

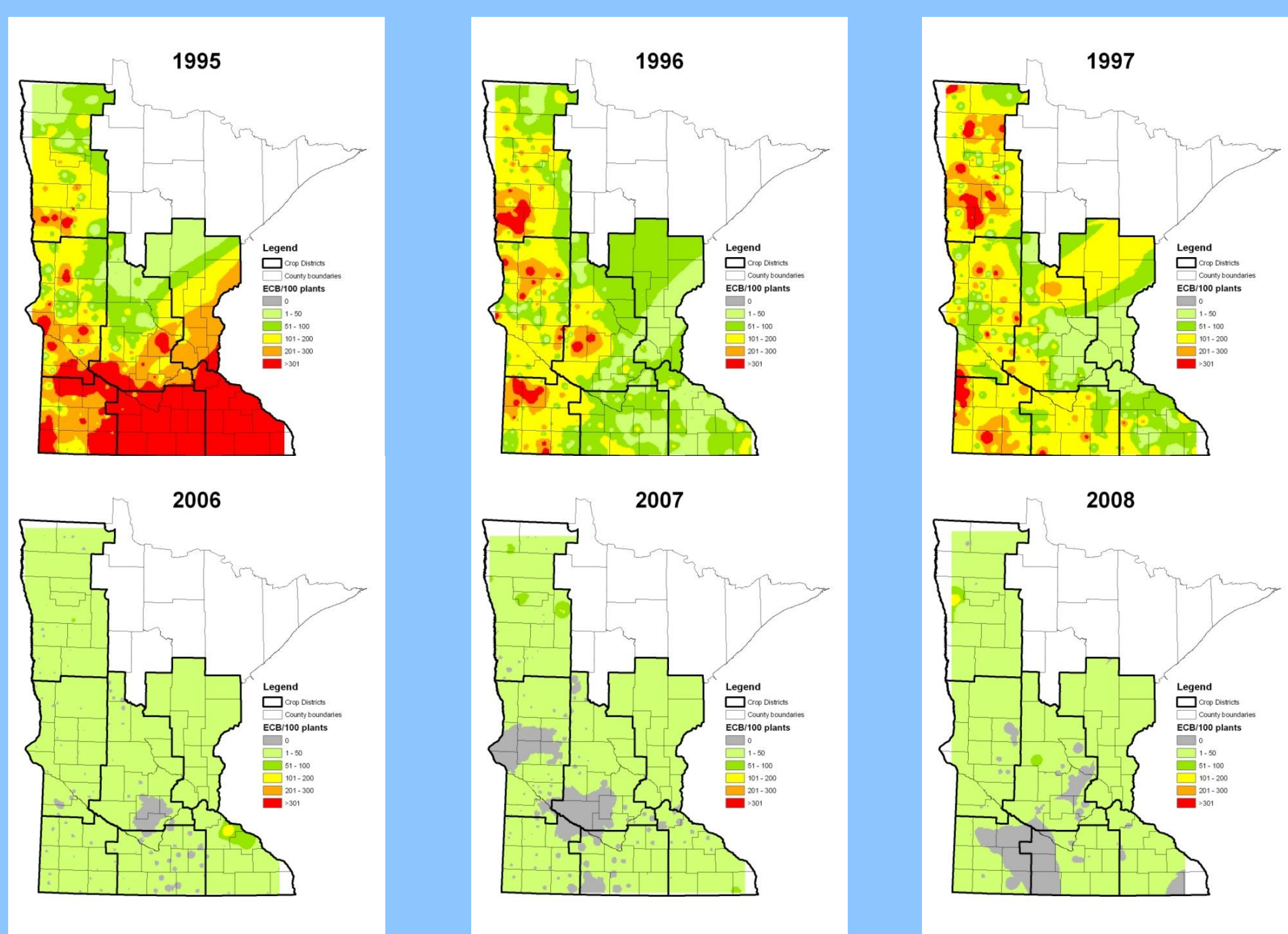
# Long-term Benefits of GM crops: Potential for *Diabrotica* Suppression in Europe using Bt Maize



