

Correlation between Cross-pollination and Fruit Yield

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INTRODUCTION

In avocado groves with Hass trees planted near trees of other varieties, high fruit counts on Hass have been observed. This is in comparison to lower fruit counts in areas with only Hass trees. This phenomenon may be attributed to cross-pollination by the other avocado varieties. With the use of molecular markers, the laboratory of Dr. M. T. Clegg at the University of California, Riverside is interested in addressing the question, 'Is there a correlation between cross-pollination and high fruit yield?'

In a grove owned by Len Francis, high fruit numbers were observed on 18-year-old Hass trees neighbouring top worked Zutanos. On 19 December 1994 a collection was made of 10 Hass fruits from each of 5 sites within the grove. The sites, chosen by Len Francis, consisted of 2-5 trees each. Two sites, (sites 3 and 4) contained top worked Zutanos among Hass trees. Sites 2 and 5 had only Hass trees and no Zutanos. And site 1 had only Hass trees located close to 70 beehives.

Analysis of DNA extracted from the embryos of the ten Hass fruits was performed with the use of a molecular marker referred to as a RAPD (random amplified polymorphic DNA) marker. The presence of the RAPD marker in Hass embryo DNA would indicate that pollination of the fruit was by Zutano or Bacon.

DISCUSSION

Table 1 gives the description of the collection sites and the resulting data for the percentage of out crossing and for fruit yield. In the table 'Out crossing' refers to the number of Hass fruits showing a Zutano/Bacon RAPD band, and 'No. of fruits' refers to the number of Hass fruits analysed for the presence of the RAPD band. The ratio, expressed as a percentage, is shown in brackets. 'Fruit yield' refers to the number of Hass fruit on each of two trees, except in site 1, where only one tree was counted. 'Average no. of fruits' refers to the total fruit count divided by the number of trees counted.

Sites 1, 2 and 5 (Hass trees and no Zutanos) had low numbers of fruit (average 115; 48,5 and 17,5 respectively) and low out crossing percentages (25 %; 20 % and 0 % respectively). This is relative to sites 3 and 4 where Zutano was present — these sites have higher percentages of out crossing (83 % and 80 % respectively) and higher fruit counts (204 and 175 respectively).

Table 1
Description of collection sites and corresponding data for percentage of outcrossing and fruit yield

<i>Site</i>	<i>Outcrossing/ No. of fruits</i>	<i>Fruit yield</i>	<i>Average no. of fruits</i>
1. Hass with beehive nearby.	2/8 (25 %)	~115	115
2. Hass (18 years old). No Zutanos topworked within 6-tree distance. Best 2 of 4 trees. (Len Francis site 2)	1/5 (20 %)	38/59	48,5
3. Hass trees (18 years old) next to 3-year-old Zutano topworked graft. (Len Francis site 1)	5/6 (83 %)	183/225	204
4. Best two Hass trees (18 years old) next to 3-year-old Zutano topworked graft. (Len Francis site 3)	4/5 (80 %)	145/205	175
5. Hass trees (18 years old). No Zutanos within 6 rows. Best 2 trees of 4. (Len Francis site 4)	0/3 (0 %)	19/16	17,5

Plotting fruit numbers against out crossing percentages shows a correlation between between the two.

The statistical test, Kendall coefficient of rank correlation, tests for the significance of association between the two values, percentage of out crossing and average number of fruits. This test shows a positive correlation with a significance of 0,05.

This positive correlation means that a high percentage of out crossing by Zutano (/Bacon) corresponds with a high fruit yield. Lower percentages of out crossing means lower fruit yield.

It should be noted that the two caveats of this data set are:

- The RAPD marker identifies pollination events by Zutano and Bacon. The presence of any Bacon in the grove will alter the results.
- This is a small study with only ten fruits analysed from each collection site. This should be taken into account when drawing conclusions from this data.