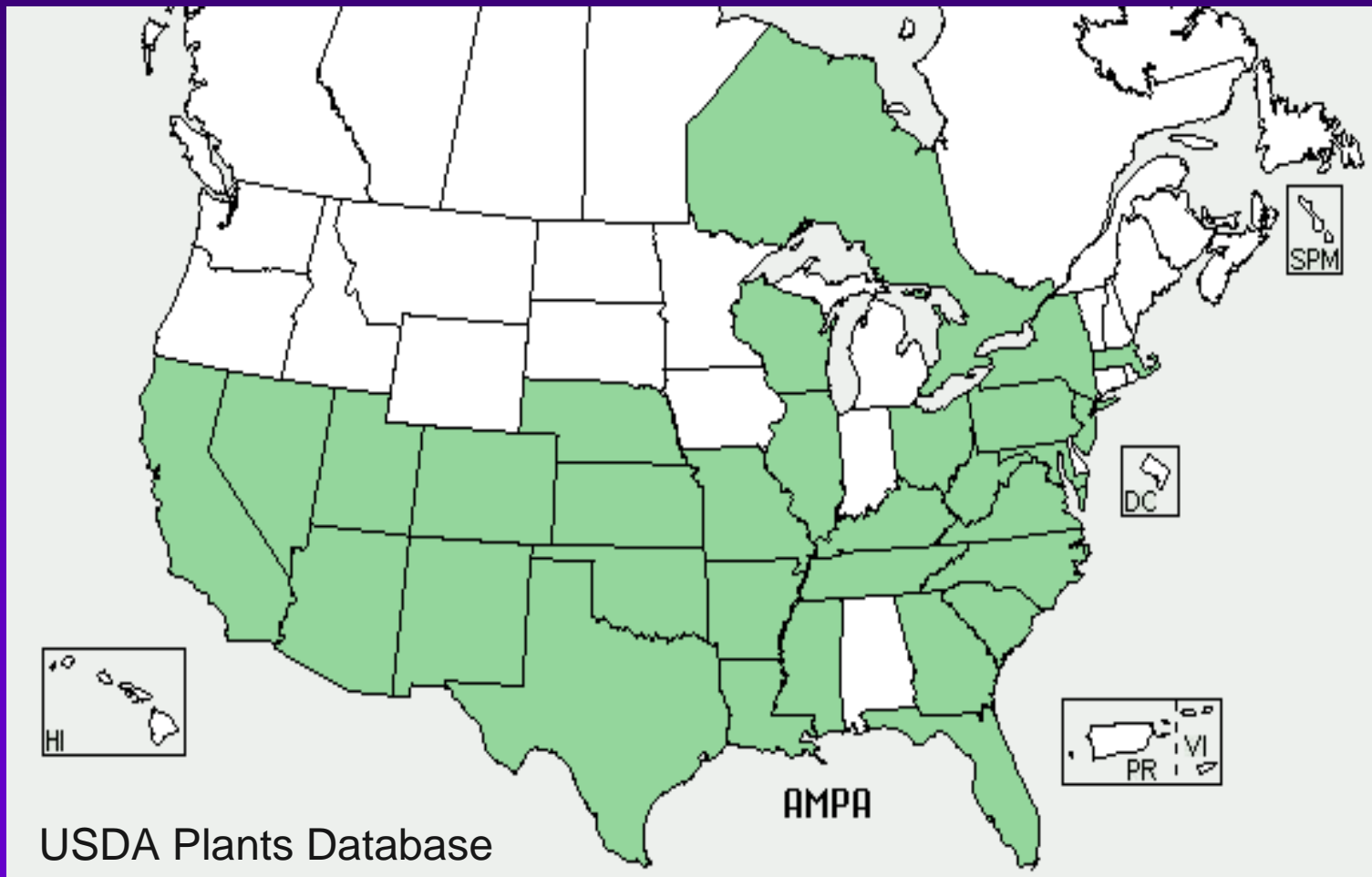


# Risk and Management of Palmer Amaranth in Sunflower

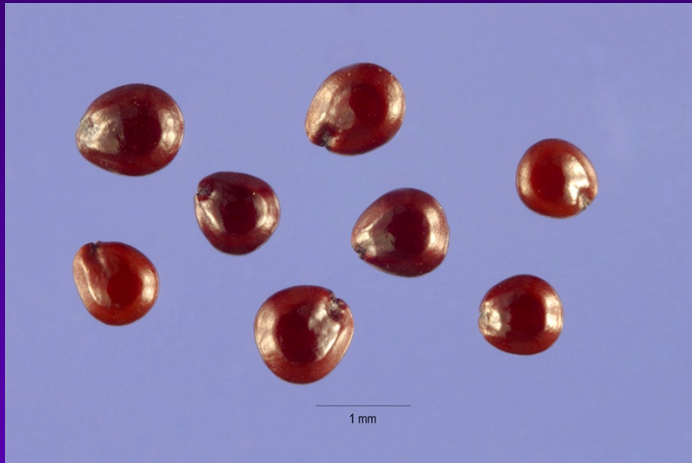


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# Palmer amaranth Distribution carelessweed



# Palmer Amaranth Biology



- *Amaranthus palmeri*
- Pigweed family
- Small reddish-brown seeds
- Seedlings emerge May-July



# Palmer Amaranth Biology



- Dense and compact smooth leaves
- Petioles longer than leaves
- Deep taproot w/lateral roots

Terminal  
inflorescence



Reddish-green stems  
with sharp bracts



Diecious species; cross  
ensures genetic diversity



# Palmer Amaranth Biology

Converts CO<sub>2</sub> into sugars via photosynthesis more efficiently than most crops.

Rapid growth even under hot and dry conditions.

Under ideal growing conditions, capable of growing several inches per day.



Growth of Palmer amaranth over 52 hours.

Sosnoskie et al. 2011. The Biology and Ecology of Palmer Amaranth: Implications for Control. University of Georgia

# Crop Competition

- Palmer amaranth competition with corn was affected more by time of emergence than weed density at Garden City, KS.
- 8-10 plants m<sup>2</sup> reduced soybean yields 79% in KS and 68% in AR.
- In KS, >50% yield loss in sunflower at moderate Palmer amaranth densities.



# Cheyenne Co. KS



9/30/10



# Wichita Co. KS



10/27/10

# Suspected Glyphosate-resistant Palmer amaranth in Kansas



## Palmer amaranth from Cowley County, Kansas

Cowley Co.  
Susceptible



0

0.75

1.5

3.0

Glyphosate rate (lb ae/acre)

Many plants survived 1X and 2X rates of glyphosate; some plants survived 4X.

