Sunflower Insect Pest Management

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Outline of Presentation

- Sunflower history & characteristics
- Pest complex & damage
- Insect pest management strategies
- Future for Sunflower IPM

Origin of Sunflower

- Native to North America
- 51 species in genus *Helianthus*
- Food source for Native Americans & domesticated in central US before 3000 BC
- Introduced to Spain in early 1500s
- Spread across Europe & adopted as crop in Russia in early 1800s
- Reintroduced into US in 1880s
- Sunflower production developed in Canada in 1950s & US in 1970s

Possible Reasons for Insect Problems in Sunflower

- Sunflower native to North America
- Pests specific to sunflower
- Change in plant architecture
- Monocultures
- Breeding for vigor, yield, uniformity
  oil content, etc.
- Ineffective natural enemies

Native & Cultivated Sunflower

- Plant architecture
  - Multiple vs. single head
  - Branched vs. single stem
  - Small vs. large seeds
- Growth phenology
  - Variable vs. discrete emergence
  - Extended vs. short flowering period
- Plant community
  - Mixed vs. monoculture
  - Small patches vs. large acreages
  - Low vs. high density

Insects attacking the sunflower head & seeds

Sunflower moth

Banded sunflower moth

Lygus bug

Red sunflower seed weevil

Sunflower midge

Insects attacking the sunflower leaves & stem

Sunflower beetle

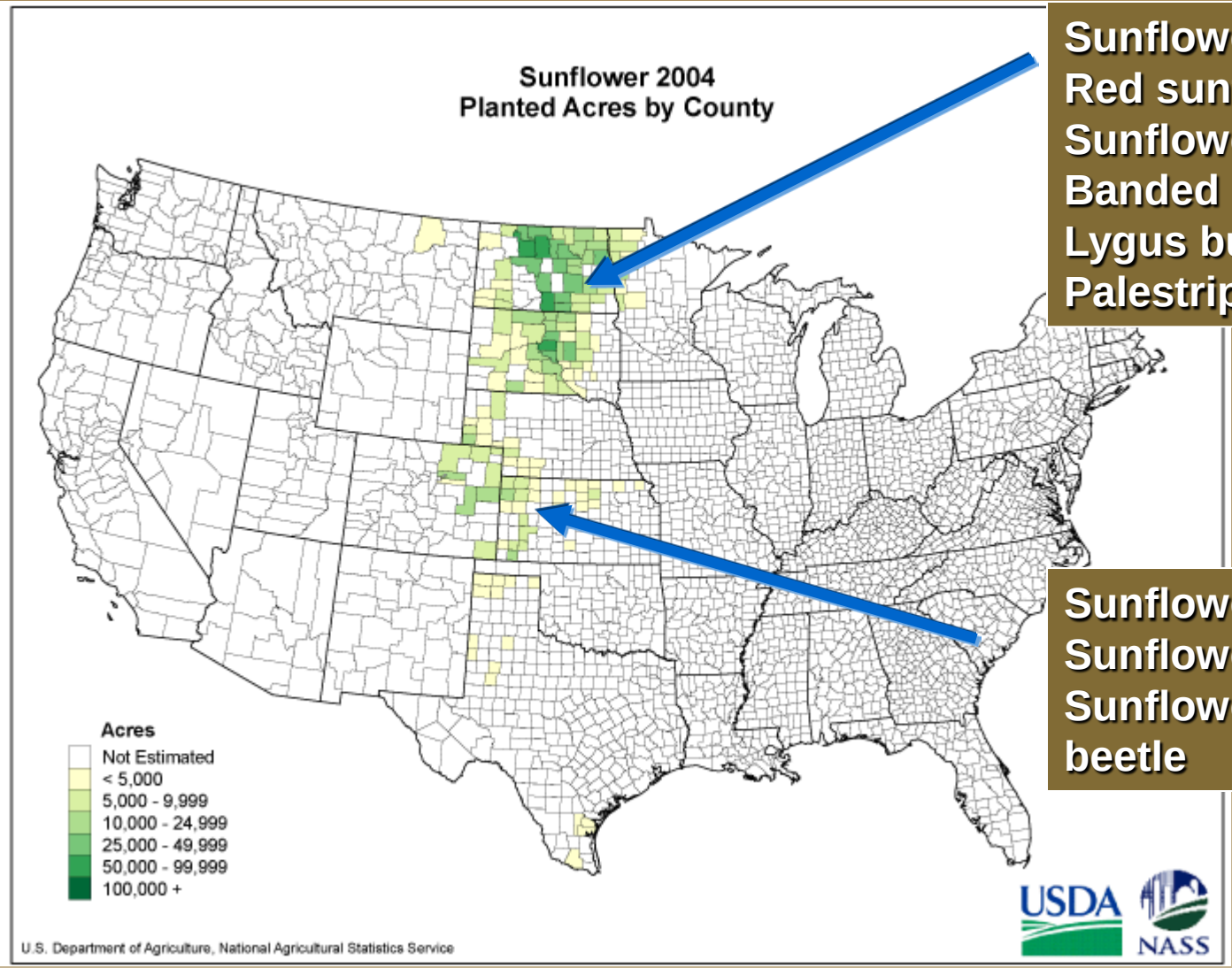
Sunflower stem weevil

Palestiped
flea beetle

Sunflower stem girdler
or long-horned beetle

Seedlings & roots attacked: wireworms, cutworms

Distribution of Sunflower Insect Pests



Sunflower beetle
Red sunflower seed weevil
Sunflower midge
Banded sunflower moth
Lygus bug
Palestriped flea beetle

Sunflower moth
