Demonstration of Using Blue Orchard Bees as a Supplement to Honey Bees for Almond Pollination

Project No.: **09-POLL8-Pickel**
09-POLL8A-Cane/Pitts-Singer

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Objectives:

The primary goals of this project are to: 1) Demonstrate the critical management practices and their timing for practical use of Blue Orchard Bees (BOB) as almond pollinators in the presence of honey bees; 2) Refine the summer and fall handling of BOB progeny with regard to proper timing of prewinter cool down; 3) Anticipate or address the practical problems that arise when these bees are put in the hands of attentive almond growers; 4) Indirectly estimate BOB's additional contribution to almond yields in the presence of honey bees.

Interpretive Summary:

Hands-on practical expertise and conceptual understanding of Blue Orchard Bee (BOB) management was delivered by Logan Bee Lab personnel to UC Extension, particularly Sara Goldman-Smith. Thus trained, she was able to take over adult BOB observation, management, interpretation and guidance for cooperating growers. To facilitate extension and grower technology transfer, we prepared BOB Demonstration Kits for UCCE personnel and participating growers. Two BOB management / training workshops for interested growers have been organized by the UCCE personnel and are scheduled for December in Chico and Modesto near Modesto and Chico. They will be led by Logan Bee lab personnel.

2008 Field Studies

In 2008 with good pollination conditions, we were able to increase two of the three BOB populations. These populations flown a second year in almonds originated from Washington (Butte County orchard) and from California (Turlock orchard) **(Table 1)**. A population flown for the first time in almonds (Butte orchard) originating from Utah did not perform well. Normally Washington and Utah populations fly in April and it has be a challenge synchronizing BOB flight with the earlier almond bloom the first year. These transition populations have a compressed wintering time affecting their emergence.

Table 1. Summary of emergence and nesting performance of BOB in 2008

Bee source and year in Calif.	*Females Released*	*Progeny (Fem./Male)*	*Cells produced per female*	*Total Cells produced*
Wash. Yr. 1	300	653/1223	8.93	2679
Utah Yr. 1	300	111/206	1.45	
California	300	618/1020	7.8	2341

The 2008 bloom was not monitored in relation to emergence, but as nesting performance indicates, bee-bloom synchrony was good for the Washington and California populations. The Utah population emerged late and emergence was extended, resulting in poor nesting performance.

2009 Field Studies

In 2009, all BOB populations were placed in Butte County orchards. Bloom time conditions here were poor, with only 92 bee flight hours vs. 175 for 2008. Hours were tracked from February 1 to March 8. As a result most populations did not perform or increase as well as possible **(Table 2)**.

Table 2. Summary of emergence, flight and bloom synchrony, and nesting performance of BOB in 2009

Bee source and year in Calif.	*First flight*	*10% bloom*	*Females Released*	*Progeny (Fem./Male)*	*Cells produced per female*	*Total Cells produced*
Wash. Yr. 1	Feb. 19	Feb 15	300	66/144	0.78	233
Wash. Yr. 2	Feb. 8	Feb. 18	553	333/702	2.13	1176
Utah Yr. 1	Feb. 24	Feb. 19	300	6/16	0.087	26
Utah Yr. 2	Feb. 12	Mar. 1	78	180/357	7.3	572
Calif. Yr. 2	Feb. 19	Feb. 10	191	11/17	0.16	30

Despite advanced wintering of first generation bees from Washington (yr 1) and Utah (yr 1) their emergence was marginally late, missing early almond bloom. Normally Washington and Utah populations fly in April and it has be a challenge synchronizing BOB flight with the earlier almond bloom the first year. These transition populations have a compressed wintering time affecting their emergence.

In contrast, the second generation Washington (yr 2) and Utah (yr 2) populations emerged in good timing to service the entire bloom period of almonds, yet not so early as to risk starvation. The first generation of these populations pollinated 2008 almonds.

Of concern is the late emergence of the California population, which should have been better acclimated to almonds, because the prior generation pollinated 2008 almonds.

Other confounding factors did or could have deterred BOB performance. A malfunctioning incubation box overheated and there was high mortality in the Washington year 1 adults that would have otherwise emerged.

Second, a large number of honey bee hives (~30) were placed near the California year 2 population shelters and there was competition for resources. Although BOB can forage effectively in the orchard with honey bees present, it is likely that the pressure from this large honey bee population had adverse effects on BOB nesting, especially because the flight hours were reduced due to the poor weather, indicating that both honey bees and BOBs were more restricted in their flight, forcing both groups into the closer trees and depleting resources. The orchard was too wet to move the honey bee colonies until quite late.

Lastly, high usage of fungicides during bloom, particularly in the orchard where the California populations were located, could have impacted the BOB. There were 11 fungicide applications in this orchard, compared to 3-5 at the other 4. Prior observations indicate this may be a factor, although there are no data for fungicide impact on BOBs.