Investigation of Pecan Dieback in West Texas

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AgriLIFE EXTENSION
Texas A&M System

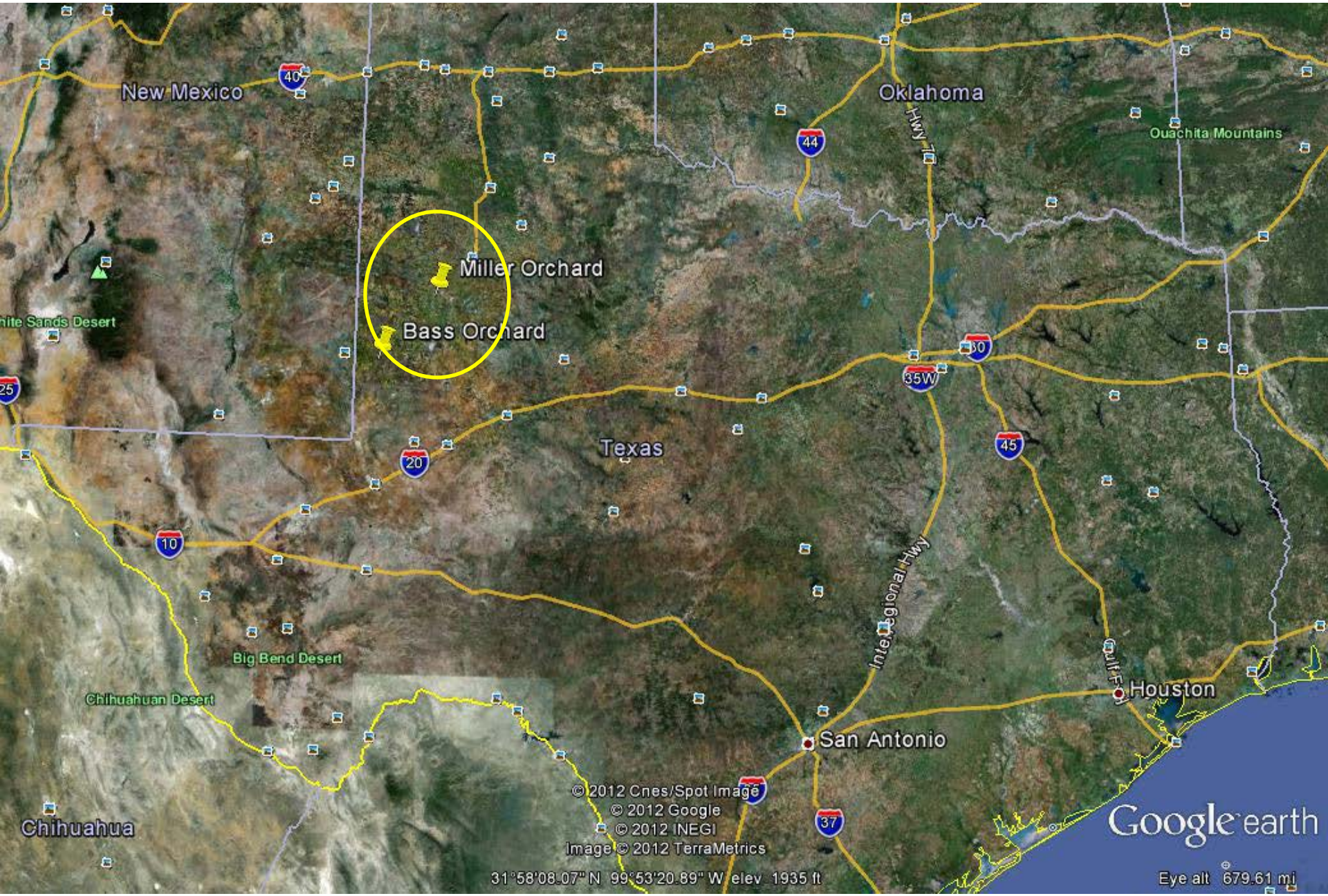
New Mexico
Oklahoma
Ouachita Mountains
Miller Orchard
Bass Orchard
Texas
Big Bend Desert
Chihuahuan Desert
Chihuahua
San Antonio
Houston
Gulf of
Inter-regional Hwy
Hwy 7
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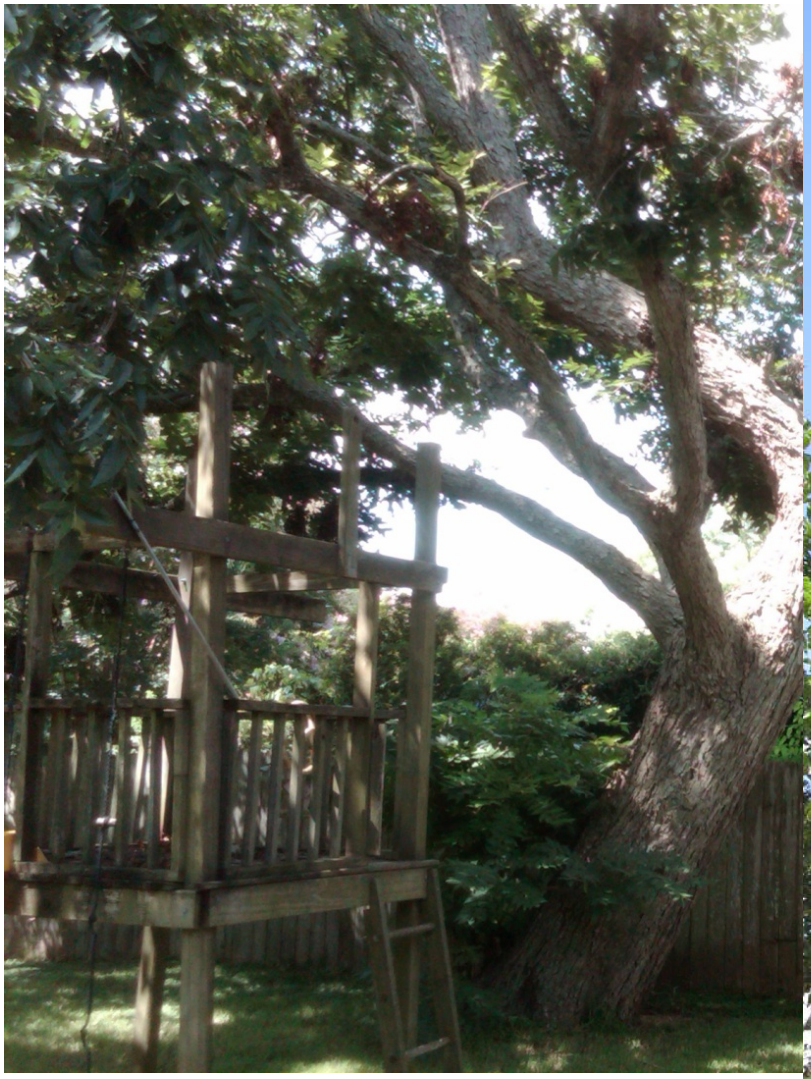
Image © 2012 TerraMetrics
31°58'08.07" N 99°53'20.89" W elev 1935 ft
Google earth
Eye alt 679.61 mi

