

The Potential of Mitigating Hurricane Damage in Pecan Orchards: Preliminary Results

Wheeler Foshee

Auburn University

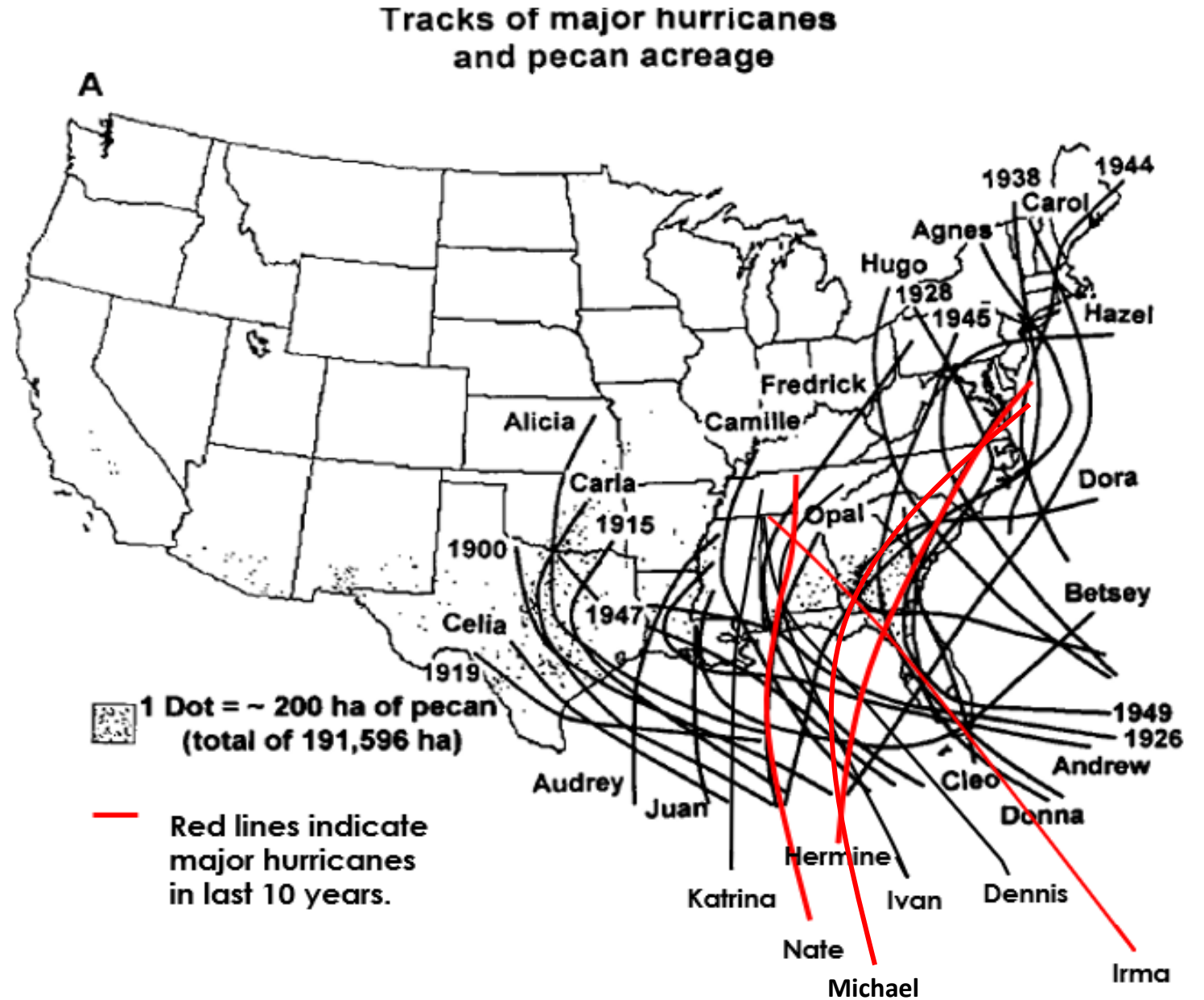
SEPGA Meeting



- Over 30 of the most economically damaging hurricanes in the U.S. have tracked over key pecan producing areas since 1900.

