Developing Field Strategies to Correct Alternate Bearing (II)

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The goal of this research is to increase grower profitability by developing PGR strategies to mitigate alternate bearing. The strategies being tested are designed (1) to overcome apical dominance to stimulate summer and fall shoot growth during the on-crop year to increase the number of nodes that can bear floral shoots the following spring and (2) to increase spring bud break to increase the floral intensity of the return bloom and increase yield (putative off-crop). Trunk injection gives a strong response, eliminates the possibility of treatment failure due to poor leaf uptake and makes it possible to test more PGRs than could be tested as foliar sprays. Once the best PGR treatments are identified, foliar sprays will be developed and tested.

'Hass' Avocado Orchard – Irvine. In January 2009, we trunk injected on-crop 'Hass' avocado trees with GA_3, two different cytokinins and the auxin transport inhibitor tri-iodobenzoic acid (TIBA) and quantified the capacity of the PGRs to increase bud break and return bloom the following spring and yield in 2010. The January PGR treatments of TIBA alone or combined with compound X (a proprietary cytokinin) increased the total number of floral shoots produced by shoots with fruit compared to the untreated on-crop control trees (P = 0.0793). TIBA combined with compound X increased the total number of floral shoots and the number of determinate inflorescences (P = 0.0789) compared to untreated on-crop control trees. The treatment increased the number of floral shoots produced by the summer shoots (P = 0.0801). These results demonstrate the potential of these treatments to overcome the inhibitory effect of the on-crop on spring bud break and increase return bloom. Due to being replicated on only five trees, no treatment significantly increased yield. However, TIBA alone increased return yield more than 2.5-fold as both lbs and number of fruit per tree: compare 186 lbs (477 fruit)/tree for TIBA to 73 lbs (172 fruit)/tree for the untreated on-crop control. TIBA also increased the return yield of commercially valuable large size fruit (packing cartons 60+48+40) more than 2-fold: compare 106 lbs (226 fruit)/tree for TIBA to 53 lbs (109 fruit)/tree for the untreated on-crop control. TIBA combined with compound X did not result in an increase in yield. These results provide evidence that auxin (IAA) is accumulating and inhibiting spring bud break.

In July 2009 and January and/or February 2010, we trunk injected GA_3, two different cytokinins and (TIBA) and a second, natural product auxin transport inhibitor. No PGR treatment significantly increased return bloom in 2010 compared to the untreated on-crop control trees. Although several treatments increased floral shoot number by 50% more than the untreated on-crop control trees, the number was still 50% less than that of off-crop control trees. Injecting the PGRs into two main branches of the tree gave similar results to those obtained by trunk injection. Based on the bloom data, it appears that same amount of PGR will be required when injecting two main branches as is used for whole trees; the final interpretation requires the yield data from harvest in July 2011.

In July 2010 we repeated the above treatments as trunk injections and foliar sprays on three sets of trees. One set will receive no additional treatment, a second set will be treated again in January 2011 and a third set will be treated in February 2011. The trees in the experiment will be harvested in 2012.

Results of the trunk injections will be use to develop foliar-applied treatments to be tested in Year 3 of this project. We conducted a preliminary experiment testing the capacity of three foliar-applied treatments to increase floral shoot number and yield of on-crop trees. Both compound X and compound X plus TIBA increased the total number of floral shoots and number of determinate inflorescences to a value intermediate to the off- and on-crop control trees (P = 0.0856). Compound X applied as a foliar spray in July and January increased the number of determinate inflorescences on summer-fall shoots above that of on-crop control trees and equal to that of off-crop control trees (P = 0.0991). Yield for the trees treated in July 2009 and January 2010 will be determined in July 2011.

'Hass' Avocado Orchard – Santa Paula 2. The treatments discussed above were repeated in a second orchard in Santa Paula. This orchard had too few trees that bloomed following the heavy on-crop to provide reliable results.

Benefits of the research to the industry

Because alternate bearing is initiated by environmental factors, especially climatic events, e.g. freeze, high temperatures, etc, there is a recurring need for a strategy to mitigate alternate bearing once it is initiated. The goal of this research is to provide a foliar-applied PGR treatment that can be used to mitigate alternate bearing, which will contribute significantly to grower profitability. Based on our first yield results, we will test the efficacy of TIBA as foliar treatment applied to 20 individual tree replications to one set of trees in January 2011 and another set in February 2011 to increase return bloom and yield.