Alfalfa Stem Nematode Management in Alfalfa Production

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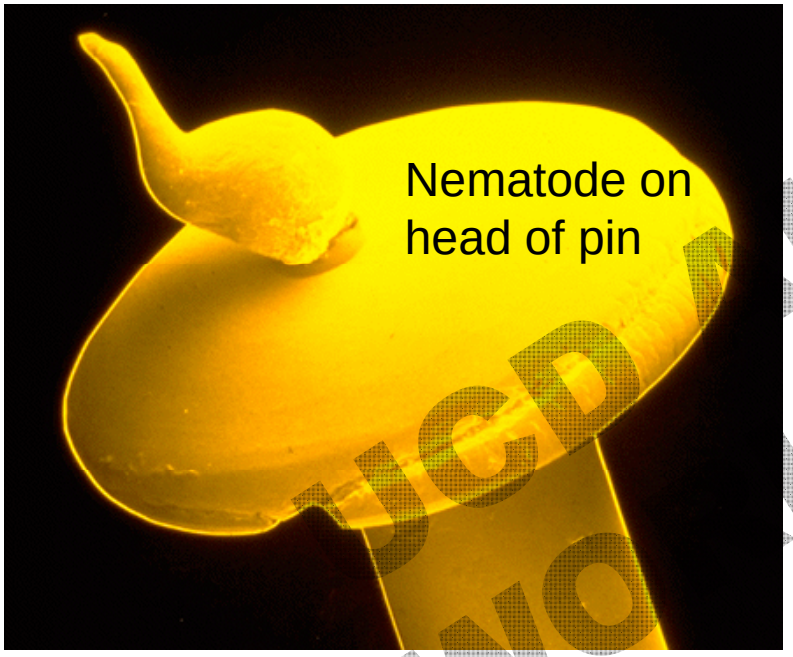
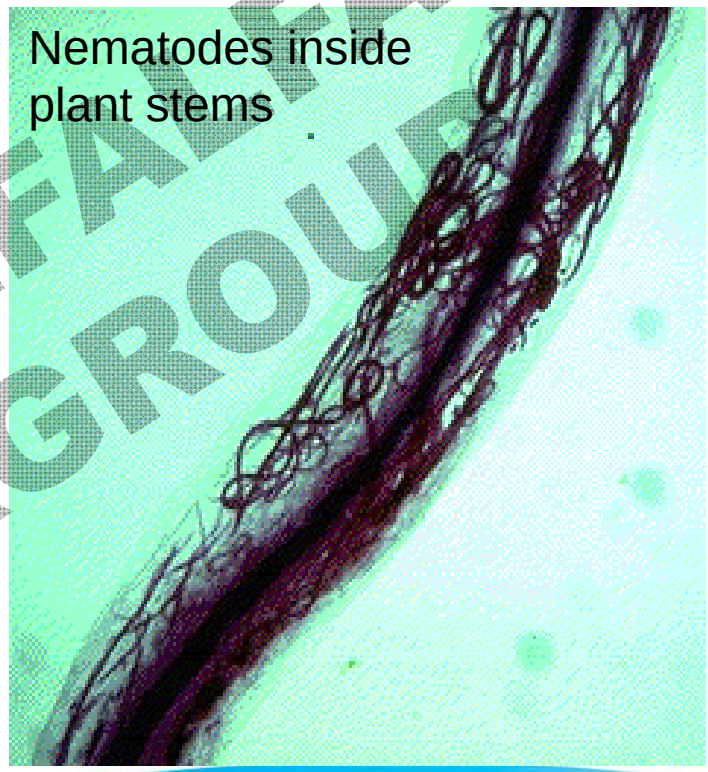
Nematodes are microscopic roundworms that live in the soil and in plants or plant debris. Most are harmless or beneficial, but some such as the alfalfa stem nematode are plant parasites that can reduce crop yield and quality.





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Alfalfa Stem Nematode:

•In group of stem and bulb nematodes because they feed on the above ground portions of the plant (crowns, stems, leaves).

•Alfalfa is the only known host (although it can survive on potatoes and sainfoin).

•Damage includes shortened internodes and swollen stems.

