Part 5 - Plain English Summary

Within Australia are there 17 species of native cotton relatives. These native species are wild plants found across the Australian continent and nowhere else in the world. Although they are distant relatives of the commercial cottons grown for the production, they have characters that could be used to improve commercial cotton cultivars. Preliminary tests identified some species with resistance to the *Fusarium* wilt that is a serious disease threat in many cotton growing regions. Other species lack the toxic gossypol in the seeds that must be removed before the seed protein can be used in animal feeds and before the oil can be used for human consumption.

Transferring the genes responsible for these desirable characteristics from the native species to the cultivated cottons is difficult. Because the native cotton relatives are distant relatives of the cultivated cottons, traditional breeding strategies are not applicable. Hybrids between the native cottons and cultivated cottons can only be made fertile with human intervention and the transfer of genetic information from the chromosomes of native species to those of the cultivated cottons is infrequent. Fortunately, this means that genes from genetically modified cotton cultivars cannot escape into native cotton populations, but it makes it difficult to transfer valuable traits from the native cottons to the commercial cultivars. With diligent effort, we have been successful in creating fertile hybrid plants that combine the wild species with the cultivated cottons. One of these lines combines a wild species with gossypol-free seeds with the cultivated cottons and the other is a hybrid between cultivated cotton and a species that has potential *Fusarium* resistance. These breeding lines provide the opportunity for some gene exchange.

To increase our chances of finding these rare gene exchange events, we developed molecular markers that identify each individual chromosome of the wild species in the hybrid breeding lines. With these markers we constructed a genetic linkage map of the wild cotton species with gossypol-free seeds. Genetic linkage maps are essentially road maps to genomes of plants (and animals). As these hybrid plants progress through the breeding program, the genetic linkage map allows us to track the inheritance of the wild genes, to detect when wild genes have moved onto cotton chromosomes, and to identify the wild chromosomes that carry important genes. With this knowledge, we can more efficiently overcome the difficulties these unique hybrids present. Research to date focused on the native species that have gossypol-free seeds, but over the next three years, the experience and resources will now focus on the species with potential *Fusarium* resistance.