Soybean and Nitrogen Fixation Research Unit
Raleigh, NC

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Breeding Soybeans for Increased Oil Content and Adaptation to the Biodiesel Market

Biofuel production provides an opportunity to enhance economic development in the U.S. and take our country toward energy self-sufficiency. One of the most promising biofuel options is biodiesel made from various oil feedstocks. Biodiesel has several advantages. It is biodegradable, non-toxic, and free of sulfur. In diesel engines, it produces less CO_2 emissions, less air pollution and has better lubricity, adding to engine longevity. So it is environmentally "friendly" and because diesel engines are more efficient than gasoline engines, they use less fuel.

One biofuel feedstock that the U.S. already produces is soybean oil. The U. S. has about 76 million acres under soybean production with a yearly average yield of around 3 billion bushels. About half of the crop is exported, and 850,000 tons of oil is produced domestically from the remainder. Soybean has the added advantage that it produces it's own nitrogen. So costly nitrogen fertilizers are not needed in the production system.

The USDA-ARS Soybean and Nitrogen Fixation Research Unit located at NC State University, has a 35 year history of research on breeding soybeans with more oil and in that respect is unique among public soybean breeding programs in the United States. Our newest variety, NC-Raleigh, is a high oil variety and produces about 14 pounds of oil per bushel if soybeans, about 2 pounds more than other varieties currently being produced. This oil will make about 1.5 gallons of soydiesel. In our program we have soybean germplasm that can produce about 17 pounds of oil per bushel (1.8 gallons of soydiesel). **A soybean variety that produces 17 pounds of oil per bushel would increase per acre oil production by about 30%.** Those materials are unique and need further breeding to make them suitable for farm production.

We have also developed soybeans in our program that have a two-fold increase in monounsaturated fatty acid (oleic acid) and half the saturated fats of standard soybeans. Soybean oil with higher oleic acid have been shown to have lower Nox (a pollutant) emissions, and soybean oil with lower saturated fats have improved cold flow. **So the soybeans we are developing in our research unit will provide oil that can make soydiesel with less Nox emissions and improved performance in cold weather**.

Objectives of our research are the following:

- Development of high-oil high-yielding soybean varieties
- Development of soybean varieties with oil that is specifically well suited for making soydiesel
- Determine the physiological and genetic basis for high-oil soybeans and engineer soybeans with oil and protein content that yield more oil and adequate protein meal quality.
- Develop molecular markers for genes that control oil content as an aid to rapid efficient high-oil variety develop.

The scientific staff of our research unit includes a molecular biologist, another geneticist, and a plant physiologist who cooperate in this research. In addition, we are located at NC State University and collaborate with another soybean geneticist and a molecular geneticist.

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