# Root Borers in Commercial Pecan Orchards in Georgia

## California Prionus Pheromone as an Attractant for Tilehorned Prionus and Broadnecked Root Borer

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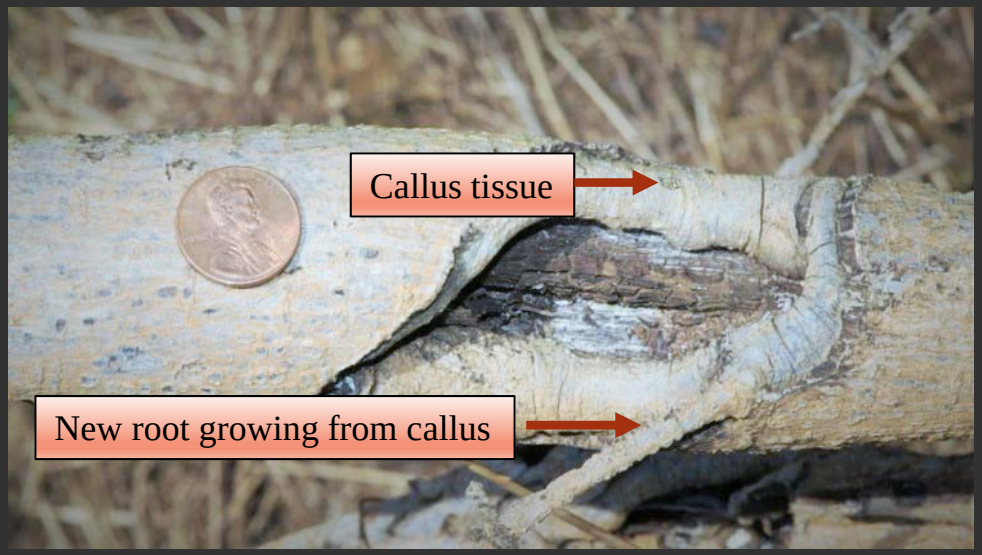
## ***KEY QUESTION***

IF THE ROOTS ARE INJURED AND THE LARVAE ARE CONTROLLED, THEN ARE THE ROOTS REGENERATED?




Large lateral roots and the tap root with injury develop undifferentiated callus tissue in the cambium tissue and this generates a live covering over the wound and a new root.

Woodroof and Woodroof found that transplanted pecan trees recover from severe root pruning by doubling the number of lateral roots generated from the tap root.

# PECAN TREES HAVE FOUR TYPES OF ROOTS
# *PRIONUS* ROOT BORERS FEED ON TAP AND LATERAL ROOTS

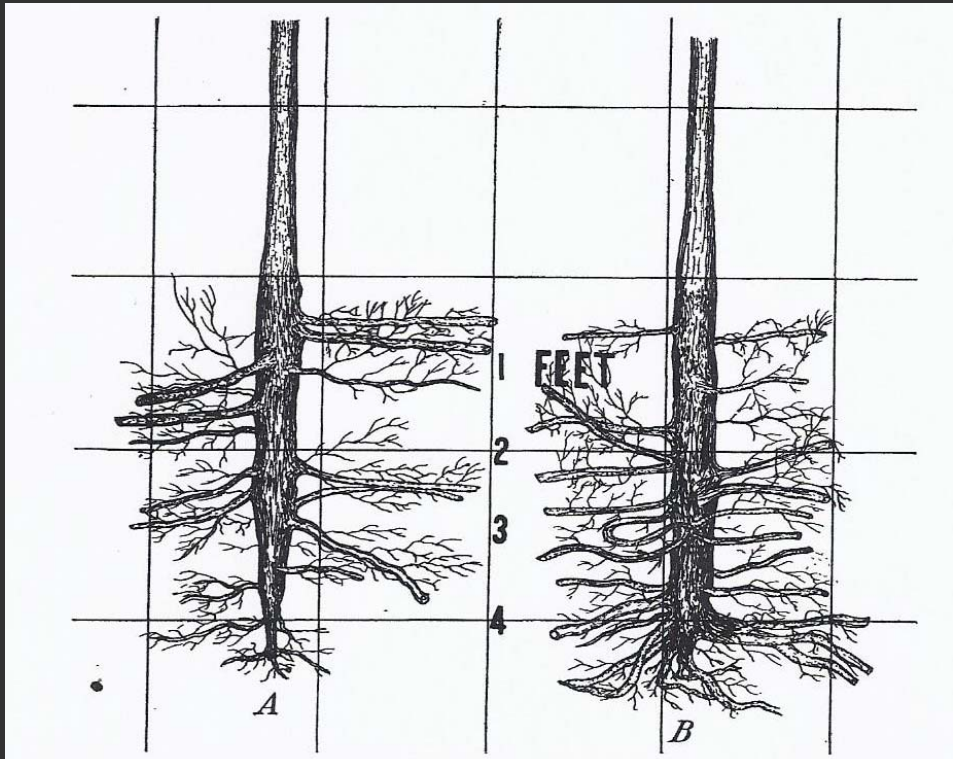



FIGURE 15.—Comparison of the orientation of lateral roots on transplanted and nontransplanted pecan trees. The nontransplanted tree *A* had 11 main laterals, while the transplanted tree *B* had 21.

1. Tap Root
2. Lateral Roots
3. Fibrous Roots
4. Mycorhizzal Roots

Fig. from: Woodroof, J.G. & N. C. Woodroof. 1934. Pecan root growth and development. J. Agr. Res. 49(6):511-530.

# LOOKS LIKE THE INJURED TREES MAY BE WORTH SAVING., WHAT DO WE KNOW ABOUT THE ROOT BORERS?

- Life Cycle –
  - The woods are full of alternate tree hosts – Oaks, pines, grapes, poplars, apples, chestnuts
  - The beetles are commonly found all across the eastern U.S.
  - The females lay eggs in the soil near roots
  - The larvae are in the roots and soil until they pupate.
  - Insecticides cannot reach the larvae deep in the soil and adult emergence pattern is not well known the adults peak measured by light traps in June.
  - Life cycle is 5 – 7 years
- Trapping
- Light traps the first effective method for trapping
- Males are attracted to prionic acid baited pheromone traps
- Females attracted to alpha pinene baited pitfall traps
- Control
  - Culling infested trees and then letting a new tree grow back eventually restores nut production but the beetles are still in the orchard.

