Decoding the Wheat Genome

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In a major scientific breakthrough, a team of international researchers, including 18 from India decoded the wheat genome.

- The DNA sequence has been mapped and it represents the highest quality genome sequence generated to date for the bread wheat. The reference genome covers 94% (14.5 Gb) of the entire wheat genome.
- The project was financially supported by the Department of Biotechnology, Government of India.
- Wheat is one of the major sources of food for much of the world. However, because bread wheat's genome is a large hybrid mix of three separate subgenomes, it has been difficult to produce a high-quality reference sequence.

Significance

- To meet the demands of human population growth, there is an urgent need for wheat research and breeding to accelerate genetic gain as well as to increase and protect wheat yield and quality traits.
- The annotated reference sequence of wheat is a resource that can now drive innovation in wheat improvement. It can establish the foundation for accelerating wheat research and application through improved understanding of wheat biology and genomics-assisted breeding.
- The availability of high-quality reference genome would accelerate the breeding of climate-resilient wheat varieties to feed the ever-increasing world population and help address global food security in the decades to come.
- The information generated will help to identify genes controlling complex agronomic traits such as yield, grain quality, resistance to diseases and pests, as well as tolerance to drought, heat, water logging and salinity.
- Using the genome, breeders could also use gene-editing techniques like Crispr to rapidly alter the traits of their crops.

Genome Editing

- It is the addition, removal or replacement of DNA base pairs to change an organism’s genome structure.
- Genome editing is of great interest in the prevention and treatment of human diseases. Currently, most research on genome editing is done to understand diseases using cells and animal models.
- It is being explored in research on a wide variety of diseases, including single-gene disorders such as cystic fibrosis, hemophilia, and sickle cell disease.
- It also holds promise for the treatment and prevention of more complex diseases, such as cancer, heart disease, mental illness, and human immunodeficiency virus (HIV) infection.
- CRISPR-Cas9 (clustered regularly interspaced short palindromic repeats and CRISPR-associated protein 9) was adapted from a naturally occurring genome editing system in bacteria.
- The bacteria capture snippets of DNA from invading viruses and use them to create DNA segments known as CRISPR arrays.
- The CRISPR arrays allow the bacteria to "remember" the viruses (or closely related ones). If the viruses attack again, the bacteria produce RNA segments from the CRISPR arrays to target the viruses' DNA. The bacteria then use Cas9 or a similar enzyme to cut the DNA apart, which disables the virus.