



CRISPR-Cas Advanced Plant Breeding Technology

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CRISPR-Cas

Advanced plant breeding to solve real challenges

CRISPR-Cas is a more efficient and targeted plant breeding technology. It enables the development of customized agriculture solutions to the real challenges farmers around the world face in growing healthy plants.

WHY?

Farmers face real challenges because plants are under constant stress from things like climate change, drought and disease. To make sure healthy food is available to a growing world population, these farmers need seeds that can thrive and are safe for people and the environment.

WHAT?

Farmers have been creating new plants through plant breeding methods for 10,000 years. CRISPR-Cas is a more targeted way to develop healthy seeds using the best native characteristics available within the crop.



DuPont Pioneer: Building on legacy of innovation

HYBRIDIZATION, PLANT BREEDING, GERMPLASM

AGRICULTURAL BIOTECHNOLOGY

CRISPR-Cas ADVANCED BREEDING



1926
Pioneer brand Hybrid 307



Copper Cross

1950
Pioneer brand Hybrid 3780

1970
Pioneer brand Hybrid 312A

2000
Co-develop



2016
First commercialized product developed with CRISPR-Cas**



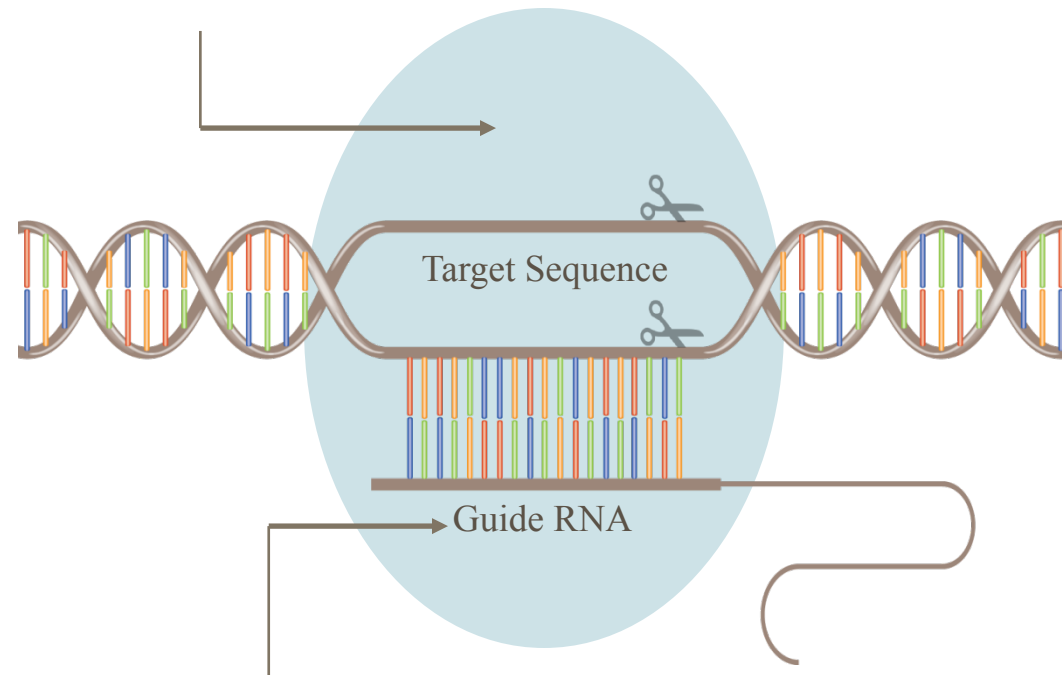
PROJECTED GLOBAL POPULATION:
9.6 BILLION



** Pending field trials and regulatory reviews.

CRISPR-Cas Enables Targeted DNA Breaks

Cas9 nuclease
(DNA cutting enzyme)



Guide RNA matches the
target DNA sequence

Guide RNA is designed to direct Cas9 enzyme
to the DNA sequence of interest

Cas9 enzyme binds to the targeted DNA and
makes double strand break

DNA double strand break is repaired
through a plant's own cellular process



CRISPR-Cas Applications

How can we use CRISPR-Cas?

delete



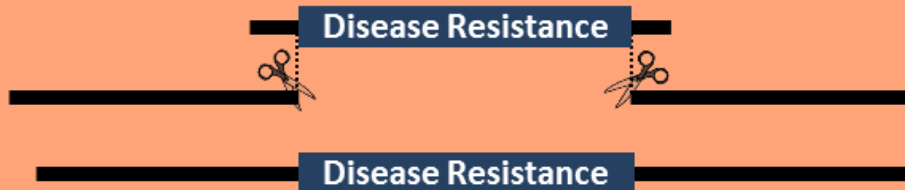
The plant **does not** have desired quality output.
The plant **does** have desired quality output.