Plants may become severely stunted (stem nematode infested plant on left, healthy on right)

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Other symptoms include small, deformed leaves

•Infestations can be patchy with levees looking better than the rest of the field. May be due to water movement (nematodes spread with water).

•Usually only first cutting affected as stem nematodes prefer cooler, moist conditions (60-70^{o}F), then stand recovers.

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In severely affected fields, stands may never fully recover because feeding by nematodes can damage the crown, causing crown rot from secondary pathogens such as *Fusarium*.

Alfalfa Stem Nematode

•Found in alfalfa in California prior to 2009, but not causing much damage.

•2009 first record of widespread significant yield losses followed by another bad 2010 year with increased damage. Losses primarily in the Sacramento and Northern San Joaquin Valley.

•Estimated losses: Unknown, likely over $50 million per year (yield, quality, stand decline).

What triggered the sudden alfalfa stem nematode outbreaks and why are they more severe in the North vs. South Central Valley?

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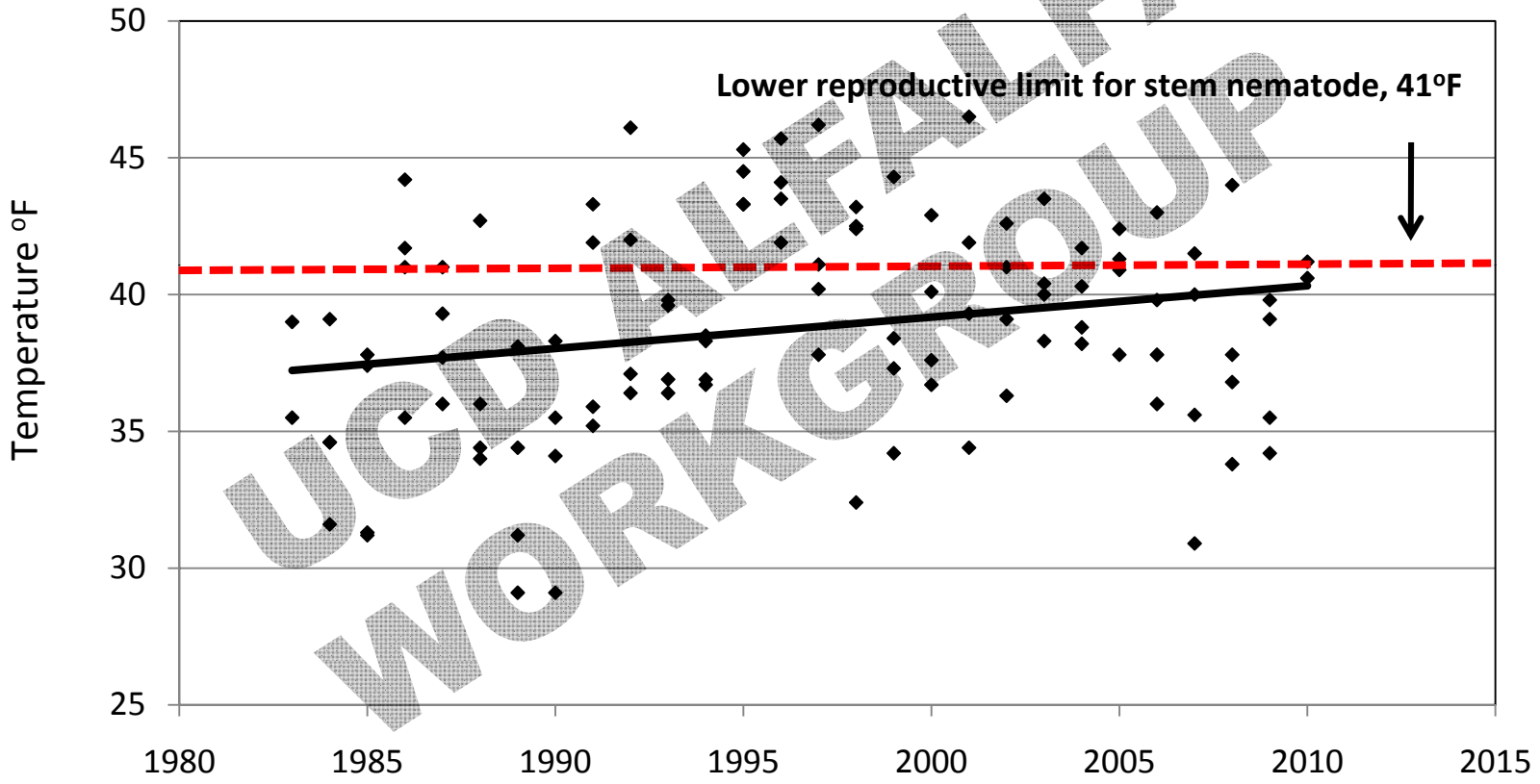
1) INCREASING WINTER MINIMUM TEMPERATURES