- In any given year the Alabama Gulf Coast has an 11% chance of being hit by a major hurricane.

- Sources:
 - NOAA
 - Wood et al., 2001. Pecans and Hurricanes. HortScience 36:253-258



Recent Storm Damage

▶ Recent Storm Damage

▶ Hurricane Irma (2017) - Georgia

- ▶ Wind gusts reached 60+ mph.
- ▶ Estimated 30% pecan crop loss and thousands of trees uprooted.

▶ Hurricane Michael (2018) - Georgia

- ▶ Wind gusts over 110 mph reported in SW Georgia
- ▶ Estimated 50% pecan crop loss and significant loss of trees

▶ Tropical Storm Gordon (2018) caused significant damage to some pecan orchards along the Alabama Coast.

▶ Hurricane Dorian (2019) - WHEW

- ▶ Sources: Alabama Farmers Federation, UGA Cooperative Ext. (L. Wells)

Pecan Research

- ▶ What can we do to reduce potential damage to trees due to high wind speeds associated with these storms?
- ▶ Previous research:
 - ▶ In a wind tunnel experiment, wind drag (resistance) of defoliated poplar trees was reduced 47% compared to foliated trees.
- ▶ Hypothesis:
 - ▶ If trees can be safely defoliated just prior to an impending hurricane or tropical storm, storm damage could be significantly reduced.
 - ▶ The ultimate goal is to be able to defoliate trees 24-48 hours prior to a hurricane.

Current Progress

▶ Summer 2018:

- ▶ Started testing potential defoliant on small trees at the E.V. Smith research orchards.
 - ▶ Defoliant included copper, zinc, diquat, carfentrazone and multiple cotton defoliant.
- ▶ Trees were sprayed with defoliant, blown with an air-blast sprayer approx. 96 hours after application then rated to determine % defoliation.

▶ Spring 2019:

- ▶ Trees were evaluated for potential damage caused by defoliant applications.
- ▶ Defoliant which caused excessive tree damage were removed from consideration.



Trees 24 hours after defoliant application

Preliminary Work



Closeup up of leaves 24 hours after defoliant application

Preliminary Work



Trees after blowing with air-blast sprayer

Preliminary Work

Current Progress

- ▶ **Summer 2019:**
 - ▶ Conducted experiments on container-grown pecan trees to determine how much wind force would be reduced by defoliating trees.
 - ▶ A force gauge was attached to the trunk of each tree and then secured to an immovable object (tractor)
 - ▶ A Toro Pro Force commercial blower simulated hurricane-force wind speeds.
 - ▶ Winds speeds averaged 75 mph and were directed to the center of each tree canopy



