Clone Warfare: Strategies for Soybean Aphid Management

Jan. 21, 2004

Ken Ostlie

Department of Entomology - University of Minnesota

ostli001@umn.edu

(612) 624-7436 office (612) 750-0993 cell

Clone Warfare: Strategies for Management

Wanted

Information Leading to the Successful Management

Soybean aphid

(*Aphis glycines* Mats.)

- **Know your enemy**
  - **Overwintering**
  - **Alate production**
  - **Dispersal**
  - **Population dynamics**
- **Damage and risk – Yield and quality dimensions**
- **Scouting: Where, when and how?**
- **Thresholds and Insecticide Decisions:**
- **Insecticides – Getting the most out of your investment**
- **Questions**

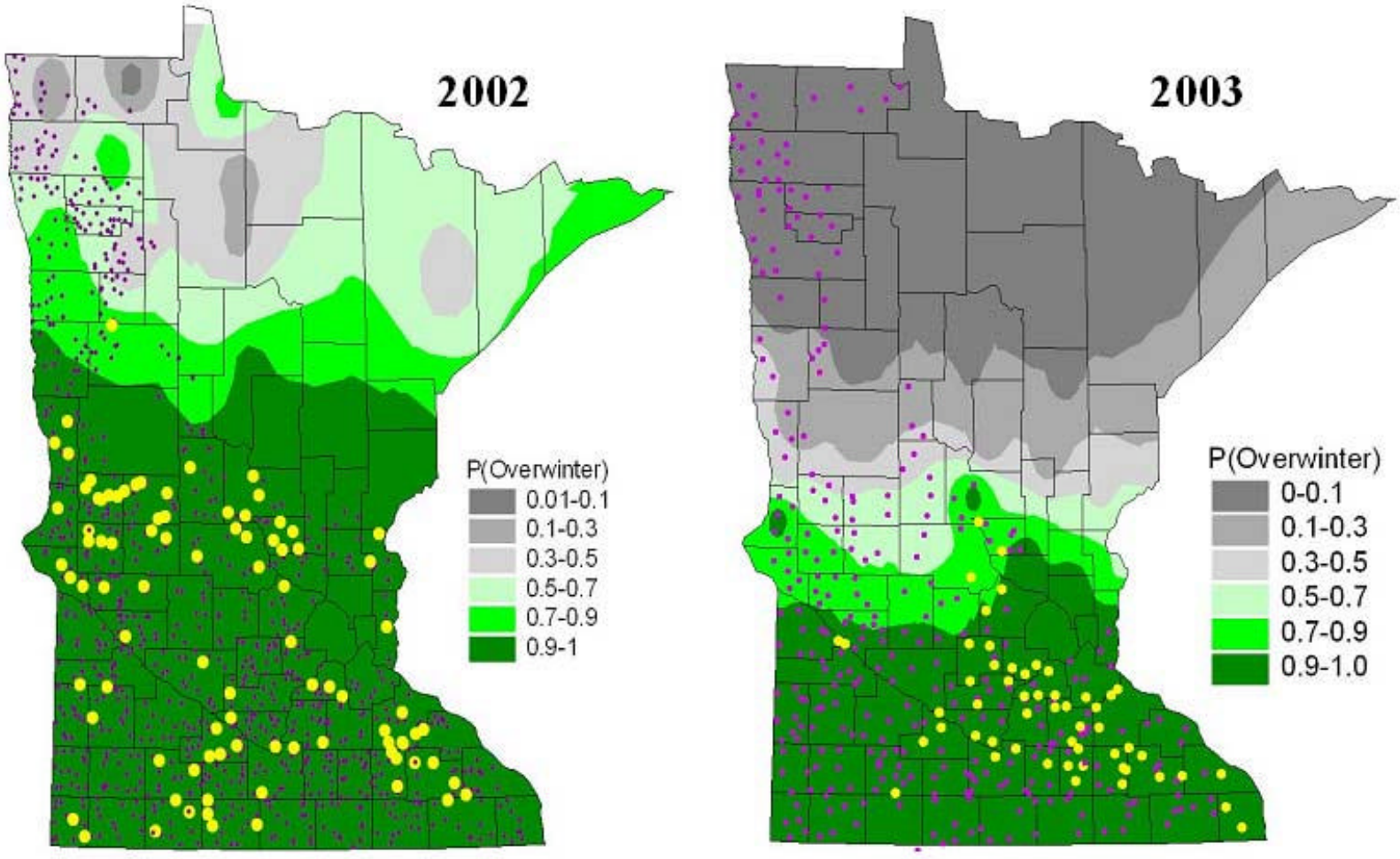
Ken Ostlie – University of Minnesota

The Challenges of Clone Warfare:

- **The soybean aphid is unlike typical corn or soybean pests.**
  - **Population female in summer**
  - **Females give birth to live young**
  - **Young mature in ca. 5 days**
  - **Populations double in 2-3 days**
- **In response to crowding, poor host quality or seasonal cues, females produce young that will become winged.**
- **Winged aphids spread within fields, colonize nearby fields or disperse long distance, avg. 7-10 miles/day.**
- **Aphids suck soybean sap; damage photosynthetic capacity of soybean plant.**

Ken Ostlie – University of Minnesota

Overwintering Success of Soybean Aphid

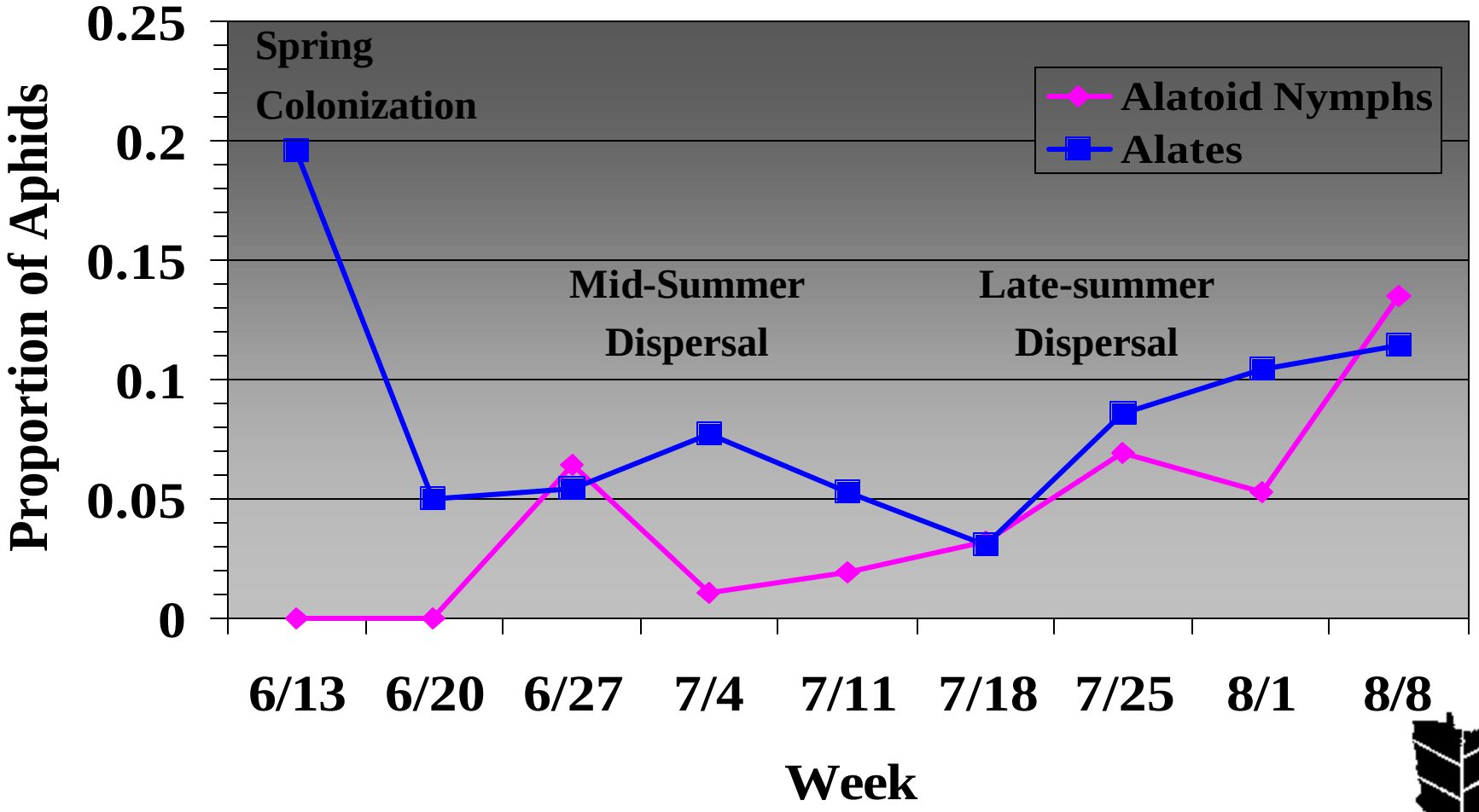


Winter conditions do affect the overwintering range!