# TRAPPING METHODS

**Light Trap**

**Pheromone Baited Panel Trap**

# Objectives

1. What is the emergence pattern in pecan orchards?
2. How long are the pheromone lures effective in the pecan orchard?
3. How effective is soil application of chlorpyrifos on the adult male beetles?
4. Can the beetles be trapped out with the pheromone traps?

# *Prionus* oviposition

# Normal Pecan Orchard - July

# Are the trees infested?

**Look for symptoms and signs of an infestation**

**Crown gall and root borer infestations**

# Fitzgerald Monitoring Site

# Pheromone traps and root sampling can be used to find the relative abundance

# Trees topple in high winds

# Clearing trees for a new orchard

# Larvae chew through the irrigation

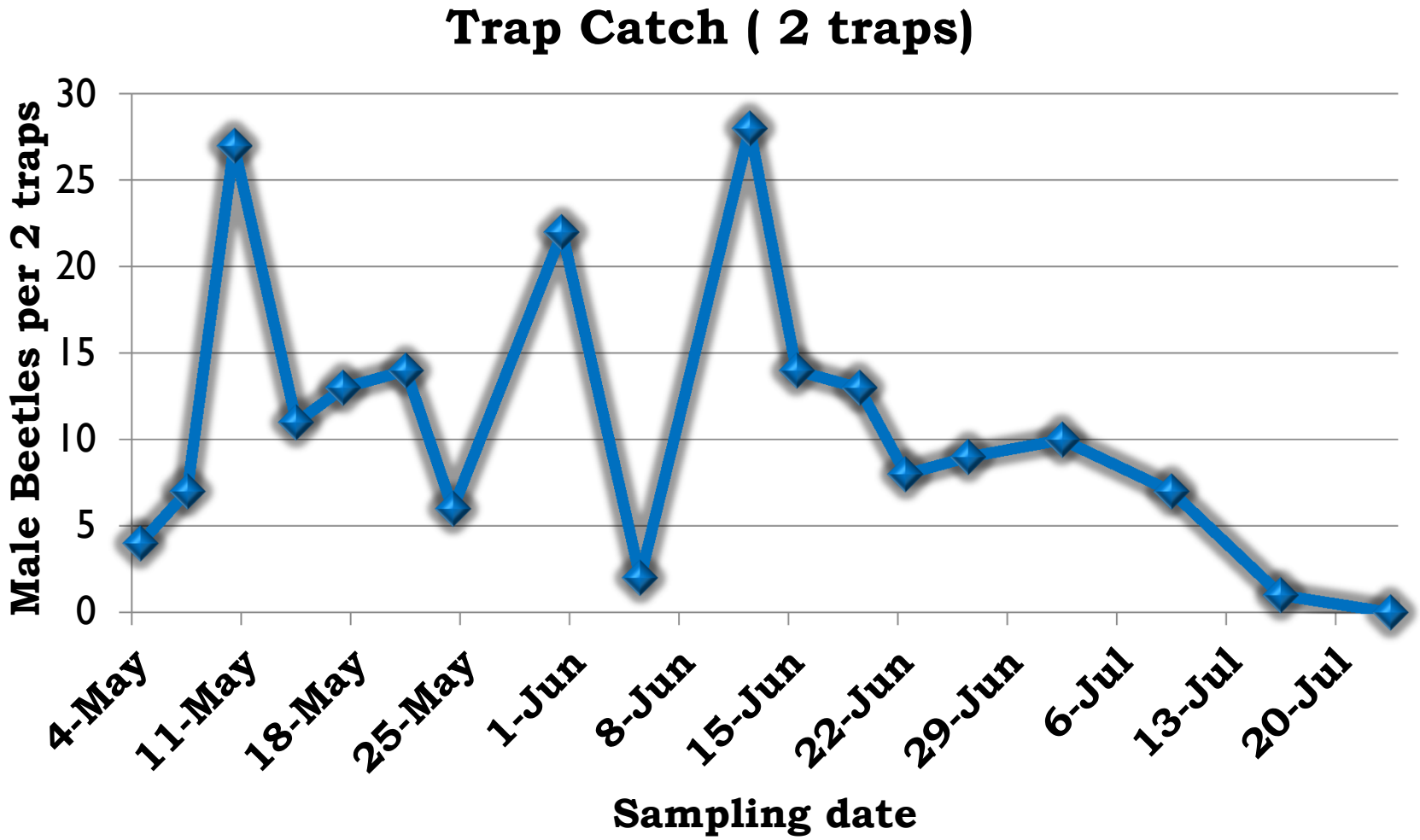
# Prionus infestation near Fitzgerald


Source of map: Google Earth 2013 Digital Globe

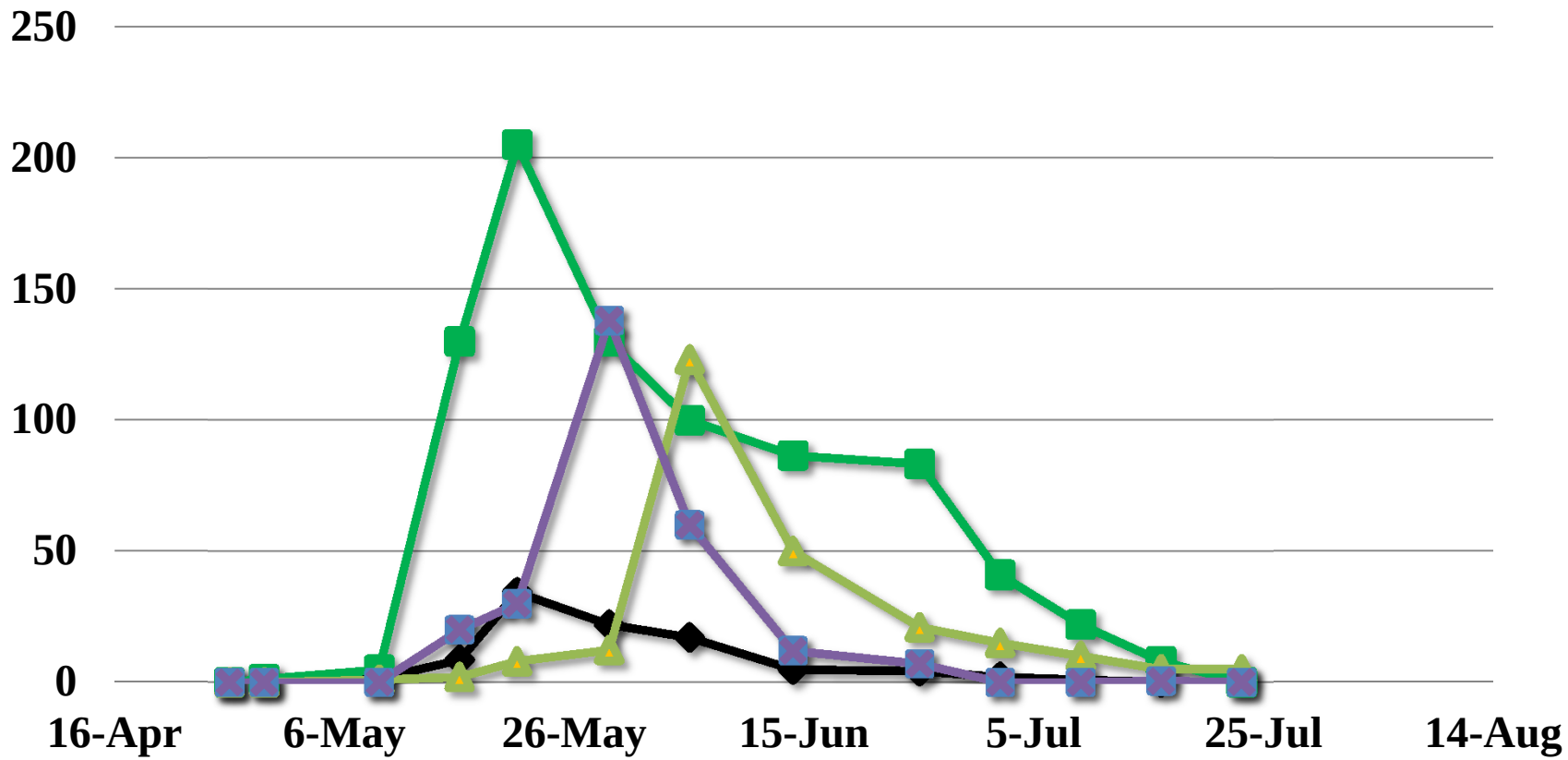
