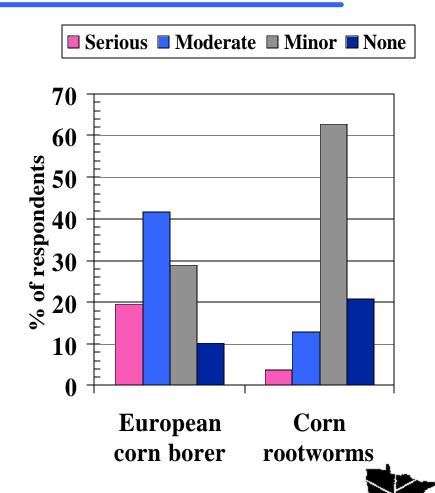


# Farmer Perceptions and Management Contrasts in Minnesota

#### 1995 Management Status

- European Corn Borer
   Yield loss = \$350 million
   or ca. 17 bu/acre
   Insecticide use = 320K
   acres or ca. 4.8%
- Corn Rootworms
  Yield loss = \$1 million
  ?cticide use = 528K
  acres or 8% (94%
  corn after corn)



1996 Survey of Southeast and Southwest Farm Management Associations conducted by G. T. Buaha. University of Minnesota. Ph.D. dissertation.





### Traditional Corn Rootworm Life Cycle



After 5 to 10 days, western (left) and northern (right) corn rootworm beetles emerge from the soil in late July and August.



Eggs hatch in early
June. Newly hatched
larvae tunnel within
roots while older larvae
attack newly initiating
roots.



Beetles feed primarily on corn pollen and silks. After two weeks, egg laying continues until frost.



Larvae feed for 3 weeks and then 3rd stage larvae build a soil cell and pupate.



Eggs laid in August and September overwinter. Fall and spring tillage redistribute the eggs.

# The Simple Management Solution for Corn Rootworms: Crop Rotation!

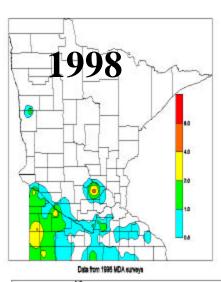
Forbes, S.A. 1896. Insect injuries to the seed and root of Indian corn. Univ. Illinois, Ag. Expt. Stn., Champaign-Urbana, Bull. No. 44: 209-296.

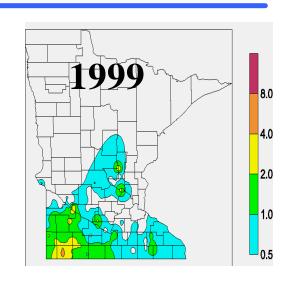
A judicious rotation of crops is so simple and complete a preventive measure, that remedies for injury to corn by the northern corn rootworm are practically unnecessary.

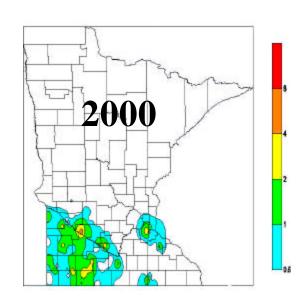


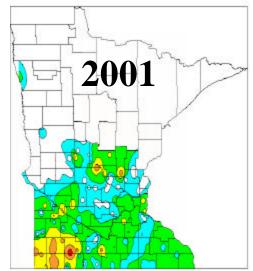
### Should Someone Tell Northern Corn Rootworms?

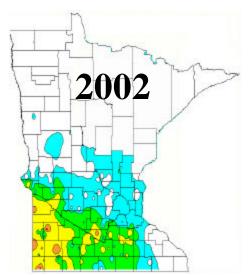
Produced by Bruce Potter. Data from MDA Plant Pest Survey Program.







