Centuries ago when farmers planted and harvested their crops, they knew little about the science involved. Nor did they have a large seed stock. But today, science is helping farmers improve their seed selection. As a result, consumers have access to a wide variety of safe, plentiful, and nutritious foods. In the future, new biotechnology tools like genetic engineering can help plant breeders continue this trend.

Scientists like ARS plant physiologist Autar K. Mattoo know the powerful contributions that science and technology can make to the world’s food supply. “Our goal is to develop plants for improved nutrition, longer shelf life, and resistance to harmful pathogens,” says Mattoo, who heads the ARS Vegetable Laboratory in Beltsville, Maryland.

**Better, Faster, With More Precision**

“A traditional breeding approach can require 10 to 15 years to release a new tomato variety. This time can be cut to less than half using biotechnology,” says Mattoo. And he has done just that. He has developed several new transgenic tomatoes in almost half the time.

Traditional breeding requires selecting a tomato species that has a desirable trait, such as early ripening, and crossing it with another tomato species that has a good genetic background. The desired result is an earlier ripening tomato that makes it to the market sooner.

Mattoo points out that the goal of a biotechnological approach is no different—the process involved is just more precise.

“In the transgenic approach, we find a particular gene that controls the trait we’re interested in, like early ripening or prolonged shelf life,” he says. “Then, using molecular tools, we reengineer the gene, confirm it’s what we want, and introduce it into a plant so it becomes part of that plant’s genome. The plant then possesses the new trait.”

In a greenhouse of the ARS Vegetable Laboratory in Beltsville, Maryland, plant physiologist Autar Mattoo examines tomato plants genetically engineered to enhance phytonutrient content and longevity of the fruit.
Traditional breeding allows transferring hundreds of genes in a relatively random manner. Good or bad traits are sometimes haphazardly passed along to the new plant. With genetically engineered plants, however, scientists know exactly what’s going into the plant and what traits will be expressed by the transformed plant.

**Tomatoes With Staying Power**

If the season is right, you may find a brilliant red tomato sitting on a table in Mattoo’s office. The tomato might look like it was just picked, but chances are it’s one of his transgenic tomatoes that has been sitting there for weeks.

In collaboration with a Purdue University scientist in West Lafayette, Indiana, Mattoo has developed a novel means for slowing ripening by introducing a gene that controls only this function. He has been perfecting his technique for creating transgenic vegetables for the last 8 years—in Beltsville and West Lafayette.

Mattoo’s new transgenic tomatoes have 2.5 times more lycopene than non-transgenic tomatoes. Lycopene is a carotenoid that has strong antioxidant properties. Antioxidants prevent oxygen radicals from causing damage in cells. Carotenoids aid in preventing early blindness in children, preventing cancer, enhancing cardiovascular health, and slowing aging. Not only are the transgenic tomatoes richer in lycopene, they’re also more robust and more solid compared to traditional tomatoes.

Another tomato genetically engineered by Mattoo has a longer shelf life. Its cell membranes deteriorate more slowly during and after ripening. “The plants bearing these tomatoes bloom three or four times over the season,” he says, “whereas regular tomatoes normal-