BASF
The Chemical Company

Looking Forward In Agriculture

Herbicides

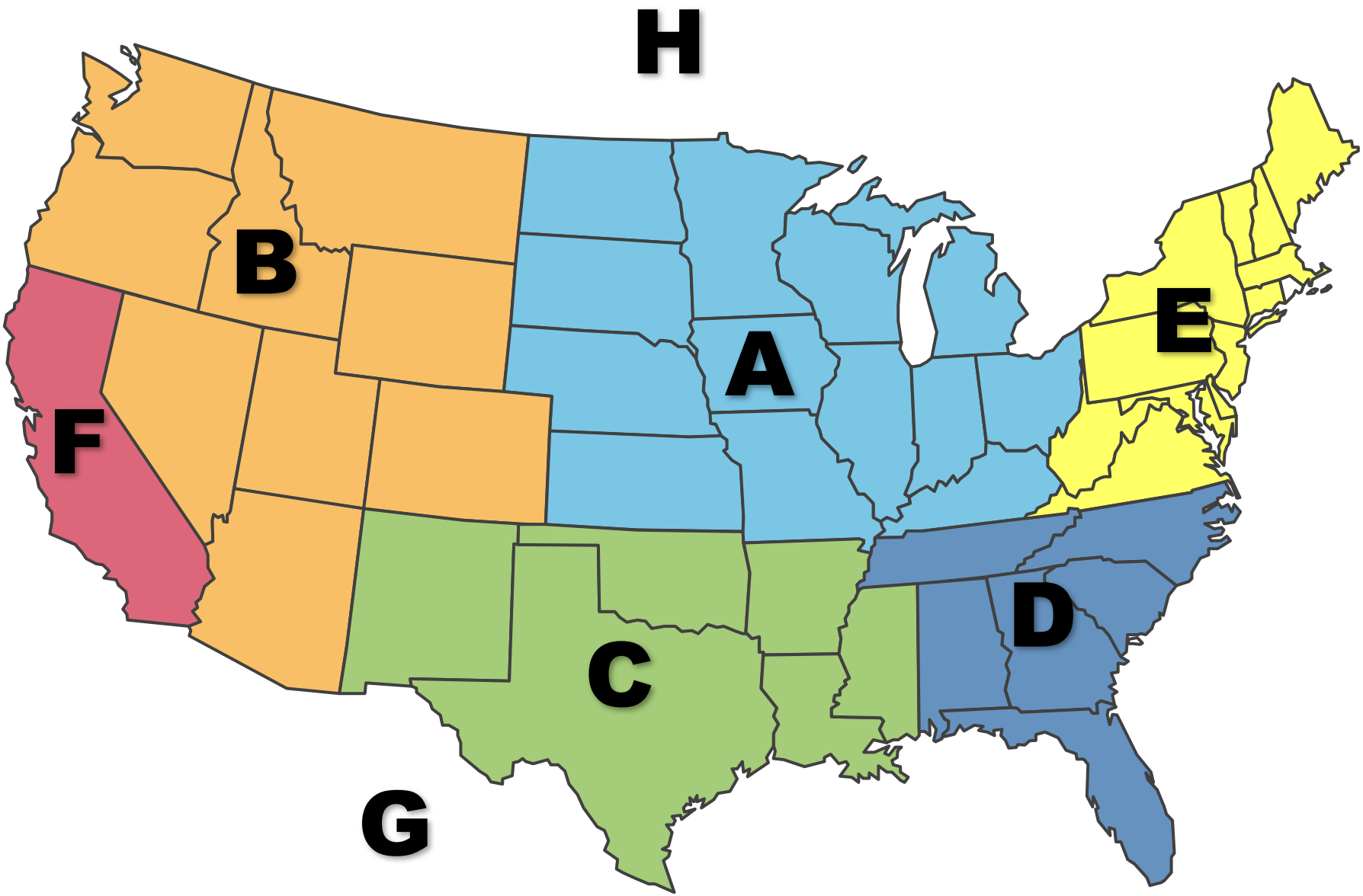
Tom Holt
Manager of Field Biology R&D
BASF

Because **weeds** just keep ***getting*** **tougher**

What is the Future of Weed Control

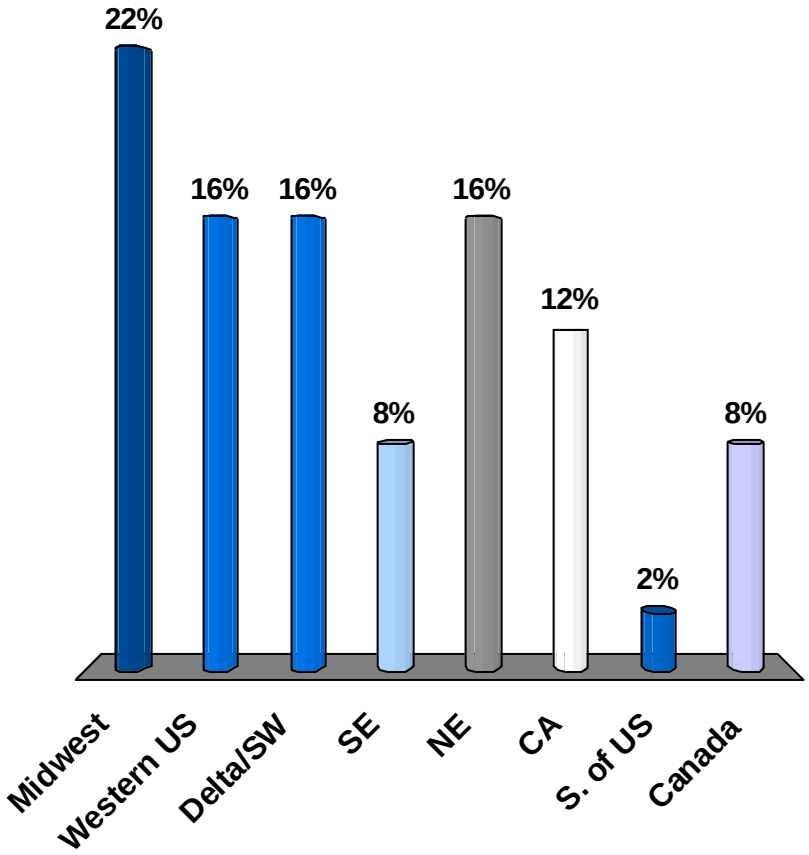
"The farther backward you can look, the farther <u>forward</u> you are likely to see."

– Winston Churchill


H
B
A
E
F
C
D
G

Where Are You Located?

A. Midwest
B. Western US
C. Delta/SW
D. SE
E. NE
F. CA
G. S. of US
H. Canada



What is Your Favorite Dessert?