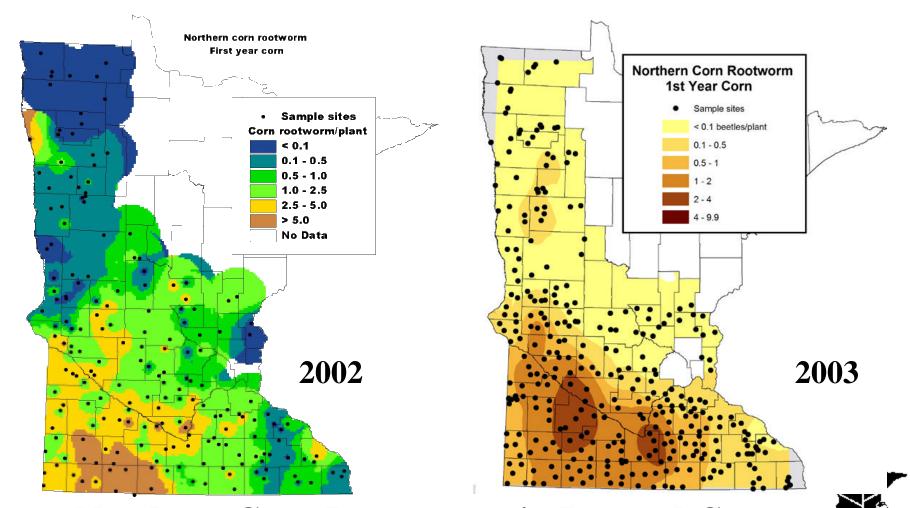






# What's happening With Northern Corn Rootworms?





**Northern Corn Rootworms in Rotated Corn** 

# What's Changing with Northerns? Extended Diapause

Ability of northern corn rootworm eggs to overwinter two or more years before hatching.

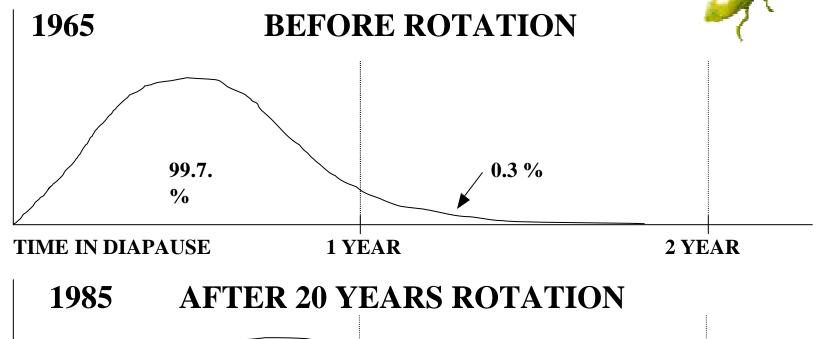


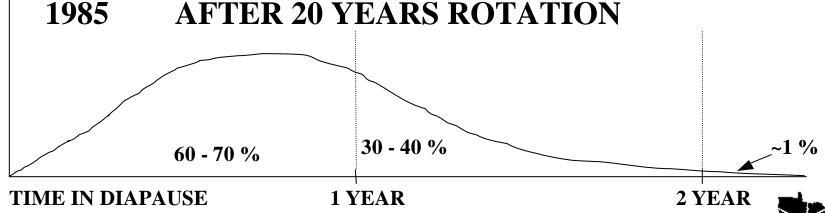




### **Extended Diapause:**

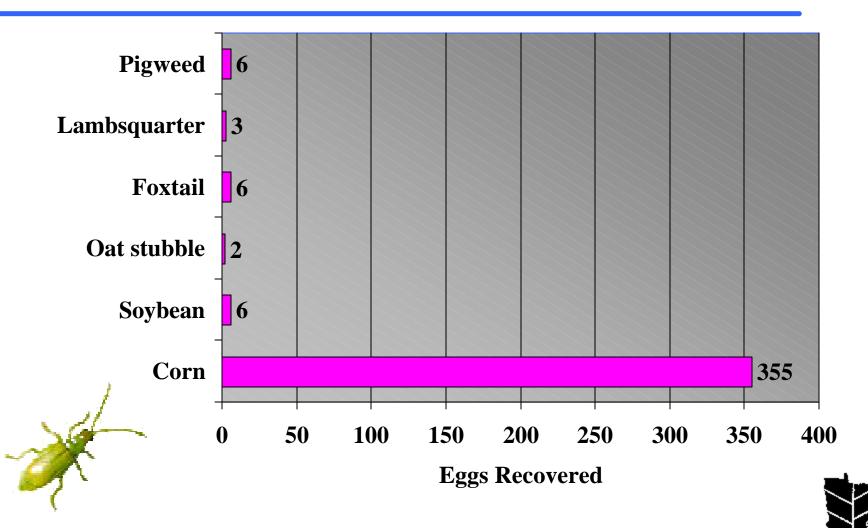






2000 Fuller (SD): All 12 samples from Brookings Co. >40%

# What about Northern Corn Rootworms on Other Crops?



## **Crop Rotation and Extended Diapause**

Corn/Sugar Beet/Corn Rotation

150 bpa (Avg of 4 checks)

