IWYP International Wheat Yield Partnership
Research to Deliver Wheat for the Future

IWYP SCIENCE BRIEF

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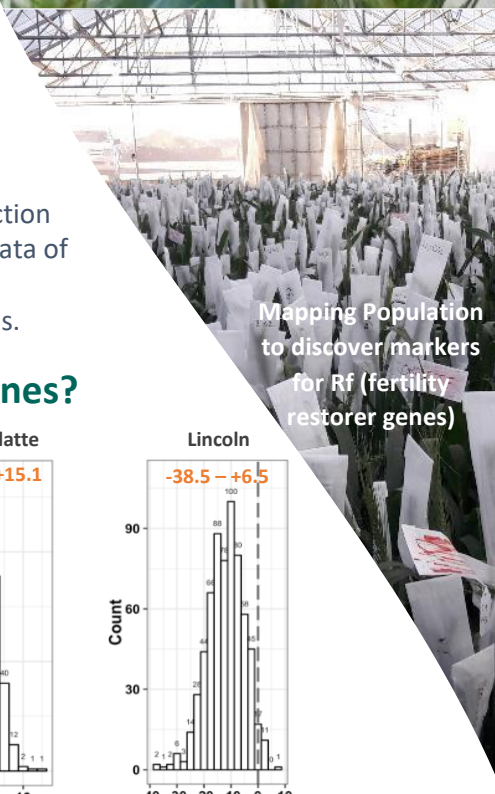
Something Old, Something New: Reviving Efforts to Create Commercial Hybrid Wheat

Hybrid wheat has the potential to significantly improve annual wheat yields and is considered more climate resilient than the inbred varieties grown today. The primary roadblocks to the development of commercially successful wheat hybrids are cost-effective methods of creating hybrids and sufficient levels of heterosis to make the extra cost of hybrid seed commercially viable. A NIFA-IWYP Project, "**Developing the Tools and Germplasm for Hybrid Wheat**", led by Stephen Baenziger at The University of Nebraska with other colleagues in the USA, France, Germany and Mexico is combining the knowledge on hybrid wheat production gained over the last few decades with the latest technologies. The team seeks to (i) identify floral and other plant traits for efficient cross pollination and hybrid seed production, (ii) create and test hybrids to establish and confirm parental line heterotic pools, (iii) use genomic data and novel algorithms to separate lines into better pools for future testing and validation, and (iv) determine the efficacy of cytoplasmic male-sterility (CMS) based hybrid systems by mapping restorer genes in *Triticum timopheevii* (Zhuk.) cytoplasm.

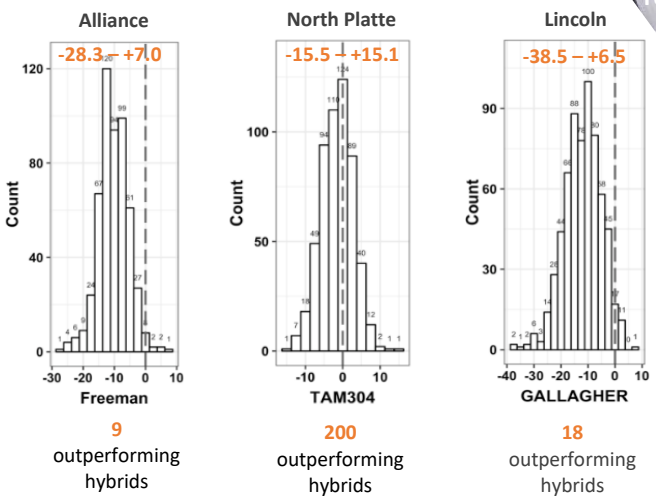


What Advances have been Made?

- Wheat hybrids are being created using a plant growth regulator (gametocide) that has no effect on overall performance of the subsequent F_1 hybrid as shown by tests.
- Hybrid crosses can be made based on plant architecture and development without regard to maternal or paternal parental line effects.
- Heterotic hybrids can be identified through breeding, statistical and genomic prediction methods. The performance of 10,475 hybrids was predicted from field evaluation data of ~700 hybrid combinations.
- Hybrids are shown to be more climate resilient and yield stable than inbred varieties.

What has been transferred to the wheat improvement pipelines?

- Modern spring and winter wheat germplasm with *Triticum timopheevii* (Zhuk.) cytoplasm and restorer (*Rf*) genes.
- Molecular genetic markers for *Rf* genes that restore *Triticum timopheevii* (Zhuk.) cytoplasm to facilitate hybrid plant breeding.
- Know-how on using genomic predictions to create new hybrids.



9 outperforming hybrids

200 outperforming hybrids

18 outperforming hybrids

Figure 1. Commercial heterosis with hybrids outperforming the highest yielding inbred check variety, Freeman, TAM304 or Gallagher (dotted vertical lines) in three locations (Alliance, North Platte and Lincoln) in Nebraska in 2018.

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