Average winter minimum ambient temperatures, 1983-2010 for Davis, CA (CIMIS weather data).



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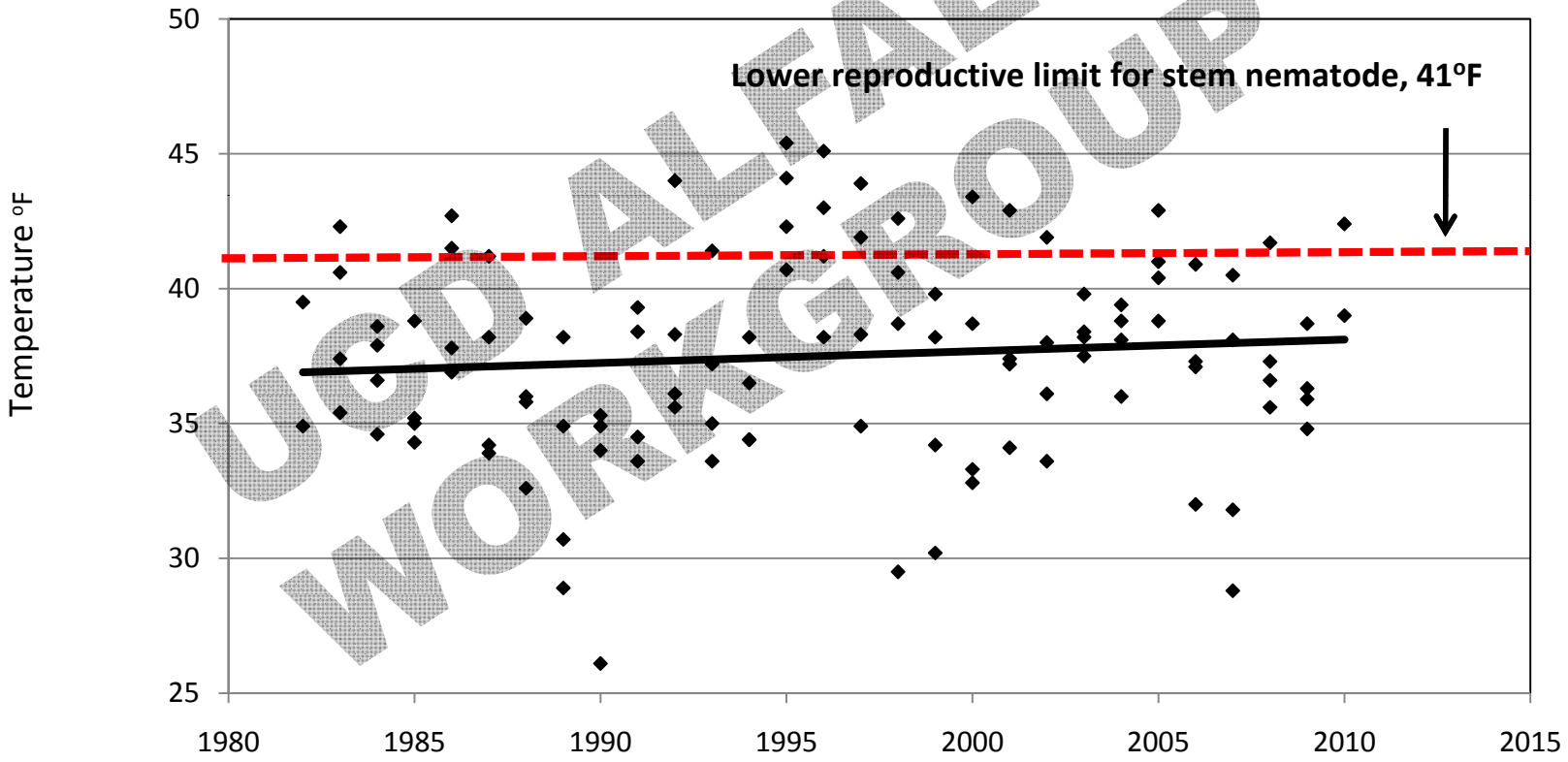
1) TEMPERATURE