Rainfall—15-20 inches per year; Irrigation required
Water quality---Boron, Chlorides, Bicarbonates, Sodium, etc. can be problems
Soils---Calcareous, Caliche subsoil, High pH, No zinc available
Temperatures---Cold in Winter, Very Hot in Summer

Classic Zinc Deficiency Dieback

Llano, Texas



Limb Dieback from structural

May be confined to one or mo
progressing slowly if main trur

Drought-Induced dieback

Summer drought increases winter injury

Nematodes cause dieback of pecans

Progressive decline

Photos: Steve Thomas, NMSU

Nematode-induced dieback/decline

Pecans can be attacked by southern rootknot nematode (*Meloidogyne incognita*)

More severe effects are caused by pecan rootknot nematode: *Meloidogyne partityla*

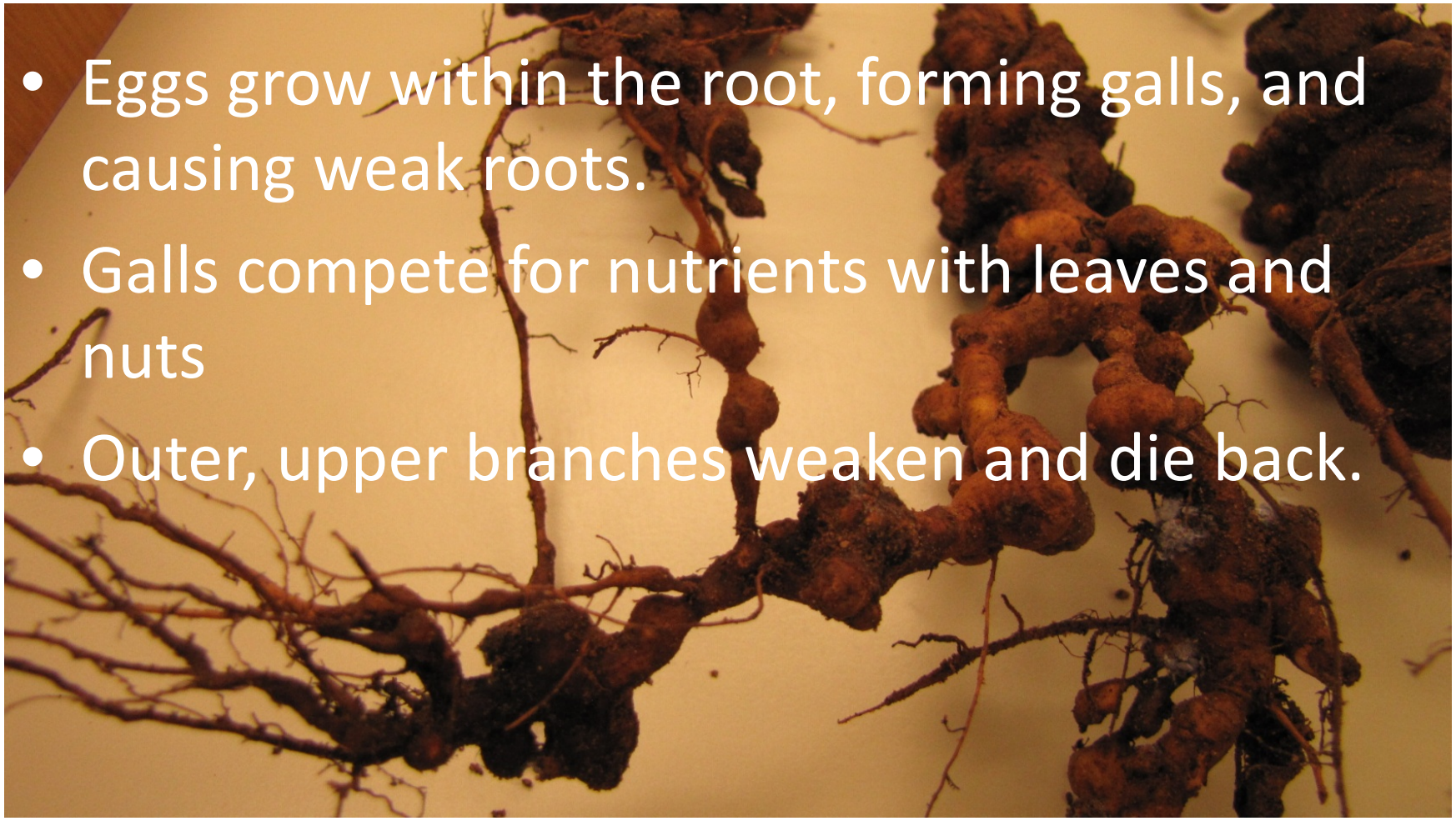
Only attacks pecan, hickory, walnut.