# *Prionus* infestations in Mendes, GA


Source of map: Google Earth 2013 Digital Globe

# Fitzgerald, GA *Prionus* Trap Catch 2012

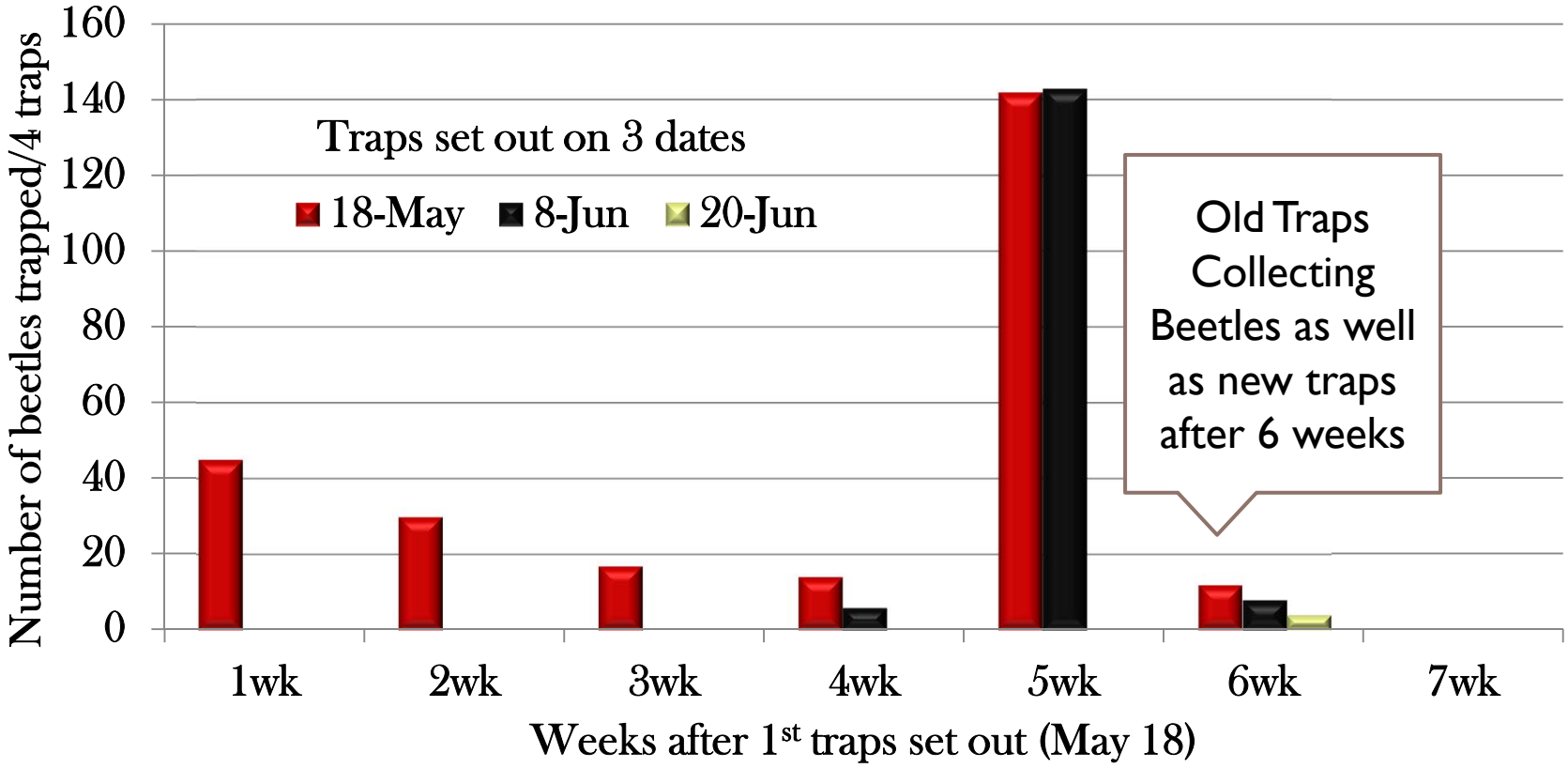


# Prionus Trap Catch 2013
# Number *P. imbricornis* males/trap

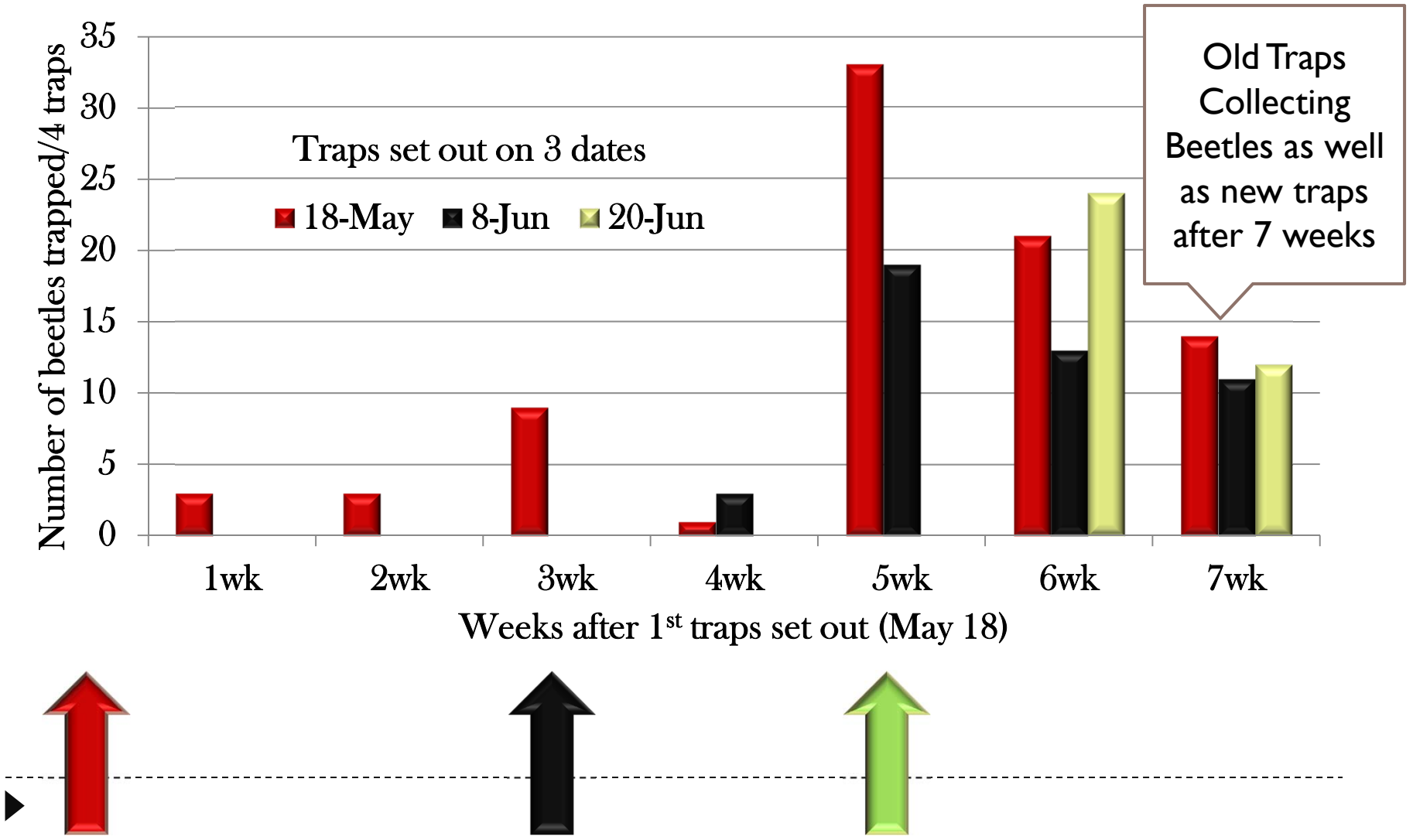



| # of traps: | 43 | 12 | 12 | 3 |
|---|---|---|---|---|

# How long do the pheromone lures last for *P. imbricornis*?



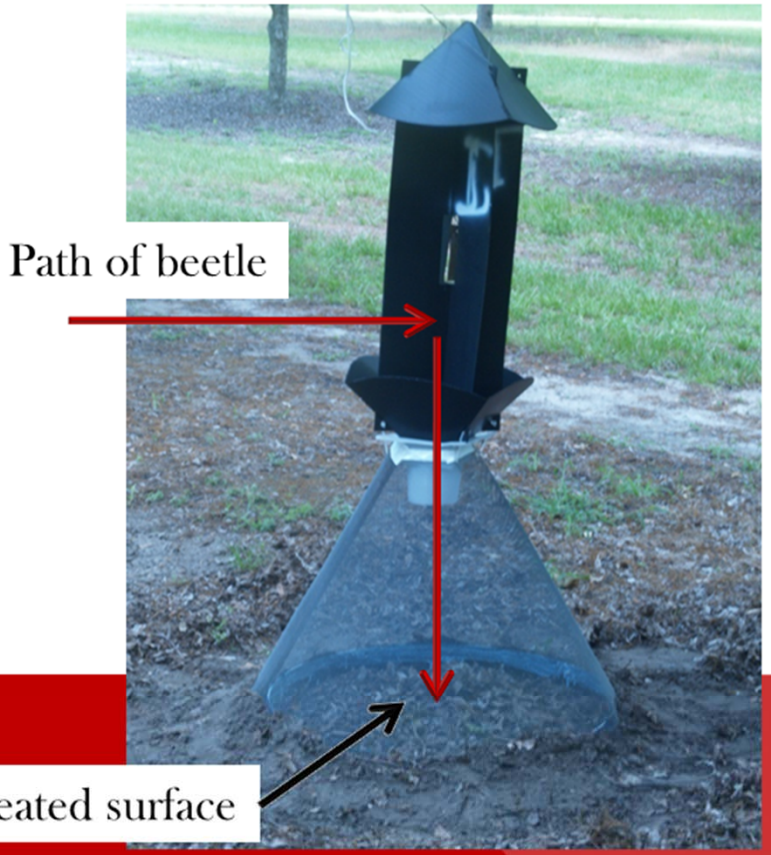
# How long do the pheromone lures last for *P. laticollis*?