Ken Ostlie – University of Minnesota

Alate Production in MN Soybean: 2003

Hodgson, McCornack & Ragsdale

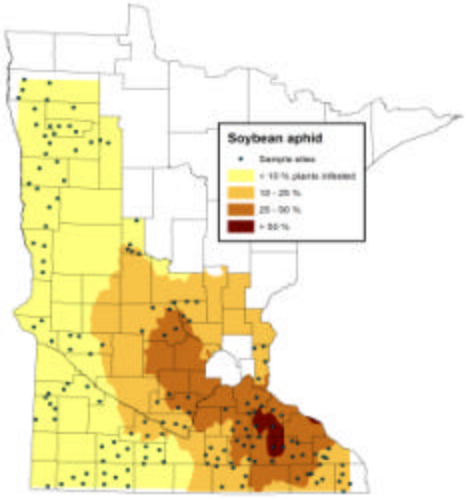


Samples collected by MDA Plant Pest Survey Program

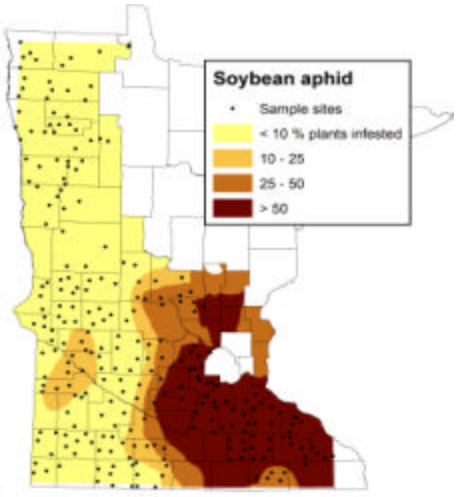
Ken Ostlie – University of Minnesota

Seasonal Dispersal of Soybean Aphid:

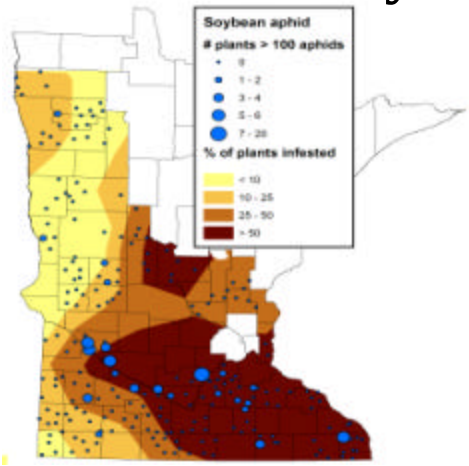
M. Abrahamson, MDA Plant Pest Survey Program



