Almond pollination and honey bee colony density

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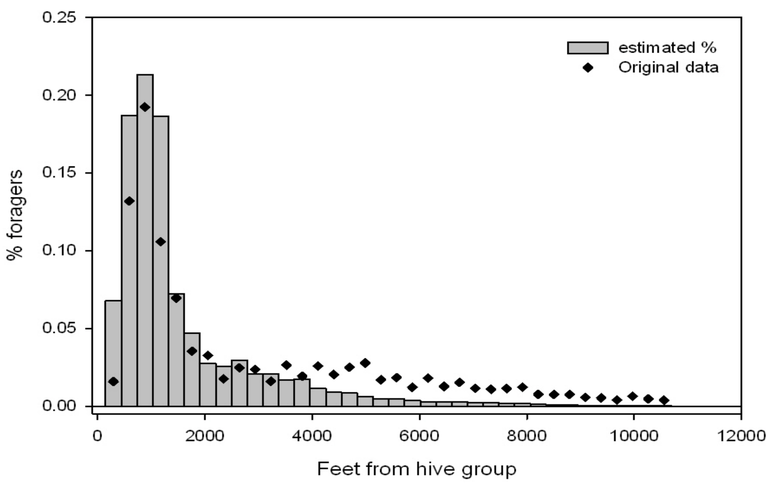
The rise in colony rental prices has caused some almond growers to reduce the number of colonies per acre. This study examined the impact lowered colony density has on pollination and harvestable nuts.

Materials & Methods

Colony density was measured two ways: a) the nominal density is the number of colonies set around an orchard; b) the effective density is based on the number of colonies set around the orchard plus the number of colonies within 1.5 miles of the test orchard. The distance a colony is from a particular tree, plays a large role in the portion of foragers from that colony that is likely to visit it.



In a typical almond Plantings,about 50% of all foraging trips are within a quarter of a mile of the colony; 90% are within 1.5 miles.

Colony size also plays a role. Bigger colonies typically have more foragers. So does the weather and the attractiveness of flowers.

Wegis North soft and hard shell orchards

Test orchards were matched for varieties, tree age, and management. The orchards above (Wegis Farms) show a typical layout. A hardshell orchard (Butte, Padre) on the left and an early variety orchard (Fritz, Nonpareil, Monterey) on the right. The dots represent a tree row. There were usually 20 trees per variety monitored for pollination, but some orchards had 30. These Wegis Farms orchards were stocked with 1.0 colony per acre for the low colony density level. About 1.5 miles away, the matching pairs of early and late variety orchards were stocked with a higher effective density of colonies.

Percent pollination for softshell cultivar Fritz: early bloom 20-23 Feb 2011

Bee exposure (hours or days)	n (trees)	One colony/acre	Two colonies/acre
0 (negative control)	10	1.1 a	0.9 a
0.5 hrs	20	19.2 a	33.9 b
1.0 hrs	20	28.4 a	36.9 b
2.0 hrs	20	34.4 a	41.8 b
4.0 hrs	20	39.8 a	53.0 b
1 day	20	41.8 a	52.4 b
2 days	20	55.4 a	61.0 b
3 days	20	52.4 a	70.7 b
Positive control-low	20	68.0 a	76.2 b
Positive control-high	20	62.8 a	72.4 b

Conclusions: 2011

Increased flower exposure to bees increased % set (pollinated)

More pollination occurred with 2 colonies/acre than with 1 for the early cultivars.

Pollination levels were substantially higher for early cultivars than for hardshells.

The rate at which flowers were pollinated was fastest at the start of exposure.

Fritz was pollinated at faster rate than Nonpareil.

A greater percentage of Fritz flowers were pollinated than Nonpareil.

Video recordings found that foragers in high bee density blocks remained on a flowering branch longer than foragers in low density blocks.

Foragers in high density orchards visited significantly more flowers on a branch than those in the lower density orchard.

Single visits to Nonpareil and Fritz flowers resulted in 4.6 and 24.0% pollination, respectively

2012 pollination: hardshell varieties

Percent of pollination for late varieties

Ranch: Colonies/acre		Butte	Padre	Mission
Wegis	1.0 colony	27.9 a	34.6 a	---
Wegis	1.5 colonies	44.9 b	47.4 b	---
King	1.08 colonies	55.0 a	61.9 a	---
King	1.33 colonies	53.6 a	53.0 b	---
King	2.16 colonies	68.5 b	65.7 a	---
Premiere	1.75 colonies	65.4 a	56.7 a	40.5 a
Premiere	2.5 colonies	71.3 a	66.5 b	48.8 b
SVF	2.0 colonies	44.8 a	37.9 a	54.1 a
SVF	3.0 colonies	58.4 b	49.5 b	58.7 a

Percent of total flowers that produced a harvestable nut: Late varieties

Ranch, Colonies/acre		Butte	Padre	Mission
Wegis,	1.0	23.5 a	28.4 a	---
Wegis,	2.0	30.8 b	30.9 b	---
King,	1.0	36.0 a	43.4 a	---
King,	1.33	38.0 ab	32.7 b	---
King,	2.16	43.0 b	39.6 a	---
Premiere,	1.75	41.3 a	31.2 a	28.0 a
Premiere,	2.5	42.1 a	34.2 a	32.2 a
SVF,	2.0	18.5 a	19.2 a	18.3 a
SVF,	2.5	35.9 b	25.2 b	22.7 b

Conclusions: 2012

Most high density orchards had significantly higher pollination than low density orchards (60% early; 66% late varieties)

When differences between a pair of orchards were below about 6%, we did not detect a significant difference (range 1.2 - 20.2%)

Single visits to a Nonpareil and Fritz flower resulted in 4.6 and 24.0% pollination, respectively

Harvestable nuts: If our sampling procedure is predictive, then many of the high density orchards had a significant increase in nut production.

If a three percent increase in nut production is of economical value, then many of the high density orchards had a significant yield (monetary) increase.

(All the harvest data is not yet in for 2012)

Many Thanks!

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