edit

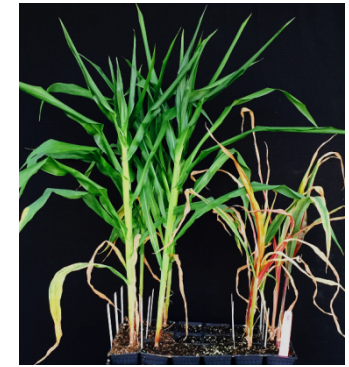
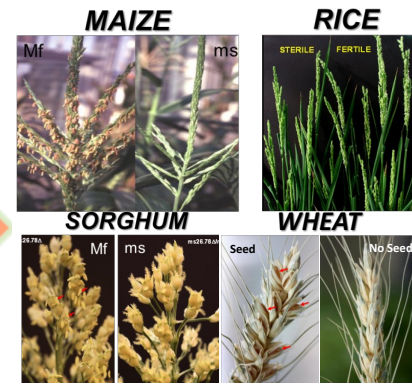


The plant has **tolerance** to drought.
The plant has **high tolerance** to drought.

replace



The plant is **susceptible** to disease.
The plant is **resistant** to disease.



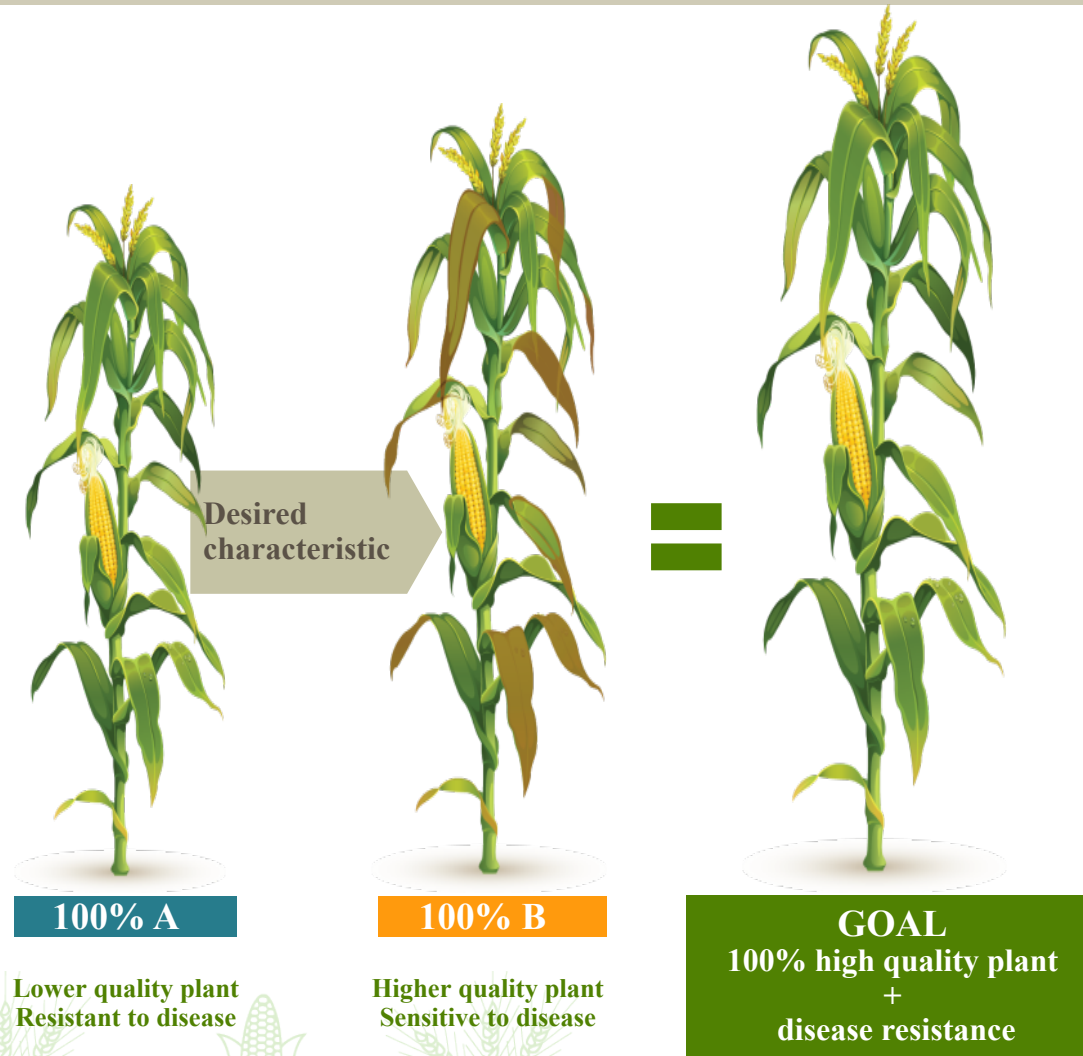
CRISPR-Cas enabling efficient introduction of desired characteristics (Advanced Plant Breeding)

DISEASE RESISTANCE EXAMPLE:

FROM:

Incorporating desired characteristics in multiple cycles of common breeding practices

TO: Incorporating desired characteristics in as little as 1 to 2 cycles via CRISPR-Cas advanced breeding



Engaging with external stakeholders