Sunflower stem weevil
Sunflower long-horned beetle

Sunflower Beetle

Eggs laid on stem or underside of leaves

Overwinter as adults in soil

Adults feed on leaf margins during the day & larvae over leaf surface at night

Stem Weevil Biology

Eggs

deposited around cotyledon or lower stem

Adult

Overwintering chambers

Larvae

feed & develop in sunflower stem

weakens the structure of the stalk which can result in lodging

Sunflower Stem Weevil Damage

Lodged fields in North Dakota

Lodging prior to harvest caused by larval overwintering chambers (20-30 per stalk), stalk characteristics, & weather

Split stalk with larvae

X-section with larvae

Palestriped Flea Beetle

Adult

1/8-inch long

Feeding damage on seedling sunflower

Sunflower Long-horned Beetle

Stalk broken at soil level

Lodged field in Texas 1980s

Lygus Plant Bugs

Adults

- Small, cryptically colored insects
- Distinctive yellow triangle or “V”
- Pale green to reddish-brown

Immatures (nymphs)

- Look like aphids

Brown spot on confection kernels

Red Sunflower Seed Weevil

Drop into soil to overwinter

- Females require pollen to mature eggs
- Oviposit during flowering
- Heads with 50% flowering preferred
- Eggs laid inside seed
- Larvae in outer seed rows
- Kernel 1/3 consumed

Exit holes

Banded Sunflower Moth

Exit holes

Damaged seeds

Sunflower Moth

- Adults attracted to blooming heads
- Eggs deposited on heads & hatch in 4-5 days
- Larvae feed on pollen, disk flowers, & mature seeds
- Mature larvae move to soil & spin cocoons to overwinter

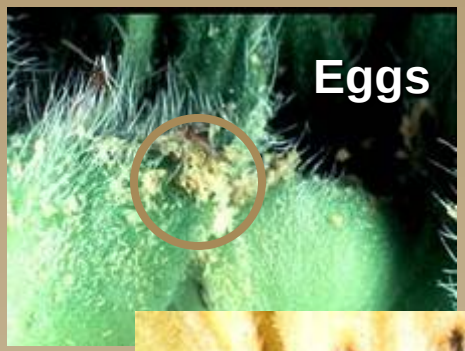
Overwinter in Texas
adults migrate to central & northern Plains on southerly winds

Webbing & frass may occur in areas on head & Rhizopus head rot is often associated with infestations

