

Sampling methods and development of thresholds for use under conventional and mating-disruption based management of navel orangeworm

Jay Rosenheim, Matthew Meisner, Jonathan Ackerman, University of California Davis
Bradley Higbee, Wonderful Orchards



Background

There are many possibly useful methods for estimating NOW populations:

- prior-year infestation of crop
- mummy nut densities and infestation % after sanitation
- egg traps
- traps for adult females, using almond meal as an attractant
- male catch at traps baited with virgin females or synthetic lures
- pre-harvest samples of early hull-split nuts

Research goal: Build a model that predicts NOW damage at harvest.

What sampling methods make the biggest contributions to accurate predictions?

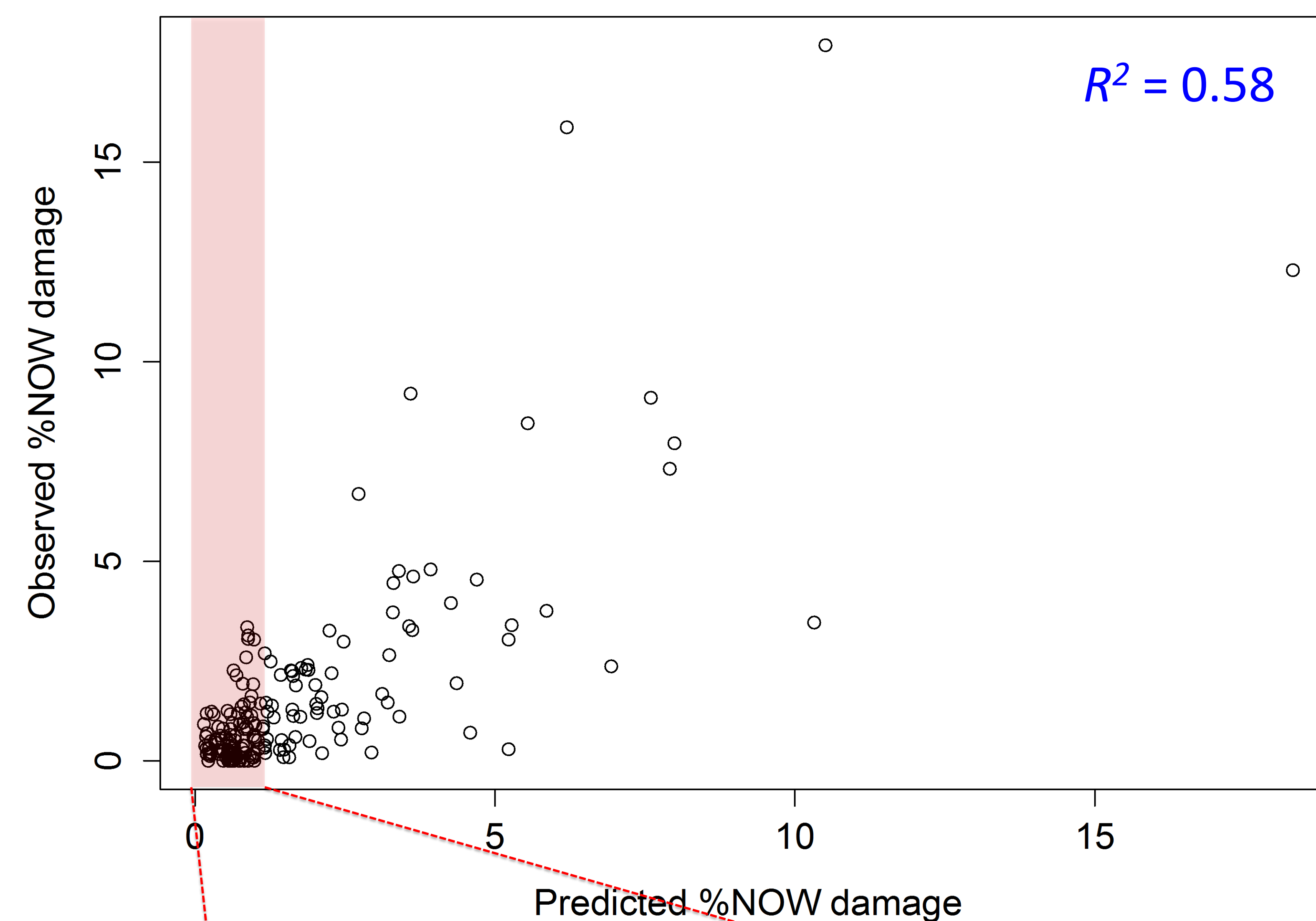
Methods

We worked with a pre-existing dataset, generated during a multi-year area-wide mating disruption research trial that included plots managed with mating disruption only, conventional insecticides, and a combination of the two. Almonds were grown in two locations over seven years (2009-2015). Generalized estimating equation (GEE) models were fit for a binomial response variable and a logit link, and recognizing the repeated-measures nature of the data.