Reported in New Mexico, Texas, Georgia

Three Years after infection (New Mexico)

Photos: Steve Thomas, NMSU

Nematode damage



- Eggs grow within the root, forming galls, and causing weak roots.
- Galls compete for nutrients with leaves and nuts
- Outer, upper branches weaken and die back.

Other causes of limb dieback

Site & Management

- Excessive shading, causing limb death
- Heavy soils and flooding.
- Salt injury (Nutrient Excess)
- Nutrient Deficiency
  - Potassium, others

Other causes of limb dieback

Insects

- Obscure Scale insect damage
- Twig girdlers----- limbs often break off
- Hickory Shoot Curculio

Other causes of limb dieback

Pathogens

- Crown Gall
- Root Rots
  - Cotton Root Rot
  - *Armillaria* (Oak Root Rot)
- Wilt Fungi
  - Fusarium
- Limb Cankers
  - *Botryosphaeria or Dothiorella* Canker
    - Wound or stress opportunist
  - 1,000 Cankers----Walnut
  - not reported on pecan

Pecan Bacterial Leaf Scorch

Samples collected in this study tested negative for PBLS

Causes erratic scorch patterns during spring or summer.

Leaflets will abscise prematurely

Branches will become defoliated and appear to die back, recovering in some cases the following season, only to repeat the cycle.

Other causes of limb dieback

- Chemical Drift, especially herbicides & cotton defoliants.