182 bpa (Avg of 4 checks)

Corn/Sugar Beet/Pea/Corn Rotation (3 Crop)

# What's Changing with Westerns? Egg Laying Site

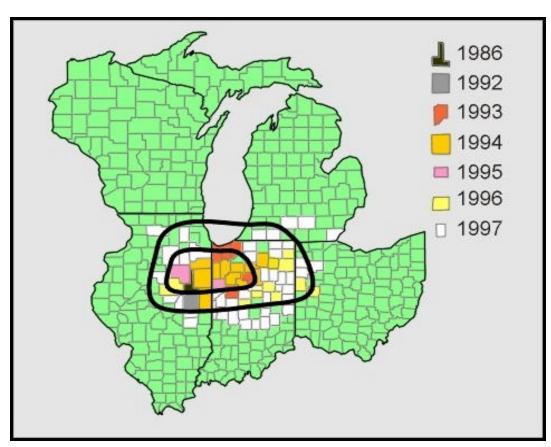
Western corn rootworms have lost their fidelity to corn and now lay eggs in other crops.



A Strategy to Succeed in Rotated Corn!

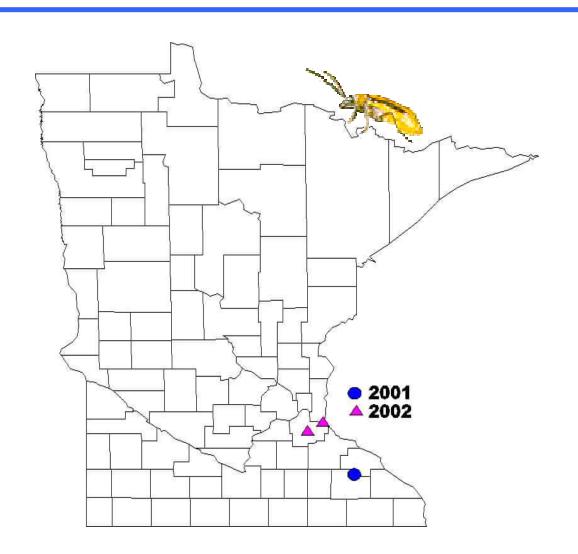


## Distribution of WCR in First Year Corn



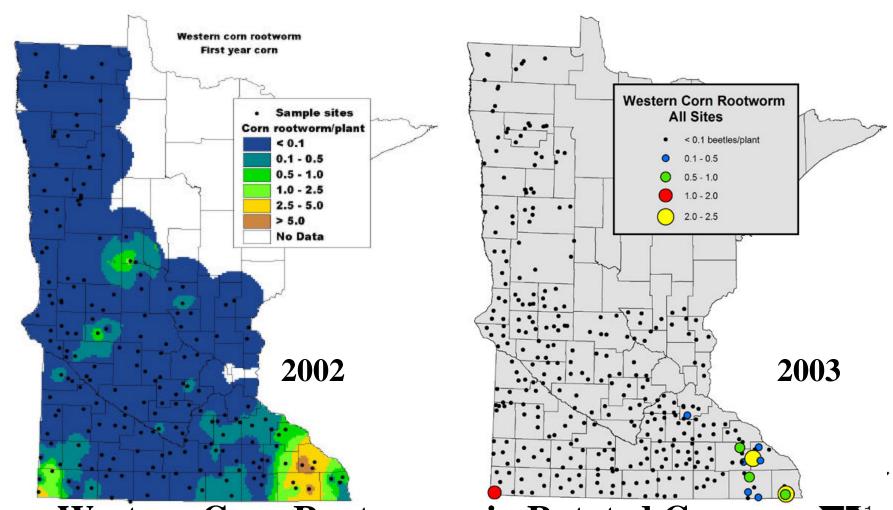


## Damage to Rotated Corn by Western Corn Rootworms





## What's happening with Western Corn Rootworms?







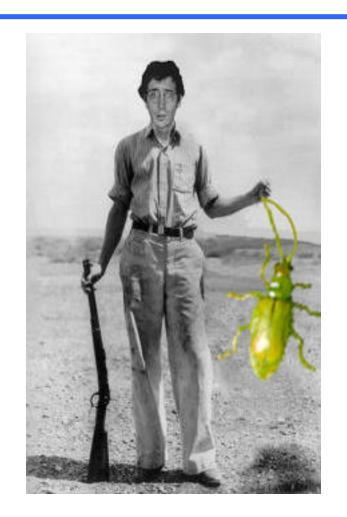


## Management Options for Corn Rootworms

Crop Rotation?

