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CROSS POLLINATION BENEFIT TO HASS

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We present preliminary results on the relationship between outcrossing and fruit yield in Hass avocado. An outcrossing event is the pollination of a Hass flower by a cultivar other than Hass. Genetic markers called RAPD markers (random amplified polymorphic DNA) were used to detect outcrossing events. Along with determining the occurrence of an outcrossing event, outcrossing rate was also correlated with the distance from the outcrossing pollen source and with different climatic regions.

The collection sites were in groves with large plantings of Hass avocados. The outcrossing pollen source was Bacon, Fuerte or Zutano. Selection of trees to be sampled was made at three distance classes, row 1, 5 and 15 from the outcrossing pollen source. Two trees were sampled from each row. Twenty fruits were taken from each tree for outcrossing analysis and the total numbers of fruit were counted on each of the six trees.

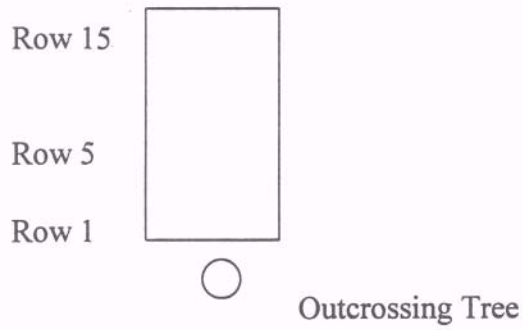

Figure 1. The basic design of the project. We sampled two trees in rows 1, 5 and 15 respectively, taking 20 fruit per tree and counting the total number of fruit per tree. The outcrossing tree was Bacon, Fuerte or Zutano.

Collection sites were located in two major avocado growing regions. The coastal sites were located in Ventura and Santa Barbara; the inland site was in Temecula.

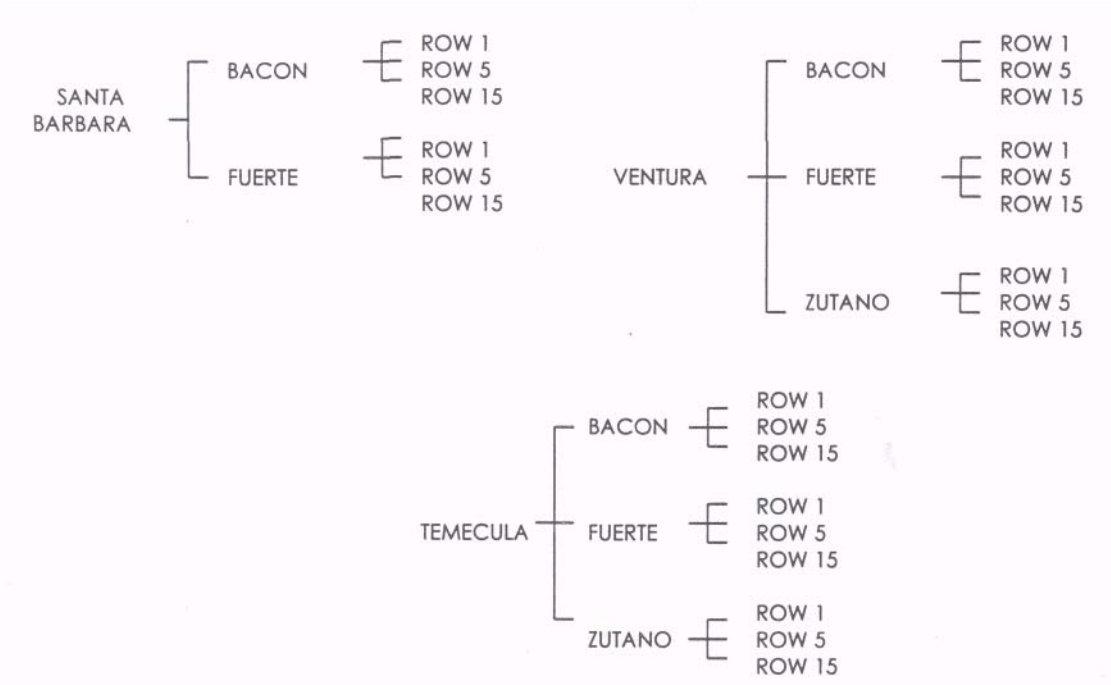

Figure 2. The collection sites were located in two major avocado growing regions, coastal (Santa Barbara and Ventura) and inland (Temecula). The site of Santa Barbara has only two collection sites, one with Bacon as the outcrossing pollen source and the other with Fuerte. The other collection sites in Ventura and Temecula have all three outcrossing pollen sources, Bacon, Fuerte and Zutano.

The avocado collections should be obtained prior to harvest. However, in 1993 and 1994, we collected after size-picking had begun. Hence these data may not accurately represent the relationship between outcrossing and fruit yield. The collection for 1995 was performed before harvest had begun.

To analyze outcrossing rate, the genetic markers called RAPDs were used. We were able to find a RAPD marker that was unique to Fuerte and absent in Hass, Bacon and Zutano. The second RAPD marker produced a common marker that was shared between Bacon and Zutano and was absent in Hass and Fuerte. With these two RAPD markers, we were able to identify whether an outcrossing event resulted from pollination by Bacon, Fuerte or Zutano.