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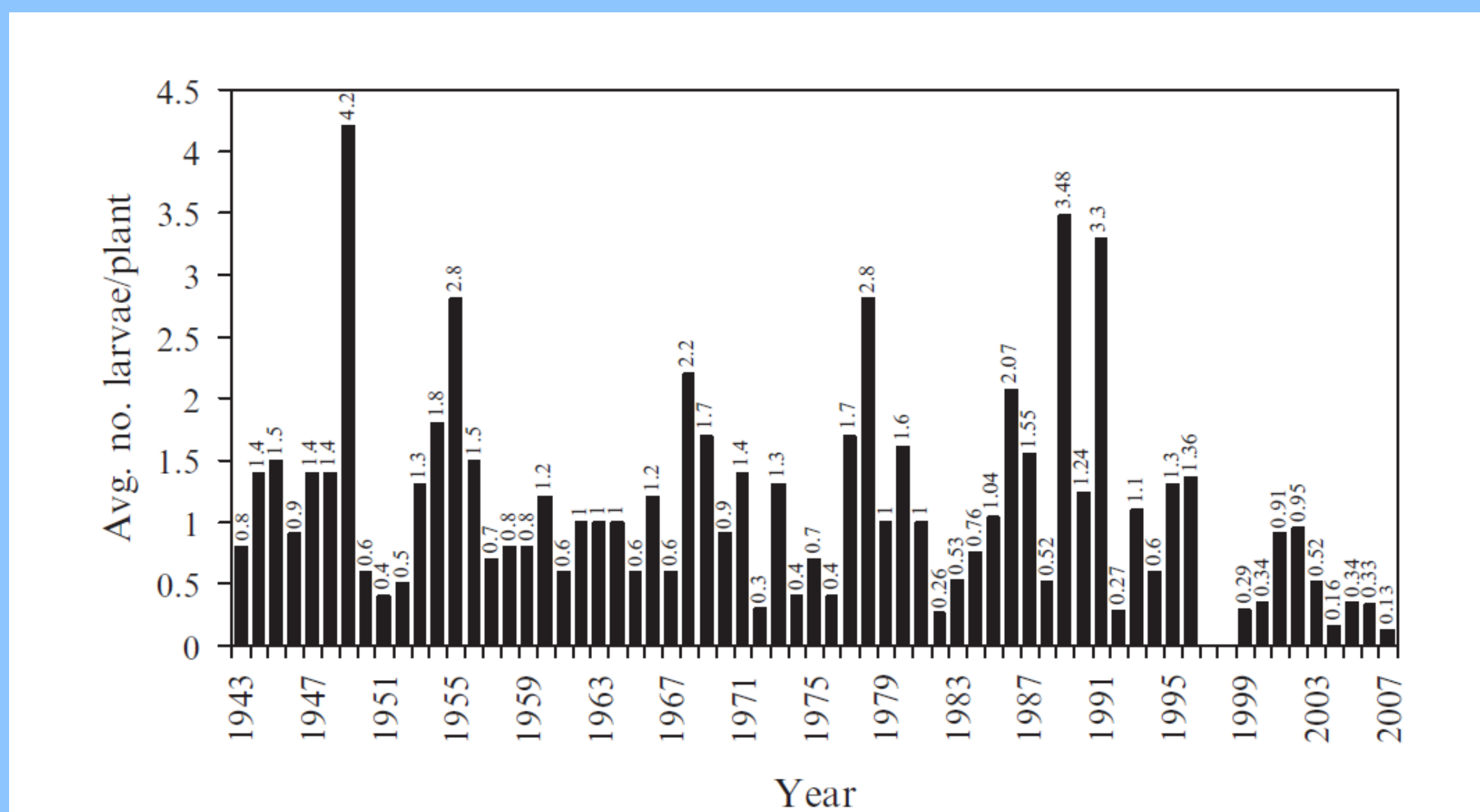
## Suppression of *Ostrinia nubilalis* in US Corn belt

