LABAVITCH

ALMOND ABSCISSION STUDIES

Annual Report - Project 82-I6

Project Leader: Labavitch

Objectives

The object of this study was to obtain a clear picture of the anatomical events which occur in the almond fruit abscission zone as separation of the nut from the tree occurs. Because an acceleration of abscission zone activity would be of benefit to early harvest operations the effects of various field treatments on nut removal were tested.

Interpretive Summary

Anatomical studies were carried out in parallel with measurements of the force required to separate the nut from the peduncle. This enabled us to determine whether an observed anatomical event was relevant to nut removal. The full range of cell separation events in the abscission zone occurred within one week. Samples collected on July 20 revealed the presence of small gaps between adjacent cells. By July 27 cells in the abscission zone were totally separated from each other except at the vascular bundles, which remained intact. Our study did not indicate any active processes that were involved in breakdage of the fibrous vascular bundles. A substantial decrease in fruit removal force (from 9.5 lbs to 5.8) was measured in this one-week period.

The data suggested that treatment of trees with Alar or the stressing of trees by withholding irrigation water accelerated maturation (by lowering the fruit removal force). Similarly, a transient, maturation-delaying effect appeared to be produced by application of "extra" nitrogen fertilizer (urea). In none of these cases did the difference persist for more than a week or two of sampling. Trees in all treatments appeared to be ready for harvest at the same time.

Procedures

The trees used in this study were six-year-old Nonpareils located in a single row at the Nickels' Estate in Arbuckle, CA. All trees received water via a drip system with four emitters per tree. Nut samples were collected on a weekly basis (8 trees/treatment; 7-8 nuts/tree) and sorted into maturity classes (according to Kester). A 50-nut sub-sample was taken for each treatment and tested for fruit removal force. The remainder of the sample was prepared for microscopy.

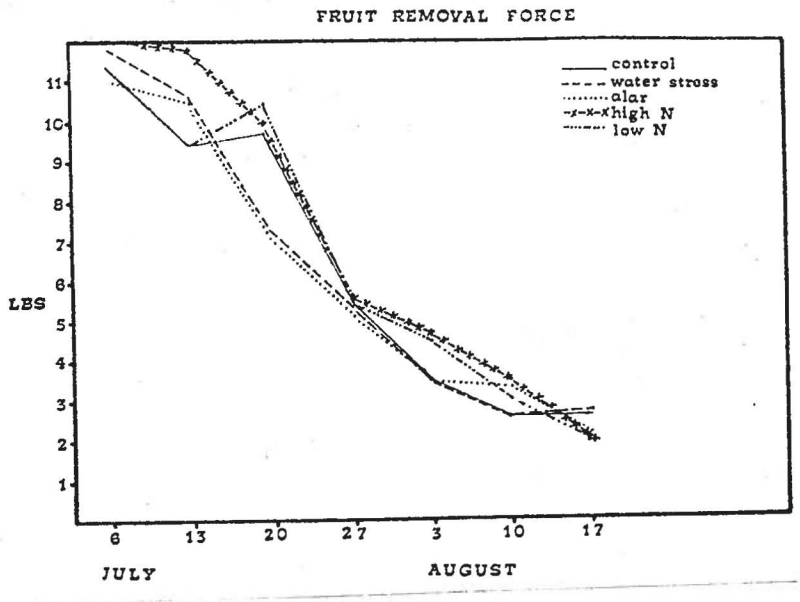
Some trees were subjected to water stress in late June through early July. Emitters to these trees were plugged. Periodic pressure-bomb readings were made to determine the extent of stress. Three levels of nitrogen fertilizer were provided to trees in a split application (May 7 and July 13). Urea solution was supplied

via the drip system. The normal dose was 400 g/tree. The low (250 g) and high (800 g) doses were supplied by combinations of emitter plugging and application, by hand, beneath emitters. Leaf samples were taken for leaf N determinations following each fertilizer treatment. A single drenching spray (approximately 2.5 gal/tree) of Alar (1000 ppm) was applied on June 7. (Procedures are described more fully in the appended Master's thesis.)

Results

Measurements of fruit removal force (FRF) began in early July. At this time the average FRF for the high-nitrogen treatment was a bit higher than all other treatments. By July 20 this effect was no longer seen. In mid-July the mean FRFs for the water stress and Alar treatments were a bit lower than those for other treatments (Fig. 1). Because of the large variations in FRF values none of these differences was ever statistically significant. At any rate, all differences had disappeared by late in the season.

Figure 1



The most rapid decreases in FRF were seen in late July. Photomicrographs (included in the attached thesis) show that during this period cell separation occurs in the abscission zone.

Discussion

The anatomical portion of this study indicates that cell separation in the almond fruit abscission zone occurs quite rapidly. Following this the sole attachment of the nut to the tree is via the vacular bundles. The strength of this attachment drops gradually following cell separation (Fig. 1). Whether there is action in the abscission zone directed against these vascular bundles is unclear. Because separation proceeds so rapidly in non-vascular regions it is clear that the "cutting" of vascular bundles is a crucial step in speeding nut removal.

No clear picture of a treatment to hasten the onset of abscission has come out of this study. As in the past there is a hint that mid-season water stress can bring earlier maturation. While we feel that this "hint" reflects a biological reality it would probably take a study on a very large scale to demonstrate the effect to be "fact". Even then, the application of water stress as a cultural practice on an orchard-to-orchard basis would require substantial grower effort. The complex interaction of climate, soil, water availability and tree status (age, vigor, root distribution, etc.) would demand that growers apply the "water stress treatment" based on current orchard data rather than by the calendar. (It is encouraging to note that no crop-reducing effects were seen this year as the result of maturation-enhancing water stress treatments applied to trees in Durham last year.)

In this year's work we appeared to get a maturation-slowing effect from high nitrogen treatments. This is in agreement with the grower viewpoint that excessive vigor (vegetative growth) seen in young or highly-fertilized trees slows nut development. If this is a valid observation grower manipulation (limitation) of N-application might lead to control of maturation. This approach, too, would require careful, regular monitoring of tree behavior for consistent results. For instance, in our work, the trees became N-deficient by mid-July even though we applied twice the recommended amount of urea per tree.

Publications

The only publication of these results, to date, is the attached Master's thesis submitted to the University of California, Davis, Graduate Division in Winter 1982.

Acknowledgement

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