Genetic Mapping of Soybean Cyst Nematode (*Heterodera glycines*) Resistance to Enhance Soybean Production in the United States

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Soybean cyst nematode (SCN, *Heterodera glycines*) is the most destructive pest of soybean in the United States, resulting in an annual extensive yield loss of approximately $1.5 billion in the United States alone. Breeding for resistance to SCN is the most effective approach to control this pest. However, most of commercial soybean varieties resistant to SCN were mainly derived from a few common resistant sources. The continuation of growing the same resistant cultivar(s) have resulted in SCN population shifts and loss of SCN resistance; thus it highlights a need of further investigation to mine new resistant genes from new resistant sources for soybean improvement. As a leading group on SCN research in the United States, the University of Missouri SCN researchers have been continuing the evaluation of exotic soybean germplasm for broad-based resistance to multi-HG types of SCN, the identification and mapping of novel quantitative trait loci (QTL)/gene(s), and the discovery of genetic markers for marker-assisted selection (MAS) programs. Using many plant introductions (PIs) with high resistance to multi-SCN HG types, we have developed genetic populations for molecular characterization and QTL mapping. These efforts led to the discovery of many novel QTL underlying the resistance to multi-SCN HG types. With sequence information using the genome-wide Illumina/Solexa sequencing technology, we have developed hundreds of genetic markers associated with the target QTL. Along with the soybean physical and genetic maps, these markers will provide a powerful genomics tool facilitating our efforts toward fine-mapping and positional cloning of candidate genes for SCN resistance. Moreover, the QTL associated genetic markers are greatly useful to incorporate novel resistant genes into new soybean varieties through the MAS approach. With SCN resistant soybean varieties, soybean yield and productivity will be increased and, in turn, enhance the seed oil production; which will significantly be an important source for the development of biofuel.