

Gene Editing to Deliver Improved Crops Through More Precise and Efficient Breeding

Genome editing is a transformational discovery process that enables targeted and precise changes to DNA, helping accelerate genetic improvement and delivery of new seed products.

The practice of producing plants with desired traits is not new. Farmers have been doing it for thousands of years through selective breeding. In more recent years, mutation breeding and GMOs have been used, but newer gene editing tools have several advantages for achieving desired traits. Gene editing allows scientists to achieve a desired breeding effect more efficiently than biotechnology. Performance can be enhanced by targeting specific changes rather than relying on random processes to create the same effect.

The advantages of CRISPR in farming

Gene editing technology allows plant breeders to improve crops in a number of valuable areas that are only just beginning to be explored. Below are some of the significant improvements that are possible using gene editing.

1. Improving growth under stressful conditions and climate change

Some DNA variants increase crop resilience to extreme environments, enhancing plant yield and yield stability across diverse environments. In addition, researchers are looking at possible tools to help society adapt and manage the effects of a changing climate. Gene editing approaches are being used to address multiple climate change opportunities, such as enhancing the natural ability of plants and soils to capture carbon from the atmosphere and store it for long periods of time. This can help make agriculture more efficient and reduce the need for chemical fertilizers.

2. Improving pest and disease resistance

Gene editing can help create plants that have better defenses. Many plants have evolved genes that confer resistance to fungal diseases. Using CRISPR, we can mobilize multiple disease resistance genes from resistant low yielding varieties to susceptible high yielding varieties. Similar techniques could make plants resistant to harmful bacteria and viruses.

3. Improving commercial properties

Many tomato varieties are bred to be beautiful and transport well, but they've lost much of their flavor. Researchers have identified DNA sequences responsible for pleasing tomato flavors. Gene editing could help restore these sequences, making more flavorful, large tomatoes.

Gene editing could also change traits to benefit the crop, such as preventing bruising, increasing shelf life, creating seedless fruits, changing color/appearance and improving the nutrient profile.

4. Making plants more productive

Through gene editing, breeders can edit the proteins involved in photosynthesis to produce plants that are better at converting sunlight into biomass, helping crops achieve higher yields per land area.

5. Improving nutrition

Nutritional value can be derived through gene editing in varieties such as "golden bananas" that have a richer color due to increased beta carotene. They can also make some plants easier to digest. Gene editing can increase protein or oil with desirable properties in soybean seeds to benefit both food and feed industries. Researchers are currently working on removing allergenic proteins from peanuts. Used these ways, CRISPR tools could make more nutritious, safer foods available to more people.

6. Enhancing the production of natural products

Gene editing can be used to get plants to produce more of their natural oils. It can alter these oils to make them more useful as ingredients used in fuels, lubricants, flavors and fragrances. And, it is possible to alter the sugar content of plants, making the altered plants easier to ferment into products like ethanol.

The use of gene editing tools is just beginning. With their ability to create crops that are disease and pest resistant, able to grow under less favorable conditions, with the potential of higher yields, the benefits to farmers are apparent. Gene editing technology has the ability to improve today's farming, meeting growers' needs now and in the future.

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