### Minnesota



Courtesy of Dr. W. Hutchison, University of Minnesota

### Illinois

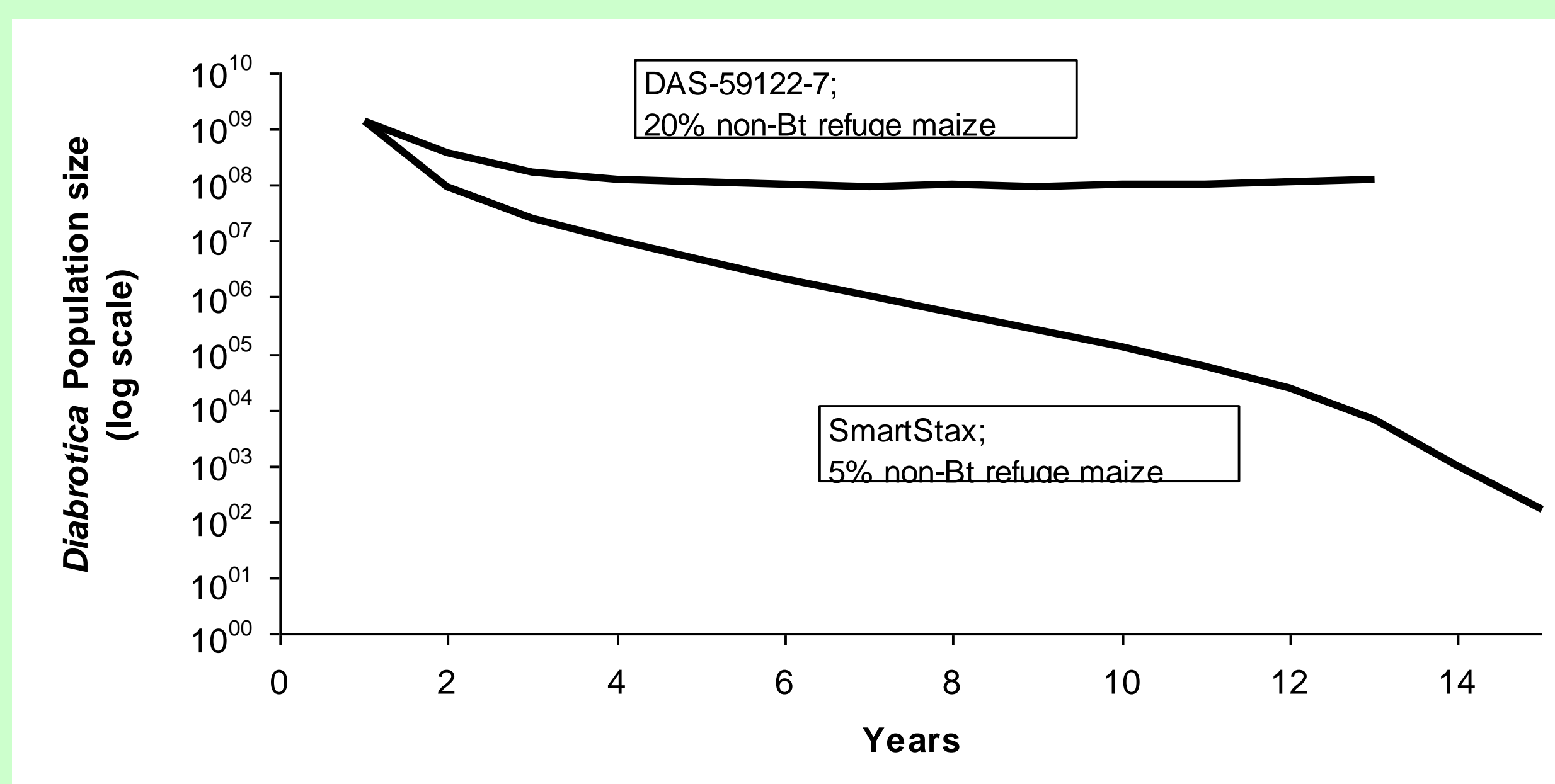


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Transgenic crops producing insecticidal proteins from *Bacillus thuringiensis* (Bt) have been widely adopted since 1996 in the United States of America to combat important pests of maize and cotton. There is growing evidence that several target pest populations have been dramatically reduced in areas where the Bt crops have been most intensively adopted over multiple years. The evidence is most dramatic for non-migratory monophagous and oligophagous species that show high mortality on Bt crops, such as *Ostrinia nubilalis* (European corn borer), and *Heliothis virescens* (tobacco budworm). Bt cotton is currently being used in the southwestern USA and Mexico as part of an area-wide eradication program for *Pectinophora gossypiella* (pink bollworm).

*Diabrotica virgifera virgifera* (western corn rootworm) is a recently-introduced pest of maize in eastern and central maize production areas of Europe. The insect has been listed in the EU as a regulated harmful organism with quarantine status and is regarded as a serious threat to agriculture in the EU. Broad-spectrum soil insecticides currently are applied to control this pest as a part of programmes to eradicate or contain *Diabrotica* outbreaks. SmartStax™ Bt maize line producing coleopteran-active insecticidal proteins is highly specific and more effective than existing measures. SmartStax causes >99% mortality corn rootworm larvae with no detectable effects on non-target organisms. Simulation models suggest that long-term area-wide cultivation of these Bt corn lines can lead to dramatic reduction, and even local eradication, of corn rootworm populations. Area-wide suppression of this economically important pest, based around Bt maize would benefit European agriculture and the environment. Such long-term benefits to agricultural production systems can reasonably be expected from the widespread cultivation of Bt crops in Europe.