Average winter minimum ambient temperatures, 1983-2010 for Shafter, CA (CIMIS weather data).



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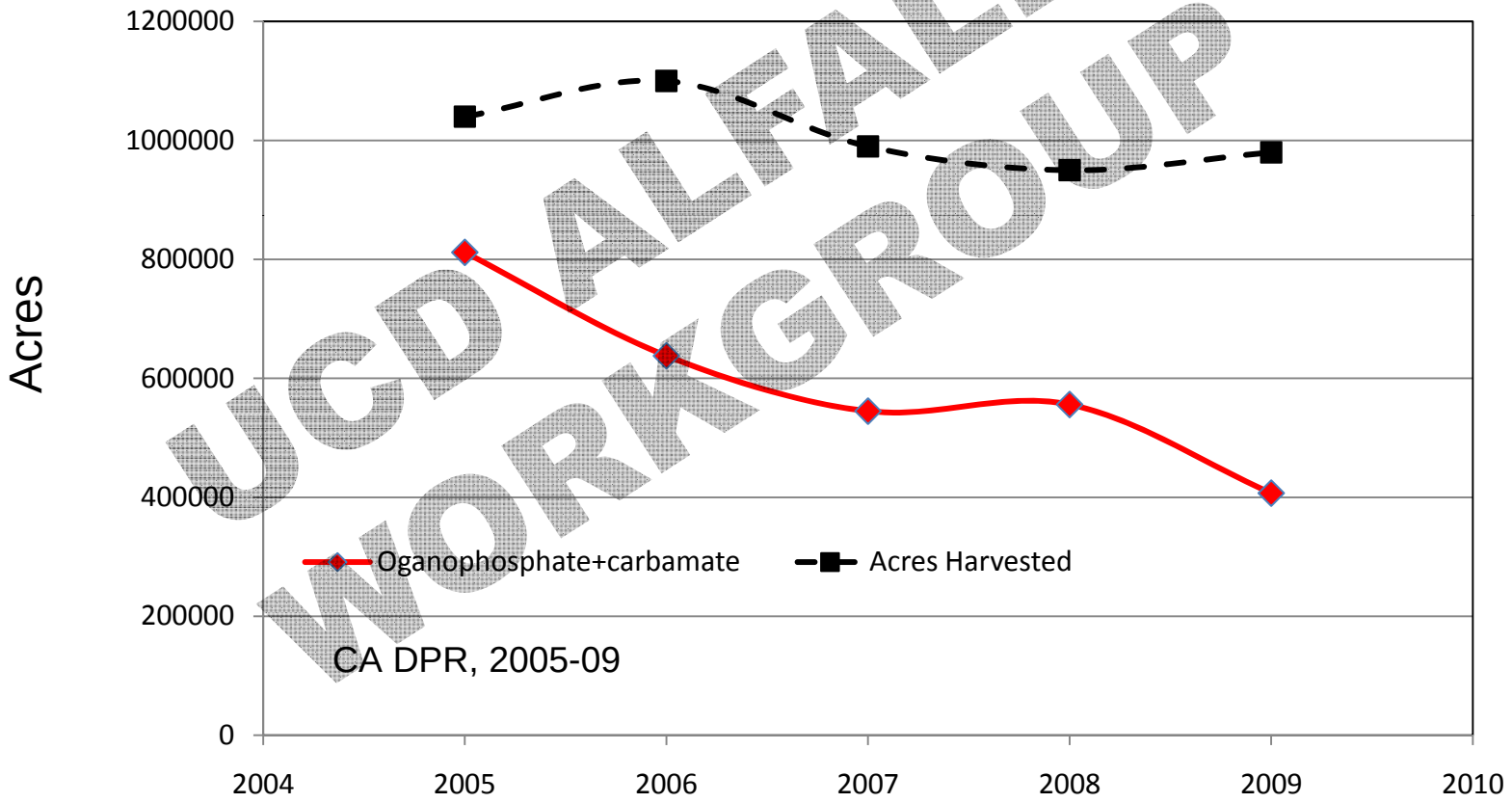
2) DECREASE IN ORGANOPHOSPHATE (OP) AND CARBAMATE USE