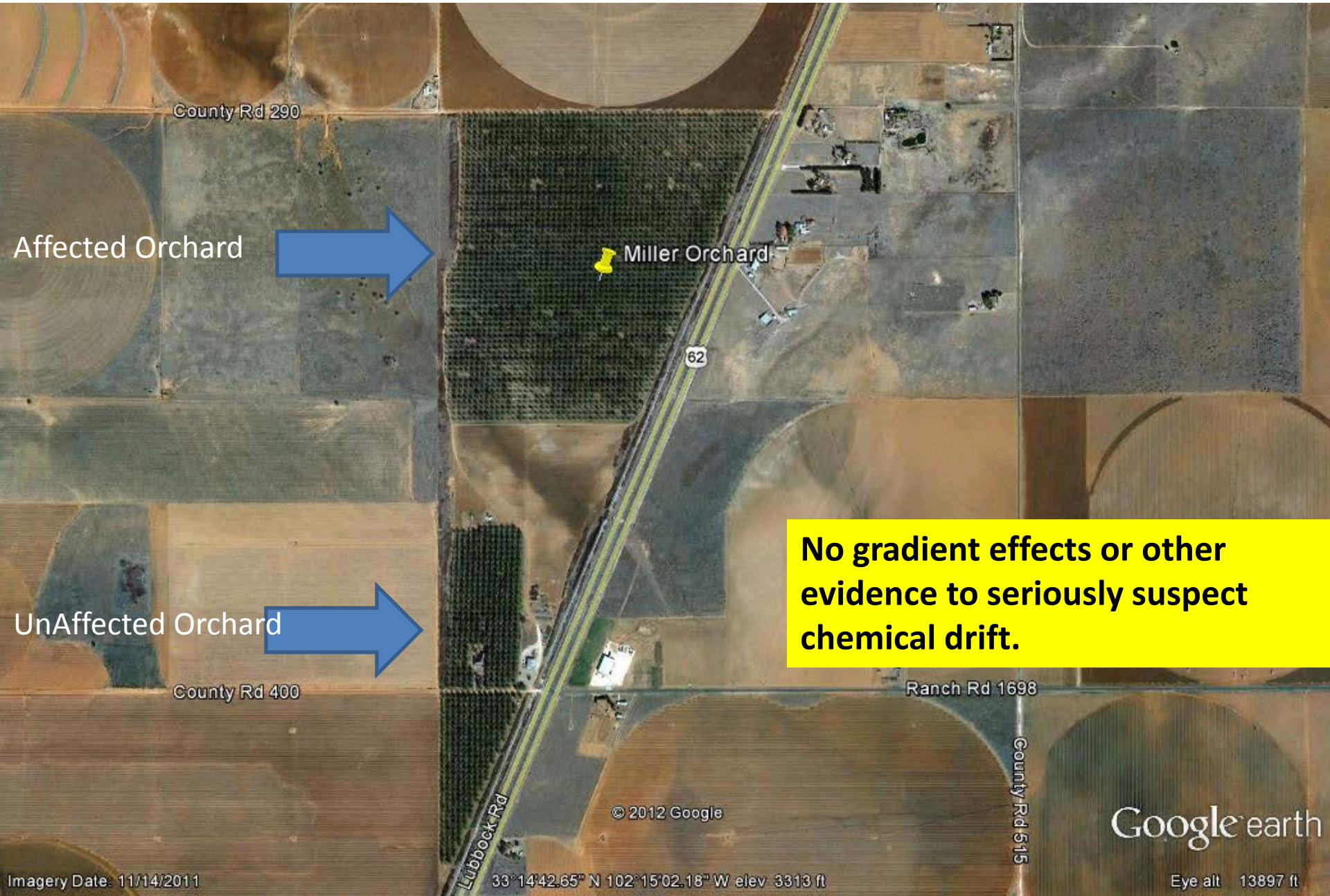
West Texas Symptoms

Symptoms start July with blackening nut clusters—(not consistent with nematode dieback)

Seminole Site Nov ‘10

Brownfield site Nov.'10

Brownfield Site: Smaller orchard on same soils, managed by same grower has little to no symptoms



No gradient effects or other evidence to seriously suspect chemical drift.

Other orchards in the area had different symptoms of dieback; more typical of chronic drought and zinc deficiency.

Big Questions

- Why would two well-managed pecan orchards in this region be suffering from the same symptoms, which began at both locations about the same time (2007 to 2008)?
- Why are some trees in these orchards not affected?
- Why were less well-managed orchards in the area not showing the same symptoms?
- Why do the symptoms appear to be getting progressively worse?
- Why have no trees completely died?