## Simulation models predict dramatic reductions in *Diabrotica* populations over time using SmartStax

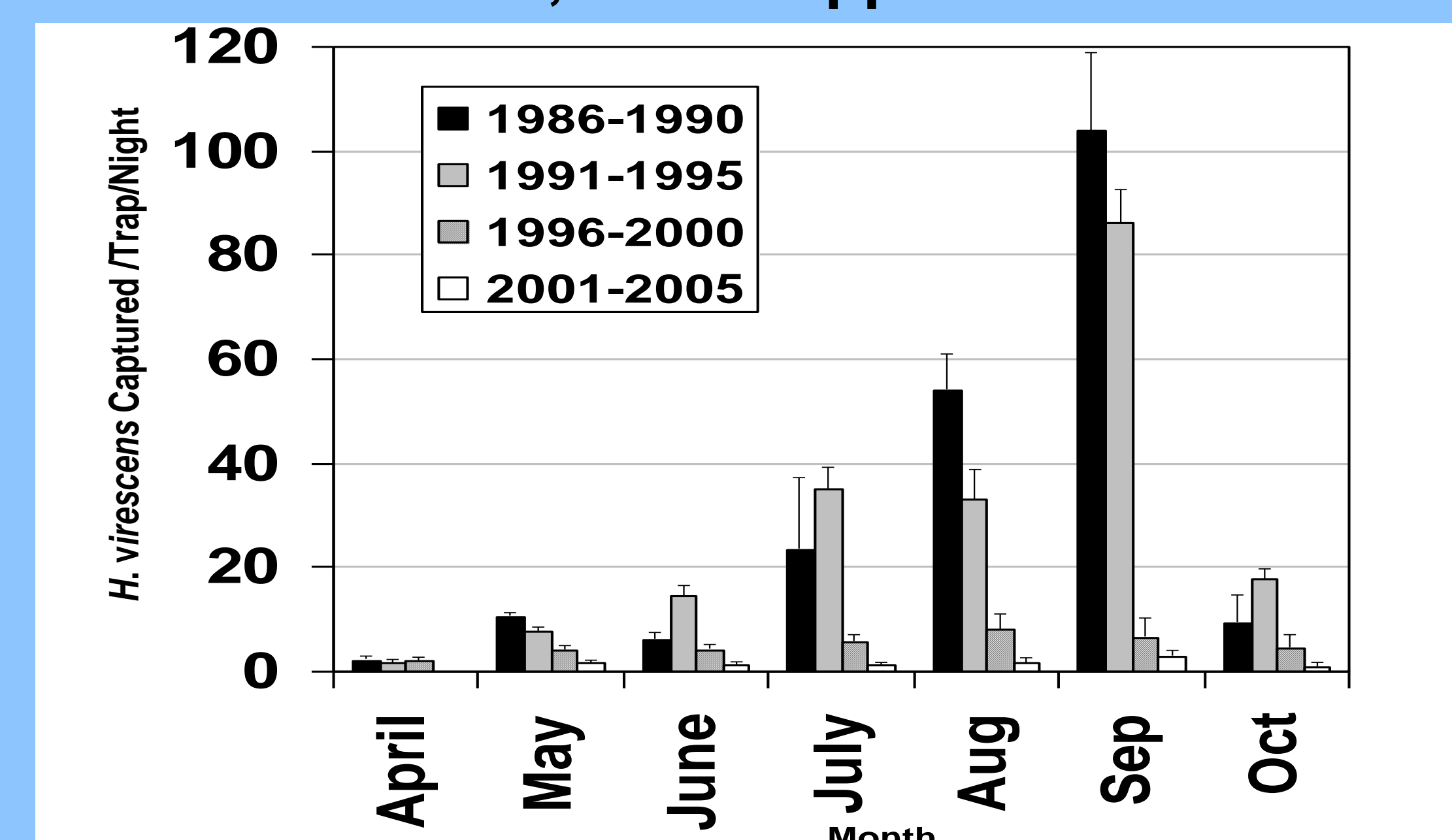


Model of Storer, N. P. 2003. A spatially explicit model simulating western corn rootworm (Coleoptera: Chrysomelidae) adaptation to insect-resistant maize. J.Econ.Entomol. 96: 1530-1547.