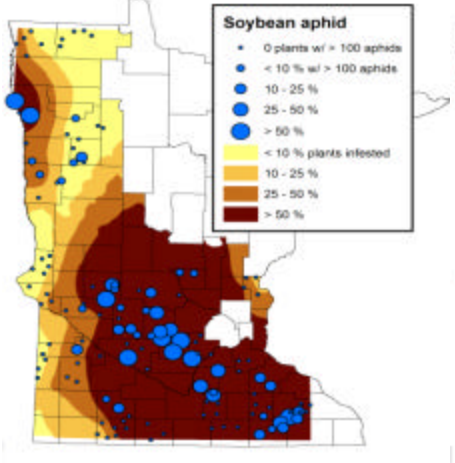
July 9



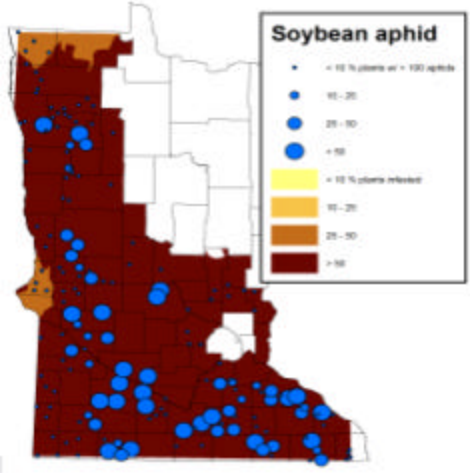
July 16



July 23



July 30

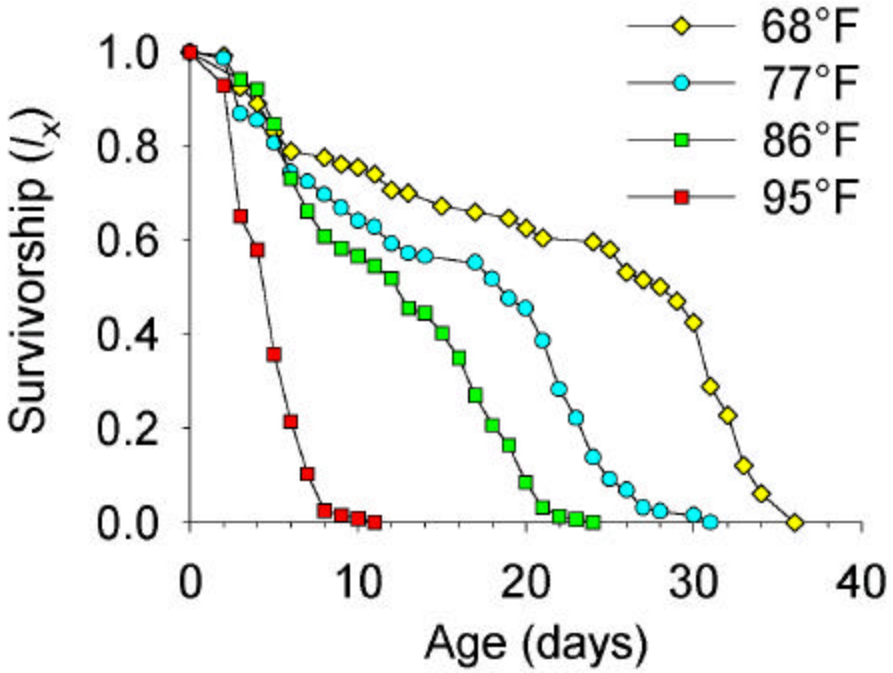


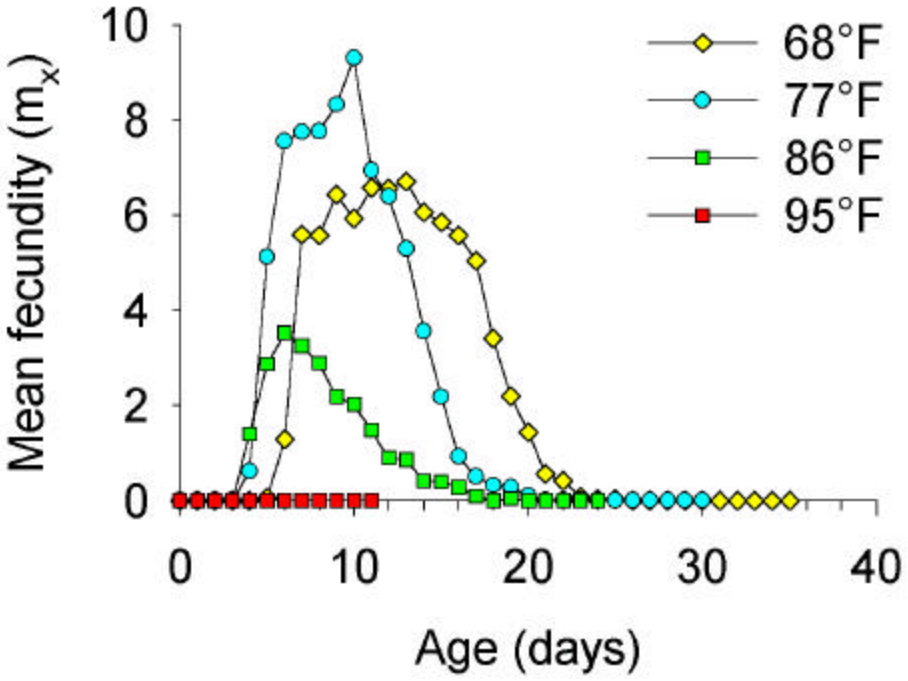
Aug. 8

Kris Ostlie – University of Minnesota

Soybean Aphid and Temperatures: Survival and Reproductive Rate

McCornack, Venette and Ragsdale - 2003





Ken Ostlie – University of Minnesota

Factors Influencing Population Dynamics of Soybean Aphid

- Duration and intensity of colonization
  - Proximity and density of buckthorn
  - Fall and spring predation on buckthorn
  - Winter mortality
  - Survival and reproductive success on soybean
- Host quality / resistance
- Natural enemies (lady beetles, minute pirate bugs, lacewings, parasitic wasps, fungi)
- Rainfall (direct mortality, fungal outbreaks)
- Temperature
  - Optimal temperature ca. 82^{o}F

Each year has seen different dynamics!

Ken Ostlie – University of Minnesota

What's the Long-Term Status? Infestation is Different Every Year!

Ken Ostlie – University of Minnesota


Damage
and
Risk

Soybean Aphid Impacts on Soybean Yield and Quality

Soybean Yield (84 fields)

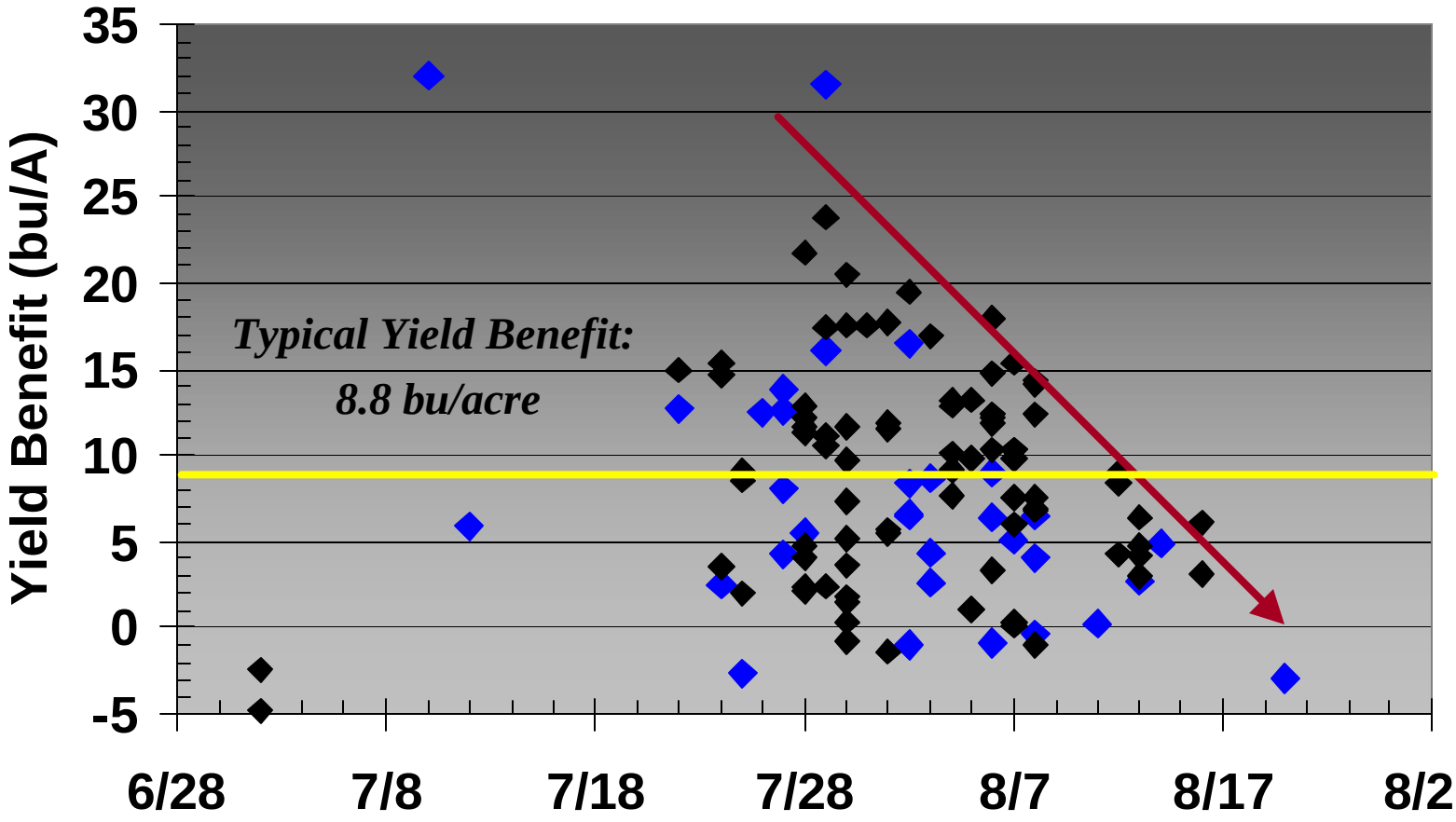
- **Insecticide sprays produced yield increases averaging 8.8 bu/A. Range (-5.0 to 27 bu/A)**
- **Primary effects on pod number with earlier infestations with greater effects on seed size with later infestations.**

Seed Quality (25 fields)

- **Oil reduced 0.5%**
- **Protein increased 0.8%.**

Ken Ostlie – University of Minnesota

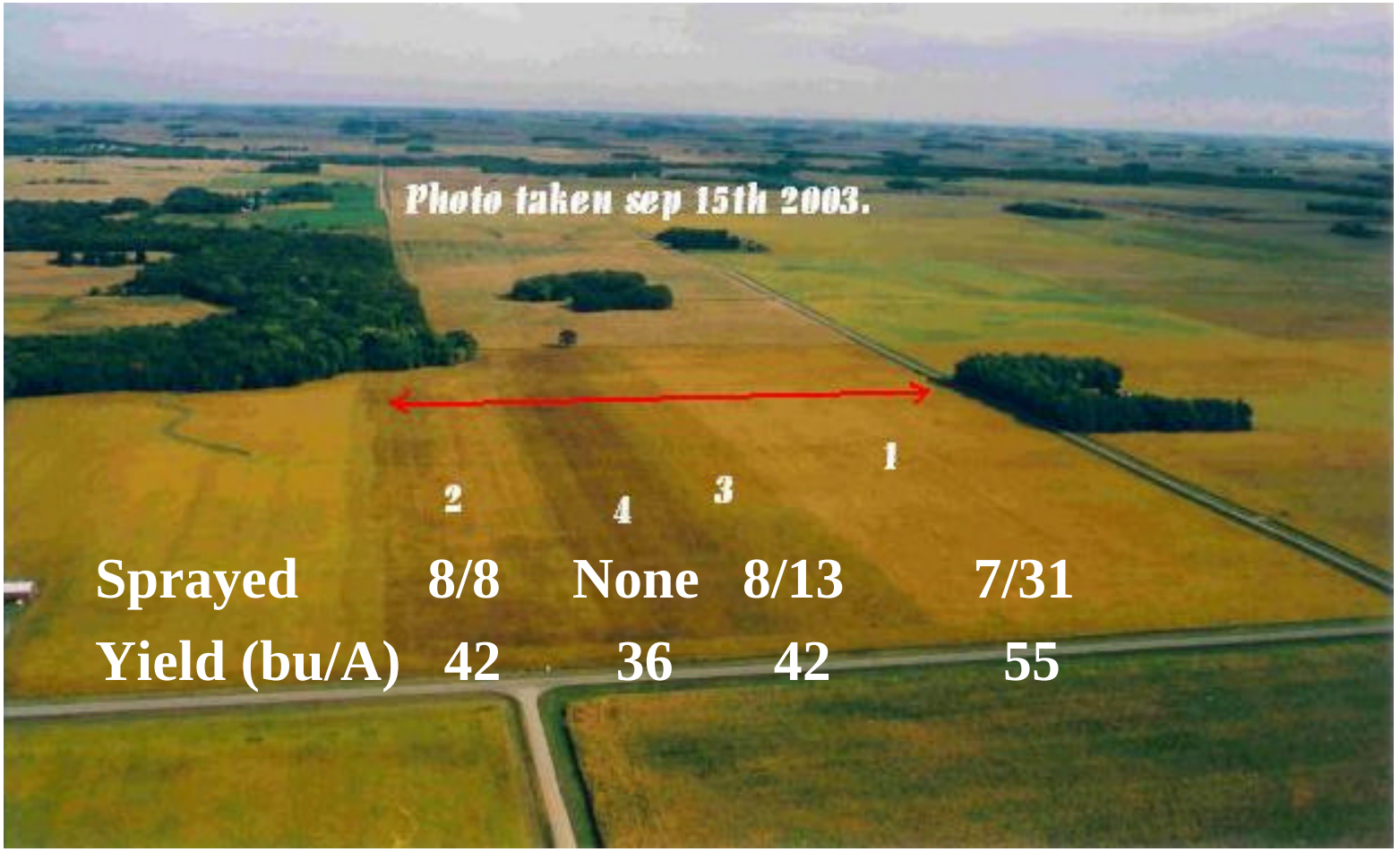
Yield Response (bu/A) to Insecticide Application for Soybean Aphid: 2001 vs 2003 *On-farm Trials*