# Kansas Sunflower Commission, National Sunflower Association, and Industry Funded Research

- Evaluate experimental compounds and herbicides labeled for use in other crops that might have potential for use in sunflower.
- Emphasis on Palmer amaranth and kochia.

# Preemergence weed control, Hays & Colby, KS, 2010

| Herbicide   | Rate  | Paam<br>H & C | Tupw<br>H & C | Kocz<br>Colby | Puvi<br>H & C | Grft<br>H & C | SF Yld<br>Colby |
|-------------|-------|---------------|---------------|---------------|---------------|---------------|-----------------|
|             | oz/ac | ----- % ----- |               |               |               |               | lb/ac           |
| Spartan     | 2.6   | 83            | 98            | 96            | 49            | 54            | 2070            |
| Spartan     | 3.2   | 80            | 93            | 97            | 62            | 68            | 2080            |
| Dual Magnum | 12.1  | 78            | 83            | 70            | 45            | 92            | 1870            |
| Dual Magnum | 15.1  | 93            | 99            | 84            | 50            | 88            | 1960            |
| Broadaxe    | 14.6  | 89            | 99            | 94            | 66            | 89            | 2400            |
| Broadaxe    | 18.3  | 100           | 100           | 100           | 73            | 94            | 2230            |
| Prowl H2O   | 48    | 84            | 83            | 83            | 81            | 85            | 1700            |
| Untreated   | --    | --            | --            | --            | --            | --            | 860             |

Palmer amaranth; tumble pigweed; kochia; puncturevine;  
green foxtail

58% yield loss.