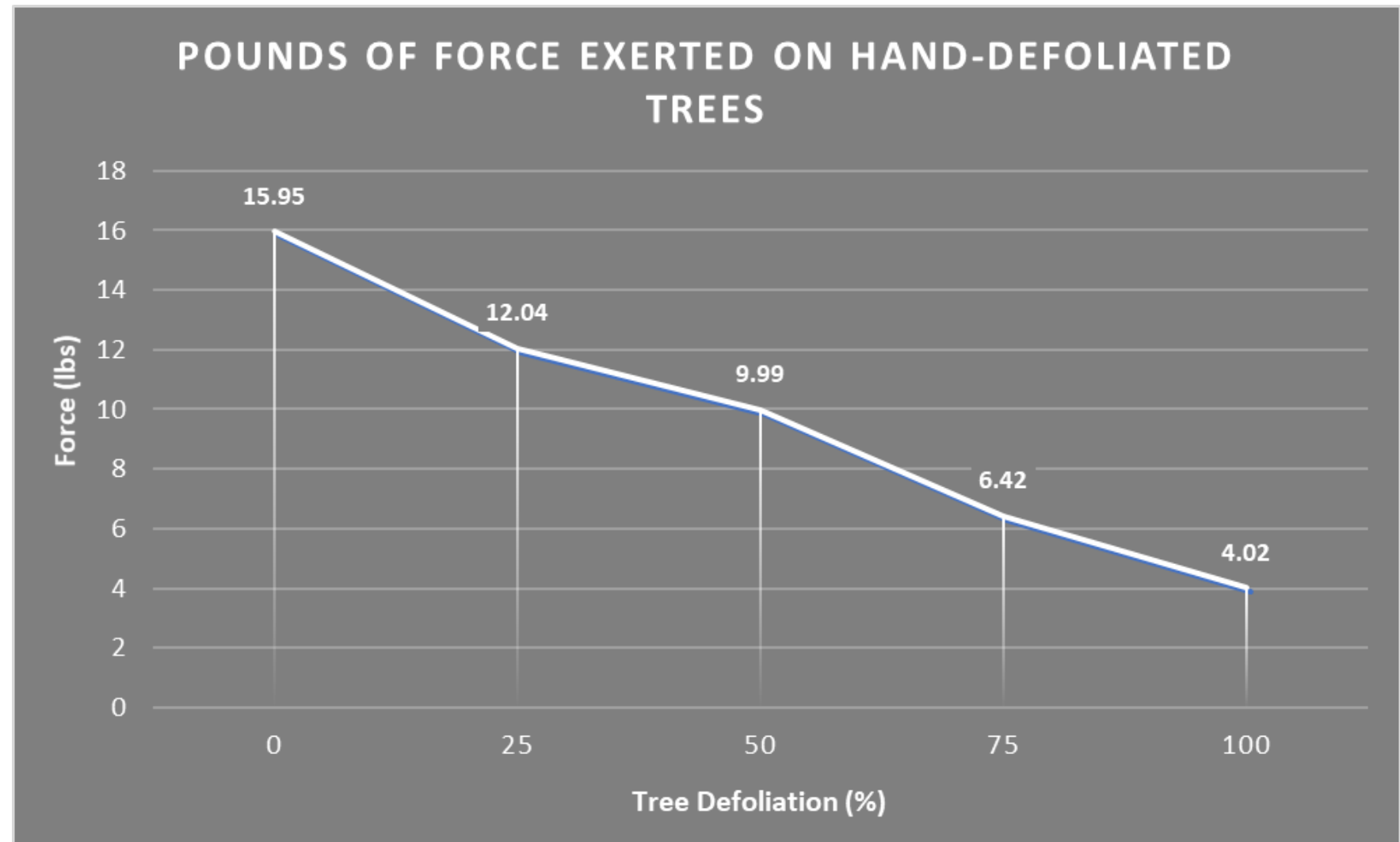
Current Progress

- ▶ Treatments included trees that were hand defoliated at 0, 25, 50 , 75 and 100% prior to blowing.
- ▶ Selected defoliant treatments from the fall 2018 field test were also tested.
 - ▶ Initial tests included soft chemistries only.
 - ▶ 1) 1% Chelated copper + silicon surfactant
 - ▶ 2) 1.75% Zinc sulfate + silicon surfactant
 - ▶ 3) 1000 ppm ethephon + 0.5% chelated copper + silicon surfactant
- ▶ Trees were blown 24 and 48 hrs. after defoliants were applied.