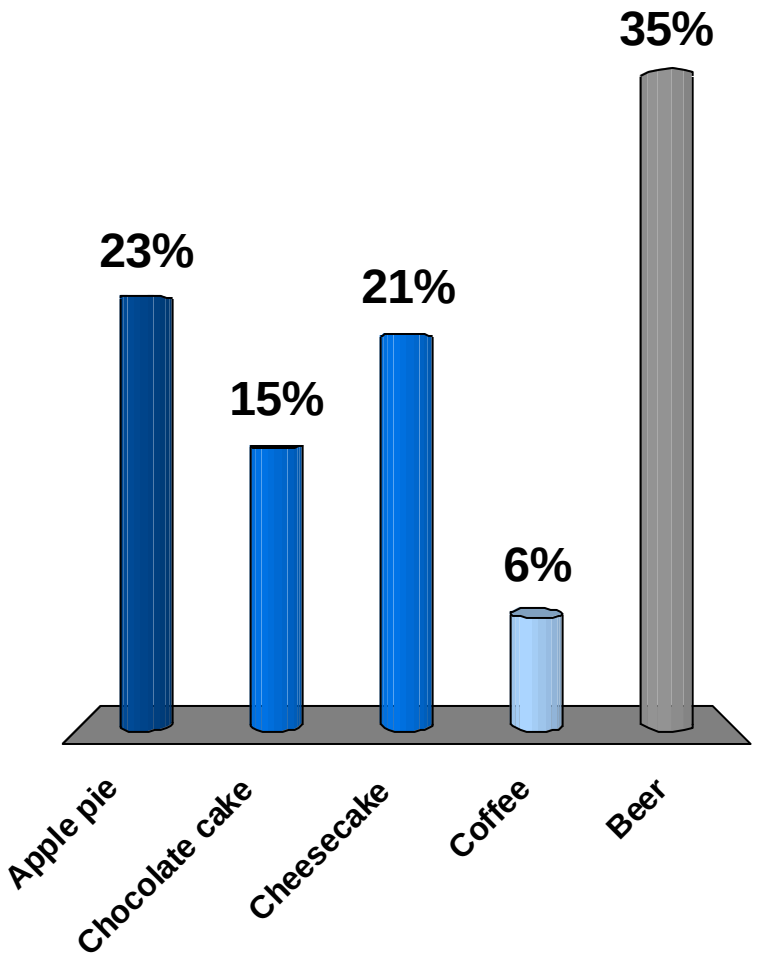
A. Apple pie

B. Chocolate cake

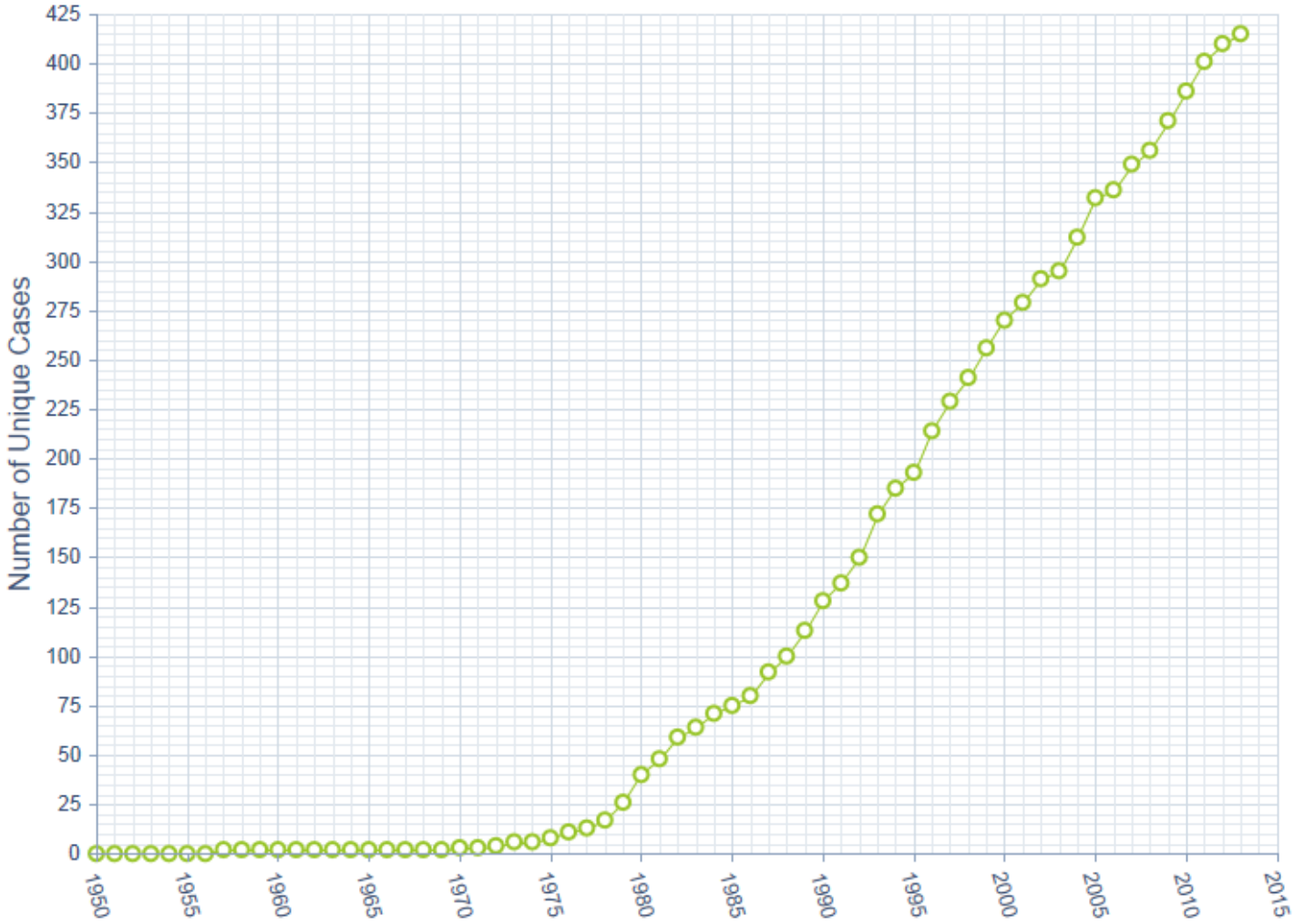
C. Cheesecake

D. Coffee

E. Beer



Chronological Increase in Resistant Weeds Globally



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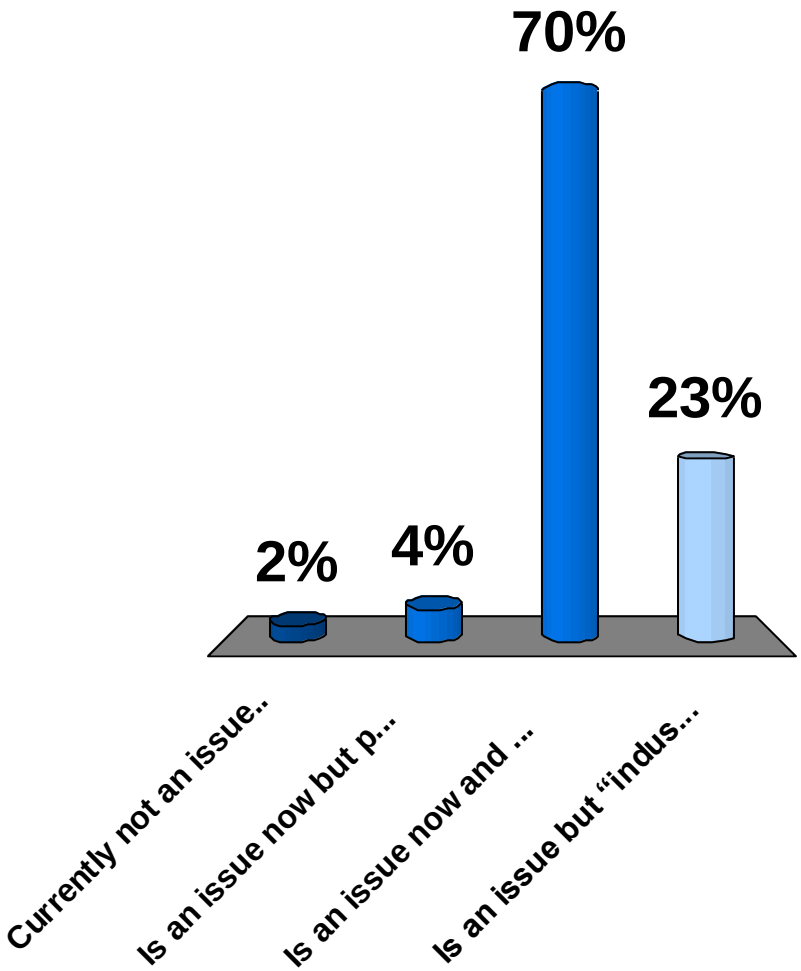
What is your Resistant Weed Situation/Belief?

A. Currently not an issue - probably won't be in the future

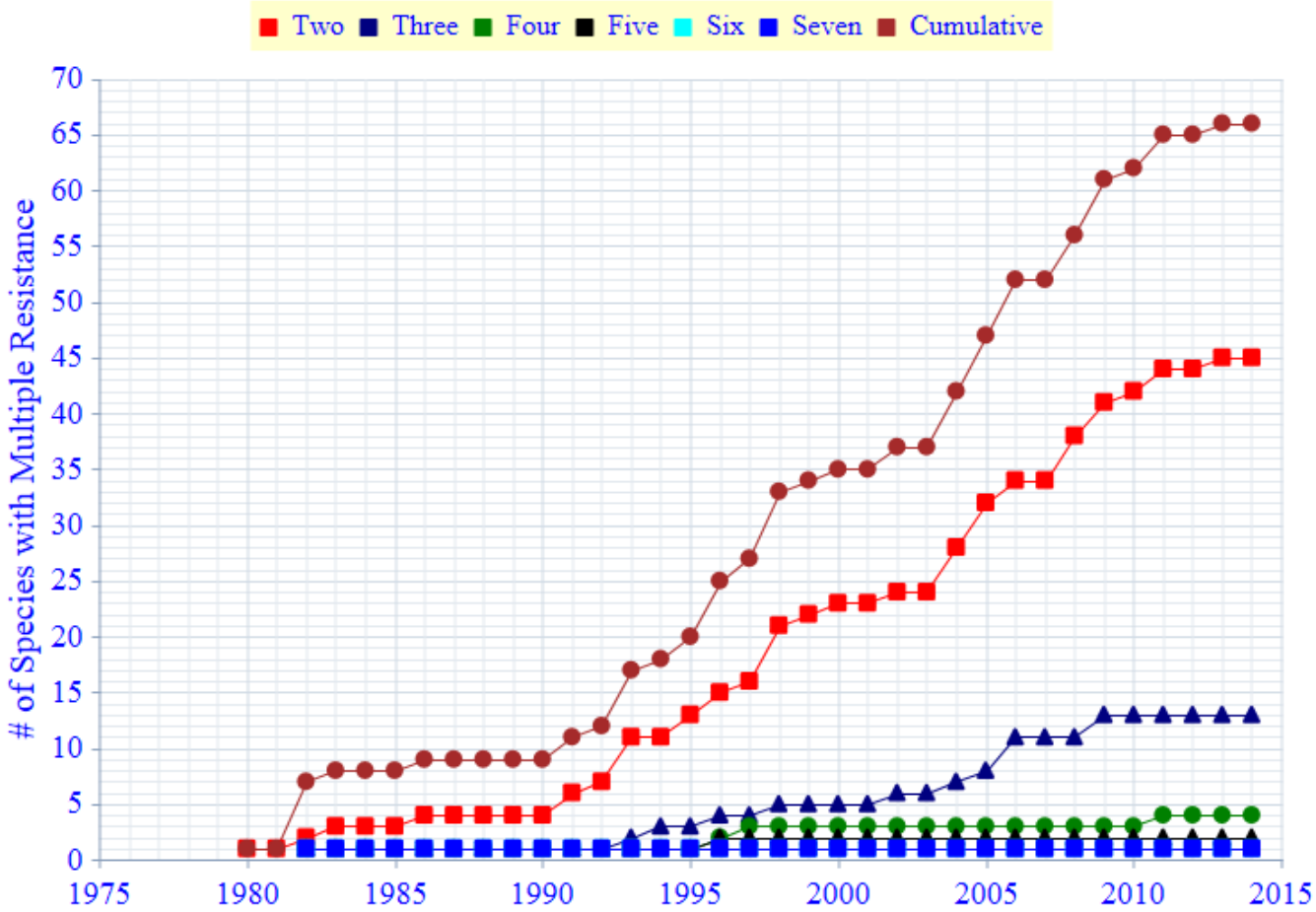
B. Is an issue now but probably won't get worse

C. Is an issue now and most probably will become a very significant problem – could become "unmanageable"

D. Is an issue but "industry" will come up with a solution (aka silver bullet) before it becomes unmanageable



Weed Populations Resistant to Multiple Sites of Action



Selection of your "H" tool by SOA is important!!