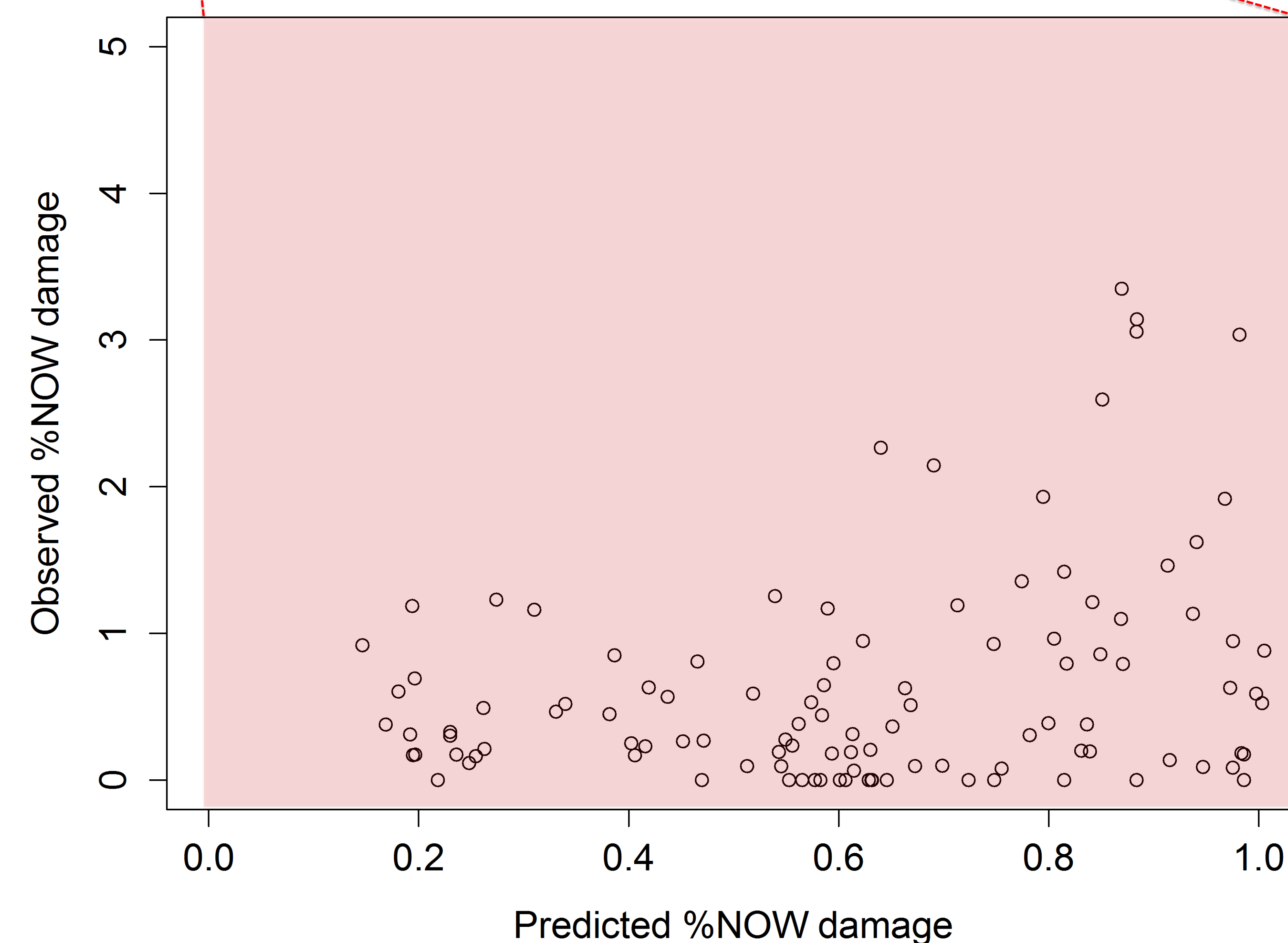
Results

Prediction of NOW damage levels at harvest is possible by integrating information from many contributing predictors, including: (1) year effects ($P < 0.001$); (2) the number of hull-split sprays ($P = 0.003$); (3) the number of NOW larvae found per tree in mummies after sanitation ($P < 0.001$); (4) egg trap catches March-June ($P = 0.05$); (5) adult males caught March-June in traps baited with virgin females ($P = 0.004$); (6) females caught June 15-Aug 15 in almond-meal baited traps ($P < 0.001$); and (7) infestation in pre-harvest nuts sampled June 15 – Aug 15 ($P < 0.001$). A model incorporating these predictors explained 58% of the total variance in NOW damage at harvest (Figure – top panel). Blocks predicted to have $< 0.5\%$ damage at harvest rarely exceeded 1% actual damage (Figure – bottom panel).

Observed vs. Predicted damage



Observed vs. Predicted damage; predicted damage $< 1.0\%$



Thresholds

Growers may have different targets for % nuts damaged at harvest. Damage can be predicted by careful sampling. To cope with uncertainty in damage predictions, growers may wish to build in a safety margin. For example, to achieve damage $< 1\%$, growers may want to treat blocks predicted to have damage $> 0.5\%$.