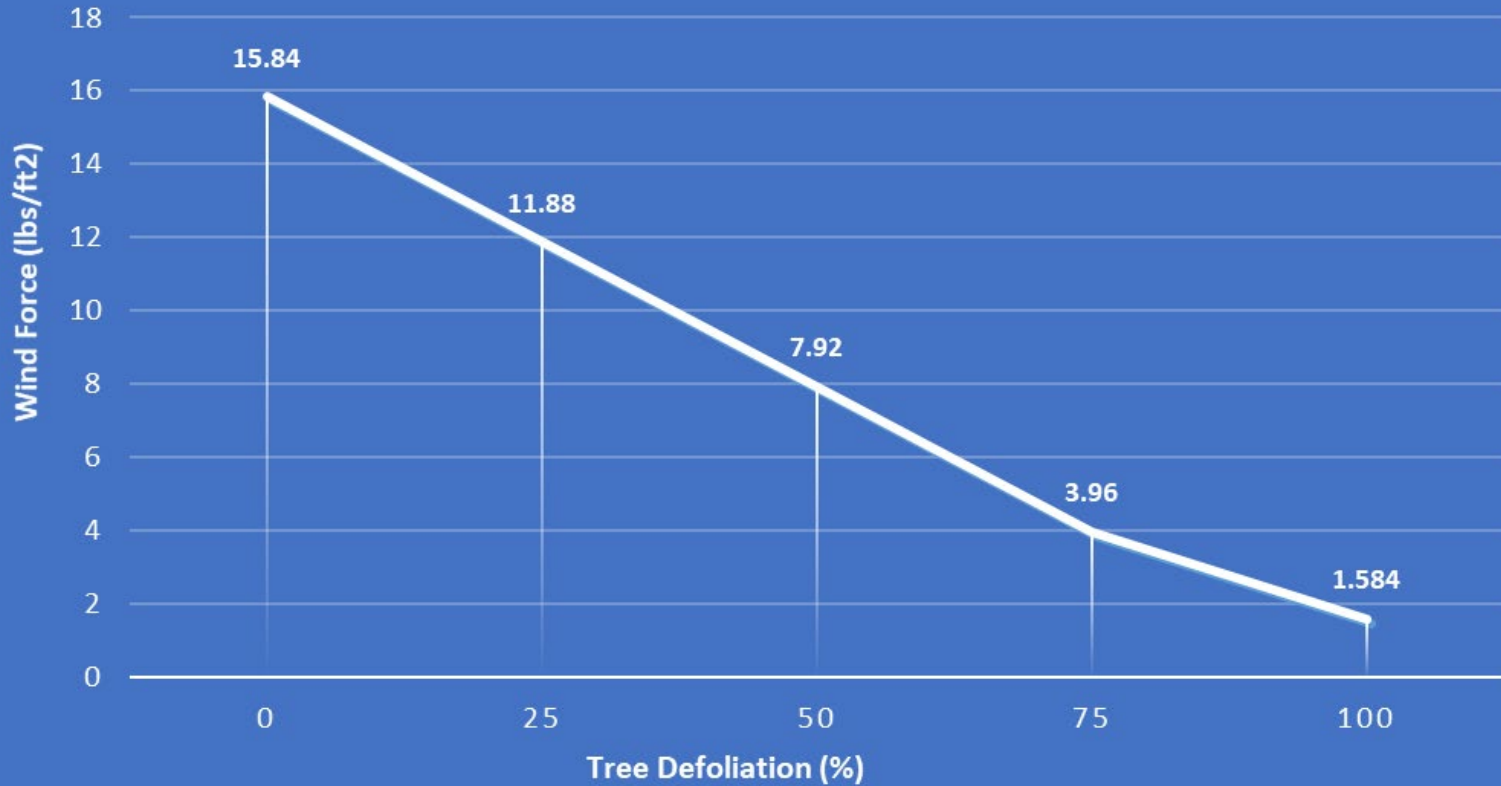
- ▶ Trees were blown for 1 minute at winds speeds averaging 75 mph.
- ▶ After blowing on the trees, the trees were rated to determine % defoliation.

Hand-Defoliated Tree Results



- Force (lbs) exerted on trees was reduced by 60% when trees were defoliated by 75%.
- Force was reduced by 75% when trees were 100% defoliated.