As seen in Figure 3, 4 and 5, usually but not always, there is a decline in the value of outcrossing rate as the distance increases from the pollen source. At best, there is a weak correlation with outcrossing rate and fruit yield. There are no clear relationships between outcrossing rate and geographic region or pollen source (Bacon, Fuerte or Zutano).

The collection sites are actual working groves that are not isolated. There are other

sources of pollen which may be affecting fruit production. In addition, the past two years' collection were made after harvesting began, and do not provide a complete picture of pollination occurring at the collection sites. Because the 1995 collection was performed before harvest began, this complete sampling of fruit should provide a more accurate picture of the relationship between outcrossing and yield in Hass orchards. Because year to year variation in yield and outcrossing rates is substantial, real trends may be obscured. It therefore is important to collect data over two additional years to minimize the effect of environment and other sources of variations.

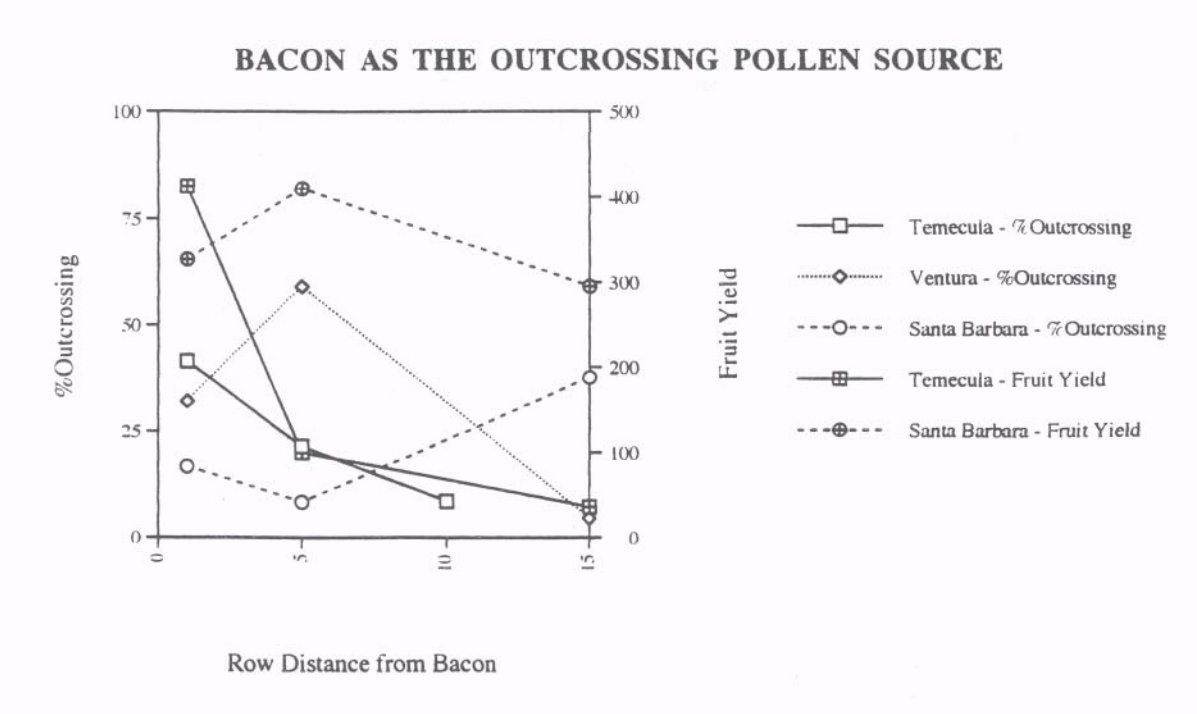

Figure 3, 4 and 5. These graphs show the average values for outcrossing rate and fruit yield for the 1993 and 1994 collection. The data has been grouped for each of the outcrossing pollen sources, Bacon, Fuerte and Zutano. Outcrossing rates are represented with the open symbols (square = Temecula, diamond = Ventura and circle = Santa Barbara, except for Zutano where there was no collection in Santa Barbara) and the corresponding fruit yields represented by the crossed symbols.

The distance from outcrossing pollen source is plotted against the outcrossing rate and fruit yield. The horizontal axis is the distance from the outcrossing pollen source. In most cases, the distance classes are row 1, 5 and 15. The left y-axis is %outcrossing which was calculated as

the number of outcrossing events detected by RAPDs the total number of fruit analyzed

The right y-axis is the fruit yield, the total number of fruit counted on the tree.

