New Developments In Soybean Breeding

DR. GROVER SHANNON

PORTAGEVILLE, MO.

The overall goal of the soybean breeding program is to integrate genomics and breeding research leading to the development of superior soybean conventional and herbicide tolerant cultivars for Missouri and U.S. farmers to improve their global competitiveness and expand utilization of the soybean crop. We conduct a broad range of laboratory and field research studies to find new genes for useful traits and introduce these genes into productive lines. The breeding program focuses on the genetic control of improved yield, seed composition, environmental stress tolerance, and pest resistance. A key goal of our team is the development of value-added soybeans with improved functionality (e.g., improved oil content, increased health benefits, modified proteins) for broader use in food, feed, biofuels and industrial products. The Soybean Breeding program utilizes molecular biology and genomic technologies to enhance the soybean germplasm base for developing superior cultivars which maximize production efficiency, and enhance nutritional value and functionality for new industrial uses.

Biotic stress: We have a major effort to develop new tools for use in breeding and gene discovery for disease resistance. There are over 100 diseases of soybeans and some are very damaging to soybeans. For example, the soybean cyst nematode (SCN) is the number one disease for yield reduction in the US and the world. Current SCN research has focused on the discovery of new resistance genes and to incorporate SCN genes into productive varieties. We are applying similar approaches to discover resistance factors to other diseases such as phytophthora root rot, root knot nematode, reniform nematode, frogeye leaf spot and charcoal rot.

Abiotic stress: Abiotic stresses such as drought, flooding, and salinity, have received significant attention of the MU soybean breeding team. Development of soybean germplasm with tolerance is very important because significant yield losses from various stresses occur annually in soybean. Breeding for increased abiotic stress tolerance in soybean is long-term and difficult due, in part, to the multigenic nature of improved tolerance. We have identified new sources of tolerance to drought, flooding and salt and have developed mapping populations to identify genes related to tolerance. Specific DNA markers can pinpoint the location of these genes and assist in sequencing and cloning genes of economic significance as well as for use in marker assisted breeding. Ultimately, incorporation of new alleles for tolerance to drought, flooding and alkaline soil conditions will lead to productive soybean varieties to reduce losses from these stresses.

Seed composition: A goal of our team is to improve the functionality of soybean protein and oil for greater utility in food, feed and industrial markets. For example, modifying the fatty acid profile in soybean oil will lead to broader use in more products. We currently have experimental strains low in saturated fats and the poly unsaturated linolenic fatty acid. Low saturate oil is associated with reduced risk of heart disease and improved cold flow of biodiesel. Low linolenic concentration improves the oxidative stability and shelf life of the oil. Recently, we discovered two genes that increase oleic acid in soy oil from 23% to about 80%. Oil processed from varieties with these genes will be similar in characteristics to olive oil for improved health benefits, greater heat and oxidative stability for broader use in frying, biofuels and lubricants. We are working to improve soybean anti-nutritional factors by reducing seed indigestible carbohydrates and we are working to understand genetic regulation of health related compounds in soybean seeds such as isoflavones, saponins, and phytosterols. Δ

DR. GROVER SHANNON: Professor/Soybean Breeding, University of Missouri