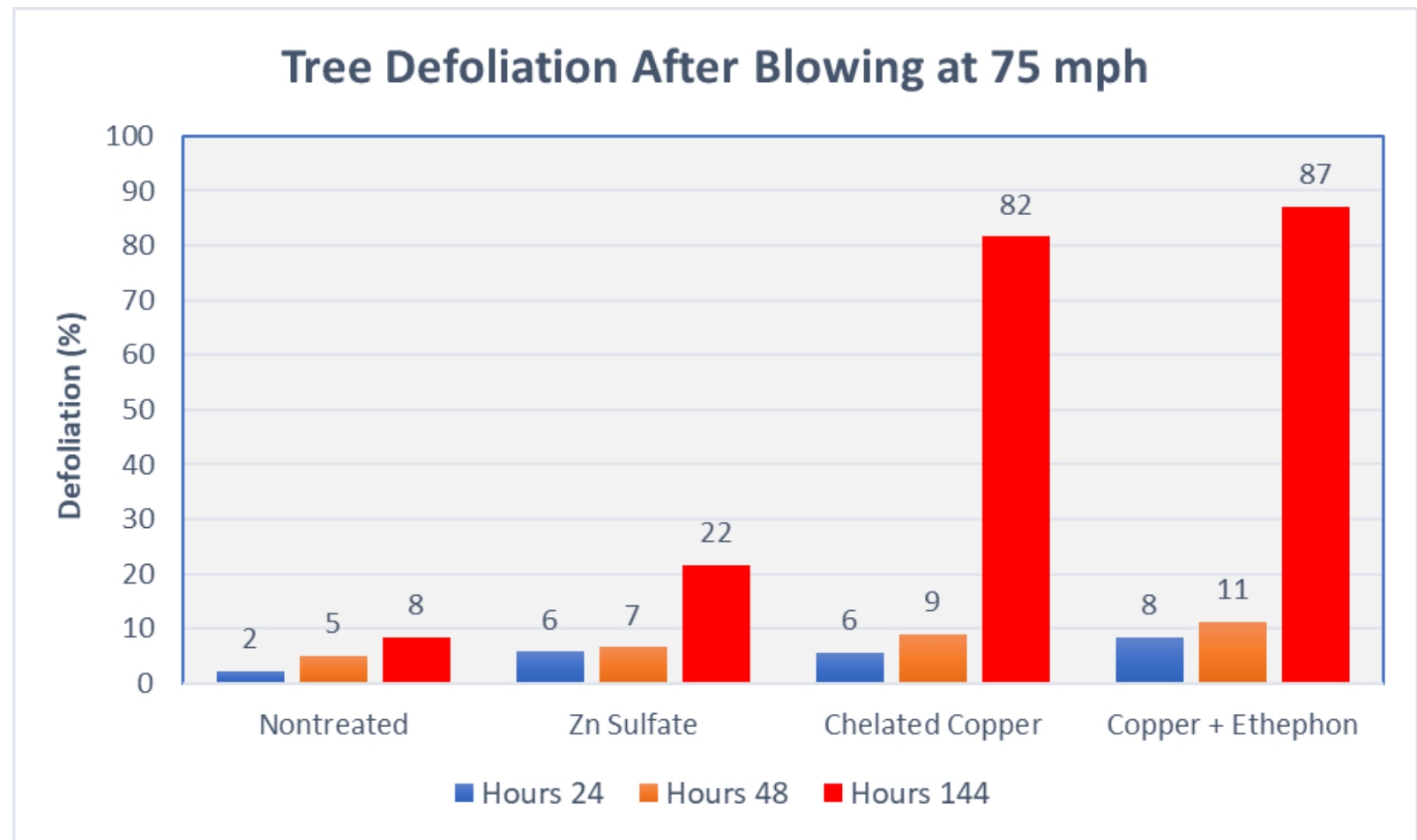
CALCULATED WIND PRESSURE EXERTED ON HAND-DEFOLIATED TREES



Beaufort Wind Scale	
Mid-Point Wind Pressure (lbs/ft ²)	Tree Impacts
1.2	Small Trees Sway
2.1	Large Branches Move
3.2	Large Trees Sway
4.8	Twigs Break
6.7	Small & Medium Limbs Break
9.2	Trees Break or Uproot
12	Massive Tree Loss