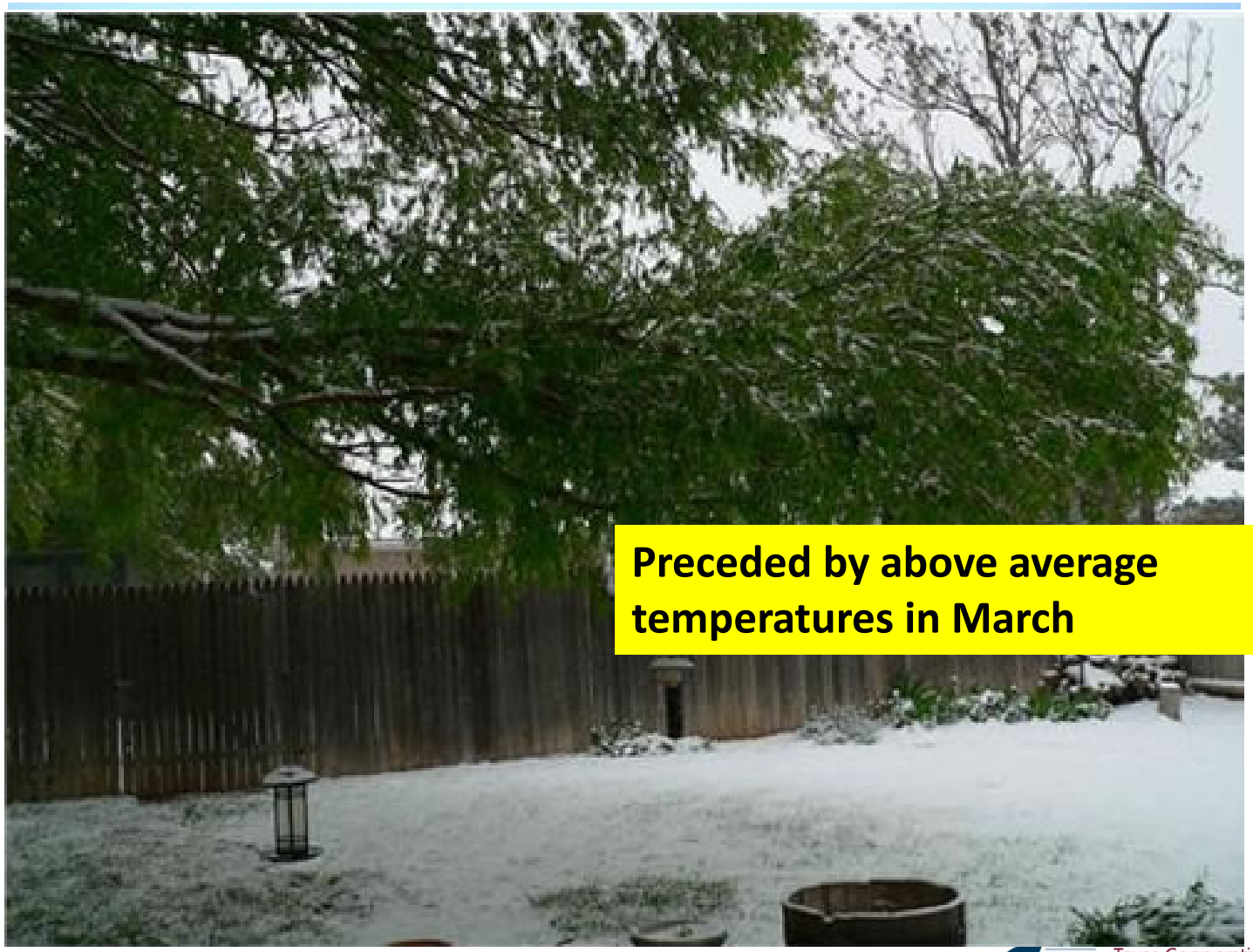
Factors Investigated

- Chemical spray drift
- Nutrient levels and fertilizer program
  - Soil samples & Leaf samples
- Water quality
- Presence of pathogens and insects
- Weather events
- Nematode presence and species identification (Terry Wheeler, Lubbock Research & Extension Center)

Common Factors: Both Sites

- Both orchards predominantly 'Western' variety & hedged.
- Both sites are on similarly well-drained soils with soft caliche layer appearing at 6-8 ft in most cases (or less in spots).
- Both orchards applying high nitrogen rates (>250 lbs N/Acre)
- Leaf potassium was within sufficiency ranges, but trending downward