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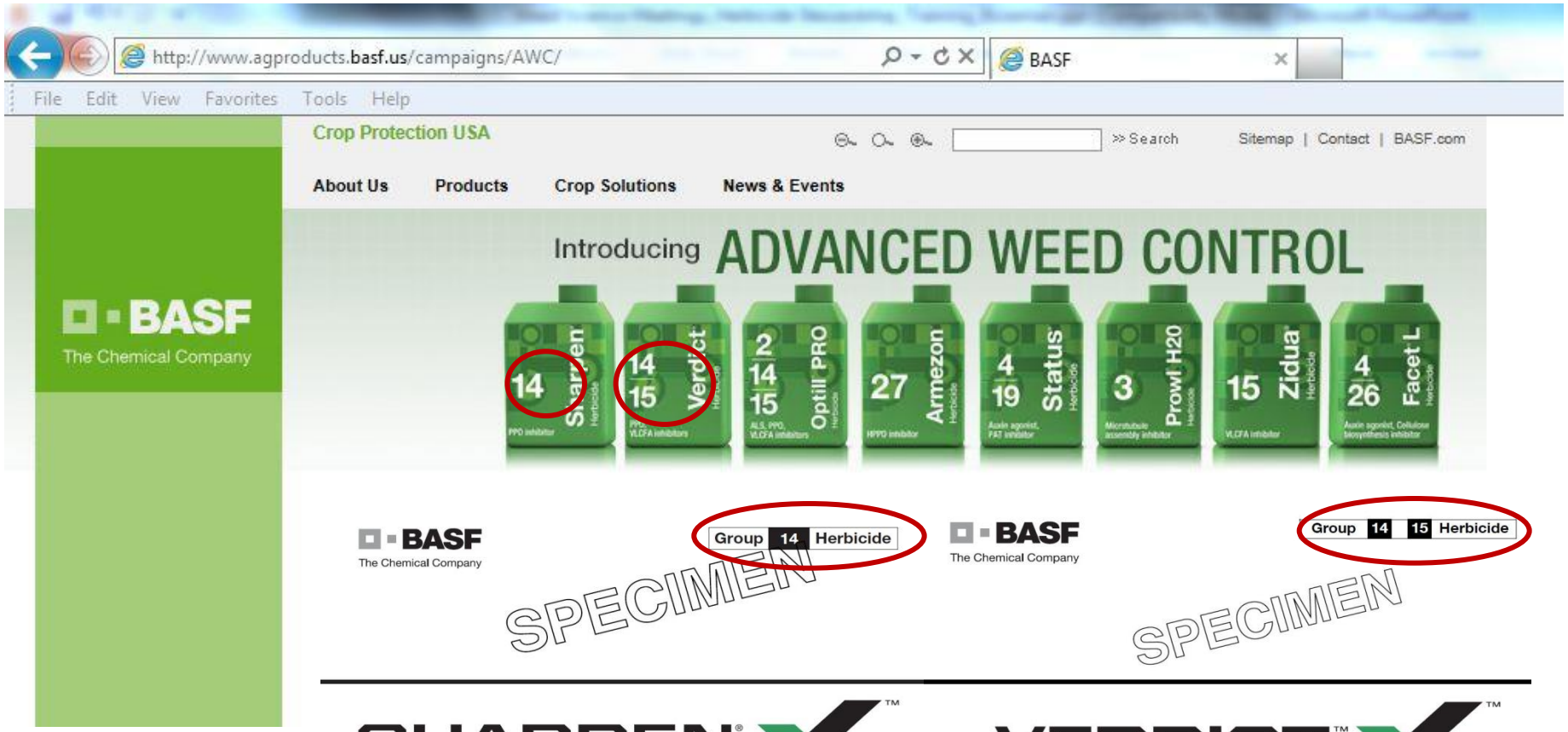
Enabling Site of Action Diversity



How Many of You Consult with Growers with Weed Resistance Levels of...

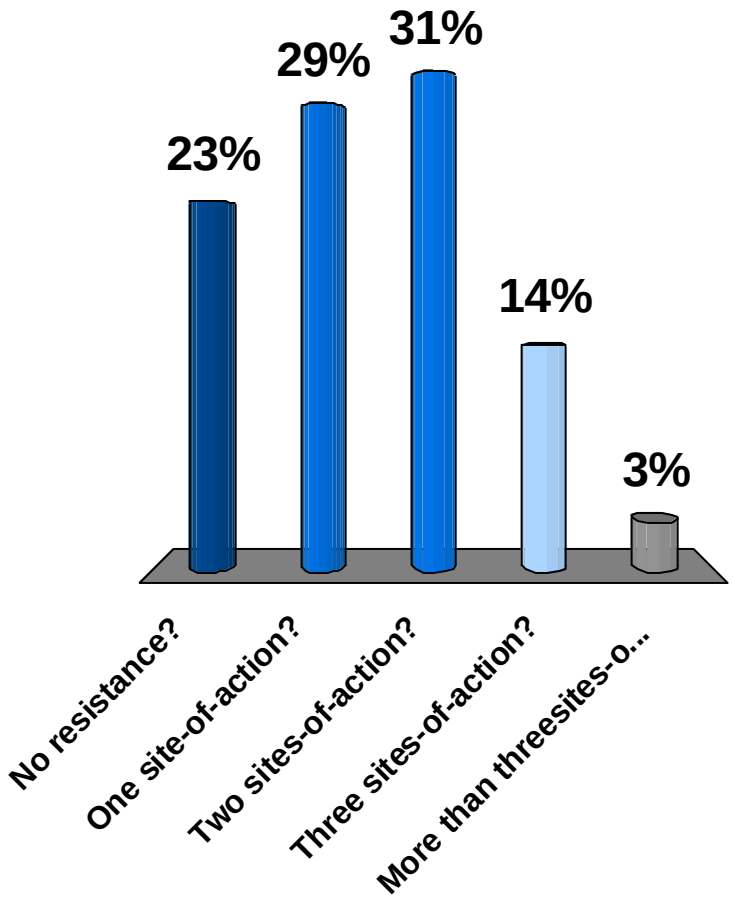
A. No resistance?

B. One site-of-action?

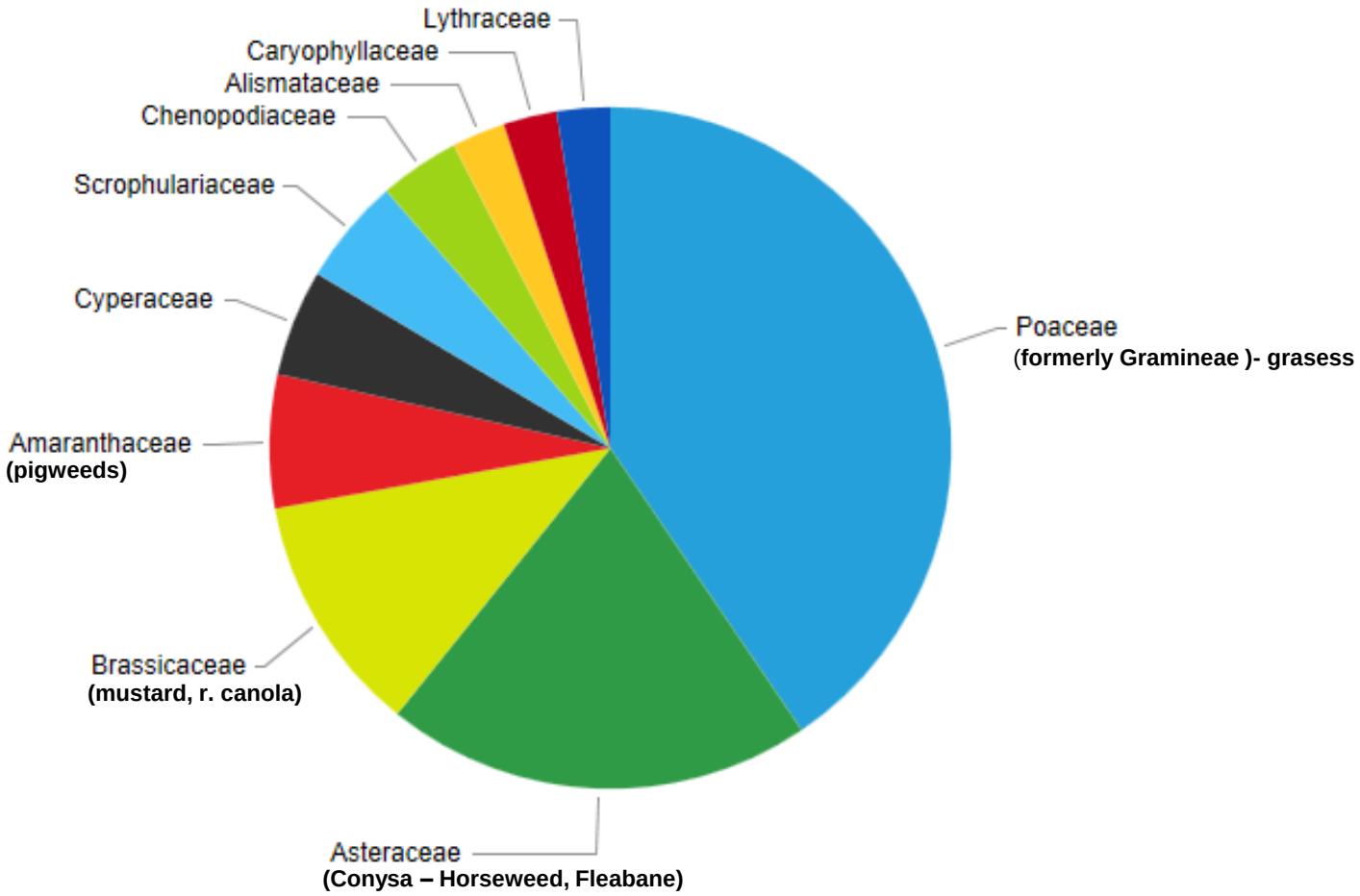
C. Two sites-of-action?

D. Three sites-of-action?

E. More than three sites-of-action?



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



Five common weed Families have a high potential for resistance

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Why Are Resistant Weeds Becoming Such a Problem?

