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AVOCADO GENETICS AND BREEDING – PRESENT AND FUTURE

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Although avocado (*Persea americana* Mill), is a relative newcomer to the international commerce, it has been consumed and selected, mainly for increasing fruit size, for about 10,000 years in Mexico. The subgenus *Persea* consists of three species (*schiedeana*, *parvifolia* and *americana*). *P. americana* consists of the well known horticultural races: West Indian, Guatemalan and Mexican. The rich and diverse gene-pool, which will probably expand as germplasm exploration continues, is a valuable tool for breeding. Genetic relatedness between avocado species and accessions has been investigated thoroughly using both morphological traits and DNA markers.

Only a few genetic analyses have been carried out in avocado but in spite of some “gut feelings”, there is no doubt that the genetic rules apply to this crop in the very same way as they apply to all other organisms. Avocado has a very high level of heterozygosity as demonstrated by the heterogeneity of avocado seedlings and by various DNA markers. This high level of heterozygosity explains the high estimate of the non-additive genetic variance which is found in quantitative analysis of avocado important traits. The genetics of fruit skin-color, flowering group and anise scent was found to be controlled by several genes with several alleles in each. The various phenotypes result from various heterozygote combinations.

Due to the long juvenile period and the large tree size, only a few avocado breeding projects exist and most of the current commercial cultivars are random selected seedlings. Classical breeding of avocado is based on either controlled crosses or open pollinations, generation of thousands of seedlings, selection of the desired ones and grafting and testing of these trees. Among the cultivars developed in the last 15 years are: ‘Gem’, ‘Gwen’, ‘Harvest’ and ‘SirPrize’ (USA); ‘Arad’, ‘Eden’, ‘Galil’, ‘Iriet’ and ‘Lavi’ (Israel).

Our main recommendations for avocado classical breeding include: focusing on increasing the genetic variation of the parent cultivars, using open pollination (unless the breeding goals are very specific), shortening the breeding project as much as possible by a “two-phase project” and avoiding dense planting of the breeding orchard.

Current breeding goals such as fruit quality, fruit appearance and yield, are achieved by selection from a large number of random seedlings. In the future, the breeding goals will include nutritional value, storage capability and resistance to various diseases and pests and will be achieved directly.

Modern biological tools, including application of DNA markers and Genomic methodologies, are expected to allow the breeder the application of specific genes and gene combinations in order to design the desired avocado fruit from the point of view of the growers, the marketing people and most importantly, the customers.