

Molecular Genetics of Avocado

Michael T. Clegg

FUNDING: 11-1-92 to 10-31-93 PROJECT EXPENDITURES AND CURRENT STATUS: All funds will be expended

effective October 31, 1993.

PROGRESS REPORT:

During the past year we invested considerable effort in exploring the use of the polymerase chain reaction technique (PCR) on avocado materials. We have screened a large number of RAPD primers for segregation within a set of HASS F₂ progeny for use in mapping. The RAPD method offers substantial advantages for the quick identification of markers for mapping. The method avoids the expensive and time consuming process of molecular cloning and Southern hybridization associated with the RFLP method that we used during the initial years of this project. However, the RAPD method has several significant disadvantages. The disadvantages are: (1) only the presence/absence of PCR bands can be scored. This means that the RAPD markers fall into the dominant/recessive category of genetic markers. As a consequence, RAPDs convey less useful genetic information than do RFLPs. And (2) the RAPD method is extremely sensitive and requires great care in both execution and in data interpretation. Despite these limitations, we believe that the advantages of economy and the ability to process larger numbers of plants outweigh the technical disadvantages.

We have recently begun to try to develop another class of molecular markers called "microsatellite" markers for avocado research. The microsatellite markers utilize the PCR method for obtaining genetic information, but have the advantage of conveying all genetic information (codominant markers) unlike RAPDs. Microsatellite markers also are easy to score, and because they tend to be highly polymorphic, they convey a great deal of genetic information. The disadvantage is that they require a greater upfront investment because microsatellite regions must be cloned and the DNA sequence must be determined to design primers for PCR amplification. We believe that this upfront investment is justified by the much greater utility of microsatellite markers.

Our current goal is to be able to construct a map of the avocado genome that contains about 100 markers by the end of 1994. The markers will represent a mixture of RFLP, RAPD and possibly microsatellites. We believe that this goal is feasible and that it will provide a very useful resource for future avocado improvement.

PRACTICAL APPLICATIONS AND SUMMARY: The major goal of this project is to develop a map of the avocado genome that can be used in the practical improvement of

cultivated avocado. A map will aid improvement efforts in a number of ways. First, it can provide a basis for the genetic characterization of important traits like root-rot resistance, cold tolerance, fruit quality, variation in flowering times etc. Second, markers closely linked to valuable traits can be employed in marker based selection strategies and this may greatly accelerate rates of genetic progress. Third, genetic markers can be used to identify important materials and to verify that desired genetic crosses have been successful.