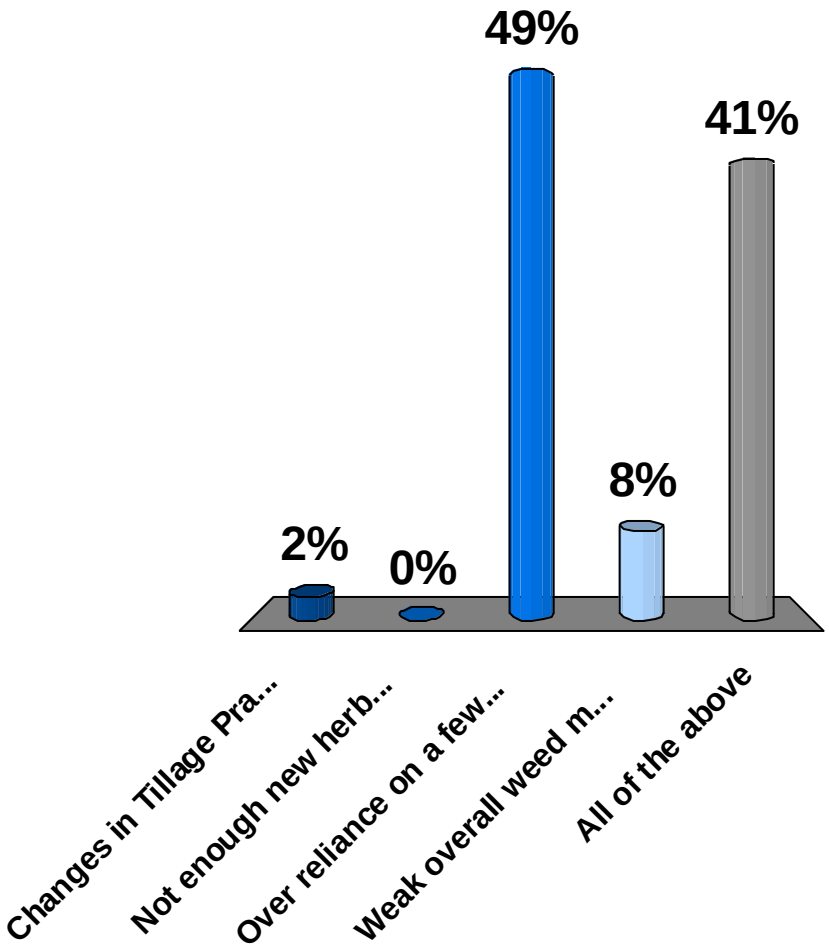
A. Changes in Tillage Practices

B. Not enough new herbicides

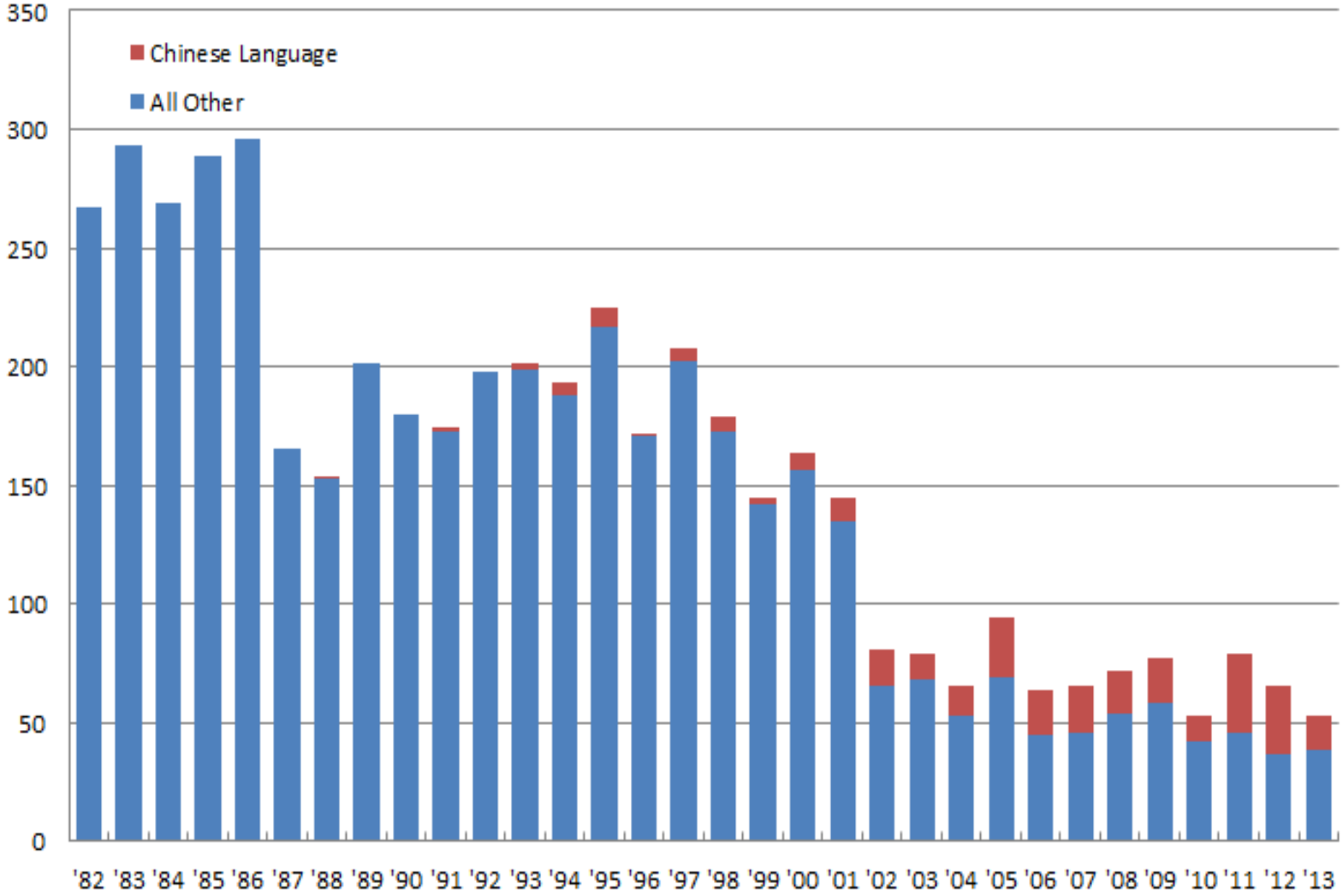
C. Over reliance on a few herbicides (Modes of action)

