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# Predicting Cross-Pollination and Nut Set in Almond Orchards Using Weather, Orchard Design and the Size of the Pollinator Population

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**Project No.:** 08-POLL1-DeGrandi-Hoffman

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## **Objectives:**

- Objective 1: Determine the progression of bloom for almond cultivars based upon temperature.
- Objective 2: Estimate the number of bees on trees of different cultivars throughout bloom.
- Objective 3: Estimate the proportion of bees carrying cross-pollen while foraging almond blossoms
- Objective 4: Estimate cross-pollination rates and nut set.

## **Interpretive Summary:**

Data on blossom opening, honey bee foraging activity and nut set were collected from an orchard planted with Nonpareil, Fritz, and Monterey. The data were incorporated into a web-based software package to predict nut set based upon orchard design, weather conditions, and size of the honey bee population foraging on almond trees. The structure of the model has been defined and programming of the software package has begun. Data analysis and incorporation into the program of equations derived from the field data are under way.

The 2008 almond bloom season was the first year of field data collection. Based upon the data we collected on the number of open blossoms and resulting bloom overlap among cultivars and the number of days when foraging weather occurred, the model predicts that nut set on Fritz and Monterey would be higher than Nonpareil. This is because there were more days when bees could forage on both Fritz and Monterey compared with Nonpareil, but more importantly, compatible pollen was available for cross-pollination of Monterey and Fritz blossoms on their first day of bloom. Nonpareil blossoms were open for several days before compatible pollen from Fritz or Monterey was available so even though bees were foraging on Nonpareil trees, cross-pollination and nut set were not occurring. The model also predicts that set on Fritz would be higher than Monterey because there was compatible pollen from both Nonpareil and Monterey available early in Fritz bloom. Foraging populations would establish on Nonpareil and Monterey and assuming significant pollen transfer in the hive was occurring, most of the pollen on the bodies of foragers would be from those two cultivars. Thus, the first Fritz blossoms visited on each foraging trip would be cross-pollinated. Indeed Nonpareil initially set only 39% of its blossoms into nuts compared with 48% for Monterey and 67% for Fritz. Simulations with the model indicate that increasing populations of honey bees can improve nut set, but ultimately the design of the orchard and choice of cultivars determines the maximum nut set under any set of weather conditions.