Sunflower Midge

Adults

Necrotic tissue under bracts caused by larval feeding; loss of ray flowers



Larvae

Heavily damaged heads: gnarled & cupped with few seeds produced

Cutworms

- Early season pest on seedlings
- Localized, erratic infestations

Wireworms

- Early season pest on seedlings
- Localized infestations
- Concern – increasing populations due to more no-till acreage, land coming out of CRP

Sunflower Insect Management

- Identification of pest
- Knowledge of pest biology
- Economic/treatment thresholds
- Field monitoring/sampling
- Management tactics include:
  - ✓ Plant resistance
  - ✓ Cultural control
  - ✓ Biological control
  - ✓ Chemical control

Chemical Control

- Has long been primary tactic for managing pests
- Effective, but expensive & has nontarget impacts:
  resistance, secondary pests, pest resurgence, destruction of pollinators & natural enemies, environmental contamination
- Destruction of pollinators can reduce fertilization & thus lower yield > pest infestation alone
- Pesticides should be used in combination with other tactics & only when pests exceed thresholds
- Because of ease of use & ability to quickly destroy pests continues to be primary management focus for producers

Plant Resistance

- Uses plant's own defense
  (antibiosis, antixenosis, tolerance)
- Developed through plant screening & breeding
- Cost effective & environmentally safe
- Usually compatible with other approaches
  (evaluate for impact on natural enemies)

Challenges Evaluating Sunflower for Insect Resistance

- **Variable insect population pressure**
  - ✓ Year to year densities often unpredictable
  - ✓ Coordination of insect presence/attack & plant phenology
- **Environmental & biotic limitations**
  - Drought or excessive moisture & wind
  - Birds
  - Plant disease
- **Labor (time & costs) in determination of insect damage**
- **Post-harvest evaluation**

Cultural Control

- Include: planting date, tillage, trap crops, rotation, crop spacing/population, intercropping, sanitation
- Advantage of no additional equipment, usually no side-effects, simple, inexpensive
- Need advance planning, control not complete, detailed knowledge of pest required

Biological Control

- **Importation & establishment of exotic species**
- **Augmentation**
- **Conservation – manipulate environment to reduce nontarget effects from pesticides & other adverse factors**
- **Predators, parasitoids & pathogens**
- **Study natural enemies & how to protect & utilize them in managing pests**

Biological Control of Sunflower Insect Pests

- Many natural enemies have made the transition along with their hosts from native to cultivated sunflower
- Many potential pests held in check by beneficials
- Natural enemies known for major pest species
  - ✓ predators & parasitoids have been studied
  - ✓ little known about pathogens
- Research has revealed regional differences in parasitoid species richness
- Studies also show some parasitoids attacking pest species in native sunflowers not present in agroecosystem

Sunflower Insect Natural Enemies

Banded sunflower moth parasitoid

Red sunflower seed weevil parasitoid

Sunflower stem weevil parasitoid

Sunflower beetle predators

Current IPM Practices for Sunflower Insect Pests

- Knowledge of pest biology & damage
- Economic thresholds developed for all except – sunflower midge
- Scouting methods have been developed, but are inadequate for some species & need to be refined
- Management strategies:
  - ✓ Chemical control most frequently used
    - Pyrethroids
  - ✓ Cultural control
    - Planting date effective for:
      - banded sunflower moth, sunflower stem weevil, sunflower moth, sunflower beetle & red sunflower seed weevil

Future for Sunflower IPM

- Compared to most row crops sunflower is relatively new
  - ✓ Research dates only to late 1960s (Texas & North Dakota)
- Potential sources of germplasm for resistance:
  - ✓ 51 native species of sunflower
  - ✓ USDA Plant Introduction Station
    - ➢ 1600+ cultivated accessions
    - ➢ 2000+ wild accessions
- Improve biological control through conservation, augmentation, or search for new beneficials
- Refine EIL, sampling, cultural control strategies (trap cropping), reduce pesticide use, & integrate methods to lower production costs