AVOCADO GENETICS AND BREEDING – PRESENT AND FUTURE

U. Lavi, D. Sa'ada, I. Regev and E. Lahav

ARO- Volcani Center P. O. B. 6,
Bet - Dagan 50250, Israel

Presented at
World Avocado Congress V
Malaga, Spain
19-24 October, 2003
Abstract A-42
Why Avocado?

- A very unique fruit
- A relative newcomer to the international commerce
- A very difficult crop to breed

If you need justifications for being interested in avocado…
There are various reasons why avocados are considered difficult in terms of breeding.

- Long juvenile period
- Large tree size
- High level of Heterozygosity
- No controlled crosses
- Limited genetic knowledge
Avocado has been consumed in Mexico for 10,000 years. It was selected mainly for increasing fruit size. The subgenus *Persea* consists of three species: *schiedeana*, *parvifolia* and *americana*. *P. americana* consists of the three races: West Indian, Guatemalan, and Mexican.
The Main Advantage of Avocado for Breeding Purposes is:

The very rich and diverse gene-pool
A fruit with a large seed.
A fruit with a small seed.
A chimeric fruit
There is genetic variation in avocado such as fruits with long necks and various colors.
Classical breeding is mainly based on the amount of genetic variation. This variation is demonstrated in mango fruits.
Genetic Analysis

A. Specific traits

- The genetics of fruit-skin color, flowering group and anise scent was found to be controlled by several genes and several alleles in each.
- Various phenotypes result from various heterozygote combinations
- The relevance to breeding projects
B. Quantitative Analysis: Variance Components

- High level of heterozygosity (demonstrated by heterogeneity of avocado seedlings)
- Estimated by DNA markers
- The heterozygosity explains the high estimate of non-additive genetic variance.

The variance components, of most avocado traits, are non-additive.
Is it Necessary to Perform Controlled Crosses for Breeding?

In my opinion the answer is no.

As a result of quantitative genetic analyses, we do not think that one should make control crosses for avocado breeding. The reason is that the definition of the optimal avocado cultivar is quite wide (one can think of very different ladies that are both beautiful and smart.....)
Conventional Breeding:

- Only a few avocado breeding projects exist (most current commercial cultivars are randomly selected seedlings.)
- The breeding process composed of: open pollinations (or controlled crosses); generation of thousands of seedlings (and more); selection; grafting and testing

The basics of classical breeding.
We Suggest a Two Phase Program:

A. The breeding orchard (not too dense)
   Aiming at selection of the best 1-5% based on fruit characteristics

B. Assessment of the "interesting" seedlings
   (commercial conditions)

   Aiming at testing for yield and storage capacities, in duplicates, under various conditions, by various experts, generation of stock for budwood

We recommend classical breeding to be carried out in two phases as explained.
Breeding is like searching for the perfect lady (perfect guys do not exist….). Thus, the goal is to combine beautiful appearance with high quality. In addition, some tree traits should also be considered.
Development in agro technologies, have impact on breeding. If one can affect yield, shape and harvest season by agro technologies, one can focus in breeding on resistance to pests and diseases and nutritional values.
New Avocado Cultivars
Developed in the Last 15 Years
40/100 – Eden
Eden
Gwen