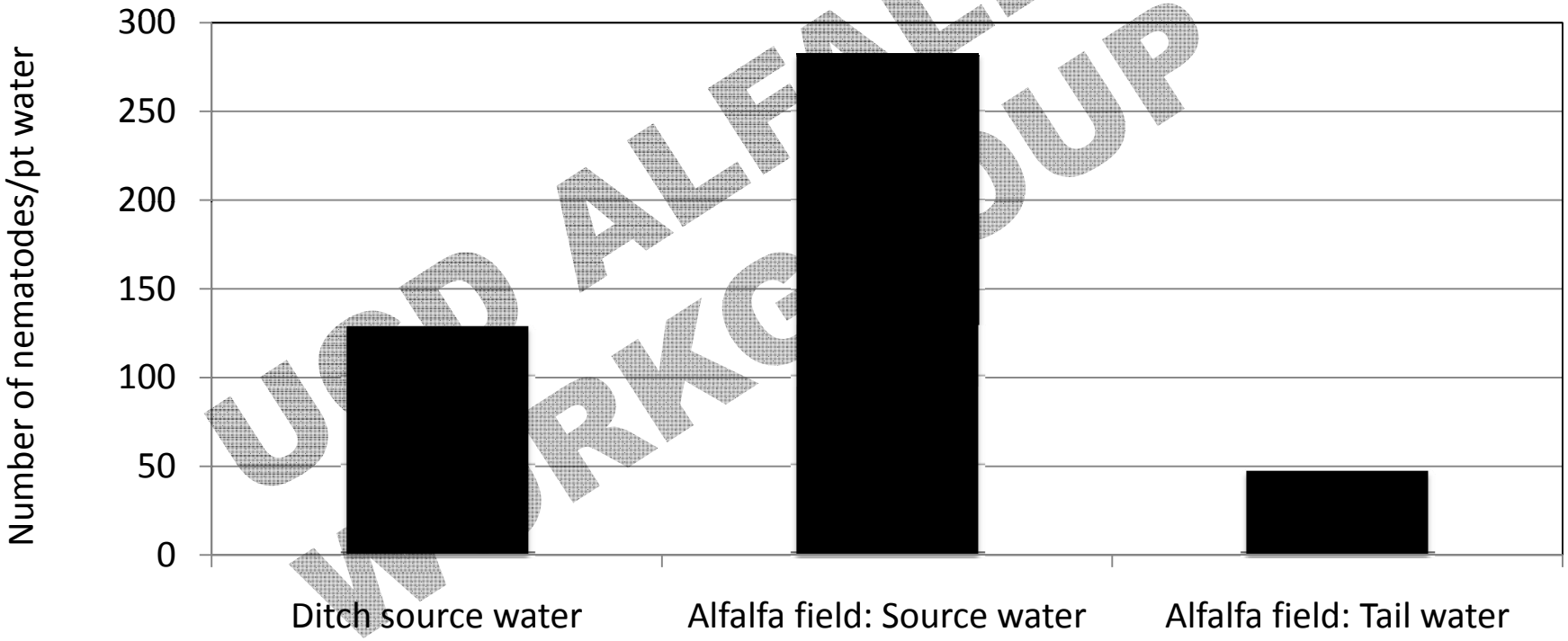
Number of acres of alfalfa and OP and carbamate use in alfalfa*. Insecticides suppress nematodes (nerve agents).