Soil Fertility?

Tillage?



Hybrid?

Plant Spacing?

Insecticide?

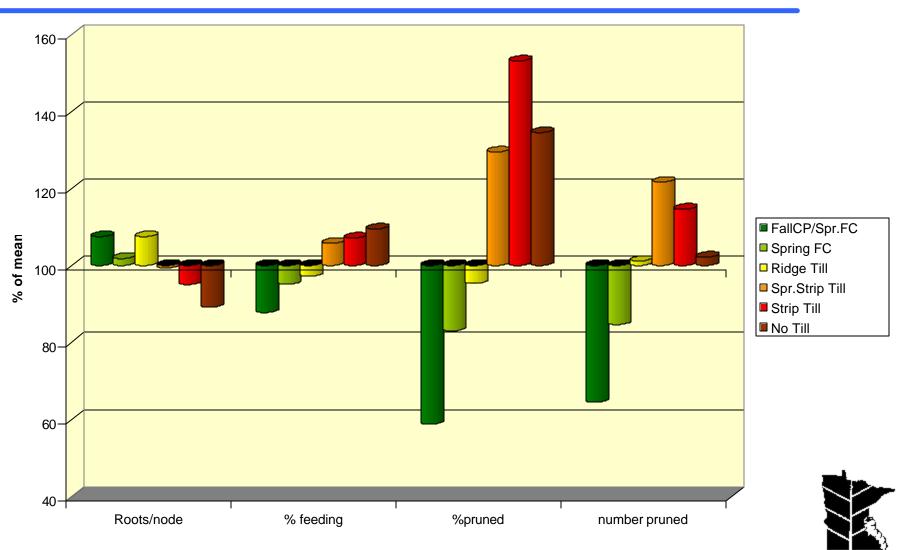






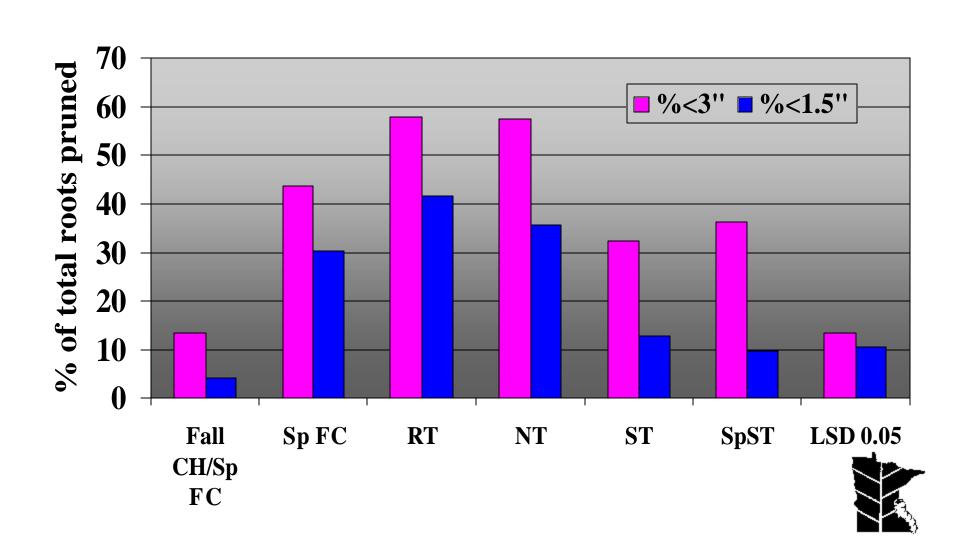
## **Corn Rootworms and Tillage**

Eash & Potter, 2001

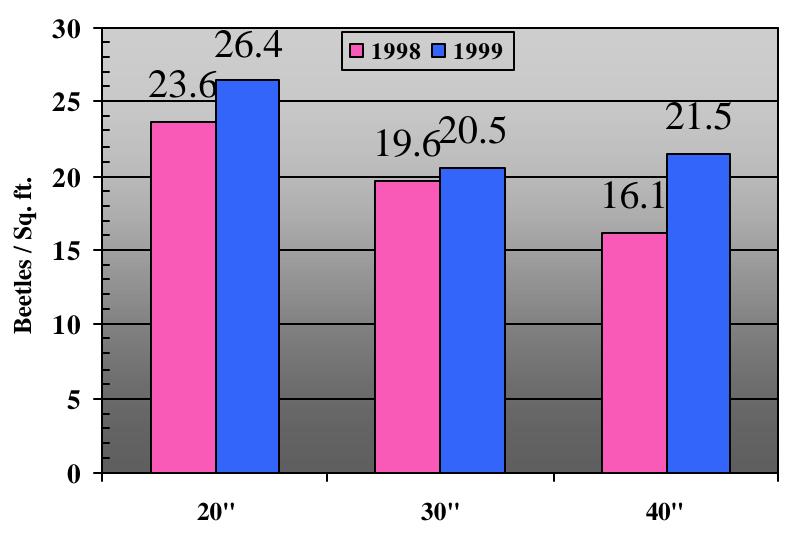


#### Tillage Effects on Root Pruning

Eash & Potter, 2002



# Corn Rootworm Emergence under Different Row Spacings





# **Insecticide Options for Managing Corn Rootworms are Diversifying**

#### **Granules**

- ◆ Aztec 2.1G, 4.67G
- Counter CR
- ♦ Empower 1.15G
- Force 3G
- **♦** Fortress 2.5G, 5G
- Lorsban 15G
- Thimet 15G & 20G
  Transgenics
- Cry3Bb (Monsanto)
- Strain 149B1 (Dow-Mycogen, Pioneer)