Ken Ostlie – University of Minnesota

Yield Response to Insecticide Timing

Tim Steier – Blue Earth Aviation



Insecticides – Warrior @ 3.2 oz/A (7/31, 8/8),

Lorsban @ 1 pt/A (8/13) in 4 gpa by air

Ken Ostlie – University of Minnesota

Scouting for Soybean Aphid: When? Where? How?

Aphids

Cast Skins

Ants

Ladybugs

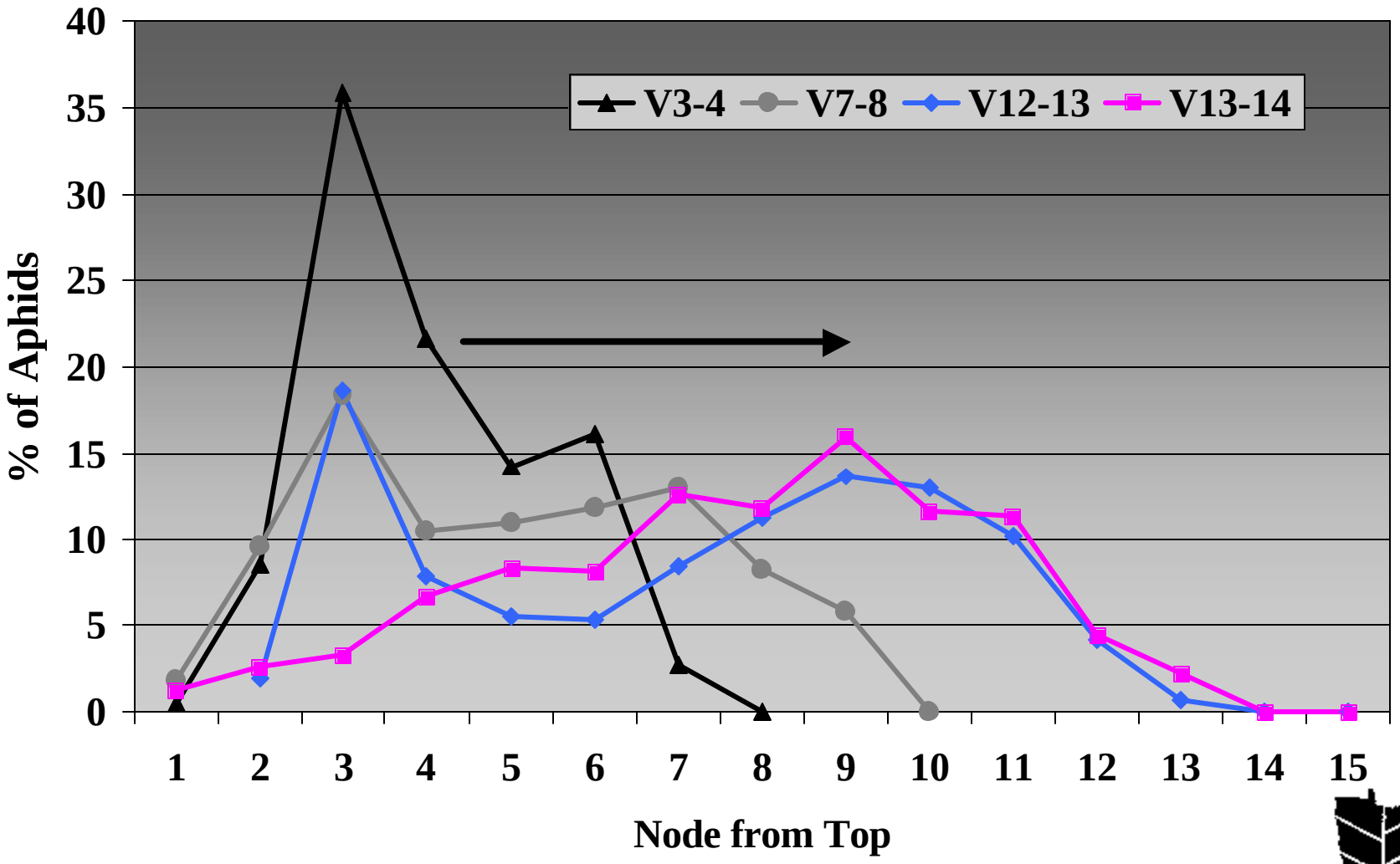
Honeydew

Sooty Mold

Room for improvement. Whole plant counts. Order of magnitude decision

Ken Ostlie – University of Minnesota

Soybean Aphid Shift Within the Plant



Ken Ostlie – University of Minnesota

Challenges to Aphid Control?

- *Aphid location on plant*
- *Every survivor is or will be a reproducing female*
- *High reproductive potential*
- *Re-colonization may occur*
- *Insecticides detrimental to beneficial insects*