*chlorpyrifos, malathion, carbofuran, phosmet, and methomyl

3) STEM NEMATODES SPREADING IN IRRIGATION WATER

Average number of stem nematodes per pint (16 oz) of water, Yolo County, CA, 2010.



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Data from: CalWest Seeds, Lei E and LeGault 2010

•Three factors combined (increasing winter minimum temperatures, decrease in OP and carbamate use, and re-use of infected water) may have increased stem nematode populations, overcoming current resistance levels in the alfalfa plant.

•Stem nematode is likely here to stay.

Alfalfa Stem Nematode Management

1) Crop rotation:

Rotation with non-host crops such as tomatoes, sunflowers, and wheat on a 2 to 4-year basis will reduce alfalfa stem nematode populations (longer rotations are better). Control volunteer alfalfa on levees.

Note: Overseeding with grasses is not a rotation, since alfalfa hosts remain in the field.

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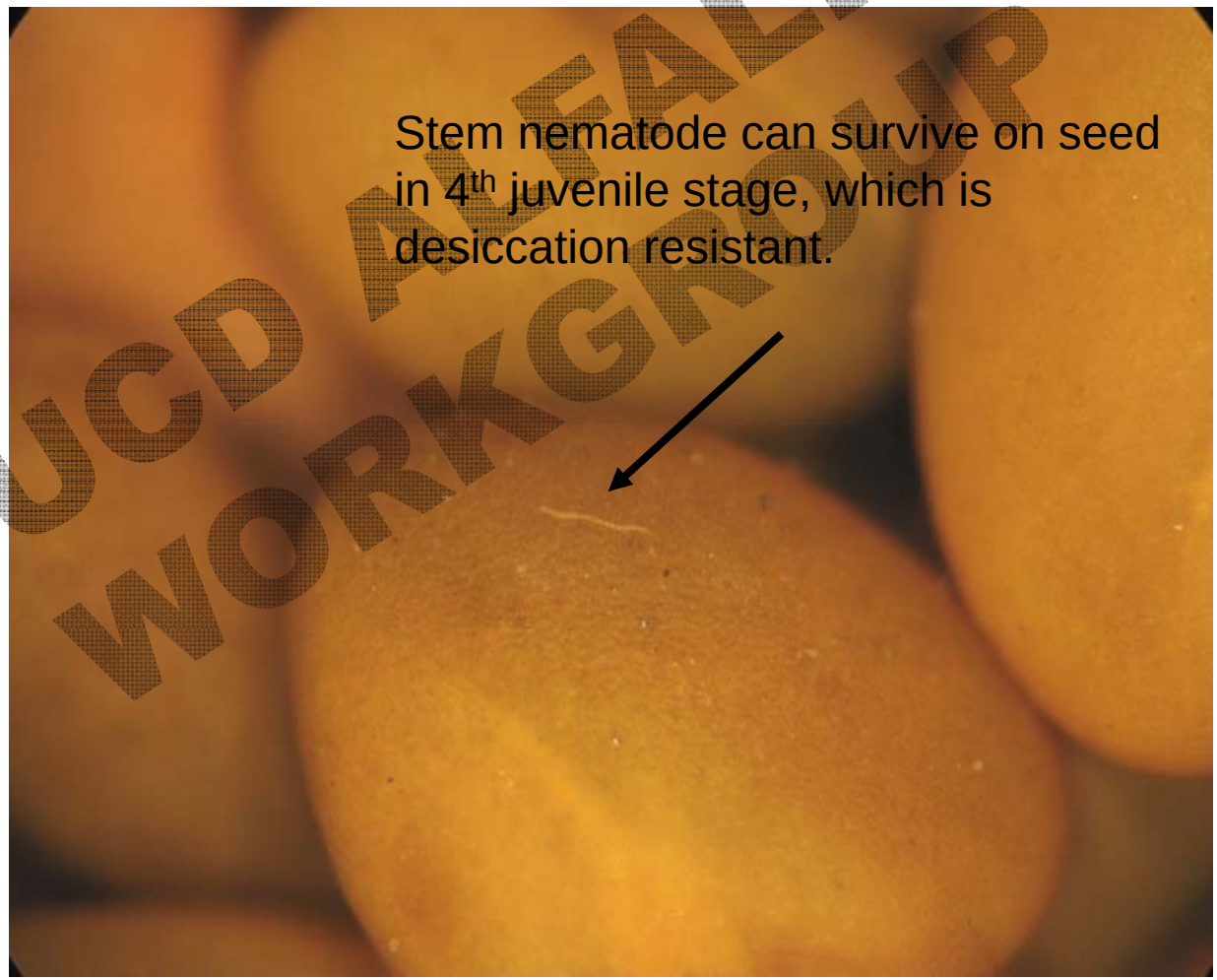
Alfalfa Stem Nematode Management

