Diversity and Breeding

In commercial plant breeding, genetic diversity provides the raw and refined components needed to drive product development. Effective management of both broad- and fine-scale diversity throughout pre-breeding, trialing, and commercialization stages is critical for the long-term success and sustainability of breeding programs. NSIP applies prediction and optimization methods to effectively control both types of diversity throughout all stages of product development.

Optimizing fine-scale diversity is especially critical because most product development decisions—selecting the next great variety for immediate release—happen in that narrower gene pool. An important consequence of focusing on fine-scale diversity is the mitigation of the risk of "model misspecification." In predictive breeding, computational models are used to forecast which crosses will yield the best offspring. However, even the best models aren't perfect. By using NSIP's set selection methodology, breeders ensure their advancement populations include a variety of materials that differ slightly—but significantly—in their genetic makeup, effectively hedging against uncertainty. This diversity buffers the breeding program against any inaccuracies in the model's assumptions and ensures robust results.

When it comes to broad-scale or unadapted sources of diversity, the potential payoff lies in tapping entirely new alleles—unique segments of the genetic code—that can solve persistent issues or help the crop thrive under emerging challenges. Wild relatives, for example, often harbor disease resistance genes that are absent from existing commercial germplasm. To efficiently make broad-scale diversity accessible to breeders, NSIP applies a combination of optimized donor selection, population sculpting, and crossing optimizations to accelerate adaptation. Systematic integration of broad-scale diversity lays the groundwork for effective program pivots in response to novel challenges from pests, environmental conditions, or competitors' innovations.

Ultimately, broad- and fine-scale diversity complement each other, strengthening every layer of a breeding program. Fine-scale improvements build on an adapted gene pool already favored for commercial success, keeping new varieties profitable and relevant to today's growers. Meanwhile, broader variations steadily extend the program's genetic toolbox, preempting tomorrow's challenges. By strategically combining both spheres, NSIP supports breeding pipelines that are both high-performing in the near term and ready to thrive in the unpredictable future.

https://genetics.nsiplants.com/

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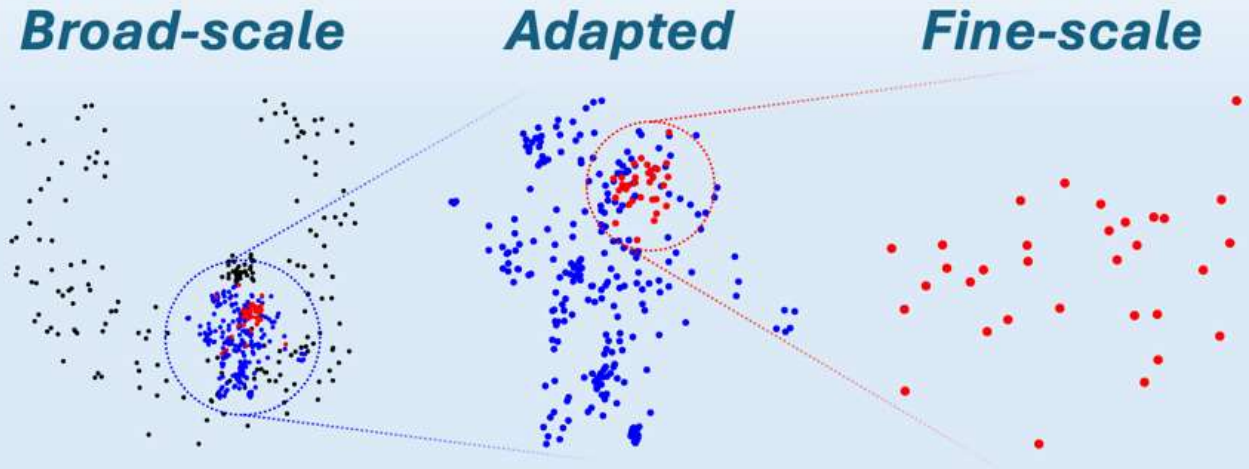
Diversity and Breeding

NSIP Genetics Scales of Diversity



Techniques

- Core Set Optimizations
- Donor Optimization
- Optimized Discovery Populations (ODP)
- Optimized Breeding Starts (OBS)
- Optimized Training Sets
- GxE Studies
- Optimized Genomic Selection(OGS)
- Optimized Trait Introgression
- Benchmarking Product Performance

Goals

- Long-term enrichment of program with novel alleles and haplotypes
- Long term product development 7—10 years
- Combining established alleles and haplotypes for multi-trait performance
- Routine product development 5—7 years
- Incremental performance variants of existing commercial material
- Rapid cycle product development 3—5 years