Thresholds and Insecticide Decisions

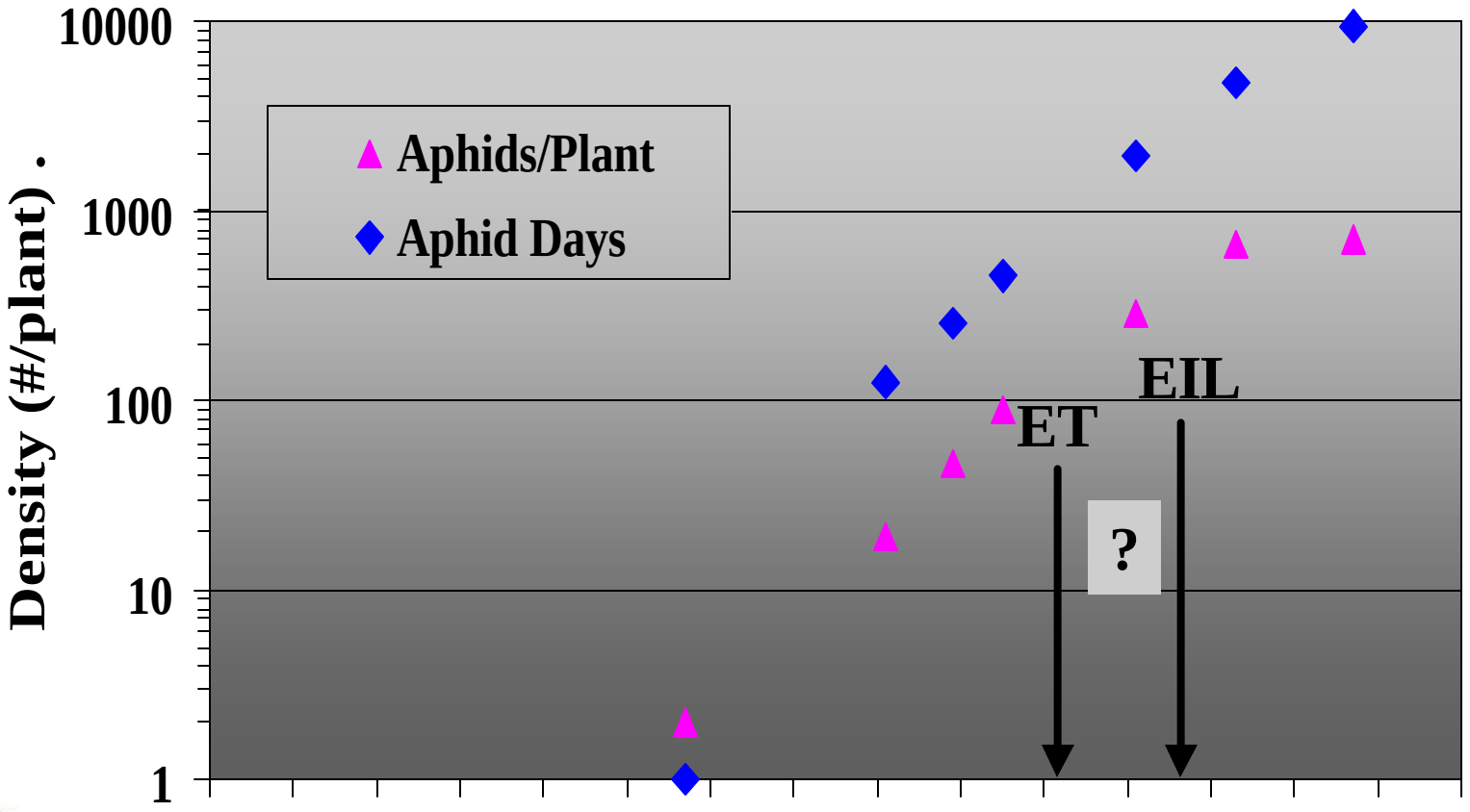
Dynamic, order of magnitude decision regarding population potential

Insecticide Decisions for Soybean Aphid: Key Concepts

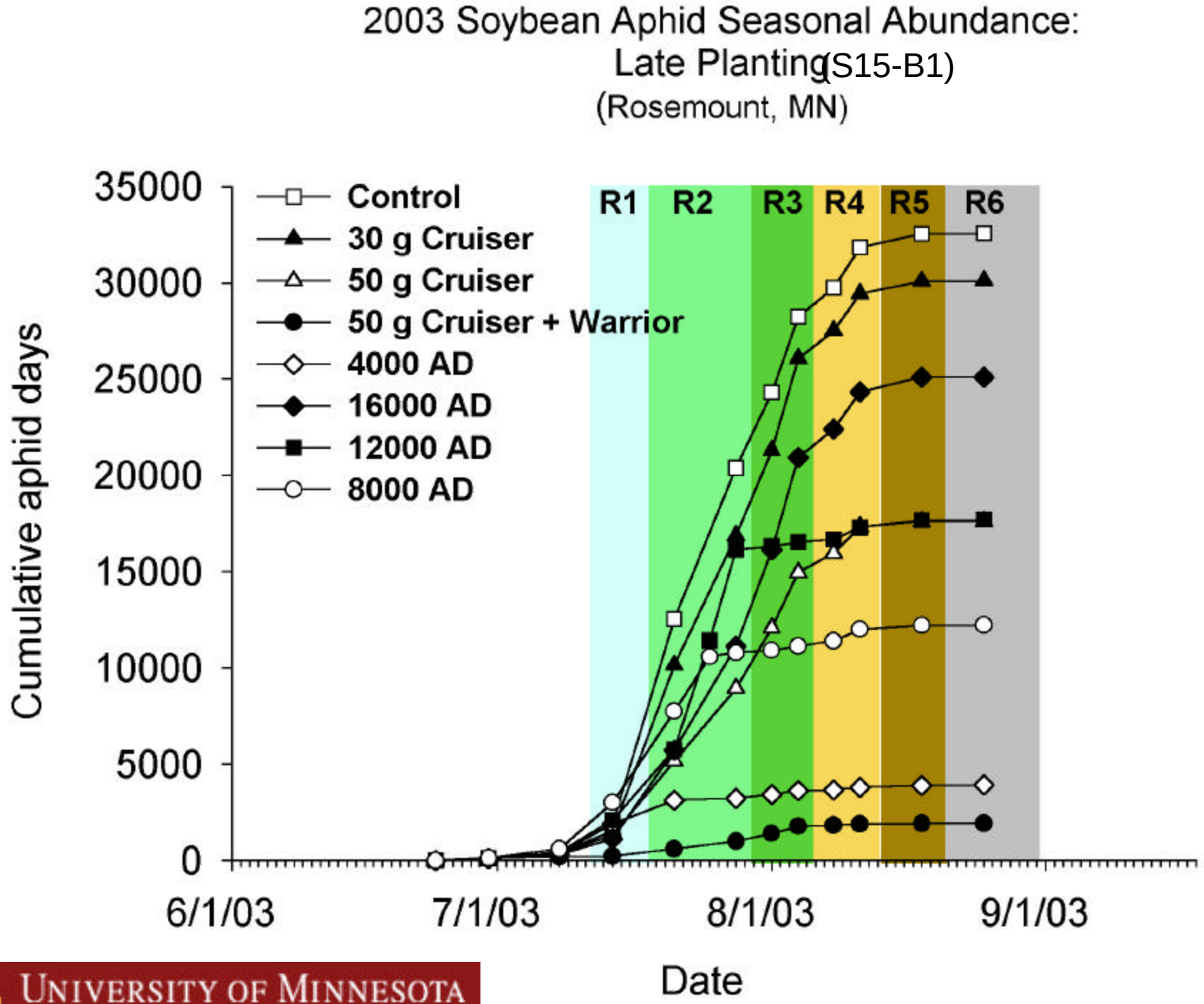
- **Goal: A reliable and accurate scouting and decision process that maximizes economic benefit with minimal scouting input.**
- **Economic damage = Yield loss equal to the cost of control…about 3 bu/acre**
- **Economic Injury Level (EIL) = pest population that causes economic damage**
- **Economic Threshold (ET) = point at which an increasing pest population needs to be controlled to keep it from reaching the EIL…considers pest population dynamics and logistics of insecticide application.**