2) Certified seed: Plant certified seed to minimize risks of introducing alfalfa stem nematode as well as other pests, weeds, and diseases in their fields.



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Alfalfa Stem Nematode Management

3) Plant resistant varieties (Mechanism likely biochemical with nematodes chemically prevented from reproducing in plant)

Pest and Disease Resistance Ratings:

0-5% Susceptible
6-14% Low Resistance (LR)
15-30% Moderate Resistance (MR)
31-50% Resistance (R)
>50% High Resistance (HR) (considered good for alfalfa)

•Consult table in proceedings with alfalfa varieties considered to have the best chance of providing resistance to stem nematode.

•Resistance is not immunity, and even the best highly resistant varieties may become infected and develop symptoms under high nematode pressure.

•Plant breeders are currently working on developing varieties showing at least 70% stem nematode resistance (3 to 4 years away).

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4) Water management. Water reused from stem nematode infected fields may be a major source of infection for healthy fields. Minimize runoff from infected fields and prevent moving this water to non-infected fields when possible.

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5) Equipment Sanitation

Avoid moving contaminated farm machinery from stem nematode infested fields to clean fields.

•Harvest healthy fields before stem nematode infested fields.

•Clean equipment when moving from a stem nematode infested field to a clean field. Use high-pressure washer or blower, or cut grass hay prior to moving equipment back into alfalfa.

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6) Livestock. Uncomposted manure from animals fed stem nematode infested hay may be a source of this pest. Sheep grazing in the alfalfa for winter weed control can also move the stem nematode around fields via tracking dirt on hoofs.

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7) Pesticides?

Treatments

1) DiTera: microbial nematicide
2) Cobalt: chlorpyrifos (Lorsban) + pyrethroid
3) Movento: systemic insecticide, spirotetramat
4) Spinetoram: spinosad
5) Agri-Mek: abamectin, miticide/insecticide
6) Vydate: nematicide/insecticide