D. Weak overall weed management systems

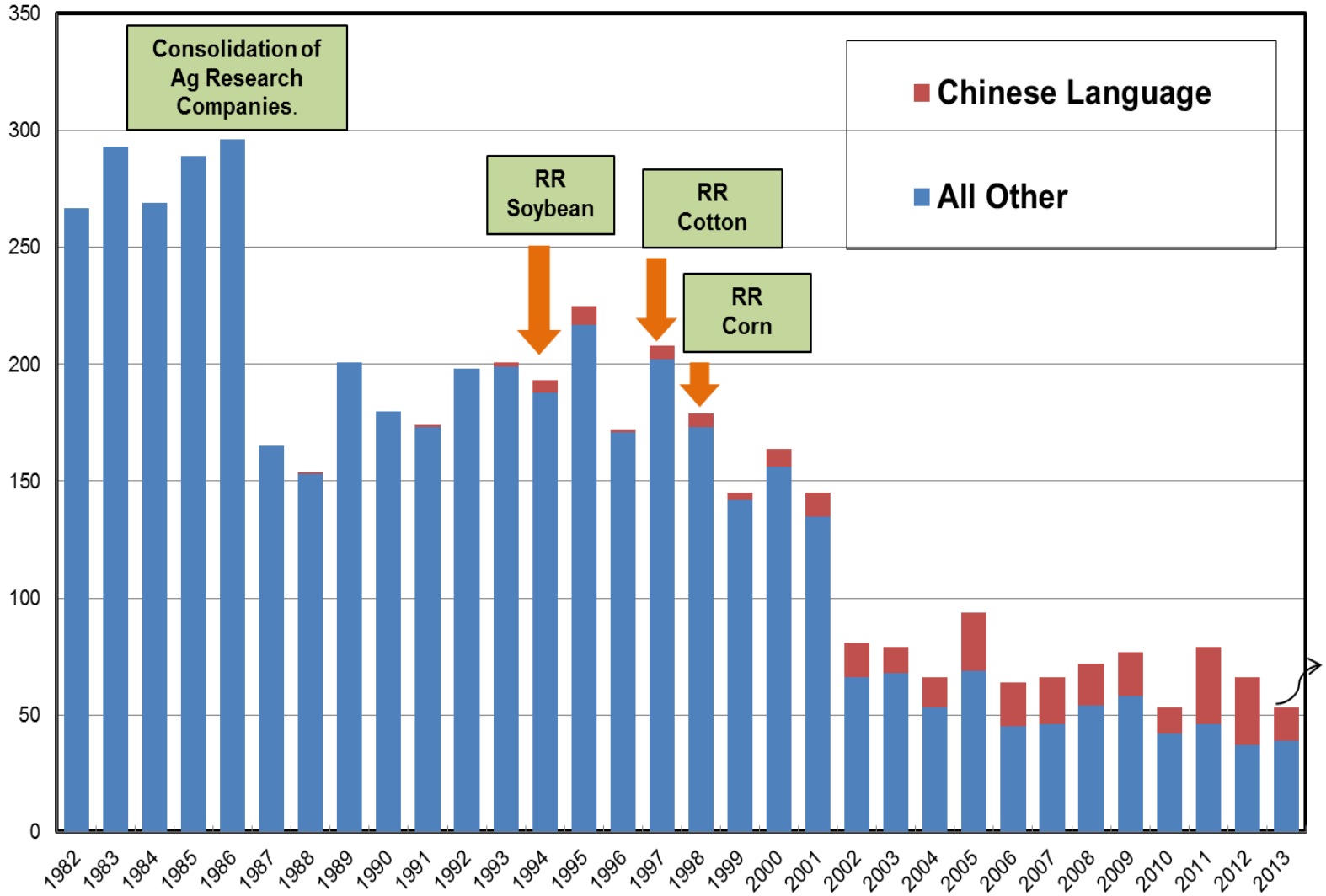
E. All of the above

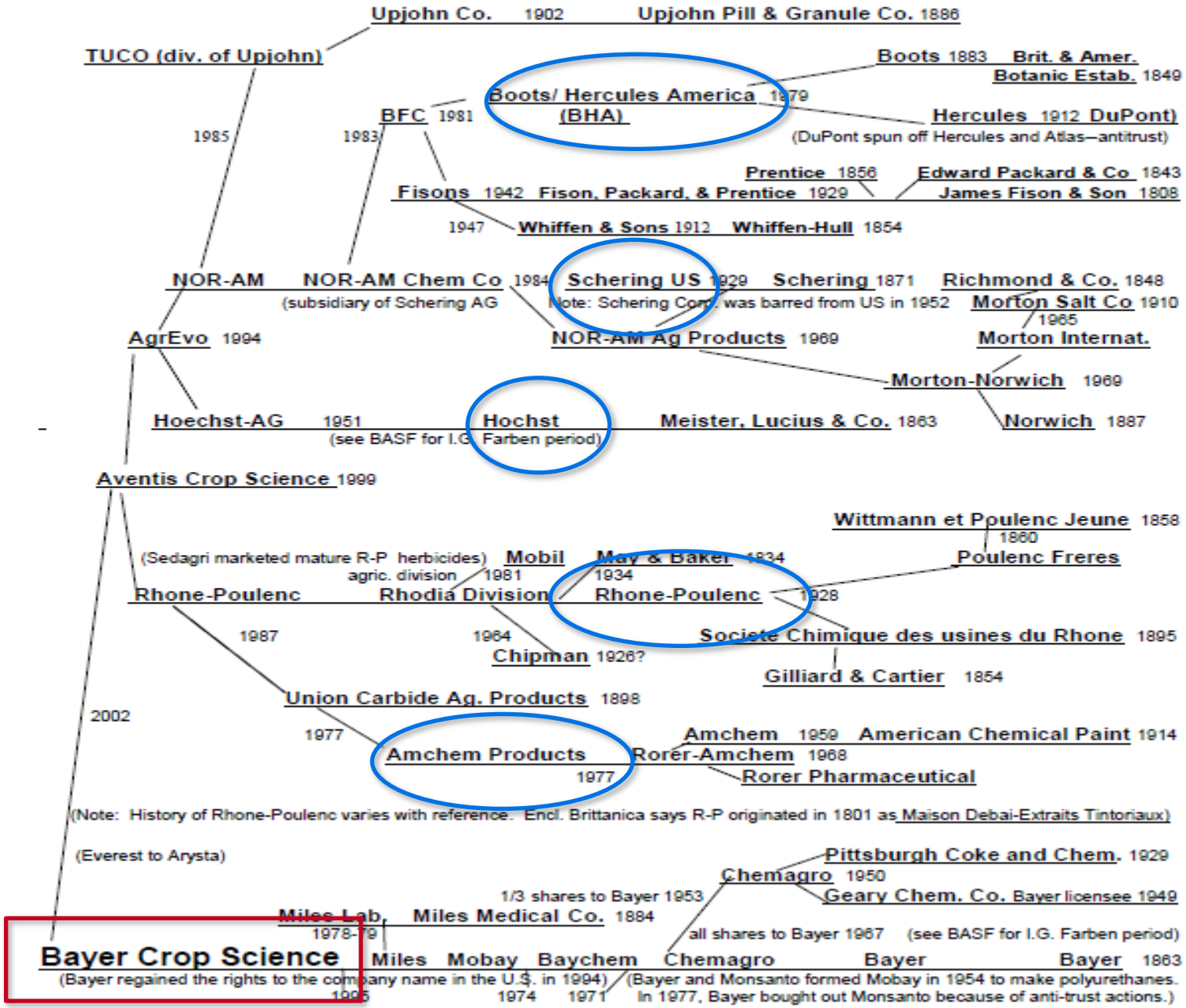


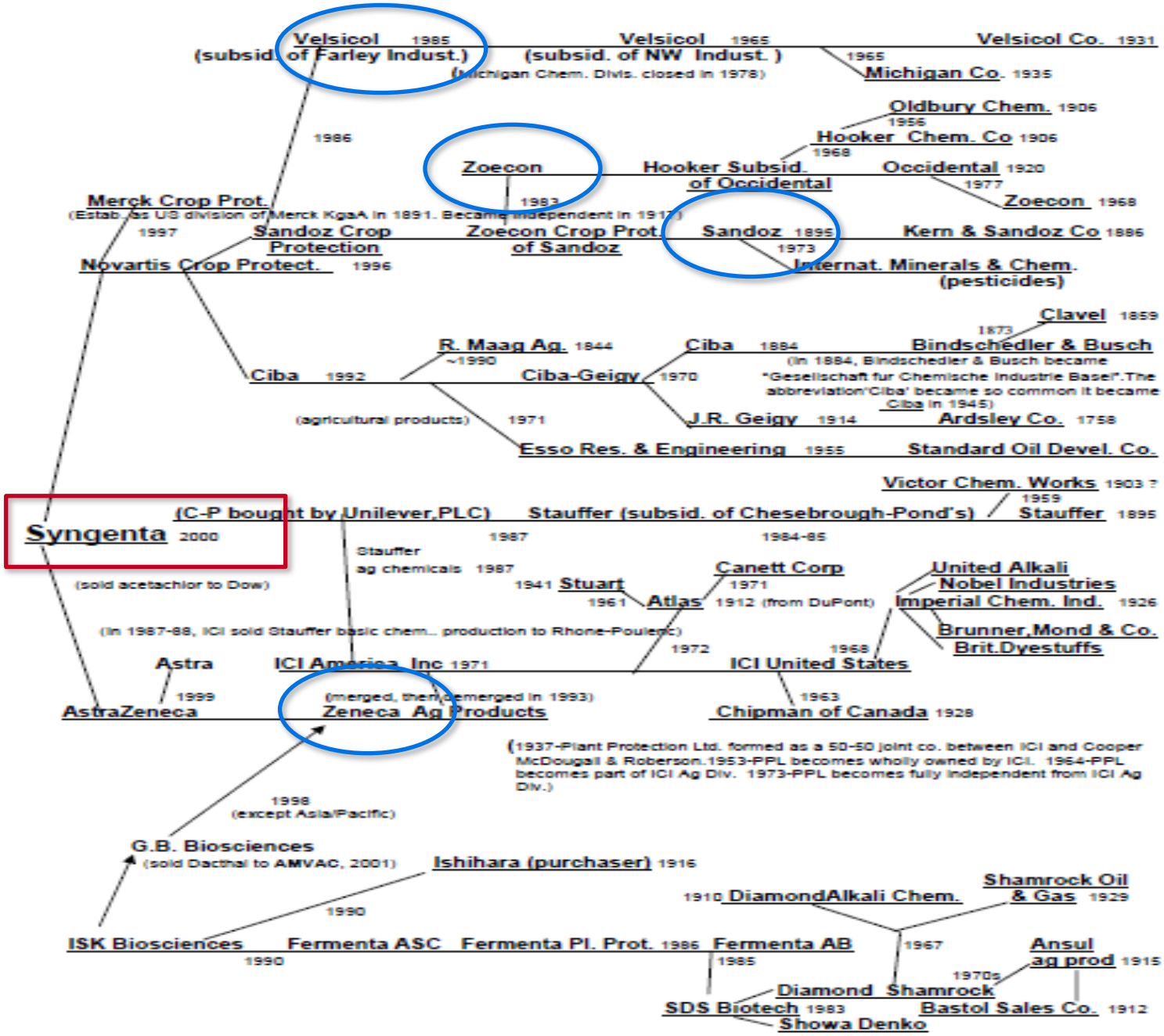
Herbicide New A.I. Patents 1982-2010



New Herbicide Patents 1982-2013




Upjohn Co. 1902
Upjohn Pill & Granule Co. 1886
TUCO (div. of Upjohn)
Boots 1883
Brit. & Amer. Botanic Estab. 1849
Boots/ Hercules America 1979 (BHA)
BFC 1981
Hercules 1912 DuPont)
(DuPont spun off Hercules and Atlas—antitrust)
1985
1983
Prentice 1856
Edward Packard & Co 1843
Fisons 1942
Fison, Packard, & Prentice 1929
James Fison & Son 1808
1947
Whiffen & Sons 1912
Whiffen-Hull 1854
NOR-AM
NOR-AM Chem Co 1984
Schering US 1929
Schering 1871
Richmond & Co. 1848
(subsidiary of Schering AG
Note: Schering Corp. was barred from US in 1952
Morton Salt Co 1910
1965
AgrEvo 1994
NOR-AM Ag Products 1969
Morton Internat.
Morton-Norwich 1969
Hoechst-AG 1951
Hochst
Meister, Lucius & Co. 1863
Norwich 1887
(see BASF for I.G. Farben period)
Aventis Crop Science 1999
Wittmann et Poulenc Jeune 1858
1860
(Sedagri marketed mature R-P herbicides)
Mobil
May & Baker 1934
Poulenc Freres
agric. division 1981
1934
Rhone-Poulenc
Rhodia Division
Rhone-Poulenc 1928
1987
1964
Societe Chimique des usines du Rhone 1895
Chipman 1926?
Gilliard & Cartier 1854
Union Carbide Ag. Products 1898
2002
1977
Amchem 1959
American Chemical Paint 1914
Amchem Products
Rorer-Amchem 1968
1977
Rorer Pharmaceutical
(Note: History of Rhone-Poulenc varies with reference. Encl. Brittanica says R-P originated in 1801 as Maison Debai-Extraits Tintoriaux)
(Everest to Arysta)
Pittsburgh Coke and Chem. 1929
Chemagro 1950
1/3 shares to Bayer 1953
Geary Chem. Co. Bayer licensee 1949
Miles Lab.
Miles Medical Co. 1884
1978-79
all shares to Bayer 1967
(see BASF for I.G. Farben period)
Bayer Crop Science
Miles
Mobay
Baychem
Chemagro
Bayer
Bayer 1863
(Bayer regained the rights to the company name in the U.S. in 1994)
1995
1974
1971
(Bayer and Monsanto formed Mobay in 1954 to make polyurethanes. In 1977, Bayer bought out Monsanto because of anti-trust actions.)


