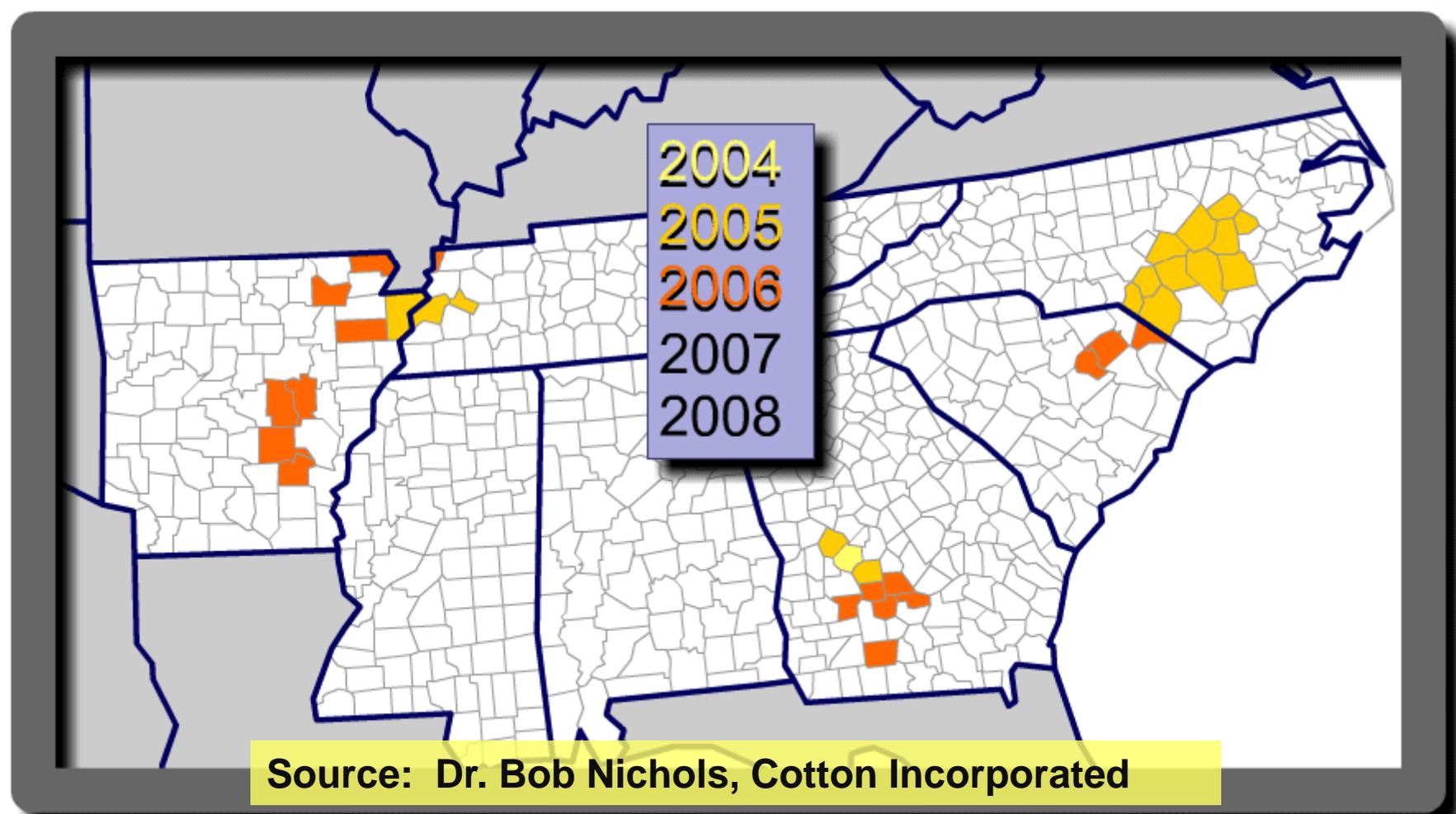
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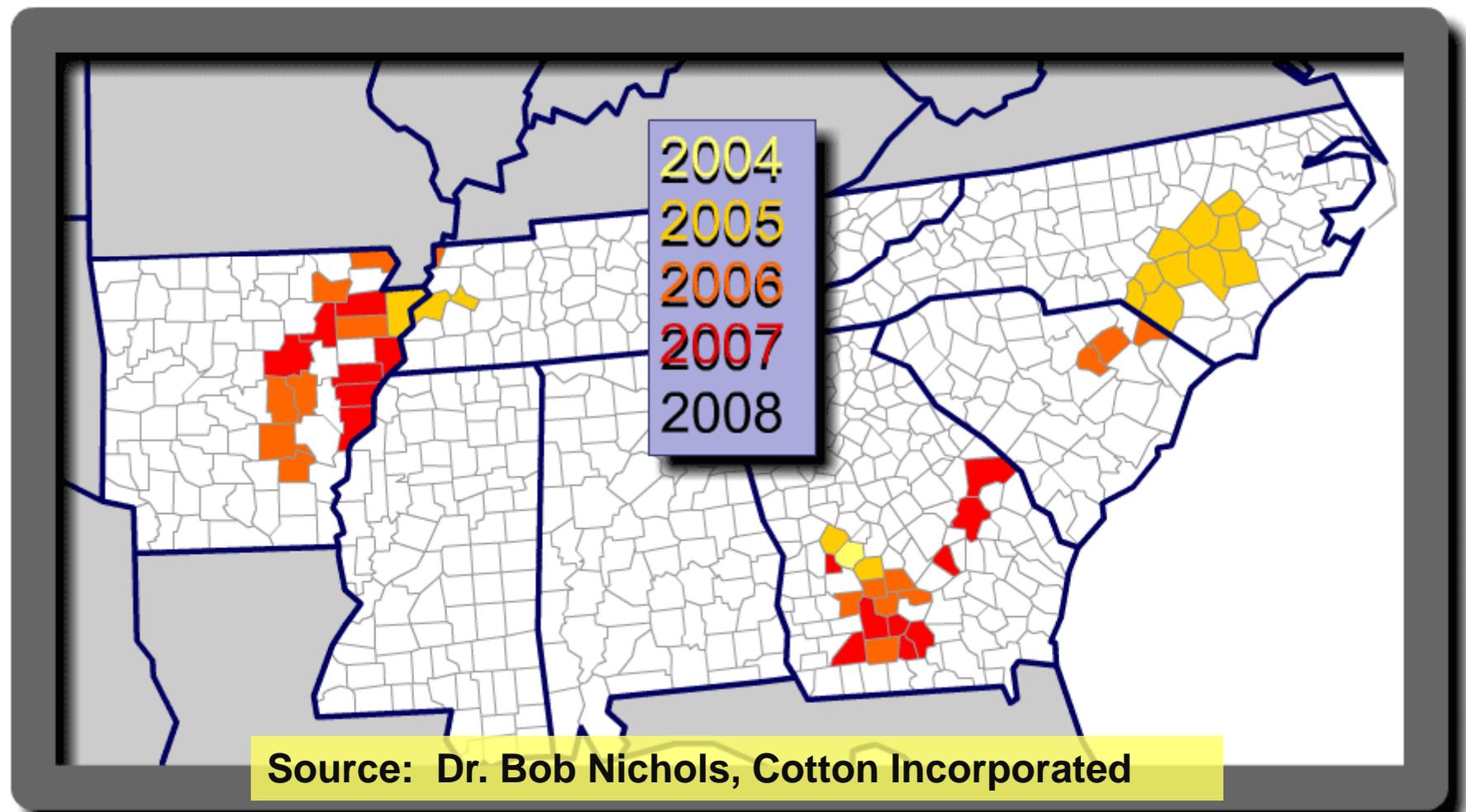
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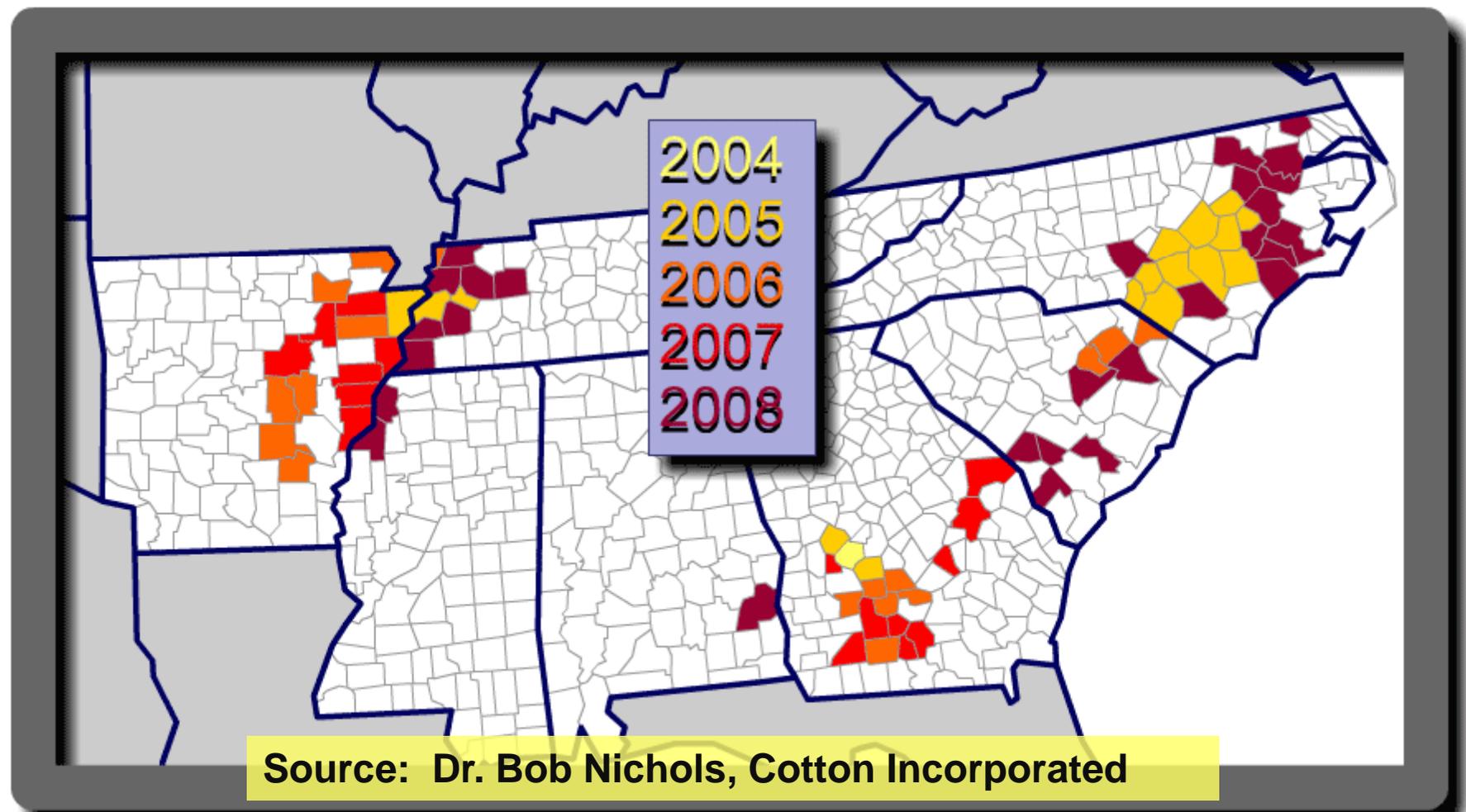
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Counties with Confirmed Populations of Glyphosate-Resistant Palmer Amaranth



**Cotton Field With Glyphosate-Resistant Palmer amaranth
Macon County, GA**



Source: Stanley Culpepper, University of Georgia

When to Suspect Resistance?

- The field or area with the weed problem sprayed repeatedly with the same herbicide or herbicides with the same mode of action.
- Surviving plants intermingled with dead plants of the same size.
- Patches of weeds occur in the same spot year after year and are getting larger.



Why has Louisiana lagged behind other southern states in weed resistance problems?

Sometimes it is good to be last...

Early education programs started in 2006 provided time to prepare.



What can be done to delay or prevent development of HR weeds?

What programs can be used to manage HR weeds already present?



These questions will be addressed
by Drs. Stephenson and Webster..



Source: Stanley Culpepper, University of Georgia