Ken Ostlie – University of Minnesota

Logistics and Timing
Soybean Aphid Insecticides

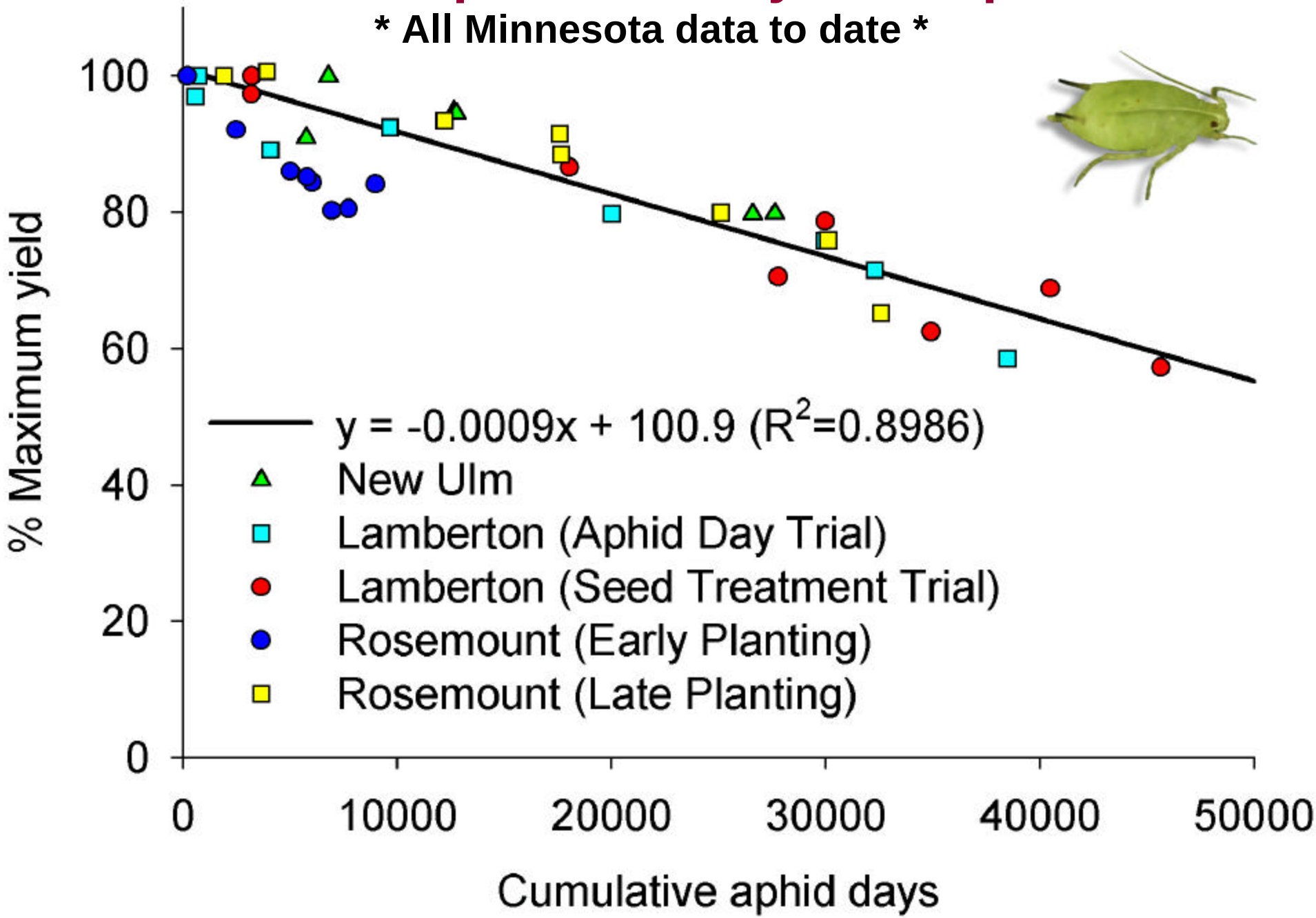


Ken Ostlie – University of Minnesota


2003 Soybean Aphid Seasonal Abundance:
Late Planting (S15-B1)
(Rosemount, MN)
Cumulative aphid days
35000
30000
25000
20000
15000
10000
5000
0
Control
30 g Cruiser
50 g Cruiser
50 g Cruiser + Warrior
4000 AD
16000 AD
12000 AD
8000 AD
R1
R2
R3
R4
R5
R6
6/1/03
7/1/03
8/1/03
9/1/03
Date

Yield Response to Soybean Aphid

*** All Minnesota data to date ***

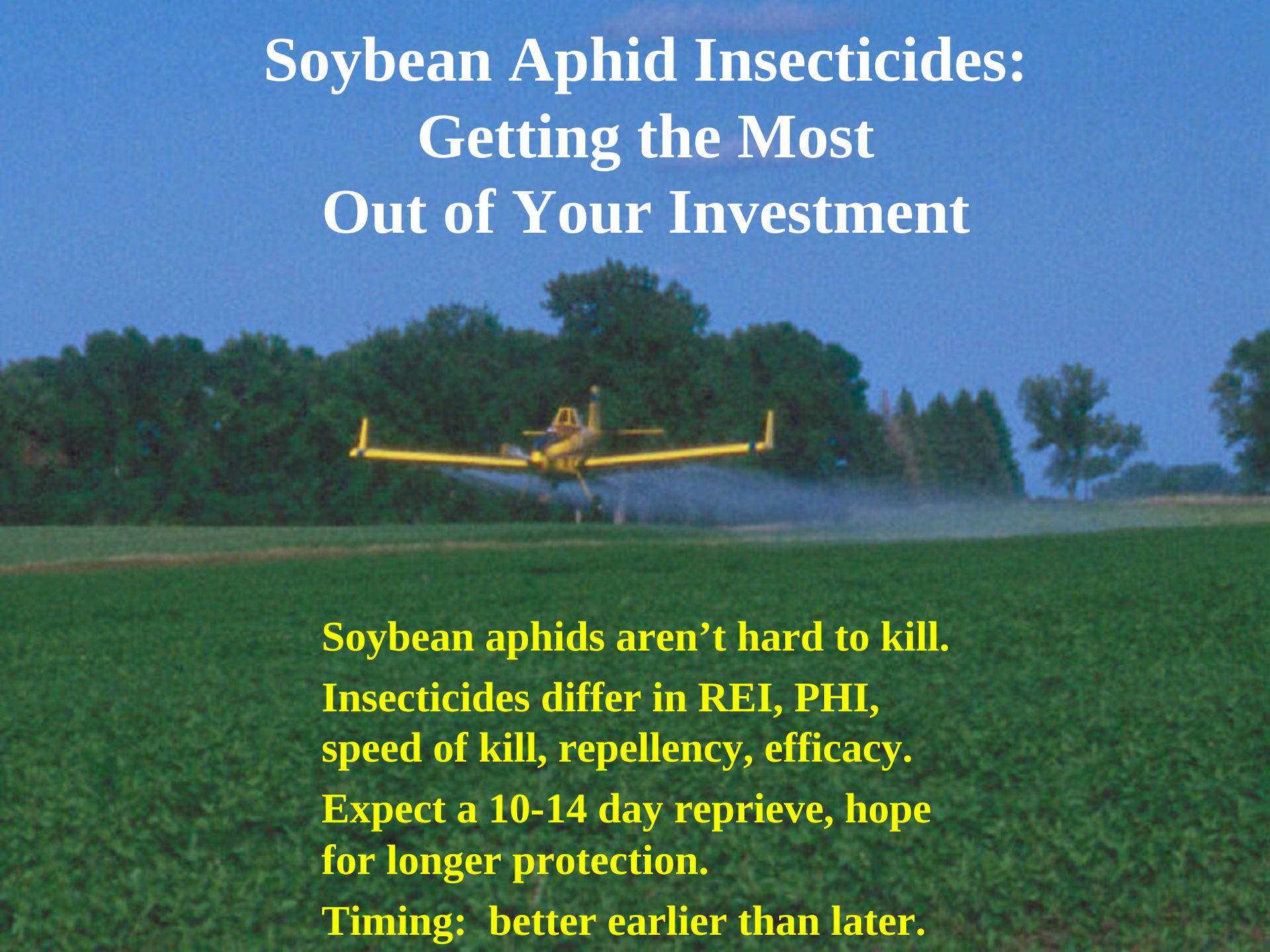


Calculating the Economic Injury Level

Max Yield (bu/ac) / Price ($/bu)	60	50	40
$5.00	254	305	381
$6.00	210	254	317
$7.00	178	216	270

Assumes: Cost of Control = $12.00/acre, doubling time 1.4d
Sampling every 7 days. EIL = Average over 7 days = (AD/7)

Soybean Aphid Insecticides: Getting the Most Out of Your Investment



Soybean aphids aren't hard to kill.

Insecticides differ in REI, PHI, speed of kill, repellency, efficacy.

Expect a 10-14 day reprieve, hope for longer protection.

Timing: better earlier than later.