#### <u>Liquids</u>

- Capture 2E
- Furadan 4F
- Lorsban 4E
- Regent 4SC



#### **Seed Treatments**

- ProShield
- Prescribe
- Cruiser





## Development of Transgenic Technology for Corn Rootworm

#### Current status:

#### **Monsanto**

- Moderate dose event (MON863)
- Expresses the Bt protein Cry3Bb
- SAP for IRM completed
- Approved by EPA in 2003



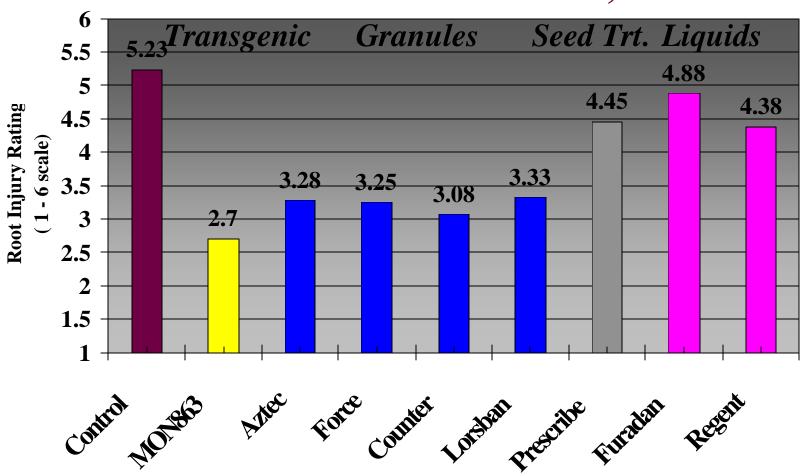
#### Dow - Mycogen / Pioneer

- **♦** High dose event (Strain 149B1)
- Expresses the Bt proteins Cry 34/35, a binary toxin
- ♦ Limited field tests in 2001-2; agronomic issues with even
- **♦** Field tests with Universities in 2004 (Pioneer)
- Anticipate registration / introduction by 2005-6