Velsicol 1985
(subsid. of Farley Indust.)
Velsicol 1965
(subsid. of NW Indust.)
(Michigan Chem. Divis. closed in 1978)
Velsicol Co. 1931
1965
Michigan Co. 1935
Oldbury Chem. 1906
1956
Hooker Chem. Co 1906
1968
1986
Zoecon
Hooker Subsid. of Occidental
Occidental 1920
1977
Zoecon 1968
Merck Crop Prot.
(Estab. as US division of Merck KgaA in 1891. Became independent in 1917)
1983
1997
Sandoz Crop Protection
Zoecon Crop Prot. of Sandoz
Sandoz 1895
Kern & Sandoz Co 1886
1973
Internat. Minerals & Chem. (pesticides)
Novartis Crop Protect. 1996
Clavel 1859
1873
R. Maag Ag. 1844
~1990
Ciba 1884
Bindschedler & Busch
(In 1884, Bindschedler & Busch became "Gesellschaft fur Chemische Industrie Basel".The abbreviation'Ciba' became so common it became Ciba in 1945)
Ciba 1992
Ciba-Geigy 1970
(agricultural products)
1971
J.R. Geigy 1914
Ardsley Co. 1758
Esso Res. & Engineering 1955
Standard Oil Devel. Co.
Victor Chem. Works 1903 ?
1959
(C-P bought by Unilever,PLC)
Stauffer (subsid. of Chesebrough-Pond's)
Stauffer 1895
Syngenta 2000
1987
1984-85
Stauffer ag chemicals 1987
(sold acetachlor to Dow)
Canett Corp
1941 Stuart
1961
Atlas
1971
1912 (from DuPont)
United Alkali
Nobel Industries
Imperial Chem. Ind. 1926
Brunner,Mond & Co.
Brit.Dyestuffs
(In 1987-88, ICI sold Stauffer basic chem.. production to Rhone-Poulenc)
1972
1968
Astra
ICI America Inc 1971
ICI United States
1999
(merged, then demerged in 1993)
AstraZeneca
Zeneca Ag Products
1963
Chipman of Canada 1928
(1937-Plant Protection Ltd. formed as a 50-50 joint co. between ICI and Cooper McDougall & Roberson.1953-PPL becomes wholly owned by ICI. 1964-PPL becomes part of ICI Ag Div. 1973-PPL becomes fully independent from ICI Ag Div.)
1998
(except Asia/Pacific)
G.B. Biosciences
(sold Dacthal to AMVAC, 2001)
Ishihara (purchaser) 1916
1910 DiamondAlkali Chem.
Shamrock Oil & Gas 1929
1990
ISK Biosciences
Fermenta ASC
Fermenta Pl. Prot. 1986
Fermenta AB
1967
Ansul ag prod 1915
1990
1985
1970s
Diamond Shamrock
SDS Biotech 1983
Bastol Sales Co. 1912
Showa Denko

How Many Basic Pesticide Manufactures Are Looking for Novel Crop Protection Chemicals?

