

Soybean oil with elevated oleic acid and low linolenic acid (HOLL) level is desirable because this fatty acid composition improves the nutrition, flavor and oxidative stability of soybean oil. In the lipid biosynthetic pathway, the enzymes fatty acid desaturase 2-1 (FAD2-1) and FAD3 are responsible for the conversions of oleic acid to linoleic acid and linoleic acid to linolenic acid in soybean seeds, respectively. Therefore, our hypothesis was that combining mutant FAD2-1 and FAD3 genes to reduce these enzymes' activity will result in the accumulation of oleic acid content and reduction of linolenic acid content. DNA sequence of the *FAD 2-1A* and *FAD 2-1B* genes of 24 soybean lines with elevated oleic acid content were compared to the DNA sequence of Williams 82, a soybean line with normal fatty acid composition. Several variations found in the DNA sequences of the *FAD 2-1A* and *FAD 2-1B* genes of three soybean lines resulted in either premature termination of peptide sequence or the substitutions in amino acid sequence that were responsible for the increased oleic level. Combination of different mutant *FAD2-1A* genes and a newly identified *FAD2-1B* mutant gene increased the oleic acid content in soybean seeds up to 60-80%. Incorporation of one or two mutant *FAD3* gene(s) into the high oleic background resulted in high oleic acid content and low linolenic acid content from 1.5-4%. It is believed that with this olive- like fatty acid composition, HOLL soybean can be used as a less expensive but equally healthy alternative to olive oil.