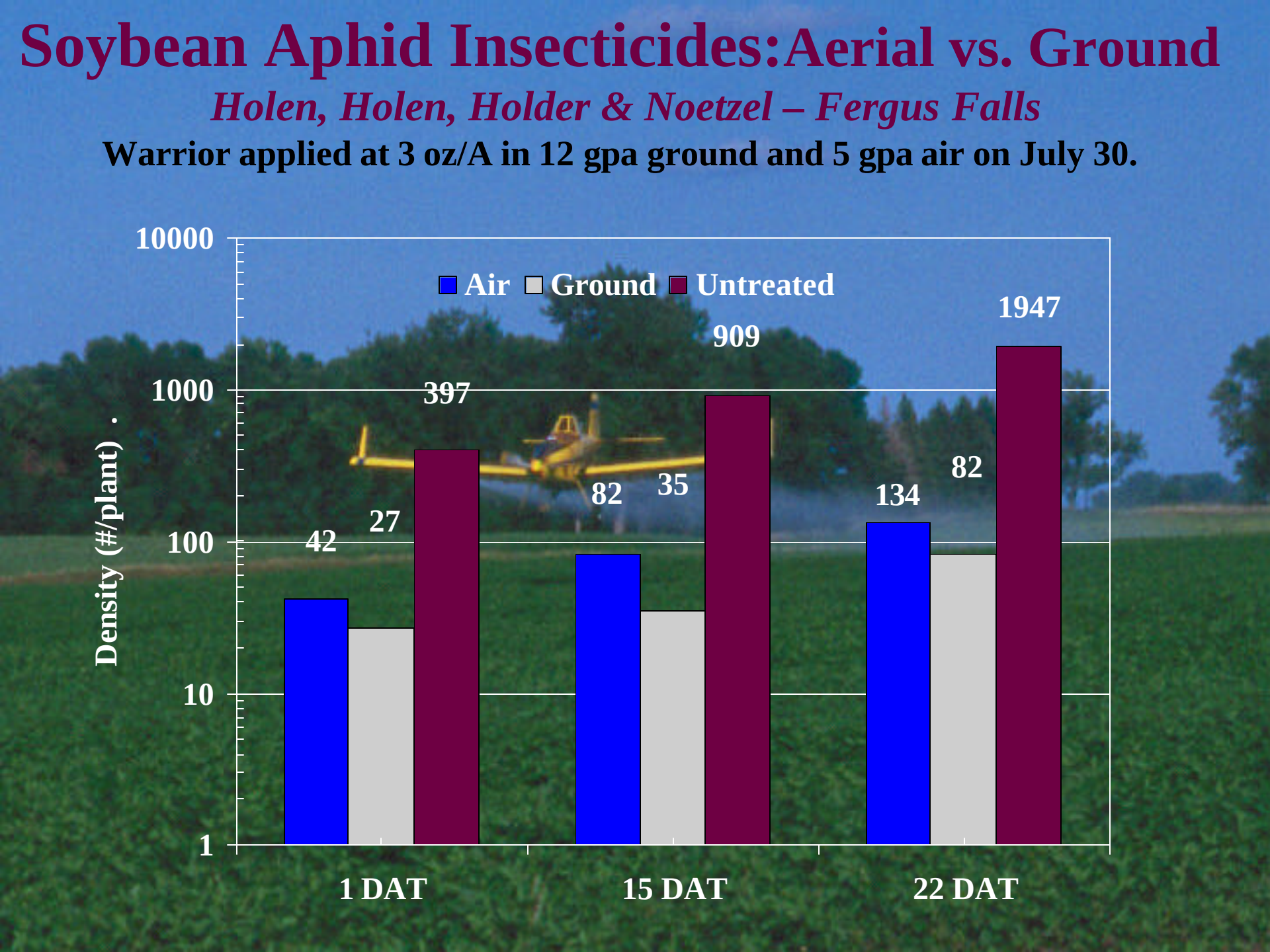
Insecticide Performance Depends on Several Factors

- **Soybean Aphid**
  - Density, canopy distribution, colonization
- **Soybean Crop**
  - Canopy development, crop phenology, density
- **Weather**
  - Rainfall, temperature (reproductive rate, effects on insecticides), wind
- **Application logistics**
  - Air vs ground; carrier volume; nozzle type, pressure and speed; adjuvents.
- **Insecticide Properties**
  - Toxicity, residual protection, repellency, natural enemies

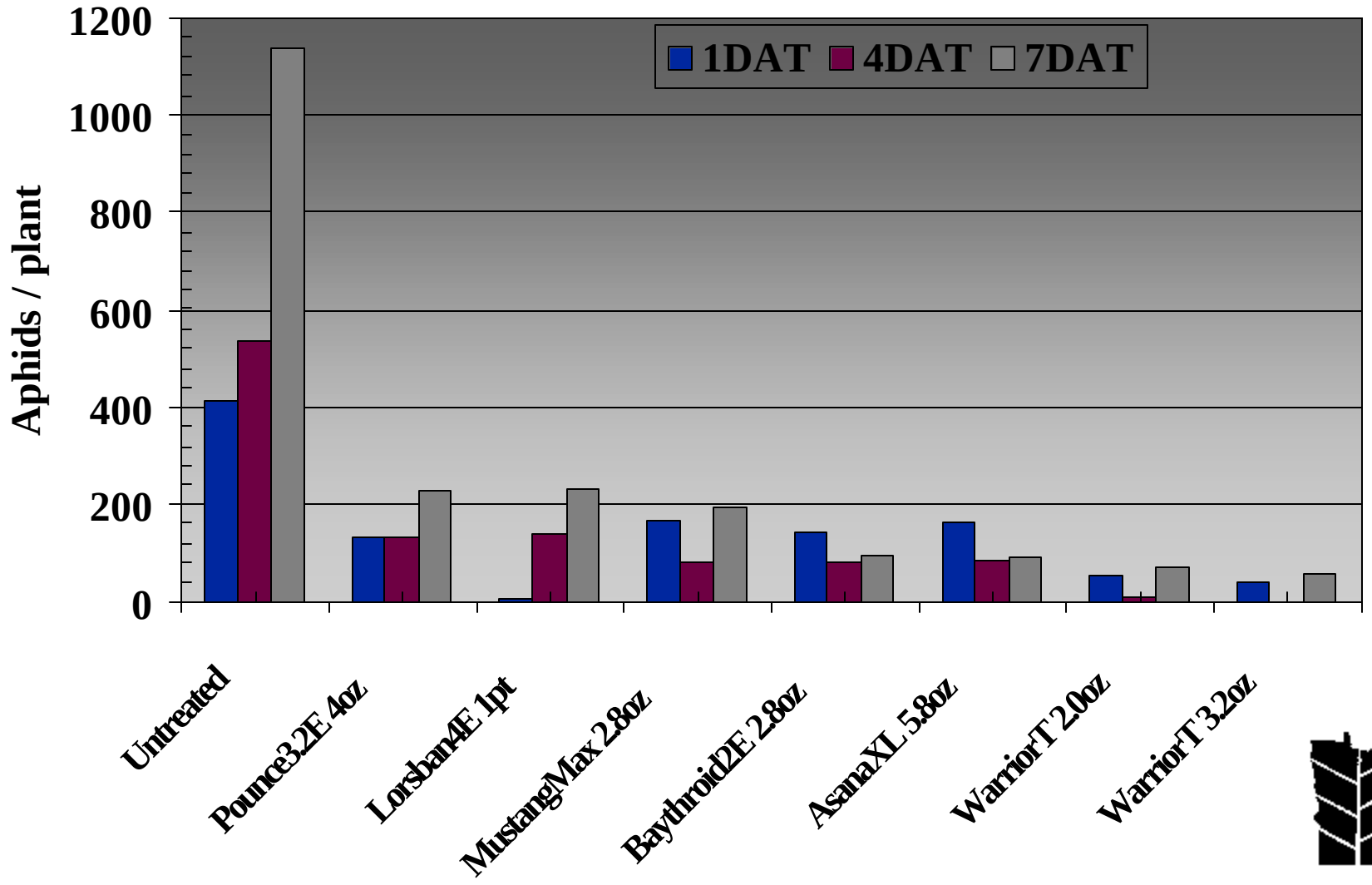
Soybean Aphid Insecticides:Aerial vs. Ground

Holen, Holen, Holder & Noetzel – Fergus Falls

Warrior applied at 3 oz/A in 12 gpa ground and 5 gpa air on July 30.