Materials applied at recommended field rates
March 13, 2009, Yolo Co., CA

Note: Only Cobalt registered for use in alfalfa

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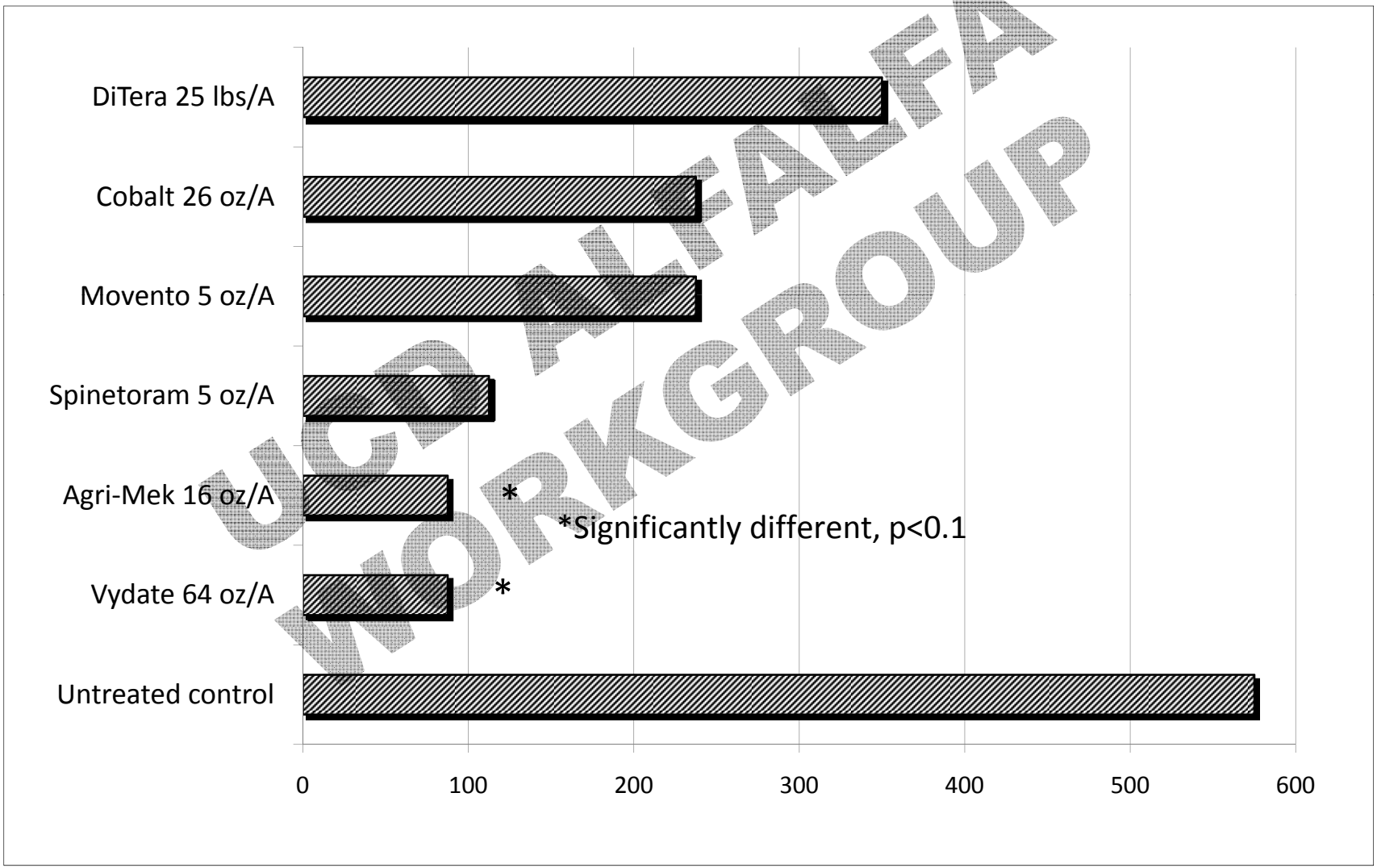
2009 INSECTICIDE TRIAL

Number of stem nematodes per liter of soil, Yolo County, CA, 5 weeks post treatment.



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Yield

No treatment effect on yield (Fall and Spring treatments, Colusa and Yolo Counties).

Pesticides not likely controlling nematodes in plants.

Pesticides not recommended for stem nematode control at this time.

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Summary

Severe stem nematode infections in 2009-2010 in the Sacramento and Northern San Joaquin valley. Likely will continue to be a significant pest (increasing minimum winter temperatures, reduction in OP and carbamate insecticides, and found in irrigation water).

In stem nematode infested areas, sample fields prior to planting to be sure fields are clean to prevent damage to seedling fields.

Pesticides can reduce stem nematodes in the soil, but not to zero, and in trials to date, have not controlled plant-based infection or reduced yield loss.

Crop rotation, variety selection, certified seed, and equipment sanitation remain our primary tools for managing stem nematode in alfalfa.

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Water quality issues

•In 2010, chlorpyrifos (Lorsban, Lock-On, Cobalt) found in surface waters at levels toxic to aquatic invertebrates in Yolo and Solano Counties. Alfalfa source from weevil sprays.

•In some counties chlorpyrifos is a restricted material and use permit required (ie. can't apply 72 hr before a rain).

•Manage irrigation water to minimize or prevent tail water.

•Follow IPM practices for alfalfa hay production (http://ipm.ucdavis.edu)

•If insecticides needed, choose those with low risk to water quality (ie. pyrethroids for weevil control).

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