## Effect of time of herbicide application on mid-season Palmer amaranth control in Kansas, 2011.

|             |         | Hays   |       | Manhattan |       |
|-------------|---------|--------|-------|-----------|-------|
| Herbicide   |         | 21 DPP | PRE   | 21 DPP    | PRE   |
| Broadaxe    | 14 oz   | 86 b   | 95 ab | 33 c      | 95 ab |
| Broadaxe    | 18 oz   | 96 ab  | 96 ab | 33 c      | 100 a |
| Broadaxe    | 22 oz   | 96 ab  | 100 a | 46 c      | 100 a |
| Dual Magnum | 1.25 pt | 33 d   | 86 b  | 0 d       | 73 b  |
| Prowl H20   | 3.0 pt  | 37 d   | 73 c  | 48 c      | 87 ab |

Means followed by the same letter within location are not different at  $P = 0.05$

# Palmer amaranth control with Spartan and Zidua combinations 49 DAP, Hays and Colby KS, 2011.

| Herbicide          | No Spartan | Spartan 2 oz/A | Spartan 4 oz/A | Spartan 8 oz/A |
|--------------------|------------|----------------|----------------|----------------|
| No Zidua           | - - -      | 84 cd          | 75 d           | 89 bc          |
| Zidua 1.7 oz       | 93 abc     | 93 abc         | 95 ab          | 95 ab          |
| Zidua 3.4 oz       | 98 ab      | 96 ab          | 98 ab          | 98 a           |
| Zidua 6.7 oz       | 100 a      | 99 ab          | 100 a          | 100 a          |
| Prowl H2O 2.6 pt   | - - -      | - - -          | 96 ab          | - - -          |
| Dual Magnum 1.2 pt | - - -      | - - -          | 83 cd          | - - -          |