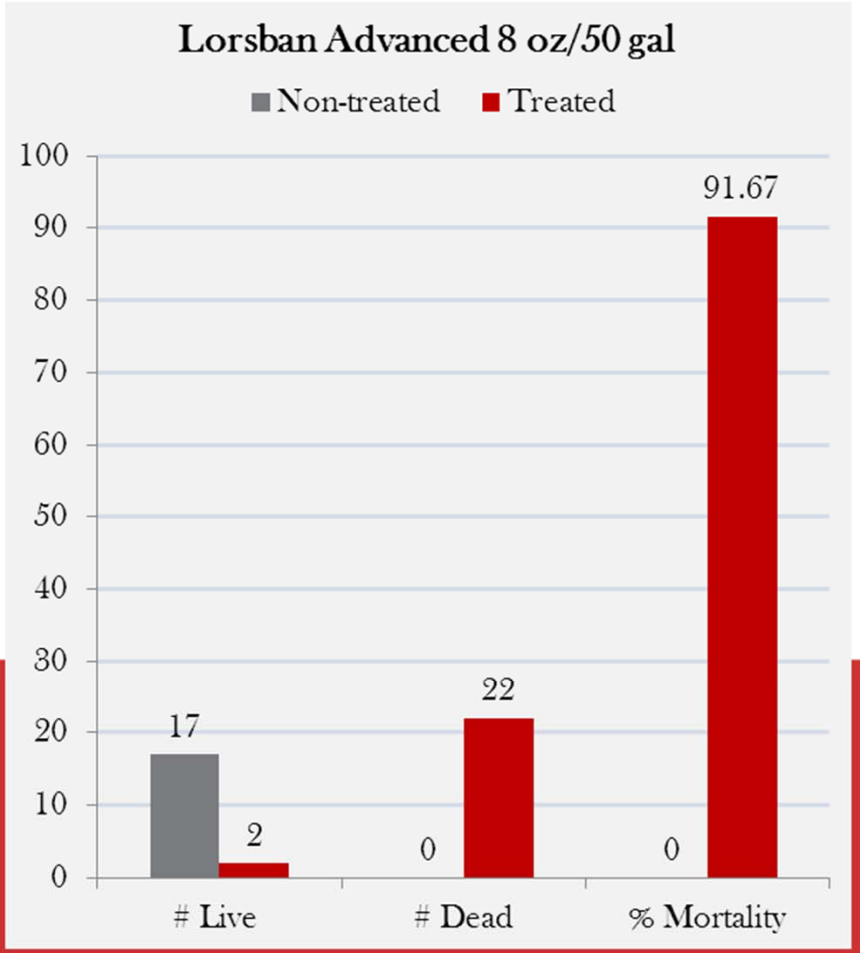


# Lorsban Efficacy Trial

# CHEMICAL CONTROL BIOASSAY

Since the adult beetles spend a long period digging through the soil chemical control may be possible to treat the soil with a long residual contact poison during adult emergence. Lorsban Advance (Dow) proved to be an effective control (92% mortality) in the field bioassays.



# Each Square is 4x4 trees

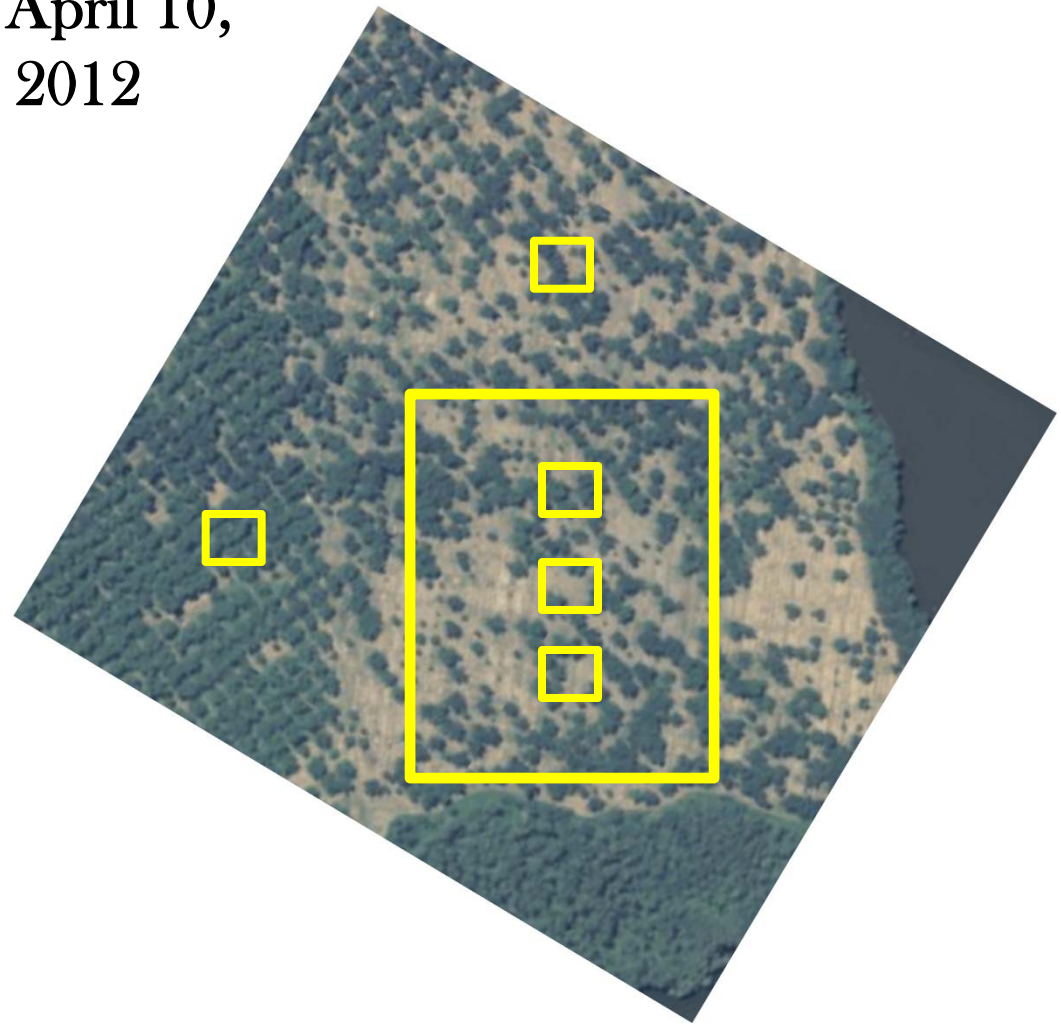
**April 24**

**nt**

Traps out on April 10, 2012

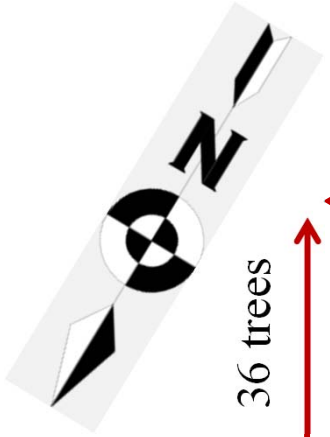
| | | | | |
|---|---|---|---|---|
| **34** | **11** | **14** | **13** | **6** |
| **34** | | | | **9** |
| **11** | | **0** | | **14** |
| **0** | | | | **9** |
| **16** | | **8** | | **8** |
| **0** | | | | **7** |
| **19** | | **13** | | **10** |
| **11** | | | | **14** |
| | **13** | **4** | **1** | **3** |