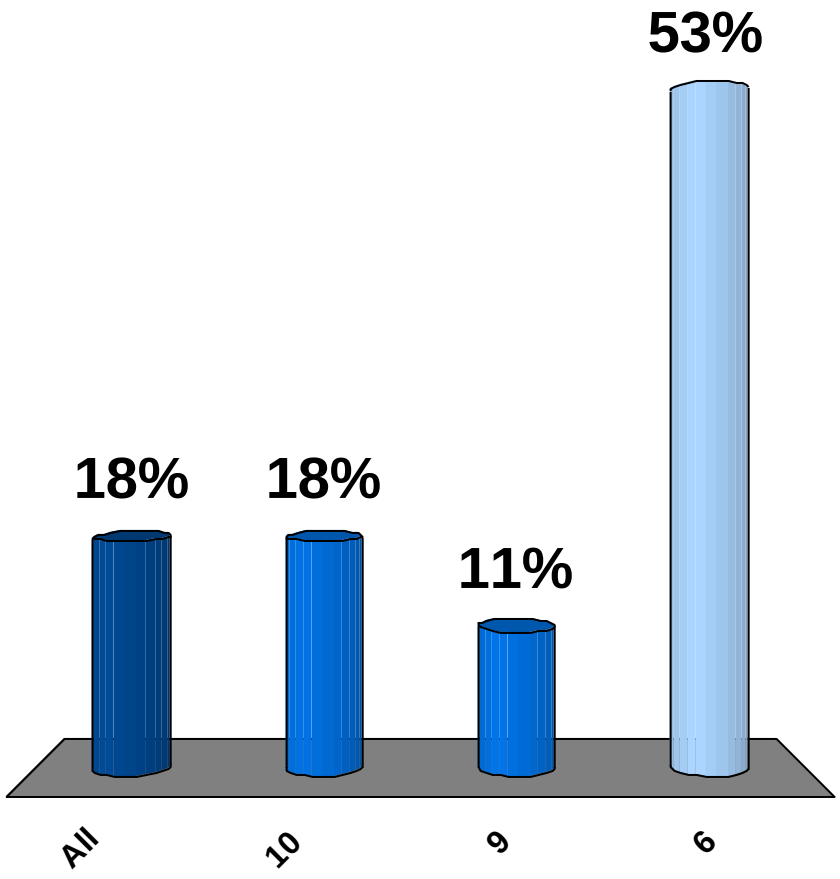
A. All

B. 10

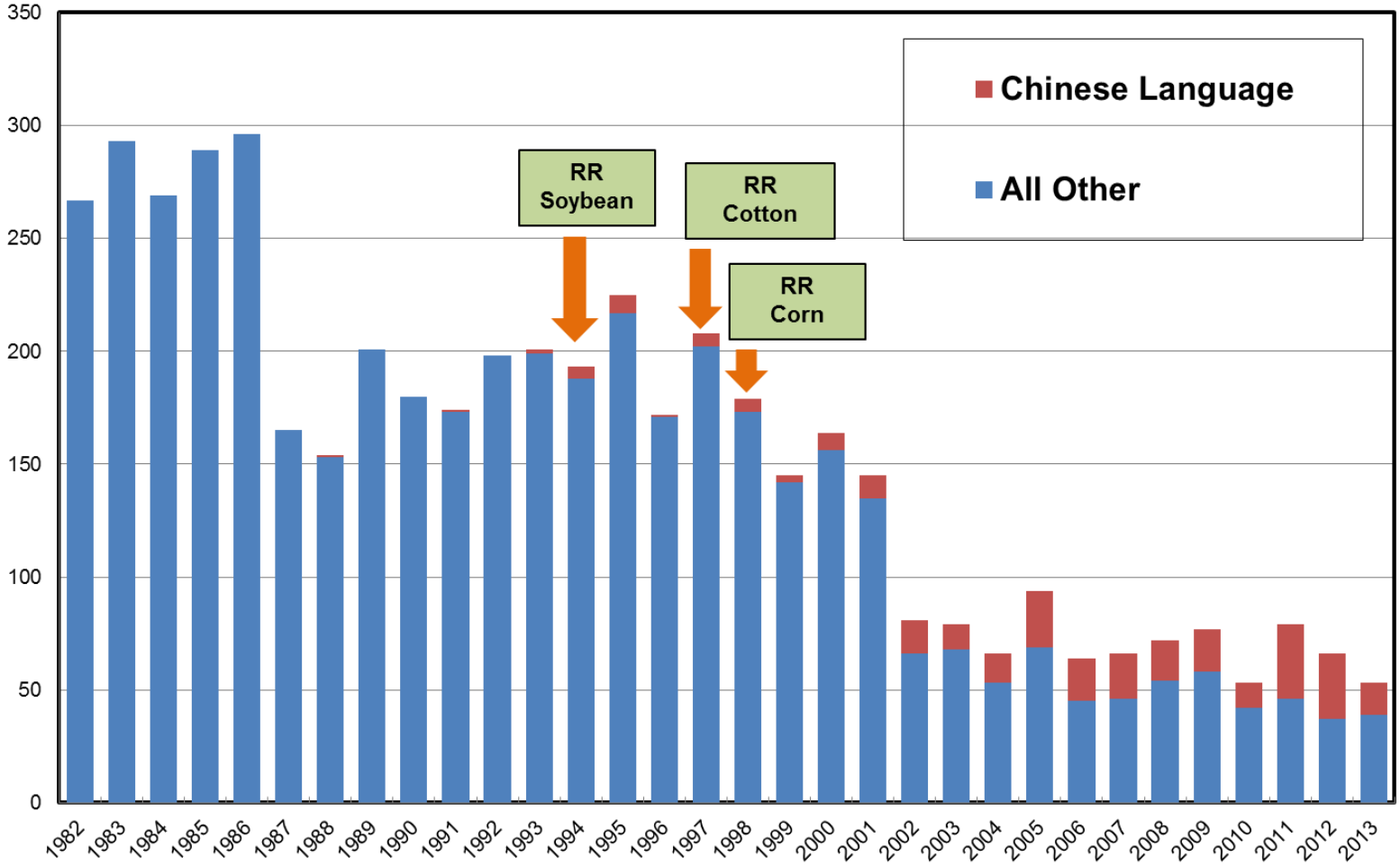
C. 9

D. 6

1. Bayer
2. BASF
3. Dow
4. DuPont
5. Syngenta
6. Valent/Sumitomo

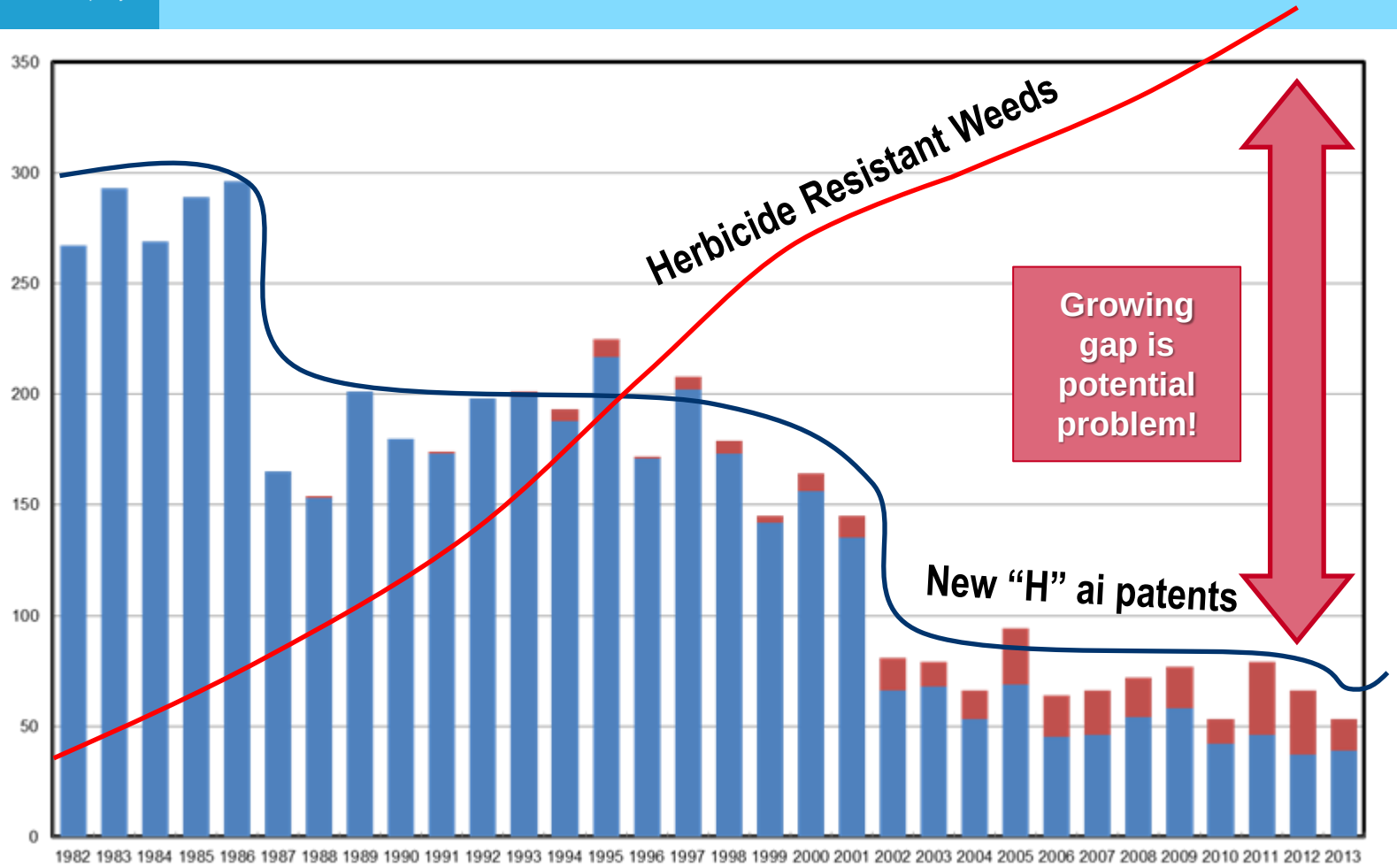


New Herbicide Patents 1982-2013



Capacity and "interest" dropped

New Patents vs. Increase in Weed Resistance



If We Do Not Get Smarter…..

Slide from
Dr. Harold Coble Prof
Weed Science, USDA-OPM

So what can we do about it?

Weed Resistance and Farmers Mindset

Predisposition for new tools has a direct correlation to the intensity of WR

WR is a relatively minor production factor allowing the farmer to "do what they have always done.

Yield and Quality;
Agronomic practices,
Machinery, Resources;
Agronomic practices
Price and weather

WR causes production problems, farmers considers WR as one of the most relevant.

Yield and Quality;
Agronomic practices, Machinery,
Resources; Agronomic practices
Price and weather

Weed Management

WR is a real production limiting problem, farmers need holistic yr-over-yr production solutions

Yield and Quality;
Agronomic practices, Machinery,
Resources; Agronomic practices
Price and weather

Production Mgmt

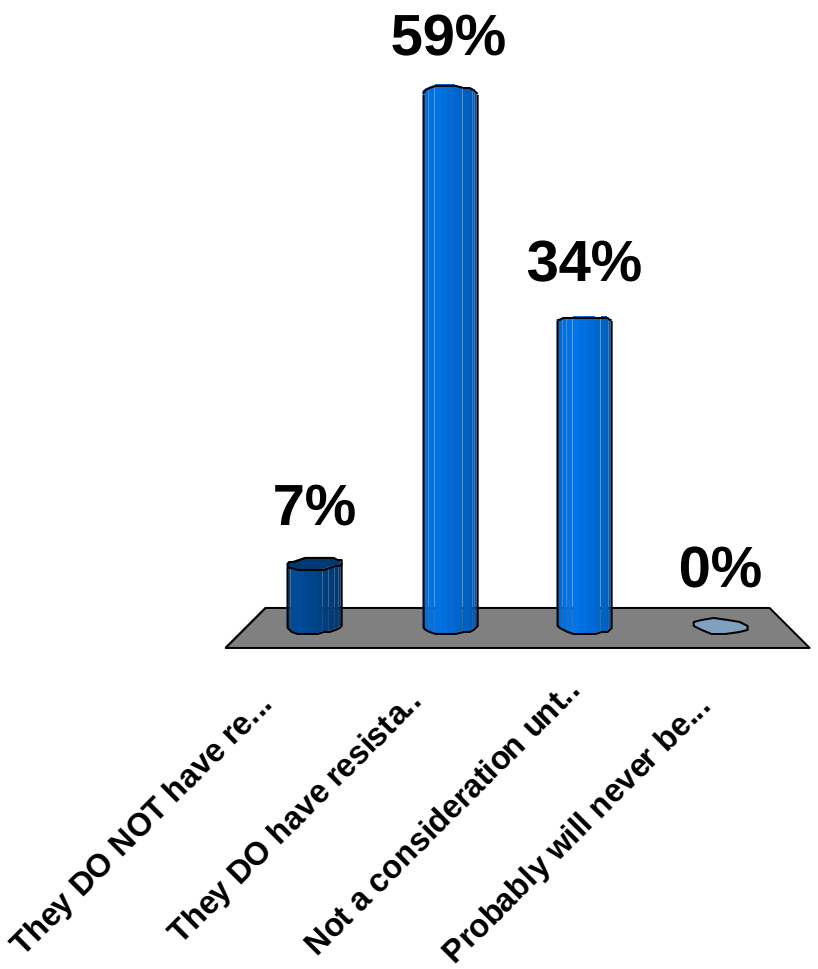
What Situation and Weed Control Strategy Are Your Producers Experiencing?

A. They DO NOT have resistance weed problems and are already proactive

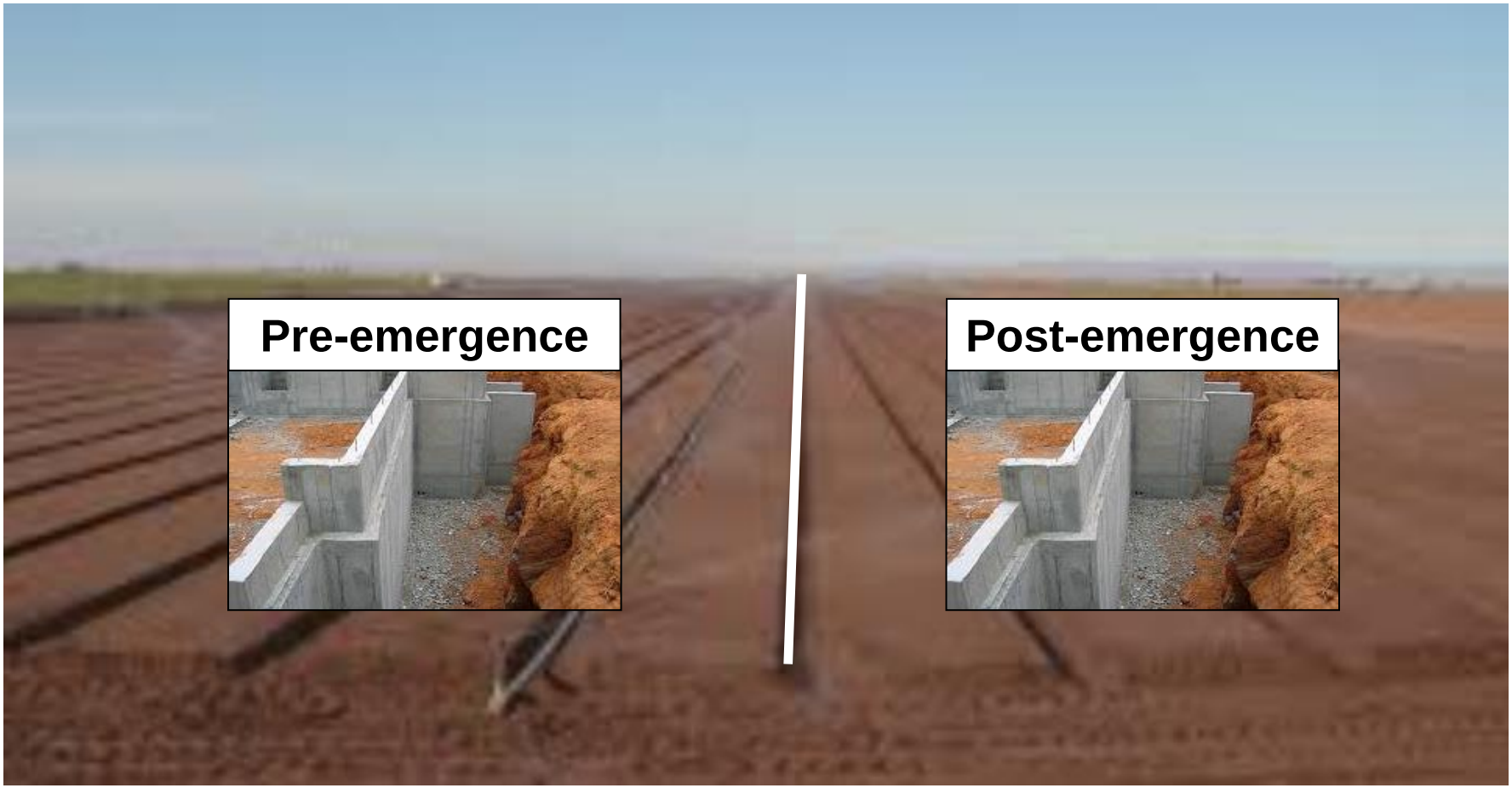
B. They DO have resistant weeds and are working to manage them