- Water quality was generally acceptable, although bicarbonates, sulfates, boron, and chlorides are present.
- Both orchards well watered
  - Brownfield= subsurface drip; Seminole=sprinklers
  - Changes to delivery system made at both sites within last 5 years
- Both orchards were growing rapidly and had flowers formed when an Easter freeze occurred on April 8, 2007. Lows of 19 F.

Cartwright Vineyard – Mason, Texas April 8, 2007 (Easter Sunday)



Slide: E. Hellman

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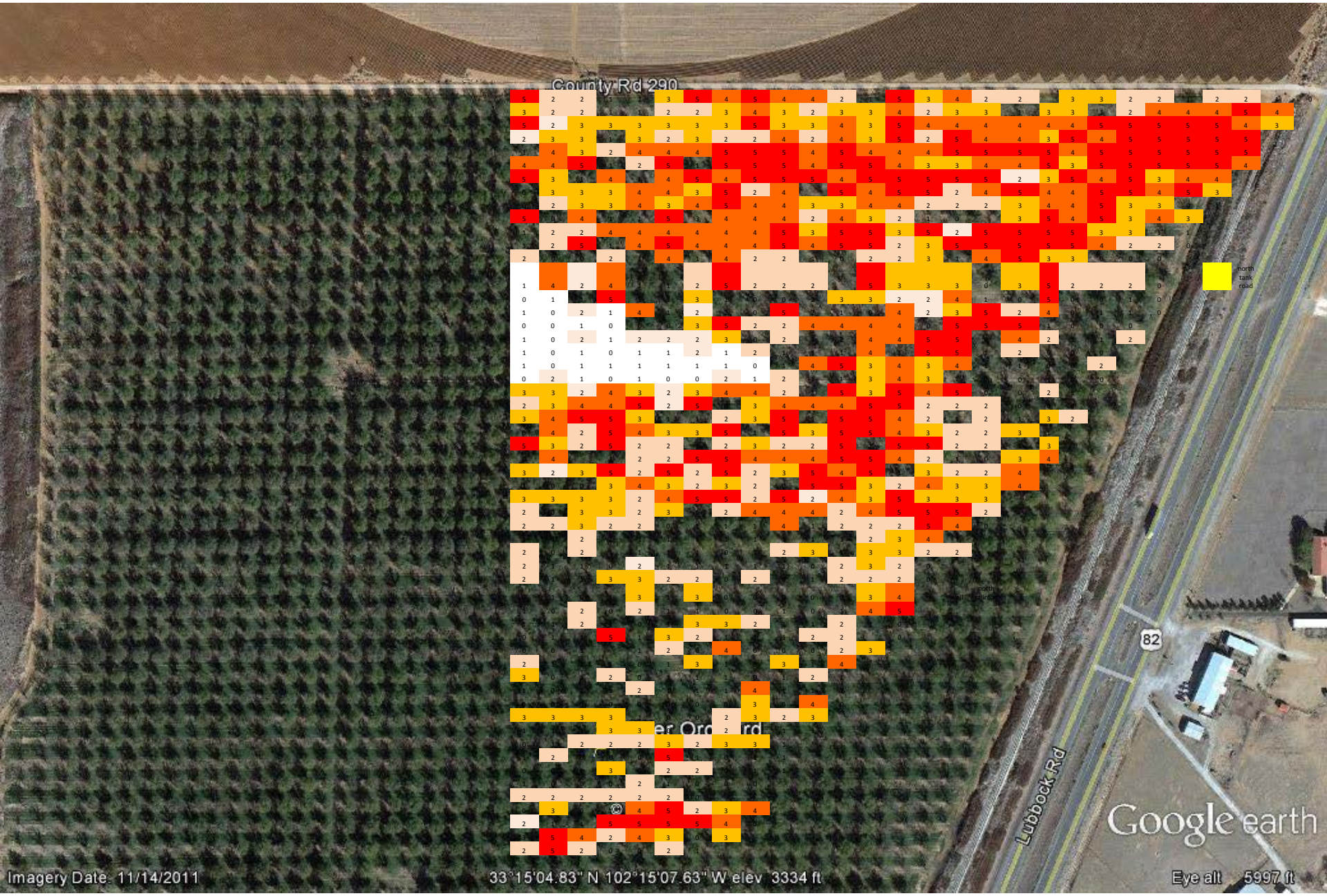
Lesser freeze event occurred in April 2009 causing crop and foliage injury.