**nt**



Mann-Whitney U-test statistics
Z = 0.8857 P = 0.3758

# *P. imbricornis* trap catch at Crisp Co.




**May 11**

| | | | | |
|---|---|---|---|---|
| | | **34** | | |
| **33** | 20 trees | | | |
| 36 trees | **113** | **64** | **65** | **16** | **30** |
| | **37** | | | | **14** |
| | **15** | | **11** | | **27** |
| | **16** | | | | **22** |
| | **17** | | **47** | | **8** |
| | **47** | | | | **17** |
| | **127** | | **15** | | **12** |
| | **24** | | | | **11** |
| | | **17** | **8** | **27** | **11** |

Mann-Whitney U-test statistics
Z = -0.3618 P = 0.7175

**May 25**

| | | | | |
|---|---|---|---|---|
| | | **4** | | |
| **18** | **20** | **4** | **14** | **18** | **6** |
| | **15** | | | | **0** |
| | **14** | | **6** | | **6** |
| | **11** | | | | **9** |
| | **0** | | **2** | | **8** |
| | **3** | | | | **5** |
| | **8** | | **7** | | **12** |
| | **0** | | | | **3** |
| | | **5** | **1** | **9** | **14** |

Mann-Whitney U-test statistics
Z = -1.5307 P = 0.1259

# *P. imbricornis* trap catch at Crisp Co.

**June 2**

| | | | | |
|---|---|---|---|---|
| | | **8** | | |
| **25** | **22** | **21** | **14** | **18** |
| **23** | | | | **42** |
| **12** | | **1** | | **35** |
| **43** | | | | **23** |
| **13** | | **0** | | **16** |
| **5** | **21** | | | | **5** |
| **19** | | **2** | | **32** |
| **22** | | | | **6** |
| | **16** | **12** | **11** | **32** |

Mann-Whitney U-test statistics
Z = -2.7717 P = 0.0056

**June 15**

| | | | | |
|---|---|---|---|---|
| | | **32** | | |
| **13** | **23** | **6** | **0** | **33** |
| **37** | | | | **14** |
| **15** | | **5** | | **6** |
| **16** | | | | **4** |
| **17** | | **0** | | **0** |
| **20** | **12** | | | | **2** |
| **10** | | **0** | | **5** |
| **4** | | | | **16** |
| | **18** | **12** | **1** | **2** |

Mann-Whitney U-test statistics
Z = -1.9723 P = 0.0485

# *P. imbricornis* trap catch Crisp Co.

**July 24**

| | | | | |
|---|---|---|---|---|
| | | **0** | | |
| **1** | **0** | **6** | **2** | **0** |
| **2** | | | | **0** |
| **0** | | **0** | | **0** |
| **0** | | | | **0** |
| **1** | | **0** | | **0** |
| **3** | | | | **0** |
| **3** | | **0** | | **0** |
| **1** | | | | **0** |
| | **2** | **1** | **1** | **0** |

**3**

Mann-Whitney U-test statistics
Z = -1.3969 P = 0.1625

**September 18**

| | | | | |
|---|---|---|---|---|
| | | **0** | | |
| **4** | **0** | **0** | **0** | **3** |
| **0** | | | | **0** |
| **8** | | **0** | | **0** |
| **0** | | | | **0** |
| **0** | | **0** | | **0** |
| **0** | | | | **0** |
| **0** | | **0** | | **4** |
| **0** | | | | **0** |
| | **10** | **2** | **0** | **3** |

**0**

Mann-Whitney U-test statistics
Z = -1.8841 P = 0.0596

# Total trap catch by beetle species

**All Season**

***Prionus imbricornis*** **78**

| | | | | |
|---|---|---|---|---|
| **210** | **124** | **126** | **63** | **96** |
| **148** | | | | **79** |
| **75** | | **25** | | **88** |
| **86** | | | | **67** |
| **64** | | **57** | | **40** |
| **79** | **86** | | | | **36** |
| **186** | | **30** | | **72** |
| **62** | | | | **50** |
| | **81** | **39** | **50** | **65** |

