

DNA TEST FOR APPLES



Apple Storability Ethylene Biosynthesis

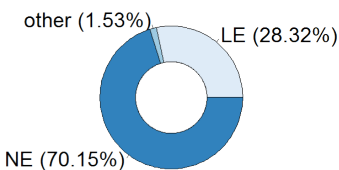
Fruit firmness is an important component of the fruit quality parameter texture. The length of time that an apple can remain firm while under storage determines its shelf life. The storability of apple fruits can be measured by their production of ethylene. As a climacteric fruit, apples ripening - and then softening - is hastened by a burst of ethylene production. Apple cultivars that produce low amount of ethylene remain firm for the longest amount of time and are highly prized by the consumers and the horticulture industry.

Genetics of the Trait

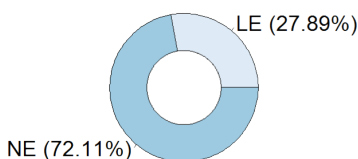
Apple firmness is a largely controlled by the Md-ACS1 gene on chromosome 15, and to a lesser extent, the Md-ACO1 gene located on chromosome 10. Two alleles are found at each locus encoding either low ethylene ("LE") or normal ethylene ("NE") production in the homozygous state or medium ethylene production as heterozygotes. These loci segregate independently and exert non-interactive effects on ethylene production. These traits affect firmness both at the harvest and after several months of storage. Thus, apples that are firm at harvest are likely to remain so after several months.

Allelic Variation

Md-ACS1



Md-ACO1



Genotype	Example Cultivar	Phenotype
LE LE & LE LE	Fuji	Ultra low ethylene/ultra long shelf life
LE LE & NE NE	Pinova	low ethylene/long shelf life
LE NE & NE NE	Pink Lady	Medium low ethylene/ medium long shelf life
LE NE & LE NE	Braeburn	Medium low ethylene/ medium long shelf life
NE NE & NE NE	Yellow Transparent	Normal ethylene/ short shelf life

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When to Assay

This test can be administered at any point in a breeding program. It has particular utility for choosing parents and advanced selections with long shelf lives or eliminating selections with unacceptable shelf life duration.

Predictive Capacity

There is a high correlation between the genotypes, ethylene production and the shelf life of apple fruits. The Md-ACS1 locus explains between 19 and 42 of the phenotypic variation for this trait, while Md-ACO1 explains 8 to 11% of the variation, depending on environmental effects. This DNA test accurately captures the variation present at each locus with no risk of recombination between markers and alleles. There are also other rare alleles at these loci whose effects on fruit firmness is not known.

Technical Details

The tests for Md-ACS1 and Md-ACO1 are each a SCAR markers targeting indels located within each gene. For more details on this DNA test, other peach tests, or tests for other rosaceous crops, visit www.rosbreed.org/breeding/dna-testing.

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