Wheat is a World-wide Crop Today Because it Imported Genes from Wild Relatives as it was Moved from its Middle Eastern Origins.

The wheat we grow today was domesticated nearly 10,000 years ago in the Middle East, in a region commonly known as the Fertile Crescent from the wild ancestor "emmer wheat". Hybridization between this first domesticated form of wheat with another wild relative "goatgrass", in the southwestern Caspian Sea region gave rise to "bread wheat" as we know it today. Humans then spread bread wheat across the world bringing it to Europe around 8,000 years ago and to China around 4,600 years ago. This fast dissemination of wheat required rapid adaptation to new environmental conditions that were often very different from those at the site of origin. The genetic basis underlying these critical adaptations is now becoming clearer.

Wheat scientists from the US Wheat CAP project, Agriculture Victoria (Australia), the University of Saskatchewan (Canada) and University of Minnesota (USA) have recently used state of the art genomics tools to resequence and compare genes from nearly 1000 diverse wheat accessions (cultivars, landraces, wild and domesticated wheats) and used the data to developed a catalog of genetic variation (http://wheatgenomics.plantpath.ksu.edu/1000EC/). Analyses gave rise to the conclusion that the adaptations to new environments were enabled by transfer of genetic material from wild relatives. The research was recently published in *Nature Genetics* **51**, pages 896–904 (2019).

More than seven million differences in the genetic code between the wheat accessions were discovered in the study, differences that can affect the function of genes controlling traits such as adaptation to new environments, including the ability to better withstand drought and heat stresses, to fight diseases and produce more nutritious grain. These differences in the genetic code provide a rich history of each of the diverse wheat accessions. The scientists discovered that extensive gene flow from a wild ancestor's genome reduced the burden caused by mutations and allowed our ancestors to find bread wheat that was better adapted to new climatic conditions. The gene flow was instrumental in shaping important traits such as yield and susceptibility to drought. The knowledge gained from this collaborative research study emphasizes the value of the targeted use of wild relative genetic diversity in breeding programs today in the quest to accelerate wheat improvement at a time when demand for wheat is rapidly increasing.

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