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## Developing Field Strategies to Correct Alternate Bearing

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In alternate bearing 'Hass' avocado orchards, yield is reduced below the potential of the orchard and grower income is significantly reduced during off-crop years. The goal of this research is to increase grower profitability by clarifying whether treatments that increase summer and/or fall shoot growth can be used to increase floral intensity the following spring and, thus, yield by establishing which buds (apical or axillary), if any, on which shoot flush (spring, summer or fall) of on-crop trees remain floral and for how long. This information is essential to learn whether future PGR treatments can be designed to increase return bloom or whether only fruit thinning strategies will work and how they should be employed, i.e., which shoots should have fruit removed and the deadline before which fruit thinning must occur.

### **Executive Summary.**

This project is in its first year and is on schedule. A comprehensive set of fruit removal treatments are being implemented combined with exhaustive shoot tagging and bud sampling from shoots with and without fruit and from the 2007 spring, summer and fall flushes. Bud fate will be quantified in spring for both on- and off-crop trees. In this research, the on- or off-crop status of the tree refers to the current spring's bloom (heavy or light) and the crop that is set and developing now and will be harvested in 2008. The results of this research will

- Resolve whether increased exposure of buds to fruit inhibits irreversible commitment to flowering and/or inhibits bud break the following spring.
- Resolve whether mature or setting fruit or both are the cause of the inhibition.
- Identify by month and developmental stage when the inhibition occurs.
- Identify which buds (apical or axillary) on which shoots (spring, summer or fall flush) do or do not become irreversibly committed to flowering.
- Identify which buds (apical or axillary) on which shoots (spring, summer or fall flush) are inhibited at bud break the following spring.
- Identify which buds (apical or axillary) on which shoots (spring, summer or fall flush) contribute floral shoots (indeterminate and determinate) or vegetative shoots (sylleptic or proleptic) during the following spring bloom.
- Provide a second set of data to confirm the pattern of hormone transport from fruit related to the effect of fruit on bud fate.
- Resolve whether the inhibitory effect of fruit on return bloom is localized to shoots bearing fruit or a whole tree effect.

- Provide a second set of bud samples that can be analyzed for PGRs, carbohydrates or other compounds if required to clarify any aspect of the above that our earlier analyses cannot clarify.

**Project 1.** To increase grower profitability by clarifying whether treatments that increase summer and/or fall shoot growth can be used to increase floral intensity the following spring and the resulting yield by establishing which buds, if any, on on-crop trees remain floral and for how long.

**Background Information and Justification.** Our earlier research on alternate bearing produced results suggesting that fruit in some way inhibit inflorescence development. First, the effect of crop load on floral vs. vegetative shoot development is reciprocal. A heavy bloom setting and developing on-crop results in more vegetative shoots than floral shoots the following spring and more inactive buds (floral buds?). A light bloom setting a light off-crop results in more floral shoots and fewer vegetative shoots and fewer inactive buds the following spring. Removal of immature developing fruit from on-crop trees after December only increases vegetative shoot number in spring. PGR strategies that successfully increased the number of summer-fall shoots of on-crop trees (without removing any of the immature fruit) only increased vegetative shoot number in spring. Our working hypothesis is that fruit inhibit irreversible commitment to flowering, resulting in reversion of a subset of uncommitted floral buds to vegetative buds, but which buds on which shoots? Our alternate hypothesis is that fruit inhibit bud break of all or a subset of floral buds in spring, but not buds producing vegetative shoots, but again which buds on which shoots – axillary buds or apical buds on spring, summer, or fall shoots?

**Approach.** In a mature, commercially producing 'Hass' avocado orchard in Irvine owned by the Irvine Company fruit removal treatments are being implemented: (1) trees setting an off crop, remove mature fruit in July; (2) trees setting an off crop, remove setting and mature fruit in July to produce trees with NO fruit; (3) trees setting an on crop, remove only mature fruit in July; (4) trees setting an off crop, remove setting crop and leave mature on crop until the end of October; (5) trees setting an on crop, remove only mature fruit in July, THEN remove young fruit in August; (6) trees setting an on crop, remove only mature fruit in July, THEN remove young fruit in September; (7) trees setting an on crop, remove only mature fruit in July, THEN remove young fruit in October; (8) trees setting an on crop, remove only mature fruit in July, THEN remove young fruit in November; (9) trees setting an on crop, remove only mature fruit in July, THEN remove young fruit in December; (10) trees setting an on crop for bud sampling from shoots bearing fruit; and (11) trees setting an off crop for bud sampling from shoots with no fruit. For treatments 1, 2 and 3, we tagged all branches bearing mature fruit before these fruit were removed at harvest in July 2007. For treatments 1 through 9, we also tagged 12 shoots per tree without fruit and 12 shoots per tree bearing setting fruit before removal of setting fruit. For treatments 10 and 11, we tagged all shoots with and without setting fruit, respectively. Tagged shoots are tagged to indicate the start of the 2007 spring shoot flush, summer shoot flush and fall shoot flush. Monthly, apical and axillary buds are being collected from spring, summer and fall shoot flushes when available on a given sampling date for microscope analysis to determine which buds transition to flowering and which become irreversibly committed to flowering. Monthly, apical and axillary buds are being collected from spring, summer and fall shoot flushes when available on a given sampling date from five trees in both treatments 10 and 11 for hormone, carbohydrate or other analysis if required to clarify the effect fruit on return bloom. We are also collecting fruit exudates

monthly. During spring bloom 2008, the contribution of axillary and apical buds of shoots in the spring, summer and fall flushes will be quantified on the 12 tagged shoots without fruit and the 12 tagged shoots with fruit for treatments 1 through 9. This includes quantifying the number of indeterminate and determinate floral shoots, proleptic and sylleptic vegetative shoots and inactive buds. We thank Jess Ruiz of the Irvine Company, who is absorbing the lost income due to fruit removal.

**Results.** This is the first year of this project. The research is on schedule.