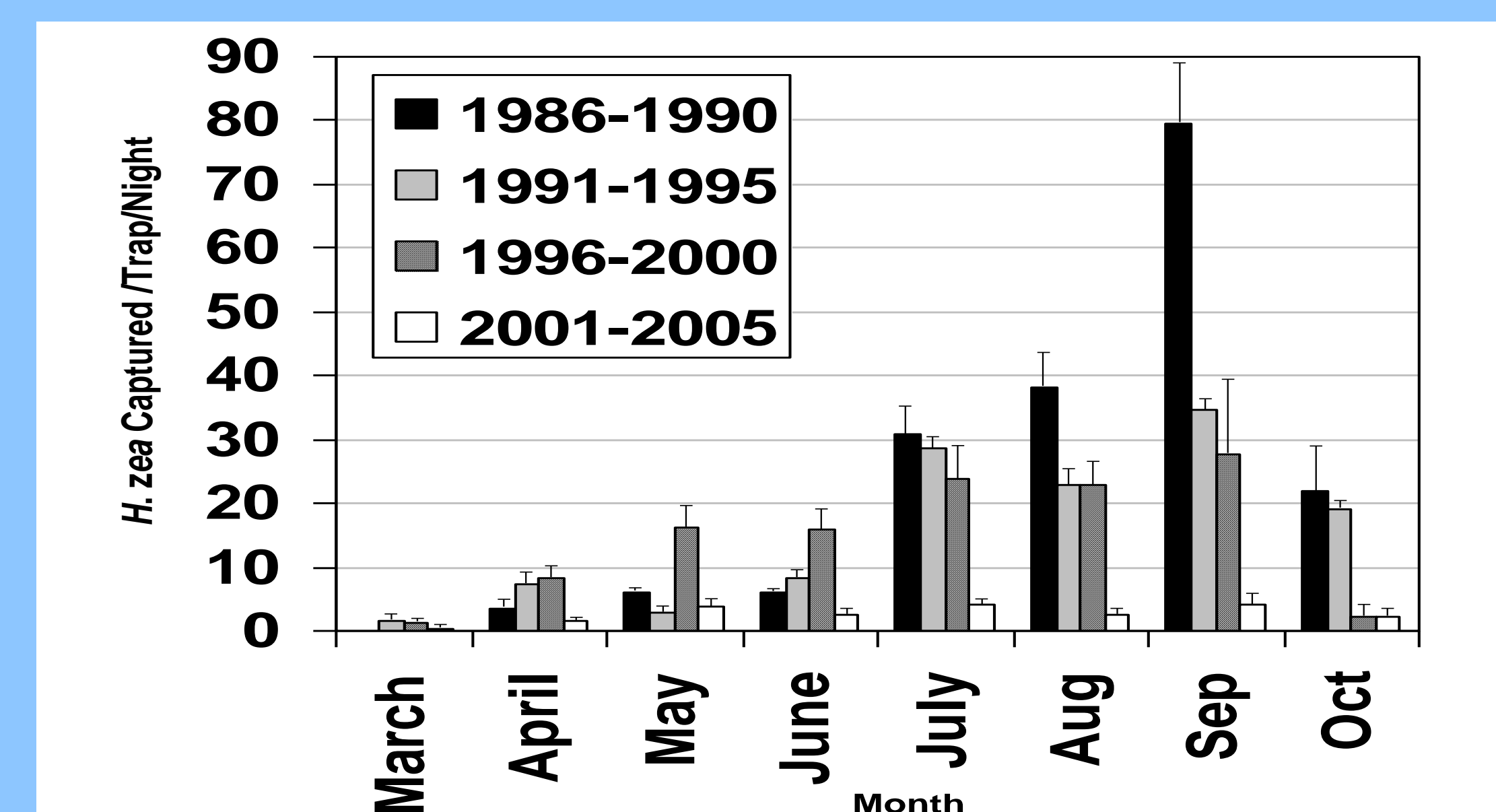
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SmartStax™ multi-event technology developed by Dow AgroSciences and Monsanto  
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## Suppression of Lepidoptera in US Cotton Belt

### *Heliothis virescens*, Mississippi



### *Helicoverpa zea*, Mississippi



Courtesy of Dr. J. Adamczyk, USDA-ARS

## Western corn rootworm biology favors population suppression with highly effective Bt maize

- Monophagous on maize
- Limited adult dispersal
  - Slow re-invasion
- Single generation each year
- High natural mortality in soil
  - Winter, disease, starvation after hatching
- High levels of mortality on SmartStax™ Bt maize
  - See lower right hand panel
- Complementary control tools available for integration
  - Crop rotation
  - Soil insecticides
  - Seed treatments

## Bt maize causes very high mortality of *Diabrotica* larvae

Adult emergence trials, by methods of Storer et al. 2006 . J. Econ. Entomol. 99: 1381-1387.



DAS-59122-7 = Cry34/35Ab1 insecticidal protein (Herculex® RW, XTRA)

MON 88017 = Cry3Bb insecticidal protein

Treatment	Mean # adults emerged	Reduction in adult emergence	Estimated larval mortality
Control	1032.8		
DAS-59122-7	35.0	96.61%	99.24% to 99.97%
MON 88017	17.1	98.34%	99.40% to 99.99%
SmartStax	11.1	98.93%	99.88% to 99.999%

SmartStax™ combines MON 88017 with DAS-59122-7 traits for *Diabrotica* control