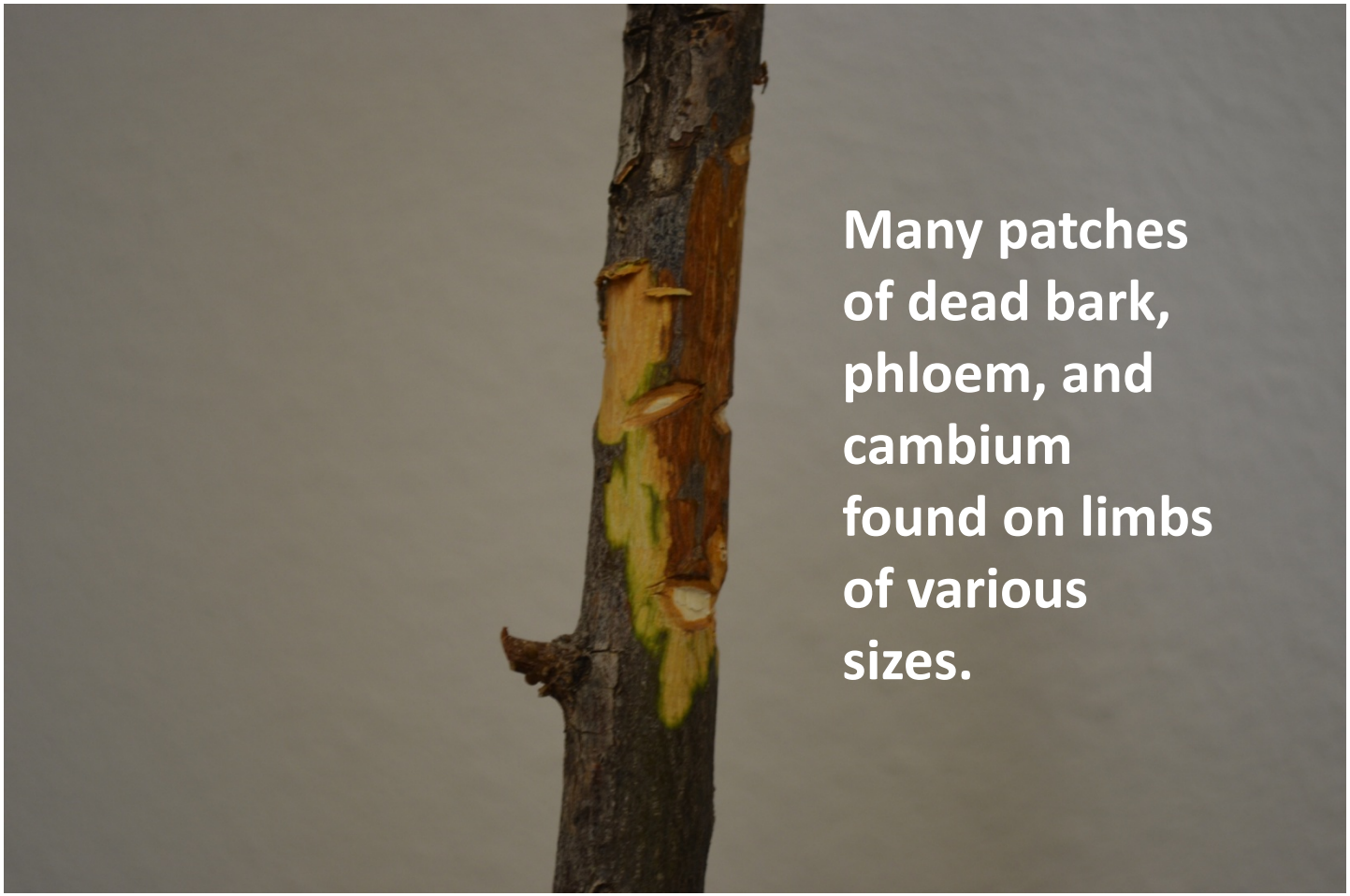
Variety Differences

Western—mild to severe
Burkett---mild to moderate
Mahan—mild
Brake---mild
Stuart---moderate to severe

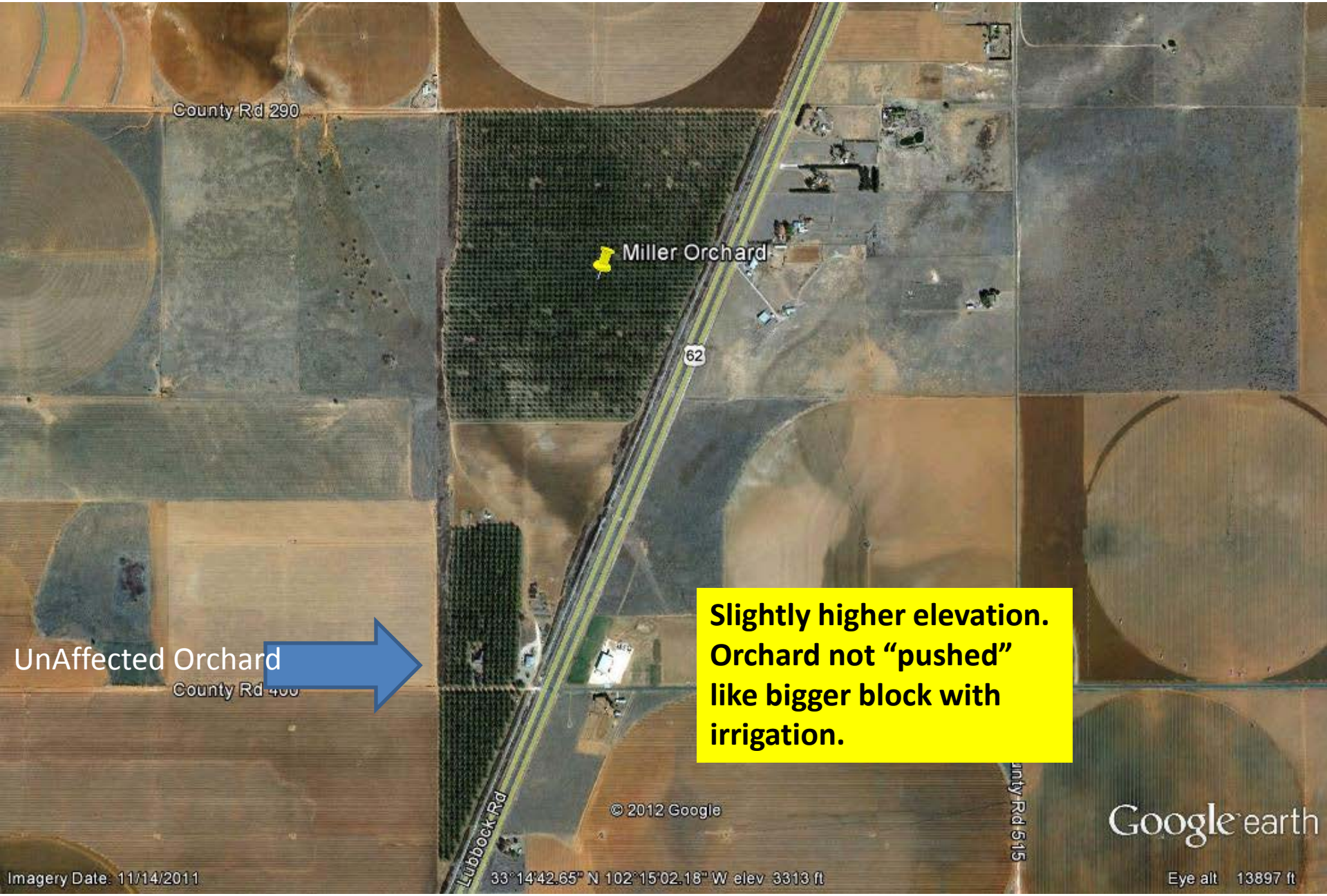
Root Excavation

Trees had well formed taproot and lateral branch roots that were in good health. Nematode galls were found on small roots, and in some cases living feeder roots were hard to locate.

Dothiorella or “Bot. Canker” isolated by Plant Disease clinic, but difficult to find/isolate and no classic cankers found.