Mann-Whitney U-test statistics
Z = -2.3684 P = 0.0179

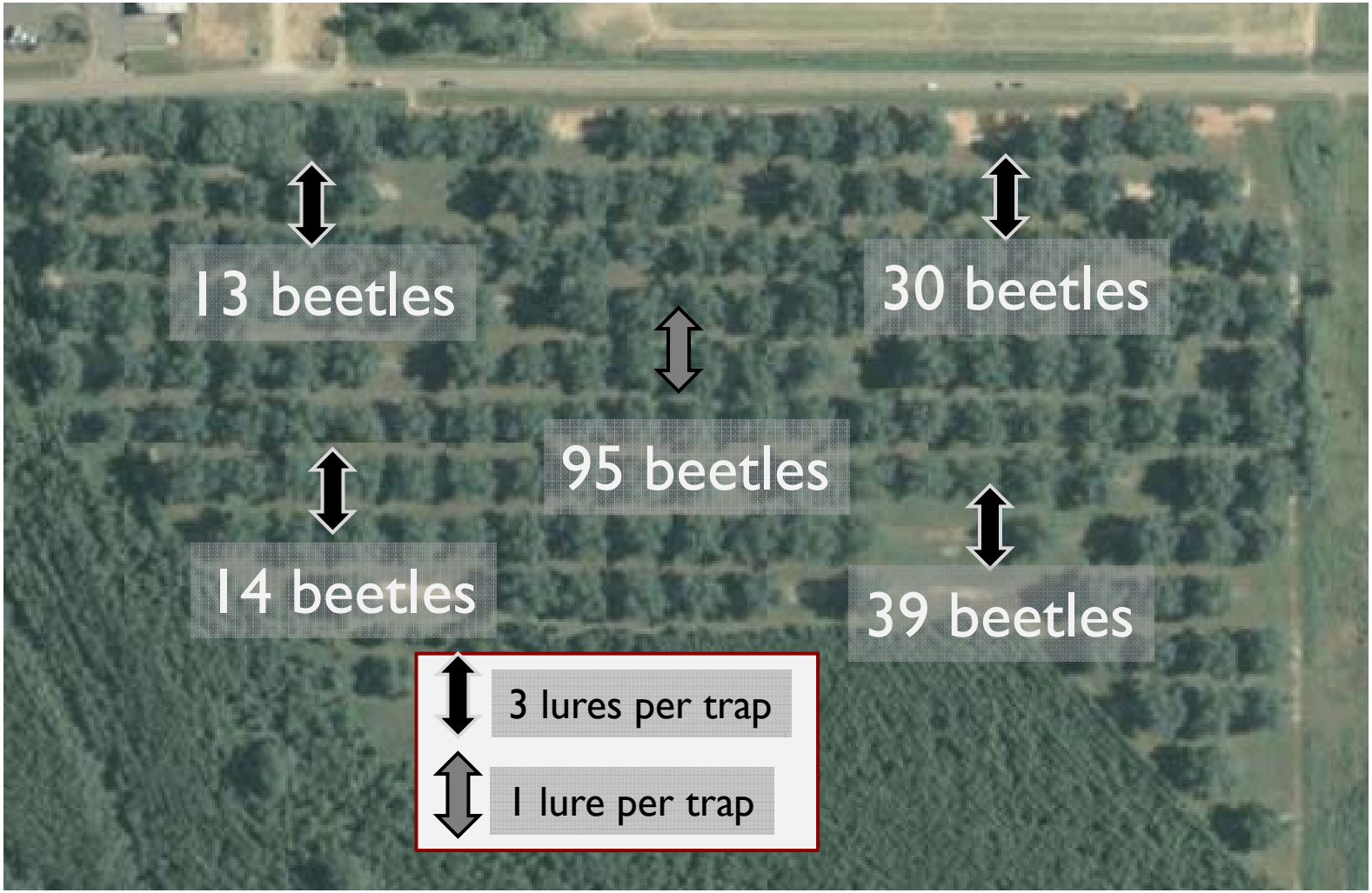
**All Season**

***Prionus laticollis*** **8**

| | | | | |
|---|---|---|---|---|
| **5** | **0** | **3** | **4** | **2** |
| **0** | | | | **14** |
| **4** | | **0** | | **2** |
| **11** | | | | **1** |
| **1** | | **0** | | **0** |
| **5** | **2** | | | | **17** |
| **5** | | **0** | | **1** |
| **0** | | | | **0** |
| | **0** | **1** | **3** | **4** |

Mann-Whitney U-test statistics
Z = -2.0974 P = -.0360

# 24-acre Peach Co. Orchard - 2012 Season




Source of map: Google Earth 2013 Digital Globe

# Alpha-pinene baited pitfall traps with Insect-o-Slip® treated inner walls

Alpha-pinene attracts female *Prionus* beetle.

Live female remains in trap one week and the number of males is recorded.

