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

IWYP SCIENCE BRIEF

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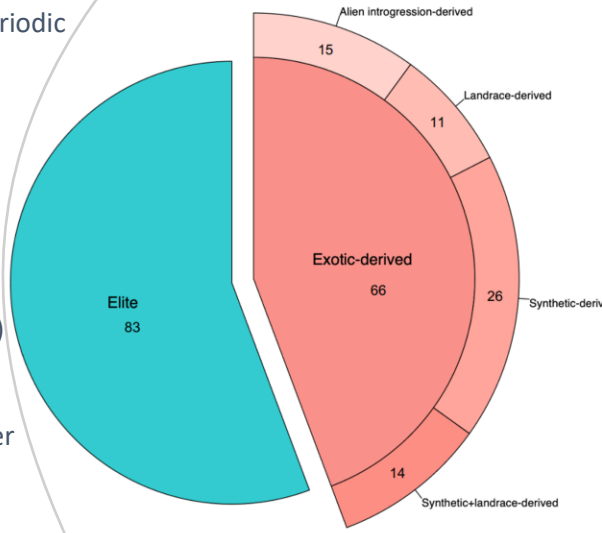
A Step Toward Climate Resilient Wheat

Average global temperatures are expected to increase in the future, and this combined with changes in rainfall patterns, will significantly impact wheat productivity. Therefore, new higher yielding wheat varieties more resilient to the impacts of a changing climate with improved stability across environments affected by periodic abiotic stresses such as drought and heat are needed.

The International Wheat Yield Partnership (IWYP) set itself the goal to raise the genetic yield potential of wheat by 50% by 2035, thus contributing to global food security. Many of the physiological processes and traits targeted by IWYP significantly overlap with those for improved abiotic stress. For example, a study by Molero *et al.* 2022, available as a pre-print in bioRxiv, identified three marker-trait associations for IWYP target traits in a panel of IWYP lines developed for their genetic yield potential (HiBAP lines, see panel) when evaluated under heat stress. The combination of these three favorable alleles increased yield under heat stress by more than 50% and reduced canopy temperature by as much as 2°C without significant yield penalty under high yield potential conditions. Interestingly, a chromosome segment transferred from a wild relative of wheat was found to be the origin of the most statistically significant marker-yield association. This new genetic source of heat tolerance could be extremely important in breeding programs seeking to augment existing germplasm for yield under heat stress with no yield penalty under optimal conditions.

Composition of High Biomass Association I germplasm Panel 1 illustrating the proportion of exotically derived material. Molero *et al.* 2022



In a second example conducted at the IWYP Spring Wheat Hub at CIMMYT in Obregon, MEX, a panel of IWYP lines containing exotic germplasm and selected for physiological traits to boost yield (PT lines) were evaluated under different managed environments. These tests identified many lines that were higher yielding under optimal conditions and also under heat or drought treatments. **Figure 1** presents a combined stability analysis of yield data for the PT lines in 4 environments (irrigated, heat, drought-drip irrigation and drought-gravity irrigation) over 2 seasons per environment. The X axis represents entry means for grain yield across environments and seasons and the Y axis the coefficient of variation for each entry. Entries in red have yields above the general mean (for all entries) and a lower-than-average coefficient of variation (CV, %). Entries in the bottom right quadrant are better performing and more stable over environments (including stressed environments) and seasons than those in the top left quadrant.

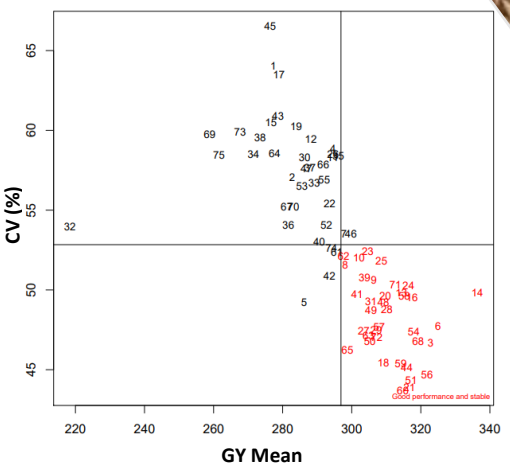
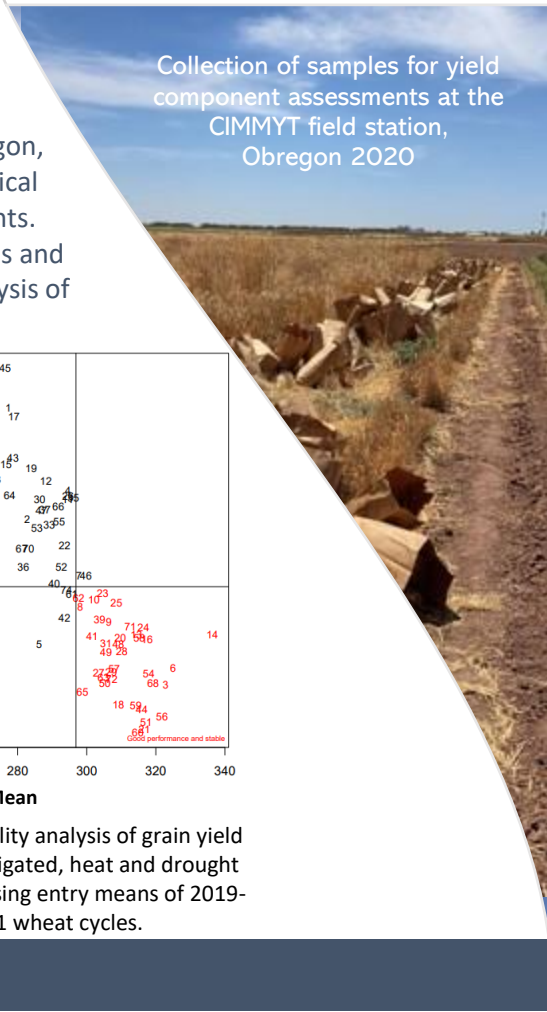


Figure 1. Combined stability analysis of grain yield for the PT lines under irrigated, heat and drought conditions in Obregon, using entry means of 2019-20 and 2020-21 wheat cycles.

Both sets of results suggest that IWYP's long-term strategy of developing elite germplasm with high yield potential under optimal conditions by exploiting novel genetic variation from wheat wild relatives is valid and should also enable development of wheat varieties that are more resilient to climate fluctuations.


Collection of samples for yield component assessments at the CIMMYT field station, Obregon 2020