

Nine IWYP Spring Wheat Varieties in 5 Countries Endorse Pre-breeding Strategy

A primary goal of the IWYP Spring Wheat Hub at CIMMYT is to understand how to assemble trait variants in ways that increase overall genetic yield potential. The scientific basis underpinning this strategy has been summarized in a series of scientific papers describing IWYP's "Wiring Diagrams" ([Reynolds et al., 2022](#); [Murchie et al., 2022](#); [Slafer et al., 2023](#)). It is based on the physiological strategy of (i) improving radiation use efficiency (source) to build the most agronomically effective plant structures including roots, (ii) increasing spike fertility related traits and grain weight potential (sink) to achieve larger harvest index and yield and (iii) hybridizing lines identified with high source and high sink potential and selecting amongst the progeny for remote sensed traits indicative of effective trait blending, such as cooler canopy temperature and longer green area duration as well as yield *per se*.

Successive generations of progeny are screened across a range of environments at IWYP-Hub sites at CIMMYT, Mexico, to ensure rust resistance, a degree of climate-resilience as well as high yield potential. The resulting nurseries (WYCYT) are requested for testing by public and private breeders at approximately 100 sites annually via the International Wheat Improvement Network (IWIN). Analyses of returned WYCYT data over the last 7 years indicate yield gains that are on track to deliver the originally proposed target of a 50% increase over baseline -Borlaug 2014- the highest yielding elite line of its day.

Five countries for which wheat production is of major importance have created varieties directly from IWYP lines tested in their breeding program and national variety trials (see Table). This is beyond expectation for a pre-breeding program designed to provide useful parents with novel combinations of trait expression and associated haplotypes. It is above expectation, even for spring wheat breeding, that, with fewer than 200 crosses per year and in so little time, nine varieties have been selected by client countries.

These results provide proof-of-concept of the scientific foundation of IWYP's strategy, namely: complementary trait-based crossing -encompassing extended gene pools previously thought to be detrimental to performance due to linkage drag-, combined with high throughput phenotyping and genomic selection. Analyses of the traits in the parents and recombinant offspring are now revealing the steps in yield generation that maximize high yield potential and those which do not. Such conclusions drive new rounds of parental selection to eliminate suboptimal traits/trait combinations.

All high performing lines and their parents developed at the IWYP Spring Wheat Hub have been fully DNA sequenced by one of our collaborators, the Agricultural Genomics Institute at Shenzhen, China (see [Science Brief 43 November 2023](#)).



9 New IWYP Spring Varieties Released in 5 Countries

Year	Name	Country
2013	Pakistan-13	Pakistan
2016	Borlaug-16	Pakistan
2017	Kohat 17	Pakistan
2018	Cascabel	Bangladesh
2020	Kunar 20	Afghanistan
2022	Misr 7	Egypt
2023	Misr 9	Egypt
2024	WGE000006939945	Pakistan
2025		Iran