C. Not a consideration until they lose control of their fields – due to weeds

D. Probably will never be an issue



Best Foundation for Sustainable Weed Control Program

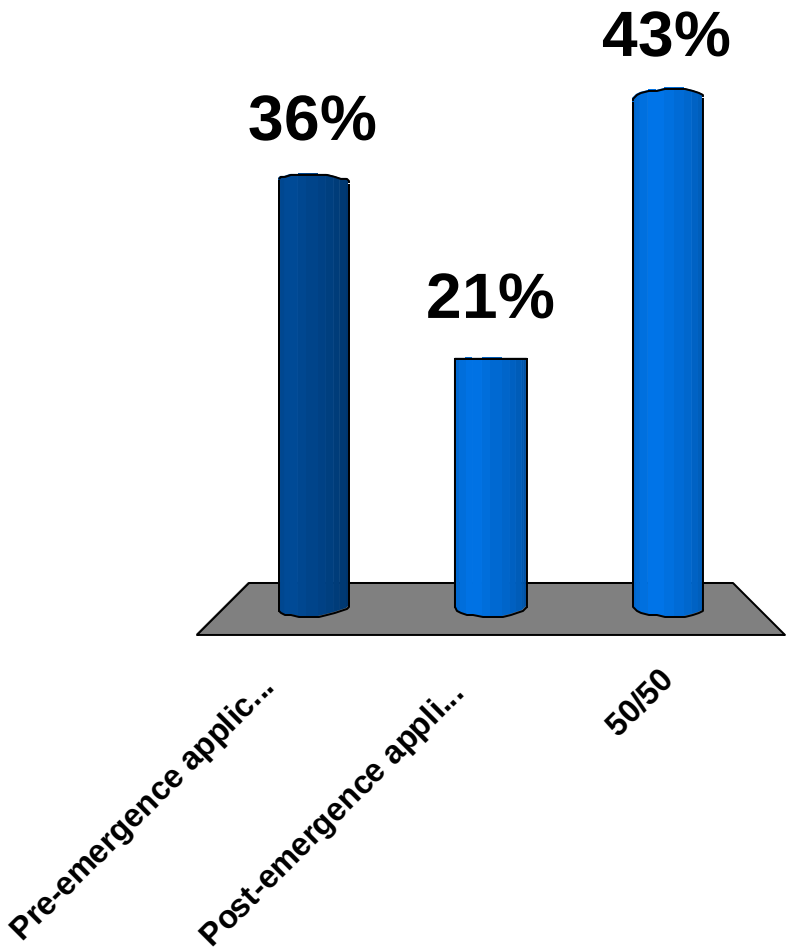


Where Do Your Weed Management Programs Mostly Rely?

A. Pre-emergence applications

B. Post-emergence applications

C. 50/50



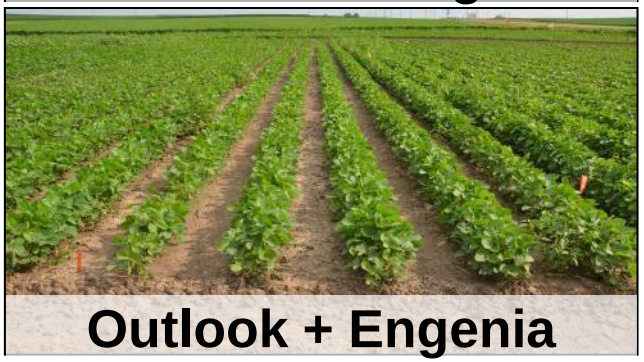
Weed Control Innovations

Photo by Dr. Bob Scott, University of Arkansas 2009

Weed Control Innovations

Photo by Dr. Bob Scott, University of Arkansas 2010

Engenia + Residual Herbicides Pre-emergence Efficacy



Engenia:
560 g ae/ha

Prowl H2O:
1064 g ai/ha

Outlook:
737 g ai/ha 48 DAT

Primarily: waterhemp and velvetleaf

Herbicide Stewardship Programs

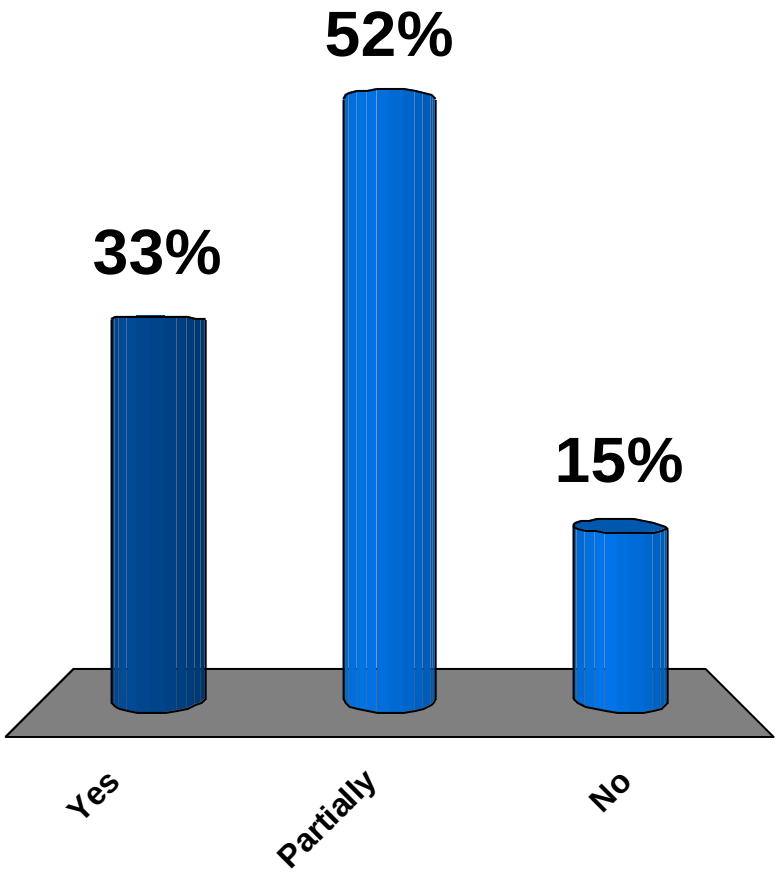
- Effective and sustainable weed control
  - Site-of-Action diversity
  - Employ residuals effectively
  - Scout for weed escapes
- Proper application
  - Maximize target impact
  - Minimize/negate off target impact

Do Consultants/Growers Take Company "Stewardship Programs" Seriously?

A. Yes

B. Partially

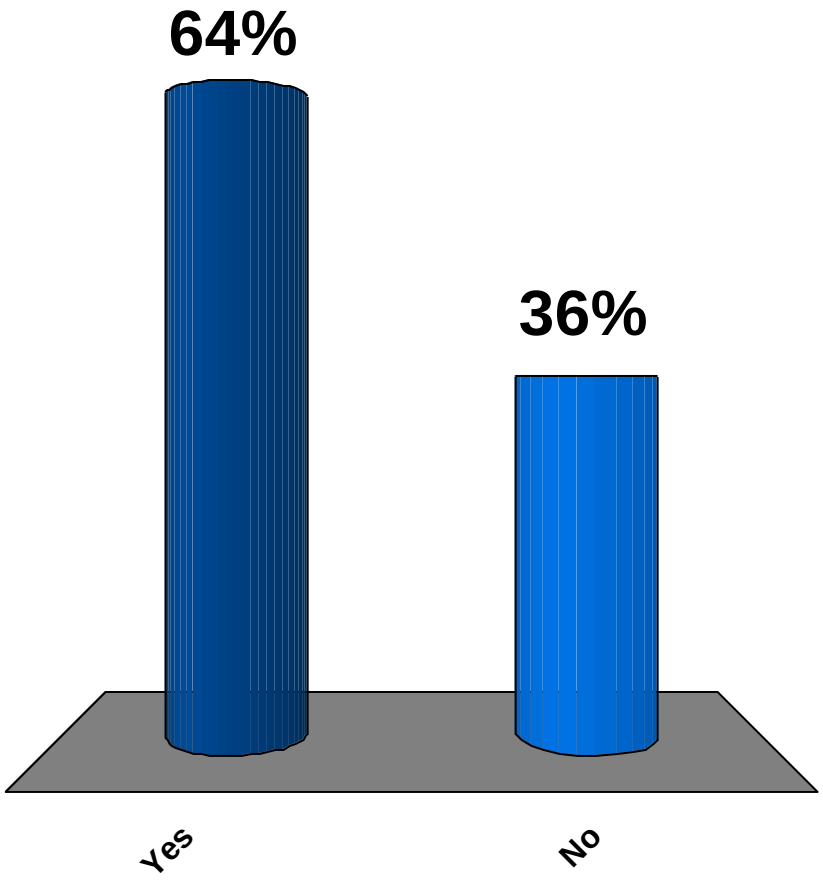
C. No



Are you Confident You Will be Able to Manage Weeds for the Next 5-10 Years?

A. Yes

B. No



Weeds Will Be Manageable

- No new “silver bullets”
- Will cost more
  - Starting with a strong “pre” foundation
- Will take more effort

  eg.
  - Attention to MOAs
  - Scouting and getting rid of escapes

Consultants become (even) more important!

Thank You!!

Photo by Dr. Bob Scott,
University of Arkansas 2009/2010

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