GENE EDITING FACTS

To achieve our vision of "a world where the best quality seed is accessible to all, supporting sustainable agriculture and food security", ISF believes that science and innovation must continue to flourish. The latest plant breeding methods can accelerate the improvement of seed varieties

Gene editing improves the precision of plant breeding

Genetic variation is the foundation for plant breeding. Compared to other plant breeding methods that are used to increase genetic variation, gene editing stands out as a tool that allows the introduction of targeted variation. Because of the precise way genetic variation can be introduced through gene editing, it results in far fewer "unintended" genetic changes.[1] When undesired changes do occur, there are proven and tested processes in place to remove them. In any breeding program, regardless of the breeding methods used, plant breeders discard plants with unintended characteristics; breeding with gene editing is no different.

You probably have noticed the uniform-looking fields of corn, soybeans, or other crops while in the countryside. However, within these fields there is significant genetic diversity among individual plants. Take corn for example. Each new generation of a corn plant may have anywhere from 17-120 new genetic changes across its genome – the blueprint for its DNA.[1] These natural and spontaneous changes are the foundation of plant diversity and drive evolution, as they continue to provide opportunities for adaptation to new environments and changing climates.

These changes can occur before any human breeding innovation is introduced to the corn crop. Counter arguments often emphasize the possibility, even small, of unintended consequences, but this is nothing new to plant breeders. Plant breeders are constantly monitoring these changes in order to preserve the important characteristics of their varieties.

HAVE CONFIDENCE IN THE PLANT BREEDING PROCESS

As with most new innovations, there is understandable concern about what impacts gene editing could have on the world. It is reassuring to know that plant breeding involves long-established safeguards and processes to effectively handle unintended changes. Only plants that have the desired characteristics are further developed into new varieties that are multiplied in the field and marketed commercially. Whether the breeding process has only used crossing and selection or has also used gene editing, plant breeders identify and remove plants showing an unintended characteristic.[2] Scientific advances are making it easier to identify those plants with these unintended attributes.[3]

> **"Plant breeding involves long-established safeguards and processes."**

All methods of plant breeding have the possibility of new and unknown genetic changes. Gene editing tools, like CRISPR-cas9, herald a level of precision never before seen in plant breeding programs because unintended genetic changes are rarer in frequency, while still being mitigated before the crops are planted in the ground.[4]

THE BOTTOM LINE

Gene editing delivers more predictable food quality and security

Consider the genetic diversity present in a corn field. Now consider how we can maintain the tradition and necessity of growing food, while reducing resources, and creating more resilient crops. Gene editing allows us to do both–with increased precision.

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3. Glenn, K.C., et al. (2017). Bringing New Plant Varieties to Market: Plant Breeding and Selection Practices Advance Beneficial Characteristics while Minimizing Unintended Changes. *Crop Science*, 57, 2906-2921. https://doi.org/10.2135/cropsci2017.03.0199
4. Tang X, et al. (2018). A large-scale whole-genome sequencing analysis reveals highly specific genome editing by both Cas9 and Cpf1 (Cas12a) nucleases in rice. *Genome Biol,* 19(84).

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