

# Crossing Block Optimization



Is plant breeding a science, an art, or a game of chance? It takes all three, but ultimately it's an exercise in resource allocation. Each year, breeders must decide how to deploy limited budgets—how many crosses to make, which parents to include, how many progeny to grow, and where to trial them—while staying on track to deliver superior products. At the center of these choices is the **crossing block**, the set of parent combinations that will shape the future of the program. Designing this block well is one of the highest-leverage—and highest-risk—decisions in a breeding cycle. NSIP helps breeders optimize this decision using its Advance software, making every dollar and every cross count.

NSIP's crossing block approach starts by framing the problem through the lens of risk and opportunity. Programs are guided to articulate their breeding priorities and constraints: Are certain traits underperforming? Has the parent base grown too narrow? Are new environments or markets demanding broader adaptation? Given this information, NSIP's Advance software uncovers what is possible given their current resources and germplasm, where selection pressure can be applied, what limitations exist, so that the breeder can quickly understand the boundaries and work around them.

The optimization is powered by outputs from NSIP's predictive platforms— OBS for line and population development or Hybrid systems—combined with practical breeding constraints such as parent reuse, seed availability, allele stacks, and population size limits. These inputs inform not only what crosses are desirable, but also how operational limits and cost-saving strategies (e.g., fewer unique crosses, reuse of stacked traits, heterotic structure) influence the performance and efficiency of the crossing block. Breeders gain insight into how much expected performance must be traded off to meet production constraints—and where compromises are most and least costly.

The value of this approach lies in making risk visible and actionable. NSIP's Advance software generates not just a list of crosses but provides a full decision-support framework: the optimal block under no constraints, the marginal cost of each additional constraint, and performance projections under various efficiency strategies. When multi-year crossing block history is available, NSIP integrates key program performance indicators to compare predicted and observed outcomes from past decisions—further grounding current choices in evidence. Ultimately, the crossing block becomes a platform for alignment and transparency: engaging breeders, leadership, and stakeholders in one of the most critical decisions of the breeding year.

Check out <https://genetics.nsiplants.com/crossing-block> for an example of the crossing block problem.

#plantbreeding #PlantGenetics #AgTech #NSIPGenetics

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Maximize Yield such that:

1. Diversity  $> 0.15$
2. Parent usage  $\leq 8$
3. Trait Allele 1  $> 44\%$
4. Trait Allele 2  $> 55\%$