# Preemergence weed control, Colby KS, 2012.

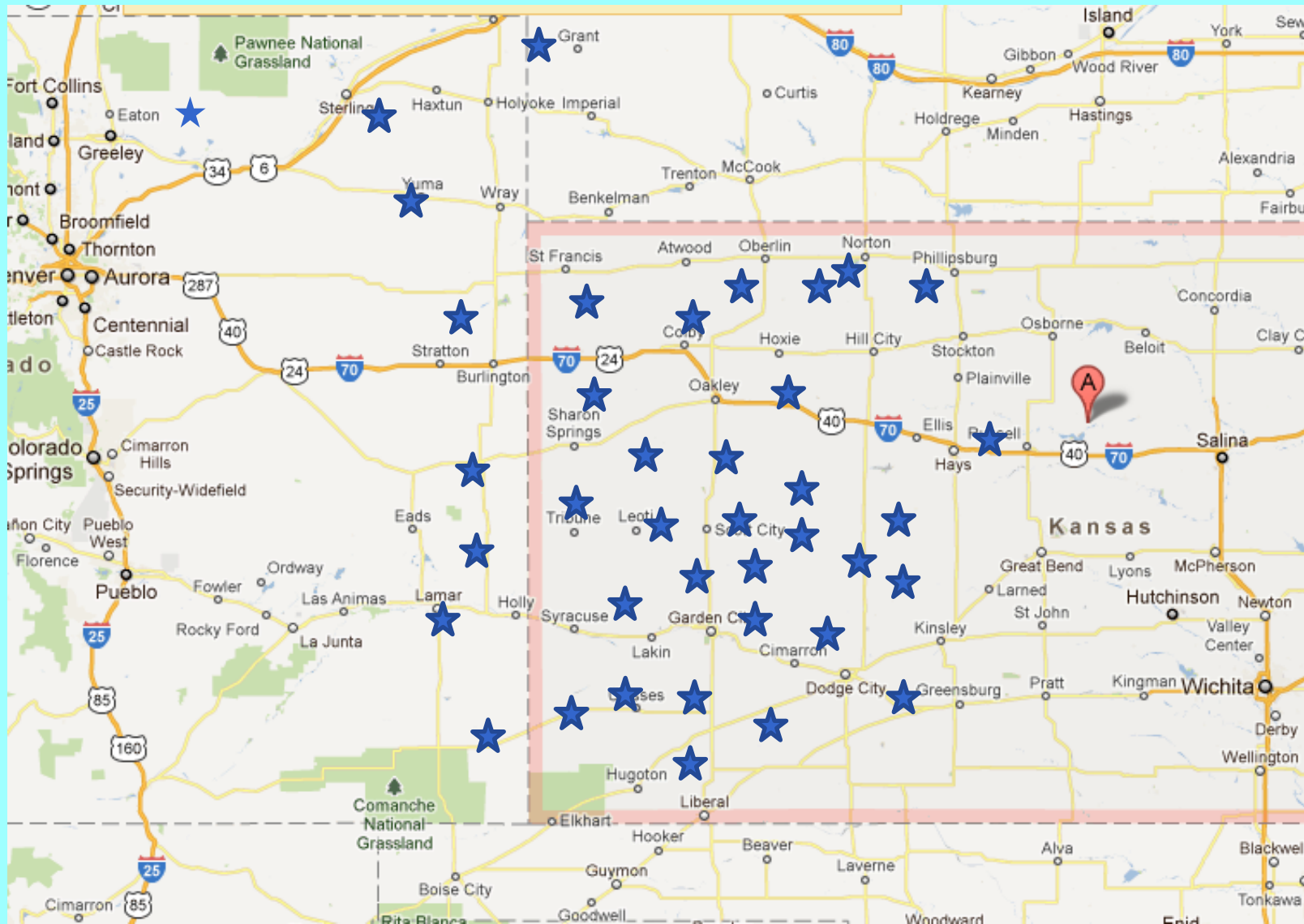
| Herbicides            | Rate<br>oz/ac | Palmer amaranth |        | Puncturevine |        |
|-----------------------|---------------|-----------------|--------|--------------|--------|
|                       |               | 22 DAT          | 51 DAT | 22 DAT       | 51 DAT |
| Spartan               | 2             | 28 d            | 23 c   | 45 d         | 25 cd  |
| Spartan               | 4             | 78 ab           | 64 ab  | 40 d         | 10 d   |
| Zidua                 | 1.7           | 70 abc          | 45 abc | 80 ab        | 55 ab  |
| Zidua                 | 3.4           | 84 ab           | 75 a   | 75 abc       | 58 a   |
| Spartan + Zidua       | 2 + 1.7       | 68 abc          | 60 ab  | 63 a-d       | 40 abc |
| Spartan + Zidua       | 4 + 1.7       | 53 c            | 46 abc | 55 bcd       | 35 a-d |
| Spartan + Zidua       | 2 + 3.4       | 84 ab           | 65 ab  | 80 ab        | 55 ab  |
| Spartan + Zidua       | 4 + 3.4       | 90 a            | 78 a   | 86 a         | 60 a   |
| Spartan + Prowl H20   | 4 + 42        | 63 bc           | 35 bc  | 50 cd        | 25 cd  |
| Spartan + Dual Magnum | 4 + 19        | 73 abc          | 64 ab  | 48 d         | 30 bcd |