### Corn Root Protection: Transgenics, Seed Treatments and Soil Insecticides

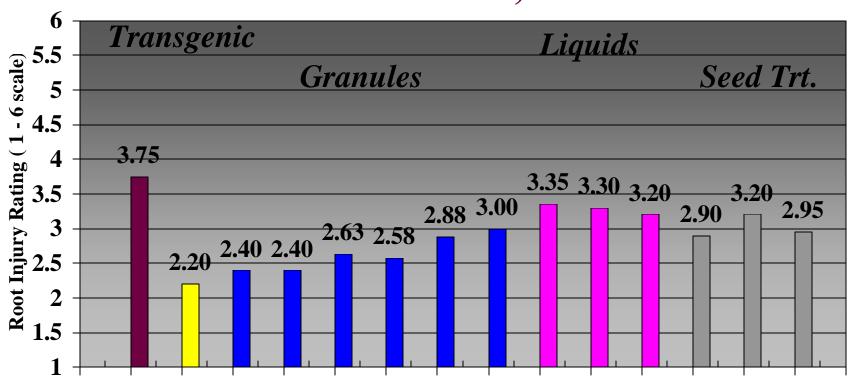
Ostlie & Potter – Lamberton, 2001





### Corn Root Protection: Transgenics, Seed Treatments and Soil Insecticides

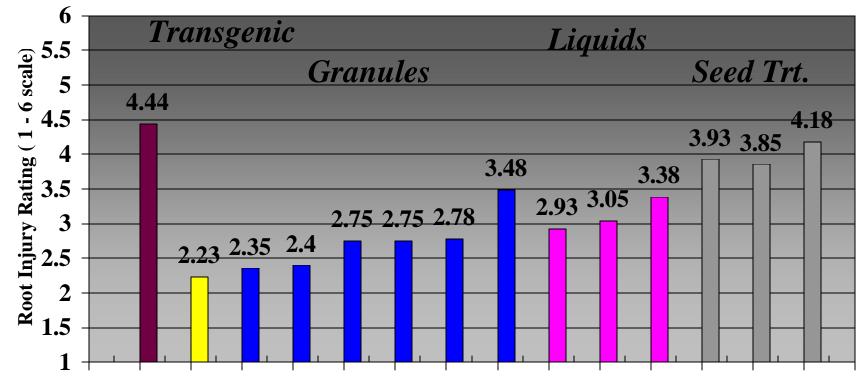
Ostlie – Rosemount, 2003



Control Counter Portress Med Force Planshan Fireday Regeld Dayline California Crises

## Corn Root Protection: Transgenics, Seed Treatments and Soil Insecticides

Ostlie & Potter – Lamberton, 2003

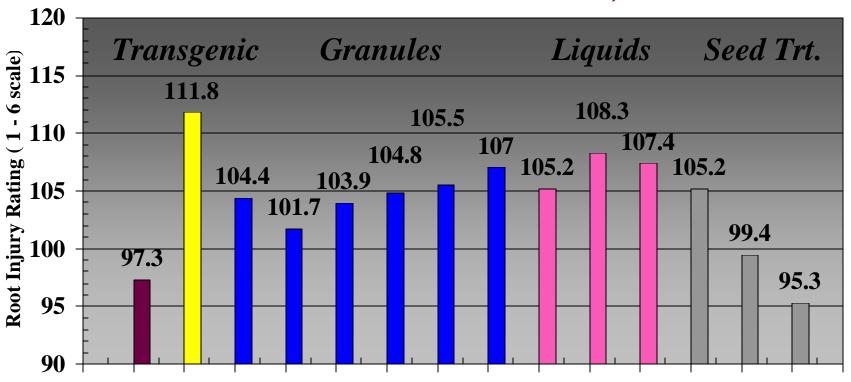


Control 363 Counter rues Mice Force Toursball Furadail Regent Porties Criser



## Yield Protection: Transgenics, Seed Treatments and Soil Insecticides

Ostlie & Potter – Lamberton, 2003



Control Country Fortress Mee Force That Finding Resent Portrol Criber



### Management Considerations for Rootworm Problems in Rotated Corn

- Lengthen crop rotation
- Ensure agronomic practices favor optimal root health
- Choose a conventional hybrid with better root system or use a transgenic hybrid
- Consider using insecticides
  - ✓ Granular insecticides offer most consistent performance and reduced rates.
  - ✓ Plumb for liquids and apply at full label. Dry weather?
  - ✓ Seed treatments convenient but do not protect roots under heavy pressure.
- Scout to target resources



## Do you have any questions?