# Peach Co. Orchard – 2013

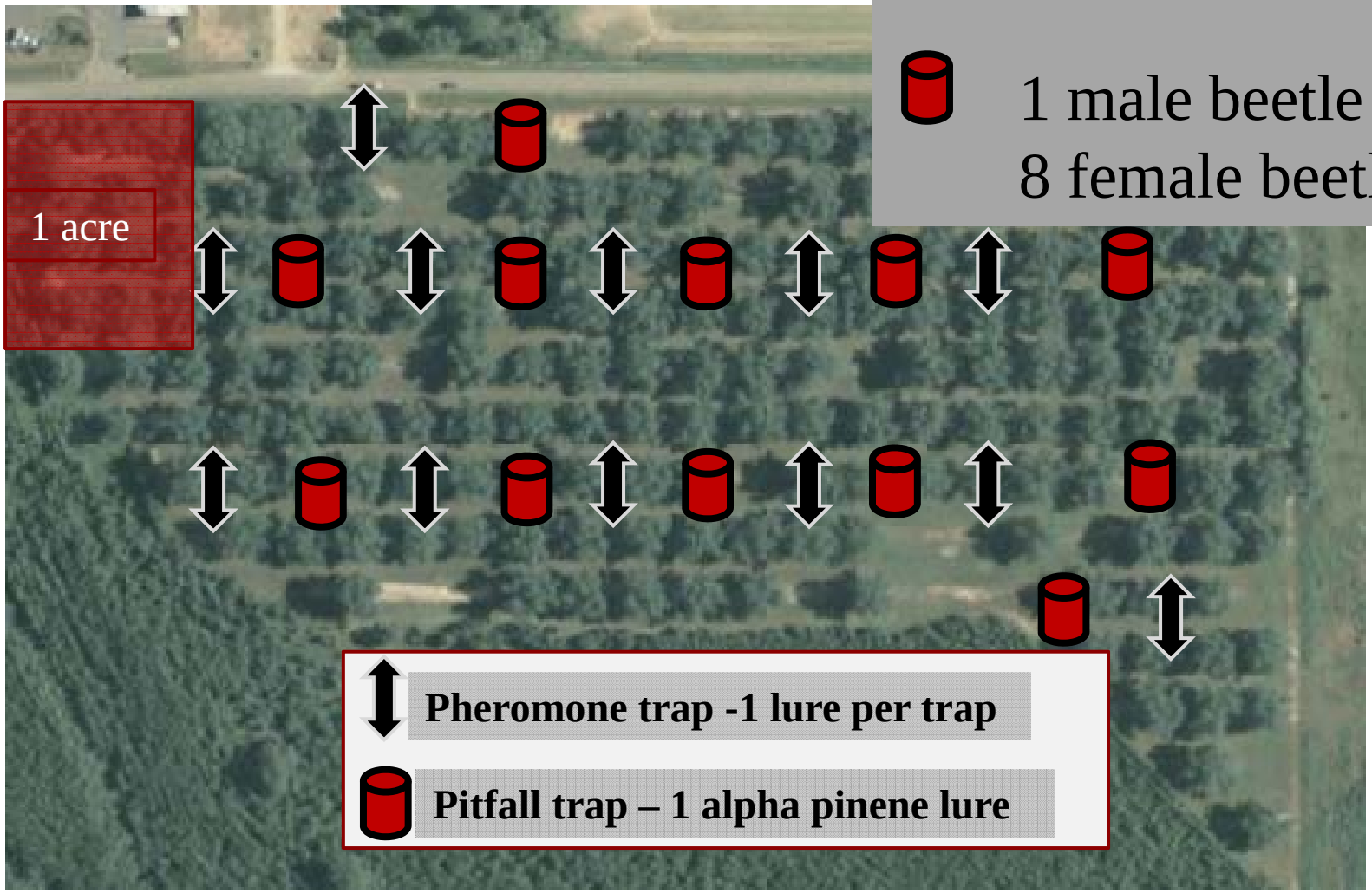
Total trap catch

596 male beetles

0 female beetles

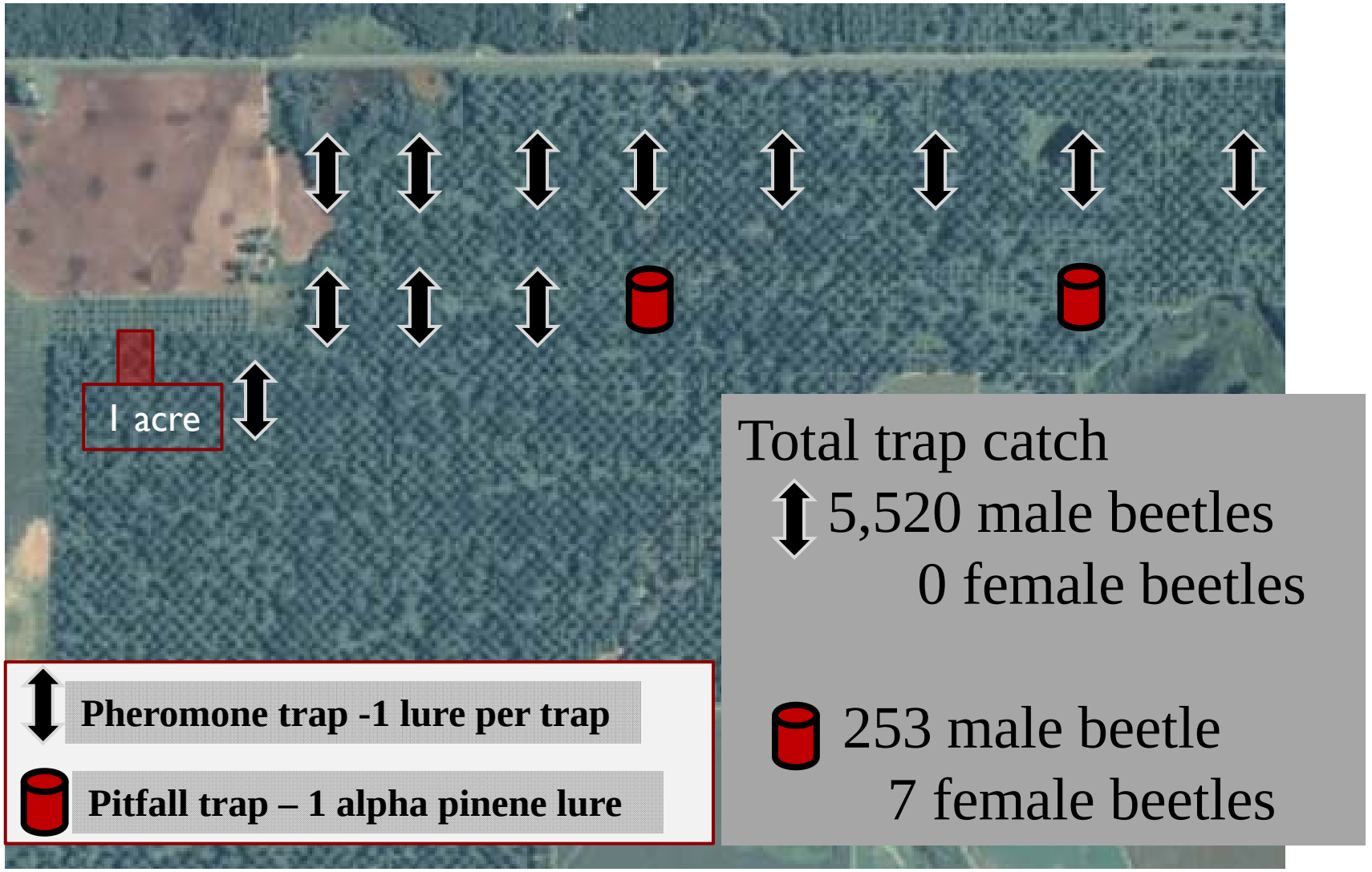
1 male beetle

8 female beetles




Source of map: Google Earth 2013 Digital Globe

# Nilo Plantation, Albany, GA -2013




Source of map: Google Earth 2013 Digital Globe

# Summary and Conclusions

1. Tilehorned prionus (98% of beetles sample) and broadnecked root borer adult males were attracted to the California prionus pheromone lures in Georgia pecans from late April thru July.
2. One pheromone lure will last for at least 6-7 weeks.
3. Chlorpyrifos at the ant-control rates as a soil application has a 93% efficacy against the adult male beetles.
4. Peripheral traps collected more adult males than traps in the center of 60 acre orchard encircled by pheromone-baited traps.
5. No males were attracted to live females in pitfall traps among pheromone-baited traps at a density of 1 trap per 2 acres. Males were attracted to live females in pitfall traps among pheromone-baited traps at a density of 1 trap per 24 acres.

# Acknowledgement


- Cooperating Pecan Growers and Agent:
  - Nilo Plantation (Mitchell Co.)
  - Cannon Farms (Crisp Co.)
  - Lane Packing Co. (Peach Co.)
  - Wade Farms (Fitzgerald, GA)
  - UGA Coop. Extension - Scott Carlson (Ben Hill Co.)
- Student Workers: Jamie Wilson, Paul Tyson
- Funding: USDA/NIFA; Georgia Agricultural Commodity Commission for Pecans, Cannon Farms
- Discount on lures: Contech Inc., manufactures the lures
- Spray Materials donated by Dow AgroSciences

# QUESTIONS?