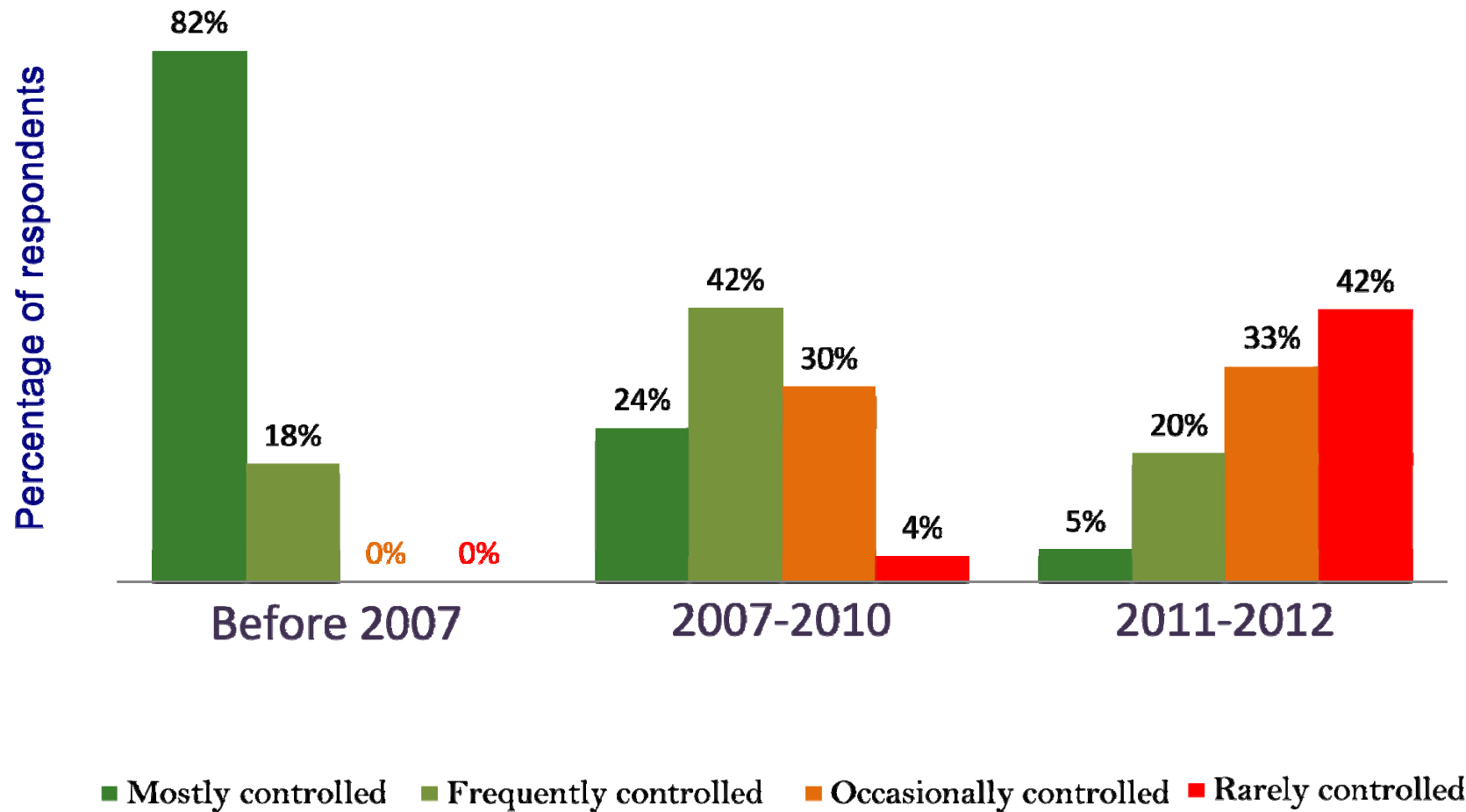
# Summary

- Single active ingredient herbicides generally have not been as effective as herbicide mixtures.
- Broadaxe (sulfentrazone & S-metolachlor) has provided good-excellent weed control; weak on puncturevine.
- Zidua (pyroxasulfone) is promising; use rate may be limited by cost. Need to evaluate early preplant applications.

