Utilization of marker assisted selection for the development of new varieties with high production

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Traditional avocado breeding programs have been successful in producing new varieties with favorable characteristics. However, in practice, these breeding programs are a time consuming and a costly endeavor. The high cost of the breeding program is attributed to the fact that majority of the trees that are selected are eventually discarded after being maintained for 5-10 years. Therefore, approaches to identify favorable varieties at an early stage of tree development would significantly reduce the breeding costs and increase the number of favorable varieties produced by the breeding program. Marker-assisted selection is aimed at reducing the costs the breeding programs by using molecular markers that predict favorable traits. The ability to predict favorable traits will allow breeders to select for trees at the seedling stage.

This project provided funds to maintain the 2 mapping populations established by Dr. Michael Clegg (MC) just over 10 years ago. The mapping populations in California are one of the oldest mapping populations of avocado worldwide. Maintaining this valuable collection which has already been used to demonstrate marker assisted breeding (MAS) and has been genotyped by the USDA-ARS group in Miami is vital for the future plant improvement efforts in California. This collection will speed up the adoption of MAS strategies for avocado plant improvement in California.

The mapping populations consist of 204 cloned individuals planted at two sites. One location is the University of California, Riverside (UCR)-Agricultural Operations (AgOps) and the second is at UC South Coast Research and Extension Center (SCREC) in Irvine, CA. At each site, two clones were replicated to verify that a given phenotype of a clone is the result of the genotype and not due to variations in environment. The avocado cultivar 'Gwen' was used as the maternal parent in an open pollinated experiment. 'Gwen' produces high quality fruit, displays a low alternate bearing potential and has a more compact growth habit than 'Hass'. Previous work by the Clegg lab found that approximately 25% of the trees are 'Gwen' x 'Fuerte' crosses, 25% 'Gwen' x 'Zutano' crosses and 25% 'Gwen' x 'Bacon' crosses. The remaining trees are crosses between 'Gwen' and unknown paternal pollen parents. All of the clones of the 204 genotypes were grafted onto the clonal 'Duke7' rootstock. A heritability analysis examining growth rates and fruit set demonstrates that this population can be used for artificial selection and mapping. Preliminary results show that the MC-population is segregating for multiple shoot architecture phenotypes, trees with low alternate bearing potentials, and variation in fruit size and color. Therefore, the MC-population is extremely valuable resource to develop molecular markers to screen for horticultural traits that are favorable and meet the requirements of the California avocado grower. In addition, the MC-population may be a new source to generate new varieties that meet the requirements for the California avocado growers and increase the profitable growing systems.

Progress to Date

The trees were irrigated, fertilized and maintained at both sites during the last year. They are in good conditions.

References

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