April 7-8, 2007 Freeze: 19 F temp. for over 24 hours; Trees in Flower

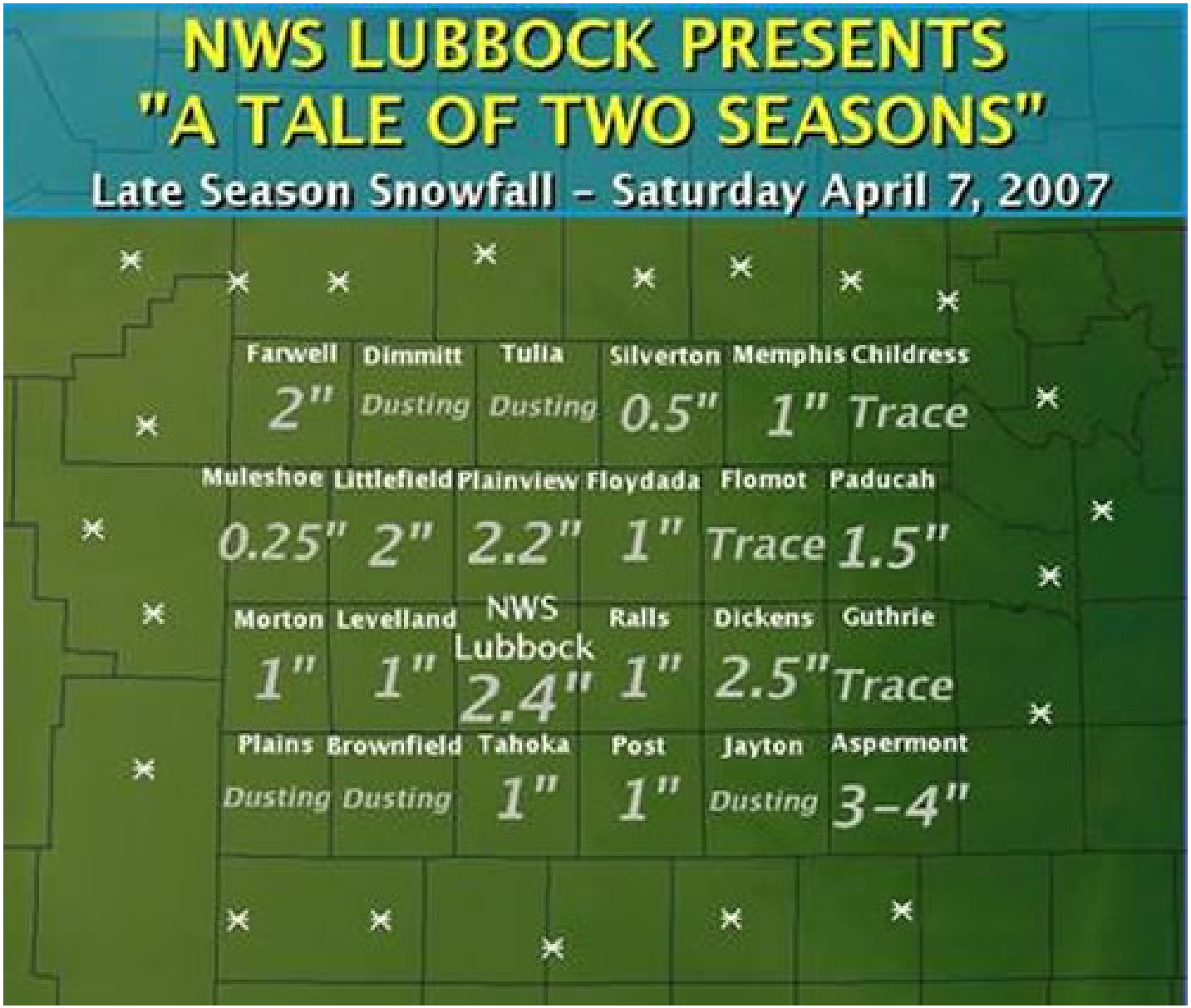


Preliminary Findings on Nematodes

- Both sites confirmed to have root knot nematodes present.
- Both asymptomatic and symptomatic trees confirmed to have nematode-infested roots.
- Density of nematodes found on severely affected trees unknown.
- Cotton grown in soil containing eggs collected from samples did not reproduce galls indicating nematodes present may be *M. partityla* instead of *M. incognita*.

Conclusions

- Acute freeze injury (2007 and 2009), resulted in impaired ability to form new xylem and meet transpirational demand in extreme temperatures of July and August, 2010 & 2011.
  - Nuts and vascular tissue on affected terminal branches weaken, and are overcome by heat and secondary (saprophytic fungi).
- Pecan root knot nematode was introduced on nursery stock previously, and are weakening roots and exacerbating stress reaction and imparing recovery.
  - Movement by irrigation upgrades and trenching.
- Recovery should be promoted by canopy pruning, moderate fertility and slowing spring phenology to avoid additional freeze events.



http://www.srh.noaa.gov/lub/?n=events-2007-20070407_snow