Pollinating Almonds with Blue Orchard Bees: Impacts on yield and insight into sustainable bee production

Theresa Pitts-Singer, Natalie Boyle, Diana Cox-Foster, and Derek Arzt
USDA-ARS-PWA Pollinating Insect Research Unit, Old Main Hill UMC 5310, USU- BNR 261, Logan UT 84322

BOBs synthesize honey bees in almond pollination!

2013-2014 Research in Almonds in Wonderful Orchards by ARS - (publication in preparation)

- Research was performed to ask how BOBs (honey bees) impact yield when used in conjunction with honey bees (2 hives per 0.4 ha) with BOBs (460 females per 0.2 ha) versus honey bees only (2 hives per 0.4 ha).
- We used orchards in both Northern (n = 8) and Southern (n = 12) ends of the San Joaquin Valley to evaluate how location, climate and management practices influence BOB pollination efficacy.
- BOB efficacy was evaluated by measuring BOB reproduction, fruit set and nut yield within each orchard. By evaluating fruit set and nut yield resulting from orchard co-polinated by both honey bees and BOBs, we evaluated the direct impacts that BOB pollination has on overall almond production.
- Northern valley almond crops during bloom (likely affected overall BOB and maybe HB) pollination efficacy in those areas.
- Synergism between BOBs and HBs was also found by Steve Peterson at AgPollen in 2014 in northern almond orchards and by Brittain, Williams, Kremer, and Klein (Proc. R. Soc. B (2013) 280: 20122767) in cage studies.

Wonderful Orchards: 2014 Blue Orchard Bee Effect on Almonds

A model has been constructed to examine of impact of BOBs and honey bees on almond yield and economics of BOB use (Mur Kohn, Eric Lonsdorf, Derek Arzt, Theresa Pitts-Singer, Taylor Ricketts, In preparation). The best fit regression model uses the following variables: density of foraging BOBs and honey bees (BOB, and HB), on individual tree, block effects (Hills), and distance to boundary (DOB) for each distance decay parameters of BOB (DOB = decreasing likelihood of foraging from nest to tree) and honey bees.

- The sampled nut yield varied by the density of BOB (BOB).
- Model included additional costs to growers such as one HB hive rental and other production costs.
- Estimated net profit was affected by 8 BOB/acre, 8 BOB nesting boxes/acre, and 8 nesting tubes/box.
- Estimated net profit varied from a decreased $90 per acre to $4000 per acre, depending upon these parameters.

BOBs prefer to nest in BLUE boxes that have about 50-100 nest tubes or cavities in box.

A chemical attractant has been defined by ARS researchers and patented. Use of the attractant increases the nesting of BOBs and keeps them where released (in tests by Steve Peterson and by ARS).

BOBs require mud for nesting: water application to soil is essential for pollination.

How to maximize the use of BOB in Almond Pollination

Pollination by BOBs depends upon several factors:
- Incubation of BOB cocoons for release of adults into field
- Nests (size of boxes, color of boxes, placement of boxes)
- Nesting tubes (number per box)
- Attraction of nest tubes to female BOBs
- Availability of mud for construction of nest cell partitions
- Available pollen supplies (overcoming limited almond pollen if short bloom period or high-level competition with other bees)

BOB cocoons with diapausing bees are purchased and require incubation at warmer temps; chilling the bees at night causes problems.

How to get sustainable BOB supply for pollination

- Fungicide spray during bloom are common in many almond orchards and can disrupt BOB nest recognition (Arts et al. 2016)
- Parasites can be problematic year round
- During nesting: HBs and BOBs
- During nesting and storage: Mites, bacteria, viruses, mites, pollen refers.
- Trapping and mark and recapture and currently under development

Floral Enhancements

Coliasia ciliata
Euchromia californica
Tetragonisca angustula
Nemapogon maculatus
Nemapogon nicians

Like honey bees, BOBs are impacted by pathogens, parasites, and pesticides. Current research at PIRU is focused on these factors and asking how they interact to impact BOB health. The goal is to enable BOB use in pollination while promoting pollination and crop yields.