- Based on the Beaufort Wind Scale, wind pressure acting on the tree likely needs to be below 6.7 lbs/ft² to reduce blow-over and major limb breakage.
- Initial research indicates pecan trees would need to be defoliated by 60-75% to achieve this.

Results for Initial Defoliant Treatments

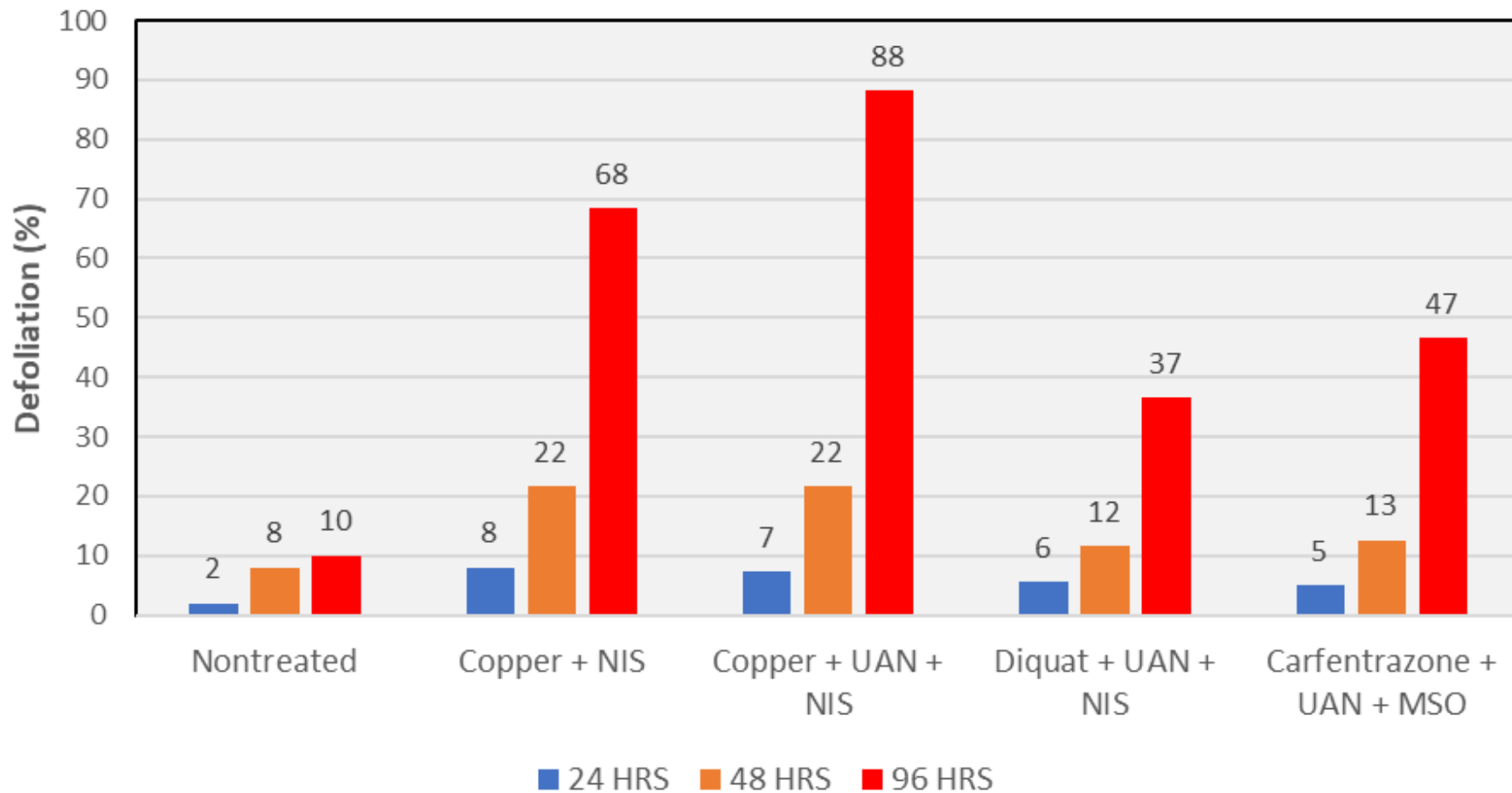


- Zinc, copper and copper + ethephon failed to adequately defoliate trees at 24 or 48 hours after application.
- Copper and copper + ethephon provided suitable defoliation after 144 hours (6 days) and could be options if defoliation can be sped up.

Current Progress

- ▶ **Late Summer 2019 (Sept.)**
 - ▶ Taking what we learned from previous tests, more trials were conducted on trees at the E.V. Smith research orchards.
 - ▶ Copper and copper + ethephon was combined with 3% UAN + surfactants in an effort to speed up defoliation.
 - ▶ Additional defoliantes were also tested.
 - ▶ Ethephon + Cyclanilide (Finish 6 Pro®) & Thidiazuron (Takedown®)
 - ▶ Carfentrazone (Aim) and Diquat
 - ▶ Trees were blown using an air-blast sprayer at 24, 48, 72 & 96 hrs. after defoliant application.
 - ▶ Trees were blown for a total of 2 minutes (1 min on 2 sides)
 - ▶ Winds speeds averaged 75 mph

EVS Tree Defoliation After Blowing with Air-Blast Sprayer - Run 1



- ▶ No treatment provided suitable defoliation at 24 or 48 hours; however, mixing UAN + copper resulted in 88% defoliation 96 hours after application.