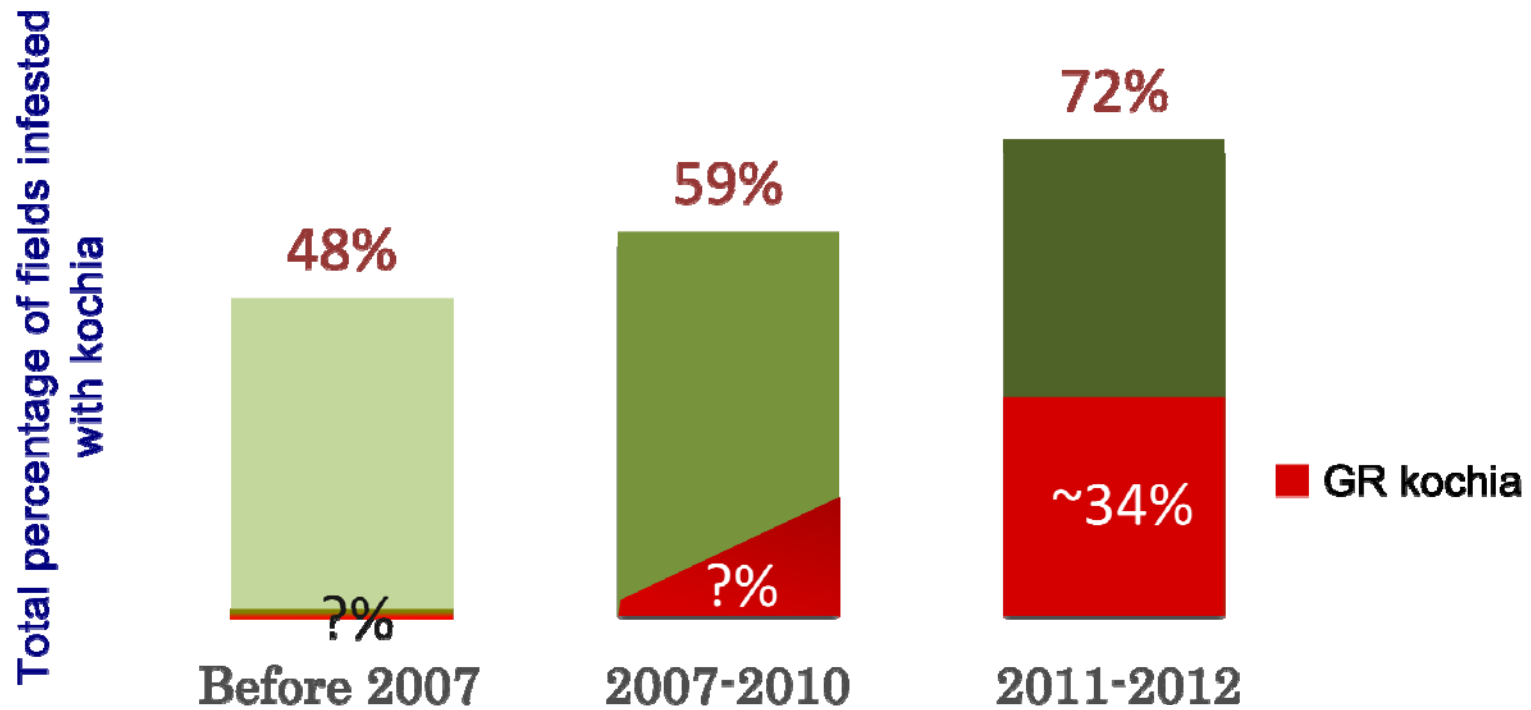
# Confirmed GR Kochia, 2011



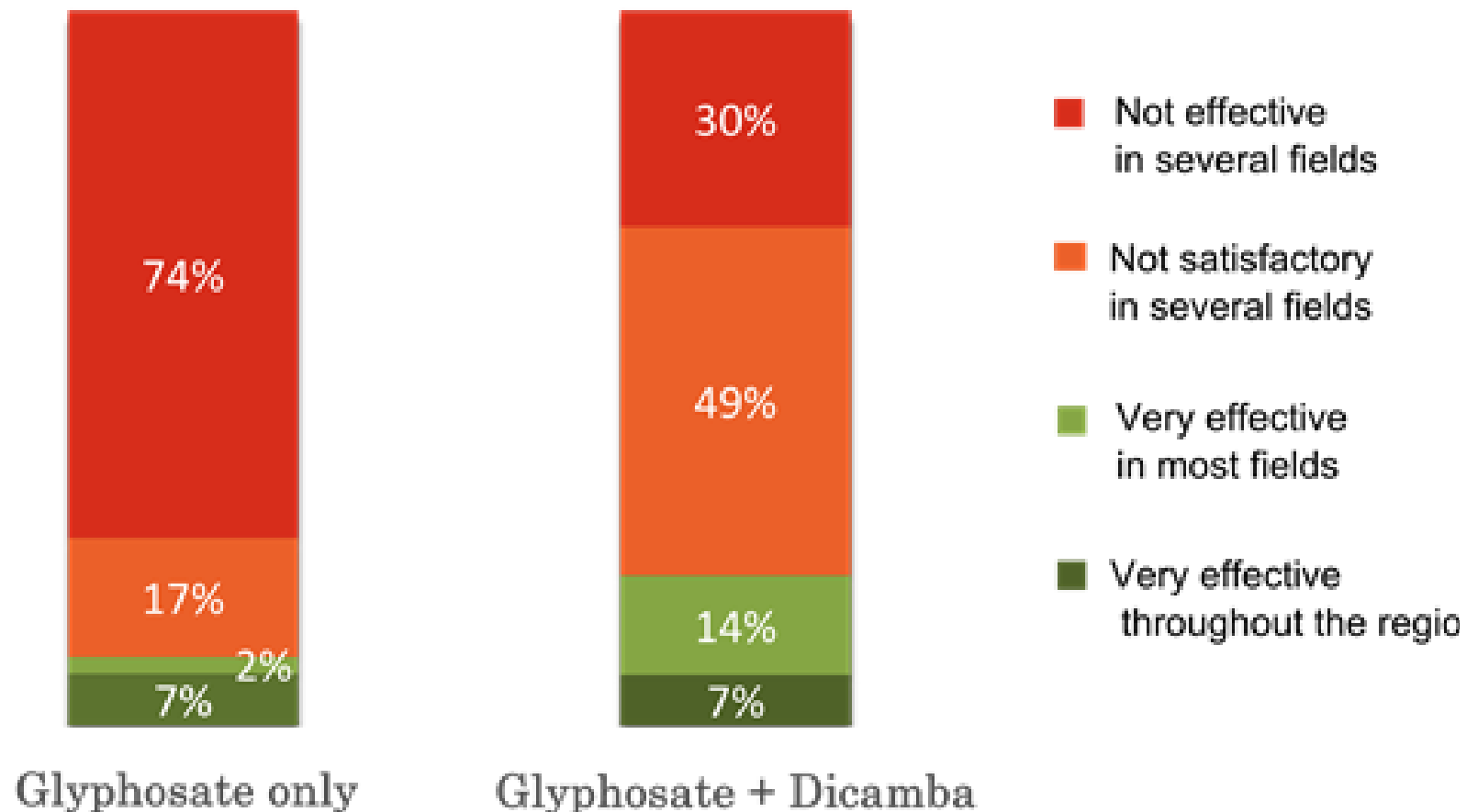
## Increasing difficulty of controlling kochia (in fallow) and indication of widespread presence of GR kochia in western Kansas



# Kochia infestation and state of glyphosate-resistant (GR) kochia in western Kansas



## Indication of dicamba resistance in GR kochia in western Kansas



Figures are the percentage of respondents



# Acknowledgements

**National Sunflower Association  
Kansas Sunflower Commission  
BASF Corporation  
FMC, Inc.**

# Cheyenne Co. KS



9/30/10