GENOME EDITING IN FOREST TREES: PROGRESS AND FUTURE PROSPECTS

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The latest genome editing technology, called CRISPR, is revolutionizing all facets of biology including agriculture and forestry. It enables generation of transgenic null mutants with unprecedented precision and efficiency—a welcoming breakthrough for outcrossing tree species with long generation cycles. In this talk, I will present case studies of CRISPR genome editing in *Populus* for targeted manipulation of multigene family members, and for mutation of tandemly arrayed genes. Sequence polymorphisms in outcrossing species pose an underappreciated obstacle to efficient genome editing. However, sequence polymorphism data are usually inaccessible via current genome portals, and are not considered in popular gRNA design programs. I will discuss genomic resources and variant-sensitive bioinformatics pipelines that we have developed to address the genome editing challenges of outcrossing, hybrid or polyploid species. I will also discuss emerging applications of CRISPR beyond gene editing, and critical gaps in our ability to harness this powerful technology to advance forest biology. In conjunction with early flowering strategies, it will be possible to cross CRISPR null mutants to generate transgene-free progenies in one breeding generation. Elite clones carrying targeted gene mutation(s) without foreign DNA may ultimately help increase public acceptance of bioengineered agricultural products.

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