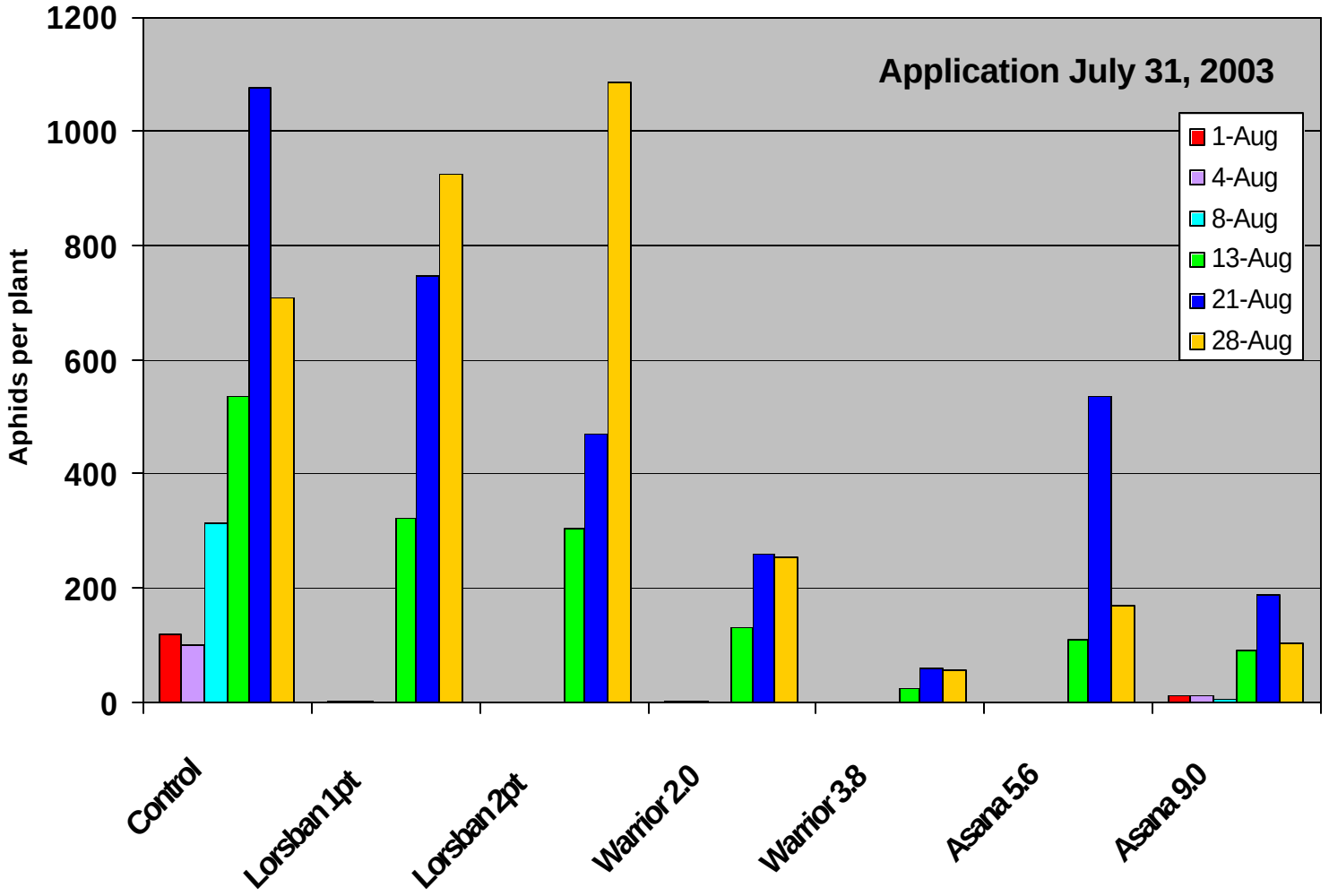
Insecticide Performance
Soybeans after Peas



Ken Ostlie – University of Minnesota

Insecticides Against Soybean Aphid

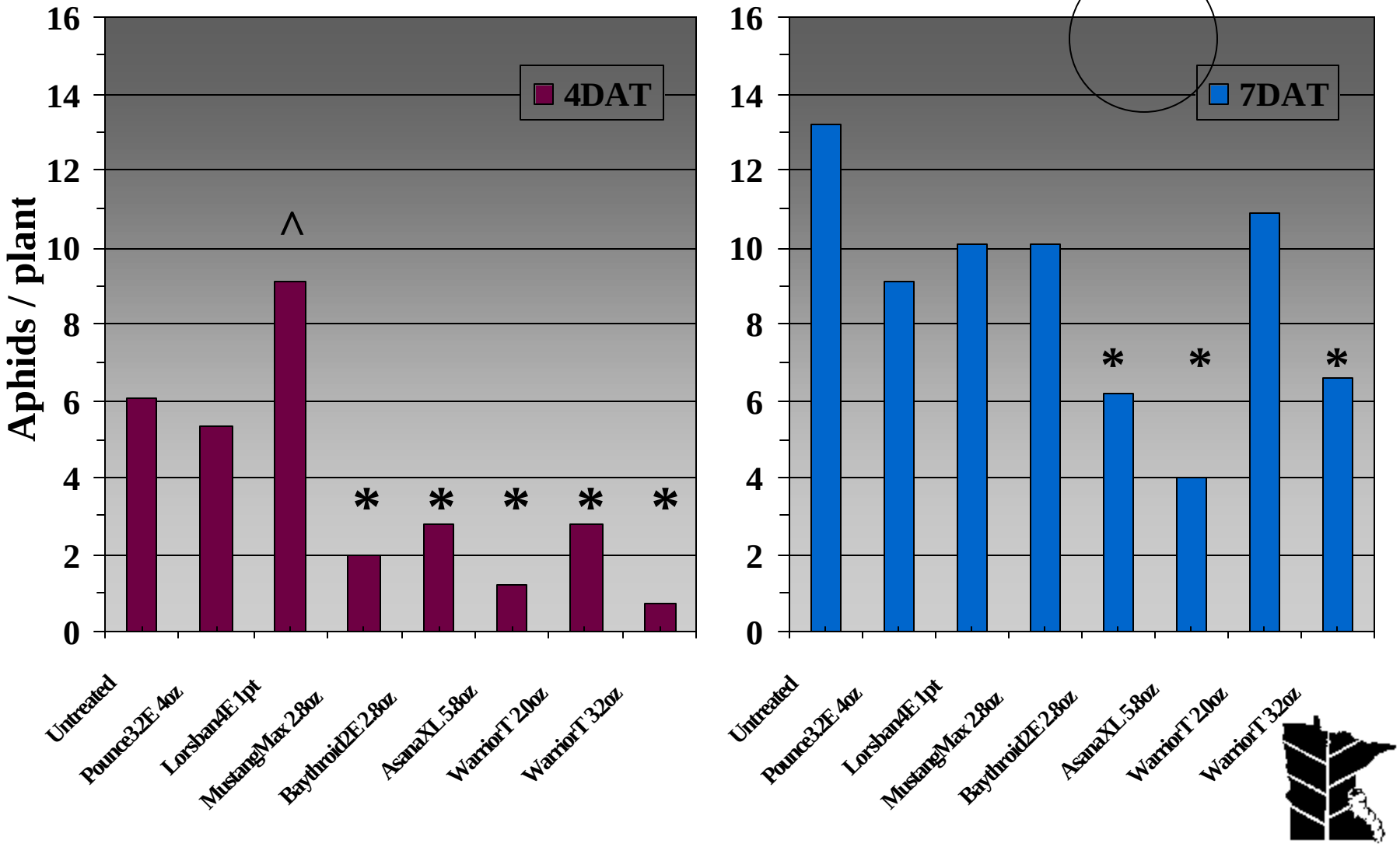
MacRae & Noetzel – Underwood, MN



Ken Ostlie – University of Minnesota

Alate Frequency After Insecticide Application

**Suspected Repellency / Toxicity ^ Enhanced Colonization*



Ken Ostlie – University of Minnesota

Data generated by:

Soybean Aphid Team – U of M

Entomology: Ragsdale, Ostlie, MacRae, Venette, Heimpel, Hutchison, Weller

IPM Specialists: Potter, Breitenbach

Agronomy: Naeve, Orf

Plant Pathology: Kurle

Soils: Baker

Economics: Olson

Funding from

Minnesota Rapid Agricultural Response Fund,

Minnesota Soybean Research & Promotion Council

North Central Soybean Research Program

Any questions?

Ken Ostlie – University of Minnesota