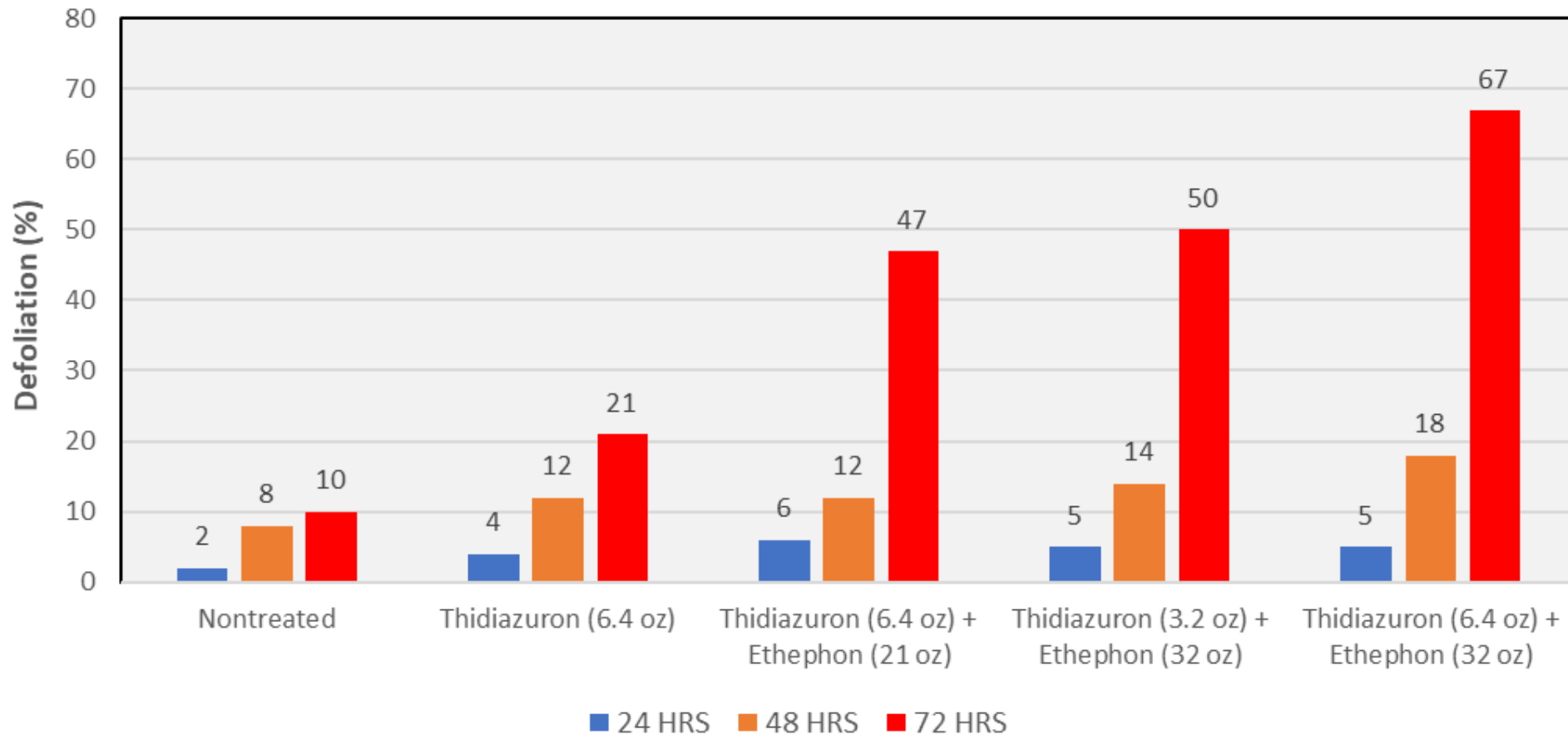


▶ Copper + UAN + NIS Before Blowing



▶ Copper + UAN + NIS Blown 96 hrs after app.

EVS Tree Defoliation After Blowing with Air-Blast Sprayer - Run 2



- ▶ No treatment provided suitable defoliation at 24 or 48 hrs after application.
- ▶ The high rate of thidiazuron + ethephon was the best treatment and resulted in 67% defoliation 72 hours after application.



▶ Before: Thidiazuron (6.4 oz) + Ethephon (32 oz)



▶ 72 hrs: Thidiazuron (6.4 oz) + Ethephon (32 oz)

Key Takeaways so far...

- ▶ As expected, defoliating pecan trees greatly reduces the amount of wind force exerted on trees.
- ▶ Preliminary data indicates pecan trees would need to be defoliated by 60-75% to significantly reduce blow-over and limb breakage.
- ▶ Copper + UAN and Thidiazuron + Ethephon showed promising results.
 - ▶ Provided suitable defoliation of trees but just outside the ideal 24-48 hour window.

Pecan Research

▶ Future Research Objectives:

- ▶ 1. Continue evaluating defoliants with an emphasis on speed of defoliation and crop safety.
 - ▶ We will test different surfactant/penetrant combinations with our best treatments to try to improve speed of defoliation.
- ▶ 2. Scale up to full-size trees once successful defoliant treatments are identified.
- ▶ 3. Impact of defoliation on yield for current and future growing seasons (bloom and fruit set data, 2020)
- ▶ 4. Winch Test: force to uproot trees

The background features abstract, overlapping geometric shapes in various shades of blue, ranging from light sky blue to deep navy blue. These shapes are primarily located on the right side of the frame, creating a modern, layered effect. The rest of the background is plain white.

“If we knew what we were doing, we wouldn’t call it research, would we.”

Albert Einstein

- ▶ Specials thanks to the AFVGA, E.V. Smith Research Center Staff and the Line Item Grant Committee for their support!

QUESTIONS?

