AVOCADO GENETICS AND BREEDING – PRESENT AND FUTURE

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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…

Due to:

- Long juvenile period
- Large tree size
- High level of Heterozygosity
- No controlled crosses
- Limited genetic knowledge

There are various reasons why avocados are considered difficult in terms of breeding.

History and Taxonomy

- 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
   - Mexican

The Main Advantage of Avocado for Breeding Purposes is:
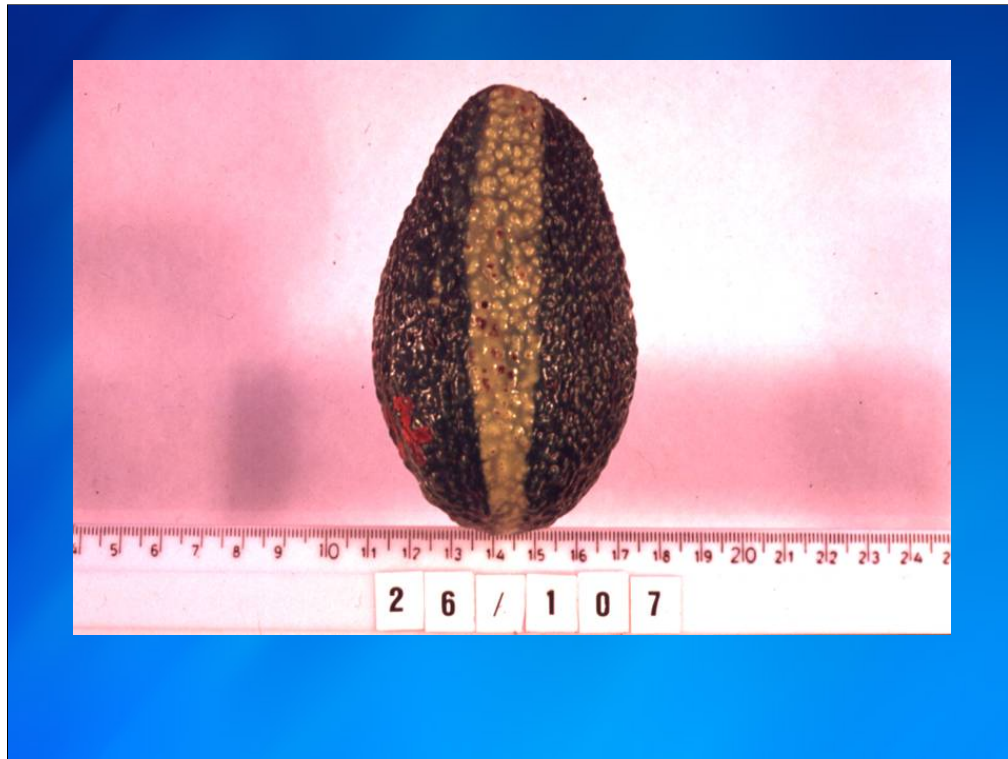
The very rich and diverse gene-pool

A fruit with a large seed.
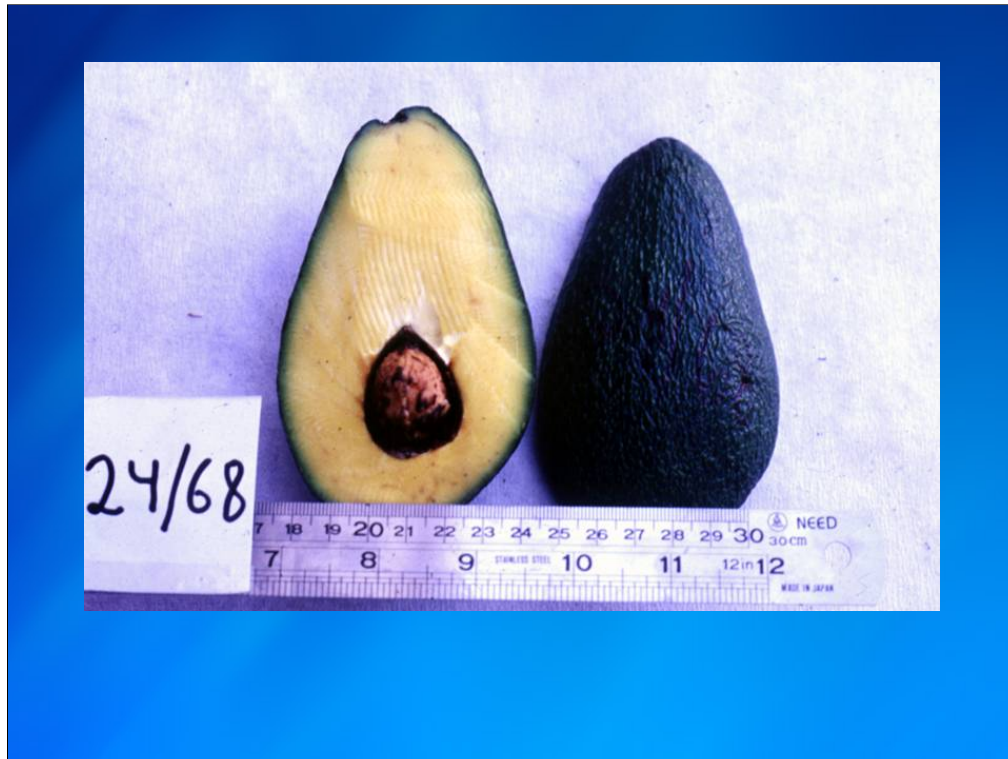
A fruit with a small seed.

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

Genetic Analysis

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 bud-wood

We recommend classical breeding to be carried out in two phases as explained.

Goals: The "Perfect Lady"

Fruit characteristics: The "wine" and the "bottle"

"Quality" and "Appearance"

Tree characteristics: mainly: Yield

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.

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Impact of new Horticultural Developments on Breeding

- **Yield**

- **Fruit Shape**

- **Harvest Season**

Conclusion: Focus on Goals Unobtainable by Horticultural Methodologies

Present Examples: Nutritional Value; resistance

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

Iriet

Gwen