Figure 3. Averaged data for the 1993 and 1994 collection years. Bacon as the outcrossing pollen source

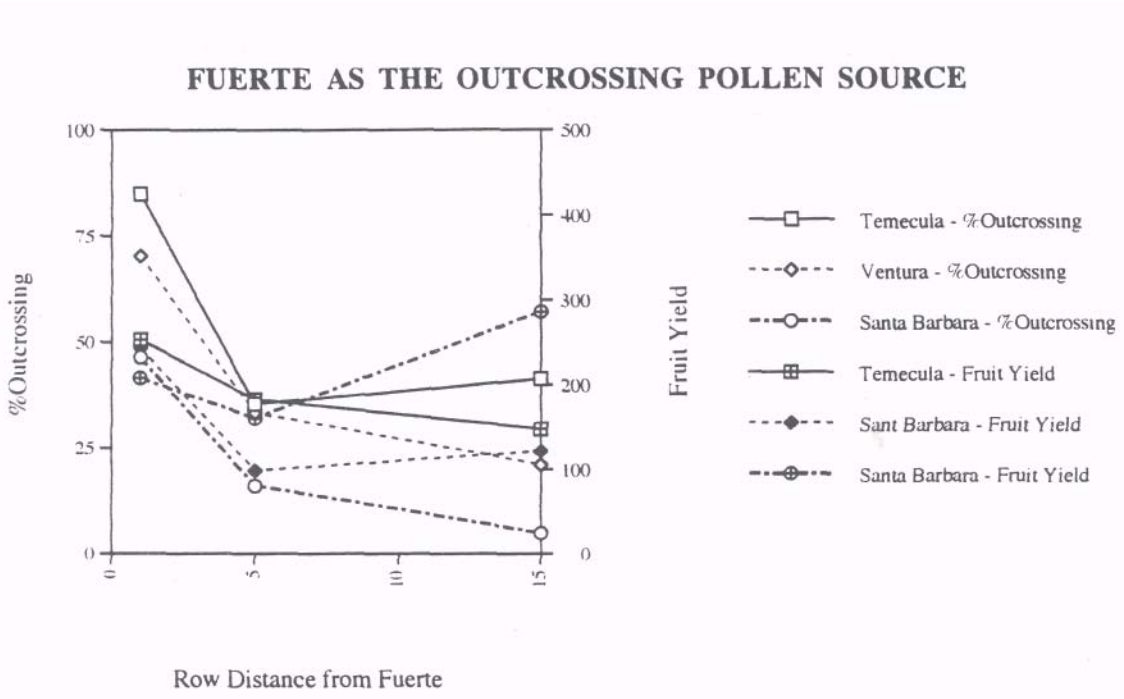

Figure 4. Fuerte is the outcrossing pollen source. Data is averaged for the 1993 and 1994 collection years.

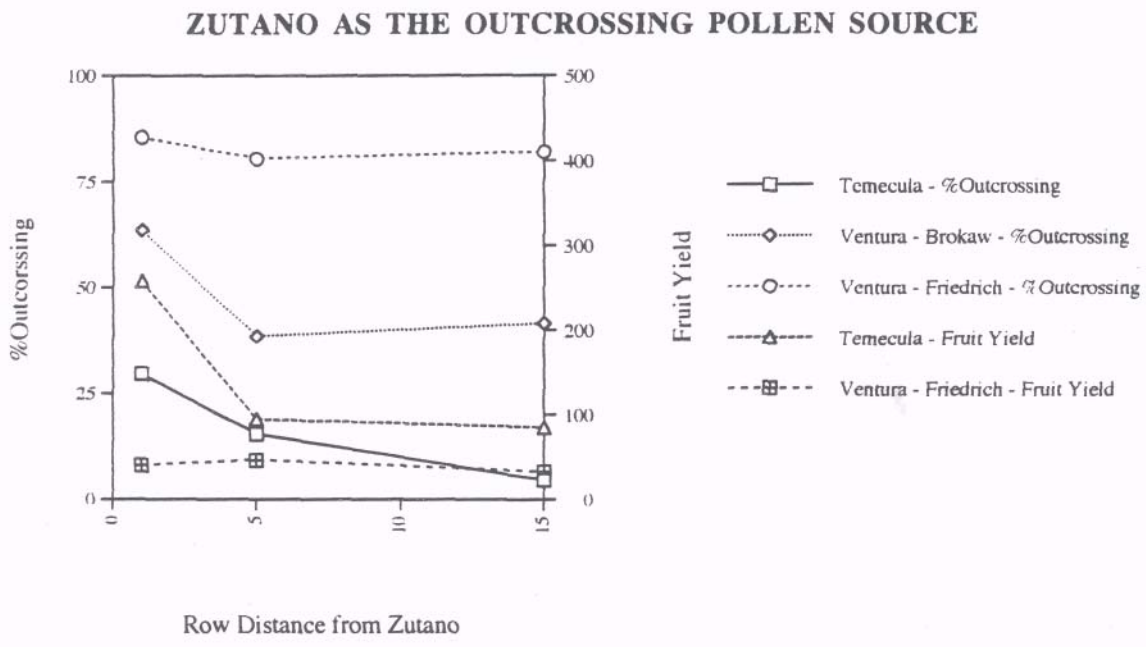

Figure 5. Zutano is the outcrossing pollen source. Data is averaged for the 1993 and 1994 collection years. There is no Zutano collection site in Santa Barbara. In Ventura, the 1993 collection was made at Brokaw's ranch (diamond symbol) and 1994 collection was made at Friedrich's ranch (circle symbol).